वार्षिक प्रतिवेदन

ANNUAL REPORT

2020-21

Bihar Agricultural University
Sabour - 813210 Bhagalpur

Annual Report

2020-21

Bihar Agricultural University

Sabour, Bhagalpur (Bihar)

Title: Annual Report, BAU, Sabour 2020-21

March, 2022

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ISSN: 2320-6969

Published by
Dr. R.K. Sohane,
Director Extension Education,
Bihar Agricultural University, Sabour, Bhagalpur-813210

Photo credits: Nawal Kishor & Devraj Vikram

Correct citation: Beura K., Aditya, Ganguly G., Ranjan. T. (2022) Annual Report, 2020-21, Bihar Agricultural University, Sabour.

Designed and Printing:
Brajesh Kumar Tiwari, Media Centre, BAU, Sabour

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Vice Chancellor

PREFACE

The development of climate smart technologies with the enhancement of resource use efficiency in agriculture and associated areas is a priority at Bihar Agricultural University. In addition, the institution is constantly working to develop Agricultural Education in order to attain higher educational quality requirements. In 2020-21, the institution provided undergraduate and postgraduate agricultural and allied programmes. The undergraduate courses were offered in six constituent colleges with a total capacity of 325 students, with 292 enrolling in B.Sc. (Hons.) Agriculture and 25 in B.Sc. (Hons.) Horticulture. The University also operated 11 Experiential Learning Program (ELP) units across six member institutions during 2020-21.

During the academic year 2020-21, the University completed 12 international, 23 national, 276 state-funded, 54 consultancies, and 20 national network research and development projects. In this period, the University has released a brinjal variety (*Sabour Krishnakali*) as well as six farm technologies, including liquid *Rhizobium* biofertilizer, liquid Phosphate Solubilizing Bacteria (PSB) biofertilizer, liquid *Azotobacter* biofertilizer, liquid biofertilizer for N and P supplementation in Rice-wheat cropping systems, A biotic stress tolerant *Trichoderma* sp. against soil born disease of lentil and chickpea and management of weeds in Direct Seeded Rice (DSR).

Furthermore, novel extension approaches such as e-Kisan Chaupal, community animal health center, video conferencing, and online broadcasting of question-and-answer sessions on agriculture were used to transfer technologies to the farmers' fields. For the benefit of the farming community, the University has launched a number of national and state-level flagship programmes including Tribal Sub-Plan, Farmers FIRST, *Apni Kyari Apni Thali*, Biotech Kissan Hub, Aspirational Districts Project, *Mera Gaon Mera Gaurav*, scheduled cast sub plan (SC-SP). Different KVKs and colleges also conducted 4766 Front Line Demonstrations (FLDs), 5492 Cluster Front Line Demonstrations in oilseeds (CFLDs) and 153 On-Farm Testing (OFTs) on various enhanced agricultural and related practices during the year 2020-21.

During this tough period in 2020-21, the University has hosted 31 interactive learning webinars on a variety of topics to provide impetus in the learning process to various stakeholders such as students, research scholars, NGOs, government officials, and faculty members.

I am glad to present before you the annual report of the Bihar Agricultural University, Sabour for the year 2020-21. I expect that, this report will be helpful in increasing visibility of the University and justifying its purpose of uplifting of the life style of farming community.

(Arun Kumar)

Executive Summary

A brief summary of various activities and achievements of Bihar Agricultural University, Sabour during 2020-21 are presented here as under:

- Agricultural and allied undergraduate and postgraduate programmes were offered at the university in 2020-21. The undergraduate courses were offered in six constituent colleges, with a total capacity of 325 students, 292 of whom were enrolled in B.Sc. (Hons.) in Agriculture and 25 in B.Sc. (Hons.) in Horticulture.
- The Master's programme was provided in 15 disciplines at Bihar Agricultural College, Sabour, with a total enrolment capacity of 102 students. A no. of 98 students were admitted in different disciplines of M.Sc. (Ag) programme.
- Ph.D. programmes were offered in nine disciplines, with a total enrolment capacity of 29 students in which 26 students were admitted.
- Presently, the University has 11 Experiential Learning Programme (ELP) units operational at six different constituent colleges.
- During 2020-21 university has implemented a total of 12 international, 23 national, 276 state funded, 54 consultancy and 20 National network projects for research and development
- During 2020-21 university has released one variety of brinjal (Sabour Krishnakali) along with six farm technologies viz., liquid *Rhizobium* biofertilizer, liquid Phosphate Solubilizing Bacteria (PSB) biofertilizer, liquid *Azotobacter* biofertilizer, liquid biofertilizer for N and P supplementation in Rice-wheat cropping system, Abiotic stress tolerant *Trichoderma* sp. against soil born disease of lentil and chickpea and Management of weeds in Direct Seeded Rice.
- An efficient protocol was developed for micropropagation of pineapple and bamboo plantlets.
- The lines carrying resistance genes for bacterial leaf blight (BLB) and blast diseases under Marker Assisted Gene Introgression (MAGI) programme in rice were evaluated for their performance
- During 2020-21, the resistant lines for blast, sheath blight, bacterial blight and false smut diseases were procured from different centres of India for further identification of desirable donors and creation of mapping population for biotic stresses resistance in rice
- Introgression of QTL(s) for increasing grain Dimethylarsenic acid (DMA) concentration in Swarna-Sub1 and Rajendra Mahsuri-1 is being carried out for effective mitigation of Arsenic.
- Introgression of Aphid resistant gene (s) in *Brassica juncea*was done through embryo rescue. The lines with aphid resistance are being further evaluated for their performance
- Identification of collar rot resistant lines in chickpea is being carried out through mutation breeding approach.
- A short duration, high yield & Synchronous maturity Mungbean (*Vigna radiata*) genotypes has been developed and these lines are being further evaluated for their performance.
- An attempt has been taken to develop brinjal hybrids for summer season and tomato genotypes suitable for processing purpose.
- A total of 4766 Front Line Demonstrations (FLDs), 5492 Cluster Front Line Demonstrations in oilseeds (CFLDs) were also conducted by different KVKs besides 153 On-Farm Testing (OFTs) on various improved agricultural and allied practices.
- During 2020-21,19 e-Kisan Chaupal on various themes were organized online during the Covid-19 pandemic period by the various KVKs under jurisdiction of the university and constituent colleges, benefiting 1795

farmers directly 49036 farmers over YouTube.

- Under centrally sponsored NICRA project implemented by KVKs located at Aurangabad, Banka, Jehanabad, Supaul and Nawada; various climate-resilient technologies like micro-irrigation, water harvesting and recycling, residue management, fodder banks, happy seeder and zero tillage etc., were evaluated as well as popularized.
- The university is also implementing various national and state-level flagship programmes for the benefit of the farming community. During 2020-21, flagship programmes*viz.,* Tribal Sub-Plan, Farmers FIRST, *ApniKyariApni Thali*, Biotech Kissan Hub, Aspirational Districts Project, *Mera Gaon Mera Gaurav*, Scheduled Caste Sub Plan (SC-SP),*Swach Bharat Abhiyan,* Attracting and Retaining Youth in Agriculture (ARYA), Paramparagat Krishi Vikas Yojna (PKVY), Garib Kalyan RojgarAbhiyaan (GKRA), and Climate Resilient Agriculture were successfully implemented.
- During 2020-21,*Kisan Mela* was organized at Bihar Agricultural University Sabour on'Empowering Youth for Technology–led Farming'. A total of 25,160 farmers and extension functionaries were among participants in *Kissan Mela*. Kisan Mela was also organized at MBAC Agwanpur, Saharsa.
- In the year 2020-21, the KVKs conducted 2,610 courses of different types for farmers, rural youth, and extension functionaries, considering their livelihood and allied requirements. As such, a total of 45,696 farmers, 14,498 rural youth, and 10,527 extension functionaries benefitted through the training.
- The university produced total 12,402.44 quintal seed of cereals, pulses, oilseed and vegetables during the year 2020-21 taking together seed produced in farms of different colleges, RRS and KVKs. Apart from that, the university has also produced 14.4 lakh planting material including tissue culture banana plants, 1204 kg of mushroom spwan during 2020-21. Through sale various agricultural inputs, the directorate of seed and farm had generated revenue of Rs 392.26 lakhs during 2020-21.
- To ensure more availability of online study materials university library acquired access of CAB abstracts with 900 full text journals apart from full access of 2777 e-Books. The library has also access to 3625 full text journals through CeRA besides 490 open access journals on agriculture science. Online access of e-resources has been also ensured for libraries at constituent units of university.
- The university has received prestigious awards such as SKOCH Silver Award for APNI KYARAI APNI THALI (AKAT); SKOCH Digital Gold for ICT-based Transfer of Technology and Capacity Building of Farmers, Farm women and Rural Youth; Times Excellence in Education Award; Agriculture Revolution Award 2021 by Agriculture Today Group and Best Institute in Agriculture by Agriculture Innovation Congress Awards.
- The University has hosted 31 interactive learning webinars on diverse topics to give momentum in learning process to different stake holders like students, research scholar, NGOs, Govt. officials and faculty members during this difficult situation during 2020-21.

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INTRODUCTION

1. INTRODUCTION

Bihar Agricultural University, Sabour, established on 5th August 2010, is one of the premier agricultural universities of the country working for accelerating the growth of agriculture sector through technological interventions. The University was established at historical Bihar Agricultural College, Sabour as its headquarter and has 6 constituent colleges (5 Agriculture + 1 Horticulture), 12 research stations and 20 Krishi Vigyan Kendras spread across 3 agro-ecological zones of Bihar.

1.1 Vision

The Bihar Agricultural University (BAU) was established with a vision of improving quality of life of people of state especially the farming community which constitute more than two-third of the population. Having set ultimate goal of benefitting society at large the university intends to achieve it by imparting world-class need based agricultural education, research, extension and public service.

1.2 Objectives

The University was established by the state government with the following objectives:

1. Making provision for imparting education in different branches of Agriculture and any other allied branches of learning and scholarship which the University may find necessary to include;
2. Furthering the advancement of learning and conducting of research in Agriculture;
3. Undertaking extension education activities for the welfare of people of State;
4. Promoting partnership and linkages with national and international educational institutions;
5. Such other purposes as the University or the State Government may from time to time determine.

1.3 Mandate

The mutually supporting mandates of University in the field of agricultural education, research and extension are:

Education: Developing quality human-ware and suitably trained quality human resources through professional programmes in agriculture and allied fields.

Research: Undertaking mutually reinforcing basic, applied and adaptive research besides acquiring and refining technologies for addressing the present and future problems in the field of agriculture. Capturing new opportunities that could prove beneficial for large number of people involved in farm activities.

Extension: ensuring transfer of technology effectively and extending assistance in adoption of technology with vibrant extension services taking into account the economic/socio conditions of the targeted groups.

Training: Imparting training for capacity building of extension professional. Paraprofessionals as well as vocational training of adults, youths and women through conventional as well as open & distance learning.

1.4 Agricultural Education

The University offering admission in Undergraduate degree programmes in Agriculture & Horticulture located over 6 different campuses/colleges of the University. The Master & Ph.D. degree programmes is available in faculties of Agriculture. The residential requirement is 8 semesters for Undergraduate, 4 semesters for Masters & 6 semesters for Ph.D. Degree Programme. Our colleges are as:

1. Bihar Agricultural College, Sabour, Bhagalpur
2. BholaPaswanShstri Agricultural College, Purnea
3. Mandan Bharti Agricultural College, Saharsa
4. VKS College of Agriculture, Demuraon
5. Dr Kalam Agricultural College, Kishanganj
6. Nalanda College of Horticulture, Noorsarai

1.5 Agricultural Research

The University is mandated to serve three agro climatic zones of Bihar *viz*., II, III A and III B for development of farm technologies, improvement of crops including horticultural crops and conducting agricultural policy research. For smooth, efficient and effective collaboration, planning, monitoring and evaluation of the research, the University has constituted five research advisory groups as given below,

a) Crop Improvement
b) Natural Resource Management
c) Crop Protection
d) Product Development and Marketing
e) Social Sciences

The University has developed collaboration with number of institutes of national and international repute. It has a strong linkage with the ICAR institutes across the country and has active collaboration with international organizations like International Rice Research Institute (IRRI), International Center for Maize and Wheat Improvement (CIMMYT), International Crop Research Institute for Semiarid Tropics (ICRISAT), International Plant Nutrient Institute (IPNI), Australian Centre for International Agricultural Research (ACIAR) etc.to develop and impart strategies and technologies for agricultural development in the state of Bihar.

University with its constant efforts has developed several varieties of rice, wheat, maize, linseed, chickpea, mango, brinjal, cauliflower, litchi, makhana etc. suitable for specific needs of the farmers. The University has also developed tailor made agro-technologies for benefit of farmers. Further, New facilities have been created for micro propagation of strawberry and exotic flowers; protected cultivation; biofertilizer and bio pesticides production. Key research themes in the University include improving resource use, natural resource management including climate change adaptation and mitigation, farming system research, genetic enlargement of crops including horticultures and livestock resilient to biotic and abiotic stresses, product development and value addition, technology transfer and out scaling, capacity enhancement and social science and policy research.

1.6 Agricultural Extension and Training

In the field of extension education, Bihar Agriculture University has many initiatives to credit. New methods have been successfully experimented by University for technology transfer to farmers. Quite a number of technologies that succeeded in popularizing among farmers were developed at the University. The institute has developed a knowledge network and dissemination system for increasing access and capacity building of farmers in the state with the intervention of Information and Communication Technology. It has established Electronic Media & Production Centre (EMPC) for audio, video and multimedia development/production which comprises of audio and video studios, PCR room, recording/edition room, digital archives, library and auxiliary facilities. An agriculture e-portal has also been developed for web-casting using Web Portal for agriculture related services, SMS facilities for farmers with high speed internet connectivity. Complete information

(climatology, variety, agronomy, plant disease management, post-harvest management, etc.) and recommended package of practices for the mandate crops in the form of video/audio/multimedia are put on the web portal which is augmented/updated continuously. Besides this, CDs and video of the multimedia are distributed to the farmers. Now, the University headquarters has also been connected with almost all KrishiVigyanKendras (KVKs) to connect with farmers from the University headquarter for timely and relevant messages.

The work taken under tribal development programme through KVKs is helping in income generation as well as employment generation by producing more and more farm products from less land water, including mushroom crop in agriculture sector, employment generation for unemployed rural youth, improvement in standard of living, income generation and improvement in health and farm well being. It has its own website devoted to the farmers i.e., www.kisangyan.com.Moreover, Bihar Agricultural University has developed its website (www.bausabour.ac.in) and information on the web and is being updated regularly.

1.7 University Administration

1.7.1 Senate

Senate, the highest body of the University is headed by Hon'ble Chancellor. Vice-Chancellor is empowered to chair senate meetings in absence of Chancellor as per provisions of acts and statutes. Agriculture Production Commissioner, Principal Secretary of Food and Consumer Protection, Additional Secretary, Animal Husbandry and Fishery Department, Chief of Forest Conservation, Director Agriculture, Director Animal Husbandry, Director Fisheries, Joint Director Agriculture Education, Director Research (BAU), Director Extension Education, All Deans and Principals of different colleges of the University are among the members of senate. Responsibilities entrusted senate to include policy review besides, review of the progress being made by University in different fields.

1.7.2 Board of Management

The Board of Management is the apex body of the University responsible for formulation/ modification and review of acts besides, formulation of policies concerning functioning of the University. The Vice-Chancellor is the Chairman and other ex-officio members of the Board include Agriculture Production Commissioner/Principal Secretary/Secretary, Department of Agriculture, Bihar, Principal Secretary/ Secretary, Department of Finance; Director Agriculture; Director Horticulture. There is one external member from academic who is well known in the field of agriculture and/or science. There are five member' nominated by state government, parliament (2), women working at grass-root level (1), Progressive farmer (1), Agri-entrepreneur (1) and one representative of ICAR. There is one each of Director, Dean, Chairman/Head of department which are nominated by Vice-Chancellor. The Registrar acts as Member Secretary of the Board. The Board is responsible for framing rules, regulations and amendments to it. It is also responsible for financial requirement and review of the University.

1.7.3 Academic Council

The top educational body of the University has been entrusted responsibility of reviewing educational programmes periodically in order to maintain high standards of education in University. The council is empowered to formulate necessary rules and regulations for implementation of educational programmes. Headed by Vice-chancellor, the members of the council include Director, Deans, Head of departments, two heads from each college, one nominated professor, one expert from the field of agriculture with Registrar as Member Secretary.

1.7.4 Chancellor

The Hon'ble Governor of Bihar is the Chancellor of the University and by virtue of his office, he is the head of the University and presides over convocations of the University.

1.7.5 Vice-Chancellor

The Vice-Chancellor is the whole time officer of the University. The-Vice Chancellor is the principal executive and academic officer of University and ex-officio chairman of Board of Management, Academic Council, Research Council and Extension Council. He shall in the absence of Chancellor, preside at the convocation of the University and confer degrees on persons entitled to receive them. Vice- Chancellor exercises general control over the affairs of the University and is responsible for due maintenance of discipline in the University.

1.7.6 Other Senior Officials

Deans and other senior officials of the University are chairman of their respective faculties besides, Board of Studies of the concerning faculty. Responsible for organizing teaching programmes, Deans are needed to report to the Vice-Chancellor. The Director Research is responsible for the direction and co-ordination of research programmes; Director of Residence Instruction is responsible for inter-faculty and inter-departmental co-ordination of under-graduate and post-graduate instructions; Director of Extension Education provides direction and co-ordination of agricultural extension programme; Registrar acts as ex-officio secretary of Board of Management and Academic Council; Comptroller is responsible to the Vice-Chancellor for preparation of the budget and statement of accounts of the University. Director Seeds & Farms, Director, Planning and Director, Administration are the other officers of the University.

1.8 The overall Staff Position (as on 31.03.2021) under BAU, Sabour

S.N.	Name of the Position	Sanction Strength	Filled-up
1.	Univ. Prof-cum-Chief Scientist	68	15
2.	Assoc. Prof-cum-Sr. Scientist	188	28
3.	Asstt. Prof-cum-Jr. Scientist	775	300
4.	Non-Teaching Staff (Hq. + Colleges + Research Centre)	1260	396
5.	P.C.	21	18
6.	SMS	126	80
7.	KVK (Non-Teaching Staff)	189	140
	Total:	**2627**	**977**

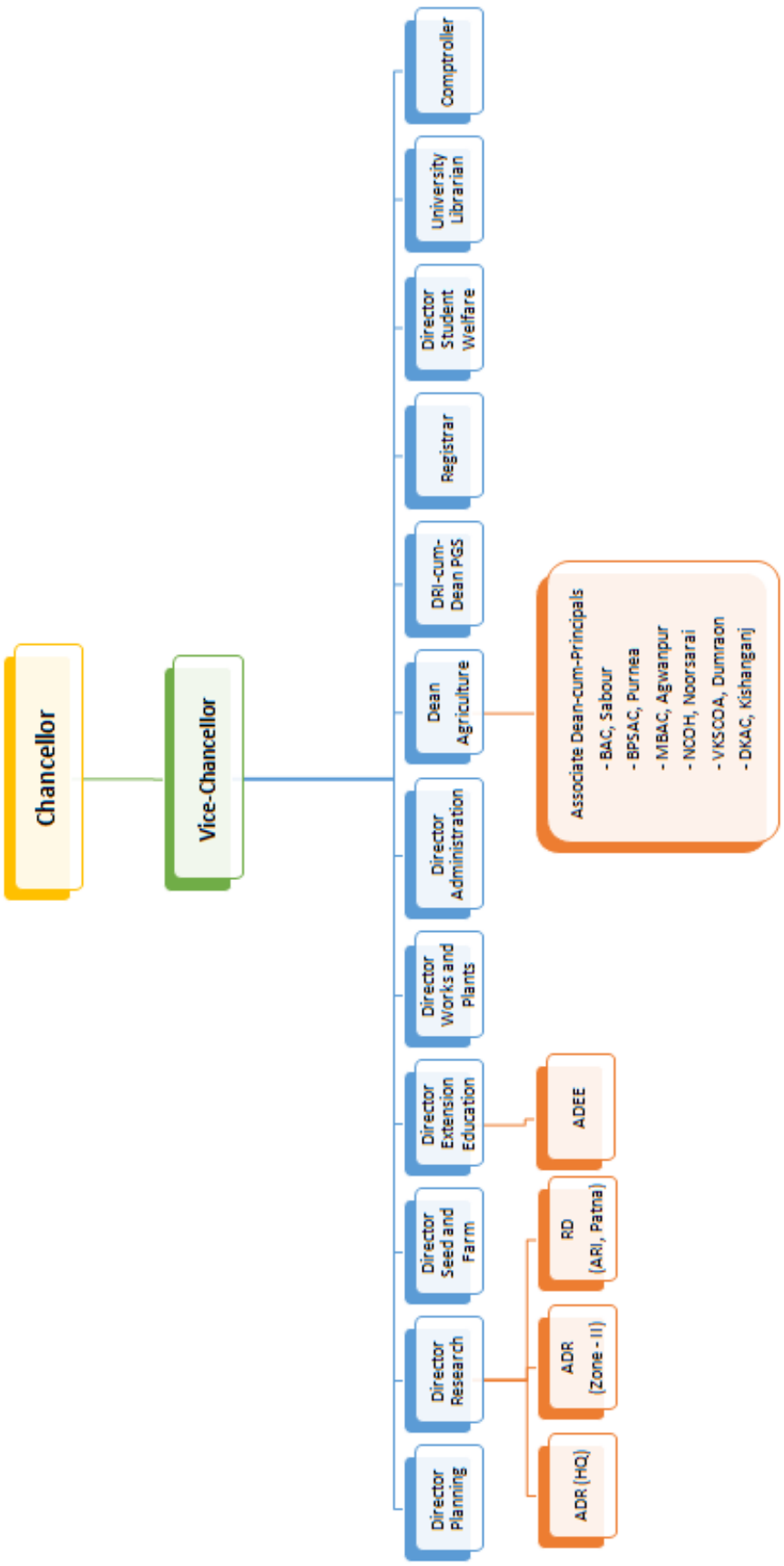


Figure 1: Organogram of Bihar Agricultural University, Sabour

EDUCATION

2. EDUCATION

Education is the most effective way to drive people Tffhnhjvgn o better for themselves and for society as a whole. In agriculture, giving education to young minds is critical for a complete understanding of the subject and the implementation of measures for improving livelihoods. Bihar Agricultural University is working hard to teach students about agriculture and allied sciences in order to achieve this goal. The fundamental goal of this initiative is to produce competent graduates at both the state and national levels. The university offers undergraduate, master's, and doctoral degrees in a variety of agricultural subjects. Six constituent colleges, spread throughout three agro-ecological zones of the state, offer undergraduate courses, one of which offers a degree in horticulture. The postgraduate courses are being offered at Bihar Agricultural College, Sabour campus in 15 disciplines *viz*., Agricultural Biotechnology, Agricultural Economics, Agricultural Statistics, Agronomy, Entomology, Extension Education, Horticulture (Floriculture & Landscaping), Horticulture (Olericulture), Horticulture (Pomology), Horticulture (Post-Harvest Technology), Plant Breeding & Genetics, Plant Pathology, Plant Physiology, Seed Science & Technology and Soil Science & Agricultural Chemistry. Whereas, Ph.D degree is being offered in 8 disciplines *viz*., Agronomy, Entomology, Extension Education, Horticulture (Olericulture), Horticulture (Pomology), Plant Breeding & Genetics, Plant Pathology and Soil Science & Agricultural Chemistry. The Indian Council of Agricultural Research (ICAR), New Delhi, has accredited five of the university's six constituent institutions as well as all of its postgraduate departments. All of the University's programmes and constituent colleges have fully implemented the recommendations of the fifth deans committee.

2.1 Constituent colleges of the university

Admission to the University's Undergraduate degree programmes in Agriculture and Horticulture are available at six different campuses/colleges. In Faculty ofAgriculture, master's and doctoral degree programmes are provided. Undergraduates must live on campus for eight semesters, Masters students for four semesters, and Ph.D. students for six semesters.

2.1.1 Bihar Agricultural College, Sabour, Bhagalpur

Bihar Agricultural College, Sabour, established in 1908, is one of the country's oldest agricultural colleges. At a height of 46 metres, it is located about 10 kilometres east of Bhagalpur (the nearest railway connection) at 86° 57' S longitude and 25° 15' N latitude. On 17thAugust, 1908, Sir Andrew Henderson Leith Frazer, Lt. Governor of Bengal, lay the foundation stone of an Agricultural College at Sabour. The college has a history of releasing the world's first mango hybrids, "Mahamood Bahar" and "PrabhaSanker." The Central Rice Research Institute, which was primarily built at Sabour with two sub-stations at Gaya and Cuttack, has a unique history with Bihar Agricultural College. *Hortus Malabaricus* (12 volumes), *Museum Restrcum* Et. Commercial (6 volumes), and Plants of the Commercial Coast (6 volumes) are among the rare books in the collection (3 volumes). M.Sc. and Ph.D. programmes are currently available in fifteen and nine agricultural subjects, respectively.

2.1.2 Mandan Bharti Agricultural College, Agwanpur, Saharsa

The foundation of Mandan Bharti Agricultural College, Agwanpur, Saharsa, fulfilled a long-held dream of the Kosi people for agricultural growth of the region's frightened but troubled land.The college was founded in April of 2007, and it offers a dynamic and innovative educational programme to meet the present difficulties of scientific manpower, important research, extension services, and high-quality planting supplies. The 77.5-acre campus is equipped with modern amenities such as smart classrooms, well-equipped laboratories, and committed faculty.Aside from education and technological transfer, the college is also involved in agricultural research. This college's research and extension area in the Koshi region (zone II), which includes Saharsa, Supaul, Madhepura, and Khagaria.

2.1.3 Veer Kunwar Singh College of Agriculture, Dumraon, Buxar

The Veer Kunwar Singh College of Agriculture, Dumraon (Buxar), is located 18 kilometres east of Buxar, in the sub-division of Dumraon, which was traditionally known as Karm Bhumi of Lord Ram and Tapobhumi of Maharsi Vishwamitra. It was founded in 2010 and now provides a bachelor's degree in agriculture.It was founded in 2010 and now provides a bachelor's degree in agriculture. Smart class rooms, laboratories, dorms, and the Administrative Building are among the college's well-established teaching facilities. This is the sole Agricultural College in Bihar's Zone-III B, and it is always ready to assist farmers and concerned officers in areas such as Buxar, Bhojpur, Rohtas and Kaimur.

2.1.4 Bhola Paswan Shastri Agricultural College, Purnea

In the year 2011, this college was founded. It is 3 kilometres from Purnea Junction and 4 kilometres from the national highway. On the 16th of June 2011, the Hon'ble Chief Minister of Bihar, Sri Nitish Kumar, lay the foundation stone. Sri Nitish Kumar, Hon'ble Chief Minister of Bihar, opened the College site, which included an administrative building, boys' and girls' hostels, staff quarters, a sports facility, and an auditorium on 10th August, 2015.At this time, the college's infrastructure includes classrooms, labs, a training hall, student hostels, a library, and computers with internet access. The Department of Agriculture, Government of Bihar, created an 84-hectare

Seed Multiplication Farm at Purnea in 1958, and the farm has been producing excellent seed of vital crops to meet the needs of farmers in the state since then.

2.1.5 Dr. Kalam Agricultural College, Kisanganj

Dr. Kalam Agricultural College (DKAC), Kishanganj, was founded on the banks of the Mahanada on August 10, 2015 near Arrabari on the Thakurganj-Kishanganj road. The College was named in the remembrance of the former President Late Dr. A.P.J Abdul Kalam. Kishanganj is also recognised for producing high-quality tea, in addition to pineapple and jute, and was the first district in Bihar to do so on a significant scale. D.K.A.C., Kishanganj is always ready to assist farmers and concerned officers in the State's Zone – II. In terms of classrooms, labs, libraries, hostels, and residence halls, the campus features a well-developed state-of-the-art infrastructure.

2.1.6 College of Horticulture, Noorsarai, Nalanda

The college, known as the Nalanda College of Horticulture (NCOH), was founded on August 22, 2006. The ancient International Monastic University, which was founded in the 5th century BC and taught ideas, logic, grammar, medicine, metaphysics, prose production, and rhetoric, is well-known across the world.The institution was founded with the goal of training high-quality human resources to help the state's horticulture sector grow faster. Smart classrooms, laboratories, well-established protected agricultural structures, and a student and farmer's hostel are all part of the college's well-developed infrastructure.

2.2 Under Graduate Programme

For 85% of the seats, candidates for admission to various Bachelor's Degree Programs at this University will be selected through the Bihar Combined Entrance Competitive Examination, which is held every year by the Bihar Government.The All India Entrance Examination, conducted by the ICAR, will be used to choose 15% of the seats. A minimum 10+2 or equivalent qualification in Physics, Chemistry, Biology/ Agriculture/ Math from a recognised Indian Board / University is required.

Table 2.1. Intake Capacity of different constituent colleges, 2020-21

SL. No.	Name of College	Number Seats		
		BCECEB	ICAR/VCI	Total
1.	Bihar Agricultural College, Sabour, Bhagalpur	51	09	60+2*
2.	Mandan Bharti Agriculture College, Agwanpur, Saharsa	51	09	60
3.	Veer Kunwar Singh College of Agriculture, Dumraon, Buxar	51	09	60
4.	BholaPaswanShastri Agriculture College, Purnea	51	09	60
5.	Dr. Kalam Agriculture College, Kishanganj	60	00	60
6.	NalandaCollegeofHorticulture, Noorsarai, Nalanda	21	04	25
Total		**285**	**40**	**325**

2.2.1 Students enrolled

A total of 319 students admitted during academic session 2020-21 of which almost37 per cent were female students (Table 2.2).

Table 2.2 Number of Student Enrolled during 2020-21

Sl. no.	Name of College	Degree Programme	Intake Capacity	Students Admitted		Total
				Male	Female	
1.	BAC, Sabour	B.Sc. (Hons.) Agriculture	60+2*	35	26	61
2.	MBAC, Saharsa	B.Sc. (Hons.) Agriculture	60	44	16	60
3.	BPSAC, Purnea	B.Sc. (Hons.) Agriculture	60	32	25	57
4.	VKSCOA, Dumraon	B.Sc. (Hons.) Agriculture	60	38	22	60
5.	DKAC, Kishanganj	B.Sc. (Hons.) Agriculture	60	40	16	54
6.	NCOH, Noorsarai	B.Sc. (Hons.) Horticulture	25	12	13	25
Total			**327**	**201**	**118**	**317**

***DQ/SMQ**

2.2.2 Students graduated

A total of 185undergraduate students from 6 constituent colleges including faculty of Agriculture and Horticulture completed their degrees during 2020-21 academic session which is mentioned in Table 2.3.

Table 2.3 List of graduated students in UG Programme

S. N.	Name of the College	Number of students
1.	Bihar Agricultural College, Sabour, Bhagalpur	39
2.	Mandan Bharti Agriculture College, Agwanpur, Saharsa	17
3.	Veer Kunwar Singh College of Agriculture, Dumraon, Buxar	33
4.	BholaPaswanShastri Agriculture College, Purnea	39
5.	Dr. Kalam Agriculture College, Kishanganj	40
6.	Nalanda College of Horticulturee, Noorsarai, Nalanda	17
	Total	**185**

2.2.3 Experiential Learning Programme

During 2020-21, **eleven** experiential units were functioning among the University's constituent colleges. The major goal of these ELP centres is to give students practical experience and to prepare them for the role of entrepreneur. Table 2.4 lists the ELP centres with notable accomplishments by colleges.

Table 2.4 Experiential learning units operational at the university

Sl. No.	Title of Experiential Learning Unit	Salient Achievement
1	Fruits & vegetables processing & preservation, BAC, Sabour	Under the ELP on Fruits & vegetables processing & preservation the total number of 32 students participated in the year 2019-20. Among the processed products of fruits and vegetables, they prepared different types of squashes like green mango,ripe mango,litchi, lemon and bael, In the intermediary moisture products they prepared guava jelly, mango jam and tomato ketchup etc. Under this scheme all the students have learnt the processing technique, essential parameters for preparation of different products, quality following the Govt. norms and knowledge of FSSAI and Food Safety hazards etc. The students sold their products in Kishan-Mela'2020 through the counter sale of the departmental stall and nearby market. From the sale of the product the total revenue generated was Rs.69, 667/-(Rupees sixty-nine thousand six hundred sixty-seven) only. However the product wise net profit by selling of fruits and vegetable products was Rs.28013/. 50% of the profit i.e Rs.14006.50 was equally distributed between 32 students.
2	Commercial Horticulture (Nursery Production Management), BAC, Sabour	Under this programme 30 students were selected in the course – ELP Commercial Horticulture (Nursery Production Management) in year 2019-2020. Hybrid Seedlings of vegetable crops were produced viz. cucumber, bitter gourd, sponge gourd, bottlegourd – long &round, brinjal and chili by following scientific protocols in the controlled condition (poly houses). Around 22-25 days old Seedling were sold by the students in Kisan Mela 2020. Farmers were intimated about the package of practice of various crops by the students. Almost 2500 seedlings of vegetable crops were produced by the students and 1400 hybrid vegetable seedlings were sold in the annual Kisan Mela 2020 and total revenue generated was Rs 8,400 at Rs 6/per plant in portray or plastic cups. Remaining seedlings of these crops were then planted by the students in the net houses at Horticulture Garden of college premise for getting the exposure of scientific cultivation of these crops.
3	Mushroom Production, BAC, Sabour	Twenty students have been enrolled under this programme. The

		have surveyed nearby villages of the Under Experiential Learning Programme (ELP), Twenty students (20) have been enrolled. Students were surveyed in Bhagalpur and their adjoining areas for knowing the status of mushroom production and spawn production activity as well as for the scope of mushroom production and market to understand the demand of mushroom among the people and local market. Mother culture of four different mushrooms (Oyster, Button, Milky and Paddy straw) were successfully cultured and prepared by using standard method. They were well acquainted and handing of different equipment's like BOD, Autoclave, Hot air oven, Laminar air flow, Distillation unit etc. Commercial spawns of different mushrooms were produced based on season under aseptic lab condition as per demand and need of progressive farmers. Best quality of mushroom spawns and fruits of Oyster and milky mushroom were produced by the ELP students and maximum were sold in Bhagalpur and their adjoining area and in the annual Kisan Mela. The produced spawn was tested for the potentiality to produce mushroom fruiting body. The total revenue of Rs. 35237.00 has been generated by selling spawn and fruits of mushroom during current session.
4	Protected Cultivation of High Value crops, NCOH, Nalanda	Under this programme 18 studentshad participated in the year 2020-21. During this year shimlamirch variety Indira has been taken for cultivation. For this, land preparation with the help of soil drenching with formalin solution 4-5 liter/m^2, layout, raising of seedlings in portray were done and after 15-20 days seedlings were planted in well prepared bed under poly house. Also students attained the knowledge about market survey, project preparation, cultivation techniques of crops to be grown under poly house so as to increase their professional skills, entrepreneurship knowledge and marketing skills through experience and working in project mode.
5	Processing of fruits and vegetables for value addition, NCOH, Nalanda	There were 18 students enrolled in the academic year 2020-21 under this programme. The students learned the process of project formulation, finance, labour and raw material management along with methods of different processed product like tomato sauce and lemon squash. They also got acquainted with the equipment handling installed in the processing unit. By this way, they learnt about the infrastructure development, budget requirement, demand & supply of raw material and processed product, quality parameter and marketing standard of the value added products, man power utilization etc. for the development of entrepreneurial skill. The revenue generation will

		be added in the revolving fund by the sale of lemon squash.
6	Processing and preservation of fruits and vegetables, MBAC, Agwanpur	To promote professional skills, entrepreneurship, knowledge and marketing skills through meaningful hands on experience and working in project mode, Experiential Learning Programme on "Processing and Preservation of Fruits and Vegetables has been operational at Mandan Bharti Agriculture College, Agwanpur (Saharsa). The students had got adequate experience in planning and managing an enterprise in totality starting from procurement of raw material to processing, production, packaging and storage of products, organizing resources and utilities, sale of products, maintain accounts and analyze profits. A total of 41 Students have been trained for the value addition of fruits and vegetables to establish their own entrepreneurship.
7	Processing of Tomato for Value addition, VKSCOA, Dumroan	To promote professional skills, entrepreneurship, knowledge and marketing skills through meaningful hands on experience and working in project mode, Experiential Learning Programme on "Processing and Preservation of Fruits and Vegetables has been operational at Mandan Bharti Agriculture College, Agwanpur (Saharsa). The students had got adequate experience in planning and managing an enterprise in totality starting from procurement of raw material to processing, production, packaging and storage of products, organizing resources and utilities, sale of products, maintain accounts and analyze profits. A total of 41 Students have been trained for the value addition of fruits and vegetables to establish their own entrepreneurship.
8	Enterprise Management Capability through Makhana (*Euryale ferox*Salib) Production System Management, BPSAC, Purnea	Under Experiential Learning Programme (ELP), Fortystudents (40) have been enrolled. Students were surveyed in Makhana growing villages of Purnea and their adjoining areas for knowing the status of Makhanaproduction, processing, value addition, marketing and branding activities as well as for the scope of Makhana production and market to understand the demand of Makhana among the people and local market.Nursery raising and transplanting of Makhana seedlings were successfully completed. They were well acquainted and handing of different equipment's like pilot makhana processing unit etc. Commercial Makhana based products were produced as per demand and need of consumers. Best quality of Makhana seed and popped Makhana were produced by the ELP students and maximum were sold in Purnea and their adjoining area and in the annual KisanMela. The produced seed(76.5q) of Sabour Makhana-1 was used in Front Line Demonstration (FLD) under Makhana Development Scheme and Bio-Tech Kisan Hub project. The total revenue of Rs. 11,47,500.00 has been generated by selling seed of Sabour

		Makhan-1 during current session.
9	Commercial Bee Keeping, BPSAC, Purnea	Forty students were enrolled under this ELP programme. Students had surveyed Purnea and their adjoining areas for knowing the status of honey production as well as for the scope of commercial bee keeping. Students were allotted with bee boxes (one for five students) for maintenance throughout the course. Students had learned about the identification of queen bee, worker bee, drone bee in the colony which was allotted to them. Students got acquainted with the bee keeping equipments such as Longsworth Hive, Newton Hive, Brood Chamber etc. They learned about handling of other equipments like Smoker, Decapping Knife, Honey Extractor Chamber etc. in commercial bee keeping course. They were also acquainted with the preparation of sugar solution to feed the honey bees during dearth period. Students were well versed with pest and diseases of honey bees and their management. They got to know about swarming, when there is shortage of food in the hive, the bees start moving one place to other.
10	Seed Production Technology, DKAC, Kishanganj	As per the ELP programme guidelines, registered students under Commercial Sericulture are 49**.** The course is offered to the undergraduate students of the B.Sc. (Agri.) for the academic session 2020-21. This course gives the students the practical aspects of sericulture both in mulberry and tasar silkworm rearing. The students will come to know each and every minute aspects of rearing which are very much necessary in successful growing of silkworms.
11	Floriculture and Landscaping, DKAC, Kishanganj	A total of 47 students have enrolled in this experiential learning programme. Nursery has been developed for different flowers. Preparation of land and layout were performed by students.

2.3 Post-Graduate Programme

The Masters and Ph.D. Degrees are awarded in Agriculture faculty at Bihar Agricultural College, Sabour.

2.3.1 Master's Degree programmes

Post-graduate Program is currently being offered in fifteen disciplines of Agriculture faculty at Bihar Agricultural College, Sabour. A total of 98 students admitted during academic session 2020-21 of which almost 50 per cent were female students (Table 2.5).

Table 2.5 Number of available seats and admitted students in Master's Programme during 2020-21

Sl. No.	Subjects	BAU Seats	ICAR Seats	Total Seats	Total Admitted Students		
					M	F	Total
Agriculture Faculty							
1.	Agricultural Biotechnology	04	01	05	03	01	04
2.	Agricultural Economics	04	01	05	02	03	05
3.	Agricultural Statistics	03	01	04	01	02	03
4.	Agronomy	09	03	12	05	06	11
5.	Entomology	04	02	06	02	04	06
6.	Extension Education	04	01	05	04	01	05
7	Horticulture (Floriculture)	02	00	02	00	02	02
8.	Horticulture (Fruit Science)	08	02	10	06	04	10
9.	Horticulture (Post Harvest Technology)	03	01	04	01	02	03
10.	Horticulture (Vegetable Science)	10	03	13	07	06	13
11.	Plant Breeding & Genetics	09	03	12	09	03	12
12.	Plant Pathology	06	02	08	04	04	08
13.	Plant Physiology	02	00	02	01	01	02
14.	Seed Science & Technology	02	00	02	00	02	02
15	Soil Science & Agricultural Chemistry	09	03	12	04	08	12
Total		**79**	**23**	**102**	**49**	**49**	**98**

2.3.2 Ph.D. Degree Programmes

Availability of seats for Ph.D. courses and students admitted in academic session 2020-21 in faculty of Agriculture is given as below.A total of 26 students admitted during academic session 2020-21 of which almost 50 per cent were female students (Table 2.6).

Table 2.6 Number of available seats and admitted students in Ph. D. Programme during 2020-21

Sl. No.	Subjects	BAU Seats	ICAR Seats	Total Seats	Total Admitted Students		
					M	F	Total
Agriculture Faculty							
1.	Agriculture Economics	02	00	02	00	02	02
2.	Agronomy	03	01	04	01	02	03
3.	Entomology	02	00	02	01	01	02
4.	Extension Education	01	01	02	00	01	01
5.	Horticulture (Olericulture)	03	01	04	02	02	04
6.	Horticulture (Pomology)	03	01	04	02	02	04
7.	Plant Breeding & Genetics	02	01	03	02	01	03
8.	Plant Pathology	02	00	02	01	01	02

9.	Soil Science & Agricultural Chemistry	04	02	06	04	01	05
Total		**22**	**07**	**29**	**13**	**13**	**26**

*one student from ICAR International Fellowship quota

Table 2.7aNumber of degree recipients in different subjects

Sl. No.	Degree Programme	Numbers of Students
A. Under Graduate Degree Programme		
1.	B.Sc. (Ag.)	168
2.	B. Sc. (Hort.)	17
Total		**185**
B. Post Graduate Degree Programme		
1.	M. Sc. (Ag.)	73
2.	Ph.D.	07
Total		**80**
Grand Total (A+B)		**265**

Table 2.7b List of Gold medalist of B.Sc. & M.Sc.programme

S. N	Name of Students	Name of College	Programme	OGPA
I. Undergraduate Programme				
1.	Mayank Kumar Sinha	BPSAC, Purnea	B.Sc. (Hons.) Agriculture	8.901
2.	EramArzoo	NCOH, Noorsarai	B.Sc. (Hons.) Horticulture	8.640
II. Master's Programme				
1.	Ankita Dubey	BAC, Sabour	M.Sc. (Ag.)	9.076

2.4. Placement cell

The primary goal of the Placement Cell is to assist students in advancing their careers. Not only does the cell provide job chances, but it also educates students on professional skills. This unit also assists students in their last year of university placement on campus. Through pre-campus placement discussions, the placement cell is also attempting to obtain feedback from potential recruiters.

RESEARCH

3. RESEARCH

3.1. About the Research at BAU, Sabour:

With a billion-plus mouths to feed, and counting, agricultural institutes have to be a natural winner in priority terms for a country like India, especially in the era of climate change, degradation of farmlands, increased soil salinity, due to drop in groundwater as well as pollution of surface water sources, more frequent droughts and so on. The research wing of Bihar Agricultural University (BAU), Sabour is involved in conducting basic, applied and adoptive research in the area of agriculture and allied sectors with the objective of developing technologies for sustainable the growth of agriculture in Bihar state. The research programmes are designed to bring technologies suited for various need of farming communities under three agro-climatic zones of Bihar viz., II, IIIA and IIIB. Development of farm technologies, improvement of various crops by the mean of conventional and advanced technology and regulation of policy research are few of the major activities that are being well taken care off. For smooth and efficient functioning of research programme, the university has constituted five research advisory groups viz., Crop Improvement (CI), Crop Protection (CP), Natural Resource Management (NRM), Product Development & Marketing (PDM) and Social Sciences (SS). Advances in gene discovery and genomics have led to the identification of several novel genes that provide excellent opportunities for effectively tackling problems of biotic/abiotic stresses, for enhancement of crop productivity, and for improvement of their nutritional quality. These scientific advances can facilitate us in accelerating pre-breeding germplasm enhancement for eventual crop improvement through effective molecular breeding. Along with basic research, genome sequencing and genomic studies for identification of useful genes, QTLs & validation of their function; developing transgenic crops and crop improvement through marker aided selection for tackling various abiotic & biotic stresses and quality traits are high priority towards crop improvement.

3.1.1. Research Projects and Funding Agencies:

The research activities in the university are being carried out with financial assistance from international collaborations, grants from national funding agencies, funding from state government and from public-private partnerships as well. During 2020-21 altogether university has carried a total of 12 international, 23 national, 276 state funded, 54 consultancy and 20 National network projects (Table 1).

Table 3.1: Research projects carried out during 2020-21.

Sl. No.	Funding Agency	No. of Projects			
		New Projects Granted	Ongoing Projects	Concluded Projects	Total
A. International Funding Agencies					
1	IRRI (STRASA, IRRAS)	01	04	-	05
2	ICRISAT	-	02	-	02
3	CIMMYT (HTMA)	-	01	-	01
4	IPNI	-	01	-	01
5	ACIAR	-	01	-	01
6	ACIAR (SRFSI)	-	01	-	01
7	UIUC	-	01	-	01
Sub Total (A)		**01**	**11**		**12**

B. **National Funding Agencies**					
1	DST	05	11	03	15
2	DBT	-	02	-	02
3	BARC	-	01	-	01
4	PPV&FRA (Govt. of India)	-	01	-	01
Sub Total (B)		**05**	**15**	**03**	**23**
C. State funded/Non- Plan Projects					
1	Govt. of Bihar/University **(C)**	**48**	**222**	**06**	**276**
D. Consultancy Projects					
1	Private Agencies **(D)**	**22**	**25**	**07**	**54**
E. Network Projects (AICRP)					
1	ICAR (AICRP)	01	18	-	19
2	ICAR (AINP)	-	01	-	01
Sub Total (E)		**01**	**19**	**-**	**20**
Grand Total (A+B+C+D+E)		**77**	**292**	**16**	**385**

3.2. Varieties and Technologies Developed:

After rigorous evaluation and discussion during research council meetings at various levels, the university has released one variety of brinjel (Sabour Krishnakali) during 2020-21 (Table 2). Similarly, university has also developed and released six farm technologies during 2020-21 (Table 3).

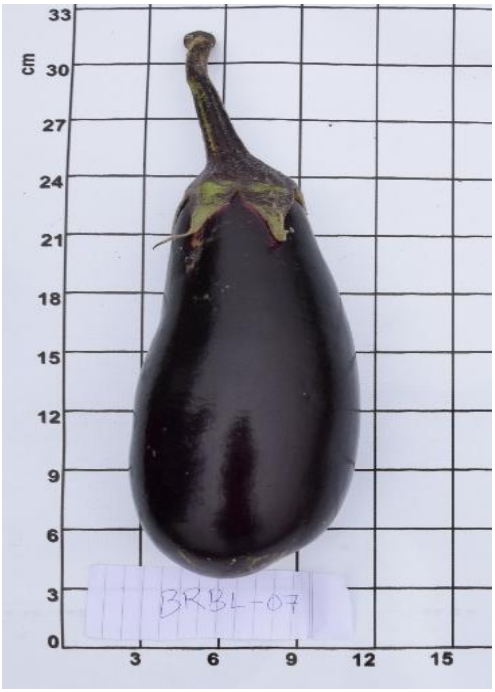
Table 3.2: List of varieties released during 2020-21.

Sl. No.	Name of Crop	Name of Variety	Year of Release from RCM
1	Brinjal	Sabour Krishnakali	2020

3.2.1. Salient features of varieties released during 2019-20

Sabour Krishnakali (Brinjal):

- Oblong dark purple fruit
- Very less seeded
- Suitable for main season (kharif-autumn-winter cultivation)
- Sowing time: mid June to July end, transplanting mid July to August end
- Average yield: 410 - 430 q/ha



3.2.2. Description of technologies released during 2020-21

i.Production technology of liquid *Rhizobium* biofertilizer

- The modified nutrient medium YEM-3 with composition containing Mannitol - 1.0 g, KH_2PO_4 - 0.5 g, $MgSO_4.7H_2O$ - 0.5 g, NaCl- 0.1 g, Yeast Extract- 2.0 g, Clucose-1.0g, Arabinose-0.5g, PVP (40)-20.0g, Trehalose-5mM, Fe-EDTA-200 µM, Glycerol - 6.0 ml, NH_4Cl - 0.6 g, $CaCl_2$ - 0.14 g, $FeCl_3$-0.84 g, NaOH-0.16 g, Distilled water -1000 ml.
- The composition should be autoclaved at 121^{O}C (15 psi) for 15 minutes.
- Inoculate autoclaved broth after cooling (28^{O}C-30^{O}C) with pure culture (5-10% of broth volume) having cells load cfu 5× 10^9 ml^{-1}.
- After 5-7 days the bacteria will reached stationary phase and hence, it is ready for final packaging

Product specifications

- Proposed name: Sabour *Rhizobium*
- Microorganism: *Rhizobium* spp.
- Density: 1 x 10^9cfu ml^{-1} (USP)
- Shelf Life: 12 months from manufacturing
- Recommended crops: Pulse crops

Method of application:

Seed treatment

Dose: Sabour *Rhizobium* @ 4-6 ml per kg seed mixed in 10% jaggery solution for seed coating followed by shade drying before sowing

ii. Production technology of liquid Phosphate Solubilizing Bacteria (PSB) biofertilizer

- The modified NB-2 with composition containing Beef Extract- 3.0 g, Peptone- 5.0 g, Glucose- 1.0 g, Arabinose- 0.5 g, PVP (40)- 20.0 g, Fe-EDTA-200µM, Glycerol-6.0 ml, NH_4Cl-0.6 g, $CaCl_2$- 0.14g, $FeCl_3$-0.84 g, NaOH- 0.16 g, Distilled water-1000ml.
- Whole composition should be autoclave at 121˚C (15 psi) for 15 minutes.
- Inoculate autoclaved broth after cooling (28^{O}C-30^{O}C) with pure culture (5-10% of broth volume) having cells load 5× 10^9cfuml^{-1}.

Product specifications

- Proposed name: **Sabour Phosphobacterin**
- Microorganism: *Bacillus* spp.
- Density: 1 x 10^9cfu ml^{-1} (USP)
- Shelf Life: 12 months from manufacturing
- Recommended crops: Cereals, pulses, oilseed crops, fruits and vegetable crops

Methods of application:

- **Seed treatment:** Sabour Phosphobacterin @ 4-6 mL per kg seed mixed in 10% jaggery solution for seed coating followed by shade drying before sowing
- **Seedling root dip:** Sabour Phosphobacterin @ 750 mL/ ha mixed with 100 L of water and seedling roots dipped for 45 mins. before transplanting.
- **Soil application:** Sabour Phosphobacterin @ 750 mL/ ha mixed with 50 kg of well decomposed compost/ cowdung manure and applied to the soil after 12 hrs (during seed sowing)

iii. Production technology of liquid *Azotobacter* biofertilizer

- The modified Waksman nutrient medium B-1 with composition containing Glucose- 10.0 g, NaCl- 0.20 g, $MgSO_4.7H_2O$-0.20 g, $FeCl_3$ (1%)- 2 drops, MnCl2 (1%% w/v)- 1.0 ml, Glycerol- 5.0 ml, PVP (40)- 20.0 g, Polyethylene Glycol (PEG)- 2.5 g, Sodium alginate- 1.0g, NaOH- 0.16 g, $FeCl_3$- 0.84g, Distilled water- 1000 ml.
- Whole composition should be autoclaved at 121°C (15 psi) for 15 minutes.
- Inoculate autoclaved broth after cooling (28^OC-30^OC) with pure culture (5-10% of broth volume) having cells load 5×10^9cfuml^{-1}.

Product specifications

- Proposed name: **Sabour Nitro Fix**
- Microorganism: *Beijerinckia*spp.
- Density: 1 x 10^9cfu ml^{-1} (USP)
- Shelf Life: 12 months from manufacturing

Recommended crops: Cereals, pulses, oilseed crops, fruits and vegetable crops

Methods of application:

- **Seed treatment**: Sabour Nitrofix @ 4-6 mL per kg seed mixed in 10% jaggery solution for seed coating followed by shade drying before sowing
- **Seedling root dip**: Sabour Nitrofix @ 750 ml/ ha mixed with 100 L of water and seedling roots dipped for 45 mins. before transplanting.
- **Soil application**: Sabour Nitrofix @ 750 ml/ ha mixed with 50 kg of well decomposed compost/ cowdung manure and applied to the soil after 12 hrs (during seed sowing)

iv. Co-Inoculation of liquid biofertilizers for N and P supplementation in Rice-wheat cropping system

- **Recommendation for N and P management using co-Inoculation of liquid Sabour Phosphobacterin& Sabour Nitrofix**
- **In Rice:** Seedling treatment with **liquid Sabour Phosphobacterin @750 ml ha^{-1} + liquid Sabour Nitrofix @750 ml ha^{-1}+ 75% (NP) + 100%K** significantly increased grain yield by 19.56% in rice when compared with 100% application of chemical fertilizers. It also showed higher available N, P and K in soil after application.
- **In Wheat:** Seed treatment is recommended with **liquid Sabour Phosphobacterin @750 ml ha^{-1} + liquid Sabour Nitrofix @750 ml ha^{-1}+ 75% (NP) + 100%K** significantly increased grain yield by 22.43% in whet when compared with 100% application of chemical fertilizers. It also showed higher available N, P and K in soil after application.

v. Abiotic stress tolerant *Trichoderma* sp. against soil born disease of lentil and chickpea

- This technology is suitable for pulses growing areas of all agro-climatic conditions in Bihar. At present no *Trichoderma* spp. has been released in our university as biological control agent having abiotic stress tolerant properties like high heat tolerant (up to 45 ºC), high salt concentration tolerant (1750 mM salt (NaCl) concentration) as well as high pH tolerant (pH up to 11).
- This isolates has the potential to tolerate heat temperature up to 45ºC, 1750 mM salt (NaCl) concentration, and pH up to 11 and also control the soil borne pathogens such as *Sclerotiumrolfsii*, *Rhizoctoniasolani* and *Fusarium oxysporum*. Field experiments indicate that BAU_T1 isolates has the potential to be used as biological control agents against soil borne diseases of lentil and chickpea as well as plant growth promoter.

Eco-friendliness:

- Since this technology requires application of native *Trichoderma* isolates, therefore it is eco-friendly.
- This technology will help to manage the collar rot disease (soil born disease) caused by *Sclerotiumrolfsii* of lentil and chickpea at bare minimum cost. This technology is eco-friendly and *Trichoderma* isolate used is also a native strain of Bihar.

vi. Management of weeds in Direct Seeded Rice

- Management of weeds in Direct Seeded Rice using Post-emergence application of Pyrazosulfuron @ 20g + Bispyribac sodium 20 g/ha at 20-25 DAS followed by 1 Hand weeding at 35-40 DAS.
- This technology save 20-30% water requirement, saves fuel, labour cost, irrigation time, reduce cost for land preparation, significant increased weed control efficiency, timely sowing of rice, risk of insects- pest was reduced and harvest the rice crop 7-10 days earlier than other methods.
- As a result, higher yield and profit was obtained at low cost. DSR emits low amount of green house gases like methane and carbon dioxide. DSR can be adopted both in irrigated and rainfed ecosystems. It gives higher profitability (B: C ratio 2.34) as compared to normal transplanted rice (B: C ratio 2.13).

Table 3.3: List of technologies released during 2020-21.

Sl. No.	List of Technologies	Year of Release
I.	Production technology of liquid *Rhizobium* biofertilizer	2020
II.	Production technology of liquid Phosphate Solubilizing Bacteria (PSB) biofertilizer	2020
III.	Production technology of liquid *Azotobacter* biofertilizer	2020
IV.	Co-Inoculation of liquid biofertilizers for N and P supplementation in Rice-wheat cropping system	2020
V.	Abiotic stress tolerant *Trichoderma* sp. against soil born disease of lentil and chickpea	2020
VI.	Management of weeds in Direct Seeded Rice	2020

3.2.3.1. Crop Improvement:

A. Rice Improvement Programme:

3.2.3.1.1. All India Coordinated Research Project (AICRP) Rice:

- **Trial: AVT- 2 ETP:**
  - D/S: 13-7-20120, D/T: 6-8-2020, Plot size: 10.08 LC- Sabour Deep, No. of Entries =17, No. of Replications- 3
  - Yield differences: Significant [CD(0.05) = 729, CV(%) =8.77]
  - 10 entries were found to be significantly superior to the local check S. Deep (3953 kg/ha)
  - Top 3 entries = Entry no. 3517 (6472 kg/ha), 3512 (6429 kg/ha), 3516 (5807 kg/ha)
- **Trial: AVT-1 ETP:**
  - D/S:21-7-2020, D/T: 12-8-2020, Plot size: 7.68 sqm LC:-Sabour Deep, No. of Entries =21, No. of Replications- 3
  - Yield differences: significant [CD(0.05) = 655, CV(%) =9.90]
  - 15 entries statistically superior to the local check S. Deep (2940 kg/ha)
  - Top 3 entries: entry no. 3615 (5309 kg/ha), 3602 (5215 kg/ha), 3609 (4992 kg/ha)
- **Trial: AVT-2 IM:**
  - D/S :21-7-2020, D/T: 14-8-2020, Plot size: 10.64 sqm, LC- Rajendra Sweta, No. of Entries =15, No. of Replications- 3
  - Yield differences: significant [CD (0.05) = 654, CV(%) =11.67]
  - 9 entries significantly surpassed the local check R. Sweta (2663 kg/ha)
  - Highest yield: entry no. 4006 (4386 kg/ha)
- **Trial: AVT-1 IM:**
  - D/S :29-7-2020, D/T: 18-8-2020, Plot size: 5.76 sqm, LC- Rajendra Sweta, No. of Entries =34, No. of Replications- 3
  - Yield differences: significant [CD(0.05) = 863, CV(%) =12.46]
  - 27 entries significantly surpassed the local check R. Sweta (2376 kg/ha)
  - Highest yield: entry no. 4108 (6279 kg/ha)
- **Trial: IVT-IM:**
  - D/S : 7-8-2020, D/T: 26-8-2020, Plot size: 7.2 sqm, LC- Rajendra Sweta, No. of Entries =64, No. of Replications- 3
  - Yield differences: significant [CD(0.05) = 625, CV (%) =13.68]
  - 21 entries recorded significantly superior yield over the local check R. Sweta (1986 kg/ha).
  - Highest yield: entry no. 4213 (3917 kg/ha)
- **Trial: AVT-1 IME:**
  - D/S :29-7-2020, D/T: 19-8-2020, Plot size: 3.84 sqm, LC- Rajendra Suwasini, No. of Entries =42, No. of Replications- 3
  - Yield differences: significant [CD(0.05) = 929, CV (%) = 12.75]
  - 38 entries recorded significantly superior yield over the local check R. Suwasini (1117 kg/ha).
  - Highest yield: entry no. 3821 (6771 kg/ha)
- **Trial: IVT-L:**
  - D/S : 7-8-2020, D/T: 29-8-2020, Plot size: LC- Rajendra Mahsuri-1, No. of Entries =60,No. of Replications- 2
  - Yield differences: Significant [CD(0.05) = 741, CV(%) =21.24]

- ❖ None of the test entries could significantly surpassed the LCRajendra Mahsuri 1 (3030 kg/ha)

➢ **Trial: AVT-1 Biofort:**

- ❖ D/S :21-7-2020, D/T: 10-8-2020, Plot size: 7.04sqm, No. of Entries =23, No. of Replications- 3
- ❖ Yield differences: significant [CD(0.05) = 659, CV(%) =11.19]
- ❖ Top 3 entries: 5405 (4924 kg/ha), 5412 (4819 kg/ha) and 5403 (4491 kg/ha)

3.2.3.1.2. State Multi-Location Trials:

➢ **Trial: MLT-Early:**

- ❖ D/S : 02/7/2020, D/T : 20/7/2020, Entry : 20 Plot size - 5 x 2 = 10 sqm, Rep : 3, LC : Sahbhagi Dhan, R. Suwasini
- ❖ Yield differences: significant [CD (0.05) = 708, CV(%) =9.39]
- ❖ 14 entries were found to be significantly superior to the check R. Suwasini (3301 kg/ha)
- ❖ Top 3 entries: BRR0053 (5179 kg/ha), Sel 44 (5027 kg/ha) and BRR0020 (4940 kg/ha)

➢ **Trial: MLT-Aerobic:**

- ❖ D/S : 30/6/2020 Entry : 8 Replication : 3 Plot Size- 4.6x 2 = 9.2 sqm
- ❖ Yield differences: significant [CD (0.05) = 431, CV(%) =10.91]
- ❖ Top 3 entries: Entry 1 (3117 kg/ha), Entry 8 (2408 kg/ha) and Entry 5 (2406 kg/ha)

➢ **Trial: MLT-Medium:**

- ❖ DS: 16/6/2020, DT: 13/7/2020, Entry: 18, Plot size- 4.2 x 2.4= 10.08, Replication: 3, LC: R. Sweta, Sabour Shree
- ❖ Yield differences: significant [CD(0.05) = 630, CV(%) =776]
- ❖ None of the test entries could significantly surpassed the best check S. Shree (5459 kg/ha).
- ❖ Top 2 entries: BBR0136 (5764 kg/ha), BRR0149 (5498 kg/ha)

➢ **Trial: MLT-Late:**

- ❖ DS: 11/6/2020, DT: 6/7/2020, Entry: 17, Plot size- 5 x 2= 10 sqm Replication : 3, LC : Swarna, R. Mahsuri-1
- ❖ Yield differences: significant [CD(0.05) = 839, CV(%) =7.52]
- ❖ None of the test entries could significantly surpass the best check R. Mahsuri-1 (7161 kg/ha)
- ❖ Four entries including highest yielders BRR 0150 (7965 kg/ha) and BRR 0148 (7807 kg/ha) could numerically surpassed the best check R. Mahsuri-1.

➢ **Trial: MLT-Biofort:**

- ❖ D/S: 29/6/2020, D/T : 18/7/2020, Entry : 7, Replication : 3, Plot size - 4.6 x 2.2 = 10.12
- ❖ Yield differences: Significant [CD(0.05) = 434, CV(%) =6.86]
- ❖ Highest yielder: entry no. 02 (4563 kg/ha)

3.2.3.1.3. DBT funded Direct seeded rice (DSR) project

- ❖ DS: 24/6/2020, Entry: 50, Replication: 2, Plot Size: 1.2 mX 2.6 m
- ❖ Yield differences: significant
- ❖ Range of yield: 1329 kg/ha to 5783 kg/ha
- ❖ Thirty entries were found to have significantly higher yield over the best check Sahbhagi Dhan (2000 kg/ha)

3.2.3.1.4. DBT funded Haplo NILS:

➢ **Control & Drought:**

- ❖ Control: DS: 27/6/2020, Entry - 490, Design- Augmented, Plot Size : 3.0 m x 0.6m =1.8 sqm

- ❖ Stress: DS: 14/07/2020, Entry - 490, Design- Augmented, Plot Size : 2.4 m X 0.8 m = 1.92 sqm
- ❖ Range of yield (kg/ha): Control: 167 to 7944 (ARC 11430 B::IRGC 14567-1), Stress : 73 to 5740 (ARC 7255::IRGC 12343-2)
- ❖ Three entries were having high yield both in control & stress condition: DILBAKSH::IRGC 74738-1, H 15-23-DA::C1, CHNNOR::IRGC 67485-1

➢ **Control & Submergence:**

- ❖ Control: DS: 02/082020, Entry - 340, Design- Augmented, Plot Size: 2.0 m x 1.0m = 2.0 sqm
- ❖ Stress: DS : 02/08/2020, Entry - 340, Design- Augmented, Plot Size : 2.0 m X 0.6 m = 1.2 sqm
- ❖ Range of yield (kg/ha): Control: 110 to 5140 (C 662083::IRGC 62101-1), Stress : 0 to 3910 (KHAO' HAWM::IRGC 78257-1)
- ❖ Nineteen entries showed more than 50% survival under submergence
- ❖ Highest survival: 80 % (IR 77390-1-6-4-19-1-B::IRGC 117303-1)

3.2.3.1.5. IRRI funded AGGRi-Alliance:

➢ **Control & Stress:**

- ❖ Control: DS: 12/6/2020, Entry - 380, Design- Augmented, Plot Size: 2.8m X 1.8m
- ❖ Stress: DS: 07/07/2020, Entry - 380, Design- Augmented, Plot Size: 2.2m X 1.4m
- ❖ Range of yield (kg/ha): Control: 1131 to 7198 (IR108031-B-B-B-2-B-B), Stress : 292 to 5045 (IR11A293)
- ❖ Six entries were having high yield both in control & stress condition
- ❖ (IR103399-B-B-2-3, IR103421-B-B-5-3, IR93339:39-B-6-5-B-B-B-47, IR06A150, IR 127339-10-1-1-1, TTB 1348-1-1)

3.2.3.1.6. Harvest Plus:

➢ **MET:**

- ❖ DS: 21/7/2020, DT: 11/8/2020, Entry: 21, Plot size- 2.0 x 1.0 = 2 sqm, Replication: 3, No LC
- ❖ Yield differences: significant [CD (0.05) = 628; CV (%) =12.93]
- ❖ Range: 1977 to 4210 Kg/ha (Ent. No. 14)

➢ **Donors:**

- ❖ DS: 21/7/2020, DT: 11/8/2020, Entry: 30, Plot size- 2.0 x 1.2 = 2.4 sqm, Replication: 2, No LC
- ❖ Yield differences: significant [CD (0.05) = 735; CV (%) =14.85]
- ❖ Range: 475 to 4917 Kg/ha (Deharadoon Basmati-64-1)

➢ **MET-1:**

- ❖ D/S : 02/8/2020, D/T : 15/8/2020, Entry : 55 Plot size – 3.2 x 1.6 = 5.12sqm, Design : Augmented LC : R. Sweta, R. Suwasini
- ❖ Yield Range: 605 to 5105 kg/ha
- ❖ Top 3 entries: HL19WS-33B-252 (5105 kg/ha), HL19WS-33A-60 (4576 kg/ha) and HL19WS-33B-127 (4441 kg/ha)

➢ **MET-2:**

- ❖ D/S : 3/8/2020 DT: 28/08/2020 Entry : 30 Design : Lattice, Plot Size- 2 x 1.6 = 3.2 sqm
- ❖ Yield range: 315 to 4619 kg/ha
- ❖ Top 2 entries: IR 108198-1-1-1-2 (4619 kg/ha), IR 108194-9-1-2-1 (4260 kg/ha)

3.2.3.1.7.State Plan Projects:

i. Breeding for Early and Medium Maturity Rice Hybrids Seed Multiplication of promising hybrids:

- ❖ Seed of 10 Hybrids was multiplied for evaluation under state MLTs
- ❖ Staggering: A-line: 3 (-7 days, 0 day, + 7 day); R-line: 1 (0 day)
- ❖ Quantity of hybrid Seed obtained (please see table below):

Name of the hybrid	Maturity	Seed obtained (g)
BRH-1	Early	850
BRH-2	Early	1750
BRH-5	Early	4540
BRH-9	Medium	4006
BRH-11	Medium	1402
BRH-15	Medium	2507
BRH-16	Medium	610
BRH-17	Medium	760
BRH-18	Medium	803
BRH-19	Medium	3530

➢ **CMS conversion:**

- ◊ BC_5F_1s-3 populations back-crossed to the respective maintainer lines
- ◊ BC_6F_1 developed
- ◊ Pair crosses were made (please see table below)

S. No.	Designation	Gen.	GT	DFF	PHT (cm)	Cross seed (g)
1	BC_5N20-1	BC_5F_1	MB	96	100	110
	BC_5N20-2	P	MB	96	105	
2	BC_5N20-3	BC_5F_1	LS	91	97	120
	$B5_4N20$-4	P	LS	90	105	
3	BC_5N20-5	BC_5F_1	LS	92	99	130
	BC_5N20-6	P	LS	89	103	

➢ **AYT trial (evaluation of B x R lines):**

- ◊ 22 BxR lines of F_6 generation were evaluated (please see table below)

Entry No.	Name	DFF	Yield (kg/ha)
1	LSF620AT-1	112	6982
11	MSF620AT-2	110	7470
13	MSF620AT-4	108	6704
18	SXT20AT-1	107	7600

C1	R. Mahsuri-1	110	6178
C2	BPT5204	109	5689
C3	Sahbhagi Dhan	87	4663
	CD (5%)		921
	CV %		8.10

- **Genetic material developed:**
  - 80 BxB lines in F6 generation
  - 112 RxR lines in F6 generation
  - 55 BxR lines in F6 generation
- **Other assignments:**
  - F_1 validation for 4 cross combinations: Sabour Surbhit × TKM-6, Rajendra Sweta × Manosarbar, RM-1× WA-9, RM-1× Patnai 23 (Salinity tolerant)
  - BC_3F_1 of Sita X Nagina 22 developed
  - SPS was done in segregating generations (F2-F4)
  - Total 53 cross combinations were made
  - Nucleus seed of rice varieties was produced

ii. Marker Assisted Breeding for Anaerobic Germination in Rice:

- **Screening of F2 population for anaerobic germination:**
  - Submergence for 10 days
  - Survival at 20-25 DAS
  - Screening of 1270 F_2 plants of 3 crosses R. Mahsuri-1 x OYT181P9, R. Mahsuri-1 x OYT181P11 and R. Mahsuri-1 x OYT181P31
  - 47 plants (13+8+26) were able to germinate under anaerobic condition
  - All the plants were replanted in the field
  - 6 plants (2 from each cross) were back-crossed with RM-1 (BC_1F_{1s} were produced)
  - DNA of the plants was isolated

No. of Cross combination	Approx. no. of F_2 plants	Total no. of F_2plants selected
22 (RM-1 x Donors for *AG1*) (R. Sweta x Donors for *AG1*)	25000	253

iii. Marker assisted forward breeding approach for improved Aromatic short grain Rice of Bihar:

- F_{1s} plants obtained by crossing Sonachur x R. Sweta, Champaran Basmati x Rajendra Sweta and Burma Bhusi x BPT 5204 and were validated by SSR markers.
- Selection for semi-dwarf and early maturing segregants in F_2 population of Hafsal x BPT5204, Malbhog x BPT5204, Shyamjira x Rajendra Sweta, Karibank x BPT5204, Kishanganj Basmati x BPT5204 and Jasua x BPT5204 were done.
- Presence of *badh2* (for aroma) and *sd1 (*for semi-dwarfism*)* gene were in selected F_2 plants was confirmed on molecular basis.

- Some validated F_{1s} of Sonachur x R. Sweta were backcrossed with Sonachur

iv. Marker assisted breeding for semi-dwarf Katarni rice

- Generation advancement and selection for semi-dwarf and early maturing backcross families were done.
- Presence of badh2 (for aroma) and sd1 (for semi-dwarfism) gene were in selected backcross families was confirmed on molecular basis.
- The homozygous and Katarni type semi-dwarf early maturing families were selected for further yield trial.
- The plant height of selected homozygous families ranged from 110-125 cm
- Days of 50% flowering of selected homozygous families ranged from 115 to 120 days

➢ **Establishment of DNA Fingerprinting Facility**

- The different hybrids under Private Hybrid Testing of Paddy programme were validated through SSR markers.
- DNA samples of different entries of Maize under Private Hybrid Testing programme were isolated. The molecular analysis will be done after getting information of the markers from the concerned agencies.
- Most of required equipments/instruments and consumables under DNA Fingerprinting facility have been/being procured through GeM portal and through Tender process.
- The DNA finger printing laboratory/facility is being developed at Lab 2 under Department of Plant Breeding and Genetics.

➢ **Development of Katarni rice project**

- Subsidy on basic seed production:A subsidy of 22% was given to 110 farmers of Katarni in different blocks of Bhagalpur, Munger and Banka region.
- Distribution of basic seed:About 65 Qtls Katarni seed of the Farmers was procured from different Katarni growers of different villages at Jagdishpur, Shahkund and Tarapur Blocks during Kharif -2019. The procured seeds were distributed to the Famers after drying and processing at DSF, BAU Sabour and payment to the concerned farmers was made for the supply of seed.

➢ **Other activities:**

- F_2 seeds of Sabour Deep x TKM-6 (YSB resistance) obtained
- BC_1F_1 seeds of Sabour Deep x TKM-6/Sabour Deep obtained
- Germplasm maintenance: Total: 121; Aromatic: 16, Non- aromatic: 105
- A medium and long term germplasm repository was established in Lab 3 under RKVY-RAFTAAR scheme on “Promotion of Katarni rice.

v. Marker Assisted Gene Introgression (MAGI) for Bacterial Leaf Blight (*Xanthomonasoryzaepv. oryzae*) and Blast (*Magnaporthegrasea*) Resistance in Elite cultivars ofRice (*Oryzasativa* L.) of Eastern Indo-Gangetic Plain Zone:

- In year 2020-21, the lines carrying resistance genes for bacterial leaf blight (BLB) and blast diseases *i.e.,*IRBB-66 (*Xa4, xa5, Xa7, xa13* and *Xa21*), PR 114 (*Xa38*), CRMS 31B*IR64MAS (IRBB-66 (*Xa4, xa5,*

xa13 and *Xa21*), RP Bio 226 (IRBB-66 (*xa5, xa13* and *Xa21*), Tetep (*Pi1* and *Pi54*) and C101A51 (*Piz5*) were evaluated along with the newly generated F_1s and recurrent parents for BLB and blast disease resistance under field condition in RBD at research farm of VKSCoA, Dumraon and ICAR-NRRI, Cuttack, Odisha during rainy (*Kharif*), 2020 and summer season (*Rabi*), 2021. Further, these lines were inoculated BLB and Blast diseases in natural condition using *Xoo* inoculums and blast pathogen *isolateLB-TN-2*(prevalent in Zone IIIB) at VKSCoA, Dumraon.

- Validation of molecular screeningresultsof these lines against resistance and susceptible gene for BLB and blast diseases through microsatellite (SSR) markers namely,RM122 *(xa5),* xa13p (*xa13*), pTA 248 (*Xa21*), RM224 (*Pi1)*, RM206 and RM 246 (*Pi54),* RM 527 and RM140 (*Piz5*) tightly linked markers.
- The heterozygosity test was performed using flanking gene linked SSR markers, RM122 *(xa5),* xa13p (*xa13*), pTA 248 (*Xa21*), RM224 (*Pi1)*, RM206 and RM 246 (*Pi54),* RM 527 and RM140 (*Piz5*)to assess the resistance and susceptible plants of F_1 hybrids (R.Mahsuri-1*IRBB66 and R.Mahsuri-1*Tetep) at VKSCoA, Dumraon.
- After the result obtained from heterozygosity assessment of F_1 hybrids ofeight independent crosses, R. Mahsuri × IRBB66, R. Mahsuri × PR 114, R. Mahsuri × Tetep,R. Mahsuri × C101A51, R. Sweta × IRBB66, R. Sweta × PR 114, R. Sweta × Tetep and R. Sweta × C101A51, backcrosseswere made to transfer the gene*xa5, Xa7, xa13, Xa21; Xa38; Pi1*, *Pi54* and *Piz5(Pi2t),* respectively, into Rajendra Mahsuriatexperimental field of Veer Kunwar Singh College of Agriculture, Dumraon (Buxar), Bihar, India.
- BC_1F_1s of individual crossesi.e.,R. Mahsuri-1 × IRBB66, R. Mahsuri × PR 114, R. Mahsuri × Tetep,R. Mahsuri × C101A51, along with the donors and recurrent'sparents were grown during *Rabi* 2021 in compact family randomized block design in three replications on three dates of sowing at ICAR-National Rice Research Institute, Cuttack, Odhisa.

vi. Identification of desirable donors and creation of mapping population for biotic stresses (false smut and others) resistance in rice through traditional and biotechnological approaches:

- During 2020-21, the resistant lines for blast, sheath blight, bacterial blight and false smut diseases were procured from different centres of India i.e., C101A51 (*Piz5*), Tetep (*Pi1,Pi54, qSBR11.1, qSBR11.2 and qSBR11.3*), CR-1014, CRMS 31B*IR64MAS (*Xa4, xa5, xa13* and *Xa21*), IRBB-66 (*Xa4, xa5, Xa7, xa13* and *Xa21*), RP Bio-226 (*xa5, xa13* and *Xa21*), PR 114 (*Xa38*), Ranjeet, IR-28 and Mayurkantha, *etc*.
- These lines were sown in three different dates under RBD at experimental field of VKSCoA, Dumraon. Rajendra Mahsuri-1, Rajendra Sweta and MTU-7029 are the most susceptible variety of rice for false smut, bacterial leaf blight and sheath blight disease as per the survey of farmer's fields in changing climatic condition or upcoming of slightly continuous or heavy rain at the time of flowering.
- The virulentisolate exists in Indo-Gangetic plains of Bihar for sheath blight, bacterial leaf blight (*XOO*) and blast were isolated and inoculated using blast pathogen *isolateLB-TN-2, Xoo* inoculums and Sclerotia (AG1) of *Rhizoctoniasolani*(which is prevalent in Zone IIIB) in the resistance and susceptible lines in the natural condition and lines showed highly resistant and highly susceptible reaction were selected.
- After the result obtained from genotyping and phenotyping, previously generated F_1s of individual crosses i.e., R. Sweta × PR 114, R. Sweta × Tetep, R. Sweta × C101A51 R. Mahsuri × IRBB66, R. Sweta x IR28, R. Mahsuri × PR 114, R. Mahsuri × Tetep, R. Mahsuri × C101A51, R. Sweta × IRBB66 were grown

along with the susceptible and resistant parents during *Kharif* 2020 in compact family randomized block design in three replications on three dates of sowing at VKSCoA, Dumraon. These F_1s were also screened through microsatellite (SSR) markers namely,RM122 *(xa5),* xa13p (*xa13*), pTA 248 (*Xa21*), RM224 (*Pi1)*, RM206 and RM 246 (*Pi54),* RM 527 and RM140 (*Piz5*) tightly linked markers and further selfed to generate the segregating populations during *Kharif*, 2020.

vii. Dissection of molecular physiology of cold stress response in rice (*Oryzasativa*) and identification of cold stress related lncRNAs

✓ Samples of rice seedlings of control and cold stress treatment were collected for NextGeneration Sequencing based RNA-Seq of control and cold stress treated rice seedlings.

3.2.3.1.7. Testing of Private Paddy Hybrids:

➢ During *Kharif* 2020-21,20 hybrids received from 11 different seed companies were evaluated along with 5 checks including 2 varietal checks, namely Rajendra Sweta (medium maturity) and MTU 1010 (mid-early maturity), and 3 hybrid checks namely Arize 6444 Gold, 27P31 (both medium maturity) and Arize 6129 (mid-early maturity).

➢ **Over the locations (Pooled) results:**

❖ Pooled analysed data also showed significant yield differences among the test entries.

❖ Average of pooled yield ranged from 3990 kg/ha to 7176 kg/ha.Among test hybrids, the hybrid KPH-412 (80 days) and INH17119 (105 days) were recorded maximum and minimum days to the 50% flowering, respectively. For plant height, hybrids namely ARRH-13551 (Ankur-7576) (133 cm) and ADV-8100 (111 cm) were found to be the tallest and the shortest one respectively among all the test entries.

❖ Among the test hybrids, the highest grain yield was recorded for KPH-7425 (7176 kg/ha) whereas the lowest yield was recorded for KPH-412 (3990 kg/ha).

❖ All the test hybrids, except KPH-412 (3990 kg/ha) ADV-8100 (4604 kg/ha), recorded more than 10% of yield superiority over the varietal check R. Sweta (4062 kg/ha).

❖ Nine hybrids could surpassed early maturing hybrid check Arize 6129 Gold (5759 kg/ha) with 5% or more yield superiority while hybrids namely MP3030 (6812 kg/ha), AZ8433DT (6933 kg/ha), KPH-7425 (7176 kg/ha) and ADV-8744 (7019 kg/ha) recorded similar or positive yield superiority over both of the medium maturing hybrid checks Arize 6444 Gold (6838 kg/ha) and 27P31 (6921 kg/ha).

3.2.3.1.8. Seed Production:

➢ Nucleus and Breeder seed of 14 Varieties was produced during *Kharif*2020-21.

Rice Biotechnology:

i. Introgression of QTL(s) for increasing grain Dimethylarsenic acid (DMA) concentration in Swarna-Sub1 and Rajendra Mahsuri-1 for effective mitigation of Arsenic

❖ Two rice landraces ofPadi Perak (Accession No. JP NO. 74372 and JP NO. 76870) were imported from NARO-Genebank, Japan.

❖ Following crossing were made to transfer the QTLs from Padi Perak to recipient rice varieties (Rajendra Mahsuri-1 and Swarna Sub-1).

S. No.	Cross combination	Total no. of F_1 harvested

1.	Rajendra Mahsuri-1 x Padi Perak(JP NO. 74372)	42
2.	Rajendra Mahsuri-1 x Padi Perak (JP NO. 76870)	37
3.	Swarna Sub-1 x Padi Perak(JP NO. 74372)	39
4.	Swarna Sub-1 x Padi Perak(JP NO. 76870)	47

◊ F_1 plants were screened using SSR marker and BC_1F_1 crosses were made. Following are the details:

F_1 Cross	No. of True F_1 plants	BC_1F_1
F_1#2	12	08
F_1#4	05	04
F_1#5	04	02
F_1#8	02	02
F_1#9	15	08
F_1#10	12	06
F_1#11	02	02

❖ Pot experiment was conducted by sowing 59 local rice germplasms in soil contaminated with arsenic. Out of 59 rice germplasms tested, 12 rice germplasms (Jasua, FR-13A, O. nivara Ac no 10297, O. nivara Ac no 10298, O.rufipogan Aura 10284, Halsul, Vermabheri, Kalabasmar, Savitri Sub-1, BaitalPakiya, Kali Kumud& RM- Mutant-2) didn't able to form any seeds.

❖ Highest arsenic accumulation in rice seeds were observed in Nambokra.

➢ **Germplasm maintenance:**43germplasms were maintained for utilization in breeding programmes:

➢ Fifty mutant (gamma irradiated) of Rajandra Mahsuri-1 (40) and Rajendrakasturi (10) rice germplasms were maintained. These mutants showed high drought tolerance in field condition. These mutants were generated in DAE-YSRA project obtained from BRNS, Govt. of India.

ii. SNP identification and marker assay development for high-throughput selection in rice

➢ GBS analysis was performed on 95 rice germplasm

➢ GBS analysis has enabled to identify more than 50,000 SNPswhich were used in association analysis

➢ Haplotype analysis leads to identification of SNP markers for grain length, grain width, drought (reproductive), salinity, gall midge, BPH, blast and bacterial leaf blight

➢ Phenotypic characterization of 168 rice germplasm was done for association analysis

➢ The association analysis was performed by GLM and MLM approaches for 12 traits.

➢ The identified putative linked SNP markers need to be cross validated on large panel of germplasm and segregating population for further utilization as functional marker.

iii. Marker assisted introgression of *Sub1* locus to transfer submergence tolerance in rice:

➢ The $BC_2F_2$and BC_3F_1seeds obtained from two backcross population Rajendra Sweta x Swarna Sub1 and Sabour Shree x Swarna Sub1were sown to generate the BC_2F_3 and BC_3F_2 populations.

Foreground selection was performed to identify the plants with *Sub1* QTL in $BC_2F_2$and BC_3F_1progenies using marker linked to the *Sub1*QTL.The plants that are homozygous (BC_2F_2)/heterozygous(BC_3F_1) for the foreground marker were selected for recombinant selection using flanking markers. Finally, the plants resulted from foreground; recombinant and phenotypic selection were used for background selection.Background selection was done and the top ten plants with higher percentageof recurrent parent genome were selfedfor the development of $BC_2F_3$and BC_3F_2 populations. The developed lines will be evaluated for submergence,agronomical and grain qualitytraits in *Kharif* 2020.

iv. SNP identification and marker assay development for high-throughput selection in rice:

- Phenotypic characterization of 168 rice germplasm was done for association analysis study.
- GBS analysis was done for the panel of 95 diverse rice germplasm and more than fifty thousand SNPs were identifiedacross each1-12 rice chromosomewhich was used in association analysis for 12 traits.
- Haplotype analysis leads to identification of SNP markers for grain length, grain width, drought (reproductive), salinity, submergence, gall midge, BPH, blast and bacterial leaf blight.
- The informative SNPs will be used to develop KASP genotyping assays.

3.2.3.1.10. Rice Physiology:

i. Analysis of leaf area development and carbohydrate reserve of drought tolerant rice genotypes:

- In conclusion, it can be discussed and suggested that every leaves have their own purpose specific to time duration and type of stress exposure.
- For reproductive drought stress first leaves in contrast from the normal situation plant are more seemingly to contribute in stress defending by increasing various osmolytes like soluble sugars. Whereas third leaves and second leaves are rather resulted as better contribution in sink development during reproductive stress and further to grain yield in rice.
- The data have been validated with basic comparison of crops exposed to in both situations (field and Rain out shelter) and therefore project may be compiled and submitted for RPF –III.

3.2.3.1.11. Rice Research Sub Station, Tilondha (Banka)

- Seed production of popular cultivars of rice (R. Sweta, Sabour Ardhjal, Katarni),
- Conducted Multi evaluation trial-2 (STRASSA), and State varietal trials of Paddy.
- 660 germplasm of rice are maintained.
- Breeder Seed and Foundation Seed Production of recommended varieties of different crops in both Kharif and Rabi season

B. Wheat Improvement Programme:

- A total of 28 experiments were conducted including station trials, state varietal trials, AICRPs, national and international nurseries. Four (4) entries were submitted to National Initial Varietal Trials (NIVTs); six (6) entries were submitted under state varietal trials and 25 new entries were submitted to IPPSN.
- 744 entries from national and international sources in various nurseries were evaluated.
- Under hybridization programme, 397 fresh cross combinations were made with parents having desired agronomic characteristics and resistant to major diseases. Various segregating generations were also

grown and 96 desirable single plants and 742 desirable progeny rows were selected for further evaluation and selection.

Significant Achievement:

- Genotypes entered in NIVTs: BRW 3895 and BRW 3902 (NIVT-1B), BRW 3897 (NIVT 3A), BRW 3901 (NIVT 5A)

Trials Conducted

1.	Trials (Coordinated) :	06
2.	Nurseries (Coordinated):	06
3.	CIMMYT Nurseries:	02
4.	Barley Trial (Coordinated):	02
5.	Station Trials:	03
6.	State Varietal Trials:	02
7.	Private Wheat Testing:	01
8.	Biofortification experiments	03
8.	Evaluation of advance lines under timely and late sown condition	
9.	Fresh Crosses made	397 Combinations
10.	Handling of Segregating Generations	F_2 - F_6

The details of experimental findings of our own experimental programme are given below-

- **Station Trial under timely sown restricted irrigated condition** was conducted with 27 genotypes including two checks HI 1612 and BRW 3723 in RBD with three replications. Significant yield differences were observed among the genotypes. Genotypes BRW 3889, BRW 3887, BRW 3881 and BRW 3901 significantly superior to better check HI 1612 (33.94 q/ha). **BRW 3901 has been entered in NIVT-5A.**
- **Station Trial** (TS-IR) was conducted with 27 entries including two checks viz., HD 2967 and Sabour Samriddhi (BRW 3708) in RBD with three replications. Yield differences among the genotypes were found to be significant. The genotype BRW 3902 recorded the highest yield (51.17 q/ha) followed by BRW 3895 (50.49 q/ha) and check variety HD 2967 (48.63 q/ha). **Based on the performance of yield & disease reaction both these genotypes i.e. BRW 3895 and BRW 3902 have been entered in NIVT (TS-IR).**
- **Station Trial under late sown irrigated condition** was conducted with 27 entries including two checks viz., BRW 934 and HI 1563 in RBD with three replications. Significant yield differences were observed among the genotypes. Highest grain yield was recorded with the genotype BRW 3897 (42.57 q/ha) followed by BRW 3887 (41.10 q/ha) and the check variety HI 1563 (38.15 q/ha). BRW 3897 was significantly superior to the check varieties HI 1563 and BRW 934. **Based on the yield performance and disease reaction BRW 3897 has been enteredinNIVT (LS-IR).**
- **State Varietal Trial** (TS-IR) was conducted with 14 genotypes in RBD with three replications. The genotype SVT-TS-21 recorded the highest yield (46.86q/ha) followed by SVT-TS-22 (44.17q/ha) and SVT-TS-24 (43.58q/ha).
- **State Varietal Trial** (LS-IR) was conducted with 9 genotypes in RBD with three replications. The genotype SVT-LS-9 recorded the highest yield (38.24q/ha) followed by SVT-LS-2 (37.68 q/ha) and SVT-LS-1 (36.45q/ha).
- **Harvest Plus yield trial (HPYT):** 10th HPYT experiment was conducted using 50 biofortified genotypes in two replications under timely sown irrigated conditions. Yield of two genotypes HPYT 411 (36.40) and

HPYT 417 (35.45) were numerically higher than the check BRW 3708 (35.22). However, grain zinc content was statically higher in HPYT 411 (32.85 mg/Kg) than the check entry BRW 3708 (20.68 mg/kg).

Evaluation of biofortified genotypes with soil zinc application

- A set of 18 biofortified genotypes from 9th HPYT including a check BRW 3708 was evaluated in three replications under timely sown irrigated conditions. There was significant difference among the test genotypes but none of the biofortified entries were superior in grain yield than the BRW 3708 (41.11 q/ha). Significant variation for grain zinc was observed. All the biofortified entries were significantly higher in grain zinc than the check BRW 3708 (31.18 mg/kg). The genotype 9th HPYT 411 was found with highest grain zinc 54.44 mg/ha followed by 9th HPYT 412 (50.44 mg/ha) and 9th HPYT 448 (48.37 mg/ha).

C. Maize Improvement Program:

- Submitted 8 (BRM17-1, BRM17-2, BRM17-3, BRM17-4, BRM17-5, BRM17-6, BRM17-7and BRM17-8) hybrids for evaluation in AICRP, NIVT. Hybrid BRM 17-3 yielded 10009 kg ha^{-1} and stand 1st rank in NWEPZ (Z2) Medium maturity. Hybrid BRM 17-4 yielded 9684 kg ha^{-1} and stand 2nd rank in NWEPZ (Z2) Medium maturity. Both of them promoted to AVT I Medium maturity. Hybrid BRM 17-6 yielded 8006 kg ha^{-1} and stand 1st rank in NEPZ (Z3) Medium maturity. Hybrid BRM 17-4 yielded 7471kg ha^{-1} and stand 9th rank in NEPZ (Z3) Medium maturity. Both of them promoted to AVT I Medium maturity.
- 229 inbreds were evaluated on yield and yield attributing traits. 17 inbreds were categorized as male, 60 as female and 19 as male and female. 689 crosees were evaluated in 7 station trials (one location), 1 multilocation (3 locations) trial and 1state maize varietal trials (6 locations in all the four agro-climatic zones of Bihar).
- Large scale seed production of selected hybrids and their parents were also undertaken.
- Published 5 Research papers with impact factors were published in journal of repute.

General Information

- Year of establishment: 2015
- Agro-ecological region for which the centre is working: Agro-climetic Zone II, III A & IIIB of Bihar
- Production constraints of the region:

Kharif-

- Early stage drought
- Erratic rainfall
- Water logging at reproductive stage.

Rabi-

- Cold at reproductive stage
- Heat and westerly wind at milking stage
- Storm (KalBaishaki) at dough stage

Spring-

- High temperature at reproductive stage

- Thrust areas of research assigned to the centre by AICRP:
- The centre shall collaborate with Dholi wrt all activities.
- Evaluation of yellow and white hybrids of normal maize and QPM for *rabi* and spring season.

Significant achievements

Parameter	Nos.

Hybrids released/identified during reporting period	3
Promising hybrids entered in to AICRP trials (in AVT)	4
No. of new hybrids tested under station trials (normal corn – white/yellow & Early/medium/late, QPM, Baby corn, Sweet corn, Pop corn)	Normal: 543, QPM: 56, MLT:15, SMVT: 5
New Crosses various traits (normal corn – yellow & Early/medium/late, QPM, Baby corn, Sweet corn, Pop corn)	Normal: 535, Specialty corn: 154
Number of early generation families	Normal: 445, Specialty corn: 135
Number of fixed lines available for various product profile (normal corn – white/yellow & Early/medium/late, QPM, Baby corn, Sweet corn, Pop corn)	Normal corn: 181 Specialty corn: 40
Breeding lines shared with other centres	A. 6 (RPCAU, Pusa)
Production and protection technologies vis-à-vis the targeted constraints of the agro-ecological region developed and entered into AICRP trials	-
Production and protection technologies released through the AICRP system and entered into FLDs	-
Sources of resistance against biotic and abiotic stresses identified based on multi year testing	-

Seed production status

Hybrid/Variety/Line	Nucleus seed Produced (Q)	Breeder seed Produced (Q)	Hybrid seed Produced (Q)
SML-1	5 kg	60kg	500kg (Sabour Hybrid Maize-1)

Outreach activities

Programme	Allotted (No.)	Conducted (No.)	Achievements
FLDs	-	-	-
TSP	-	-	-
SCSP	-	-	-

Breeding

1. **AICRP Trials**

Trial	Allotted (No.)	Conducted (No.)	Significant achievements
Breeding	10 (Kh 2020)	10	Trials conducted as per plan and the data has been submitted to the headquarters

2. Breeding activities

Trait	Achievements (Give only No.)	Remarks
Heterotic grouping efforts		
1.	189 crosses for higher productivity	Testers: CLO 2450, CML 451, SML-3, SML-4, SML-6, SML-9 & LM-13
2.	40 QPM crosses	Testers: SMLQ-1, SMLQ-2, SMLQ-5
Line derivation programme		
Normal (Medium)	New Crosses: Early generation (F2-F5 families): Fixed lines:	Give most significant achievements
	Early generation	445
	Fixed lines	229

3. Station Hybrid trial

Trait	Details (No. of entries and checks)	Achievements (Top 3-5 entry data along with best check data)
Field corn	535	Station Tr. 302 Entry No. 1 (6.5 t ha^{-1}), 9 (6.39 t ha^{-1}), 12 (7.35 t ha^{-1}), 21 (6.54 t ha^{-1}), 24 (6.2 t ha^{-1}) and 26 (6.04 t ha^{-1}) **Check-** DHM117 (5.43 t ha^{-1}) Vivek Hybrid 51 (5.66 t ha^{-1}) Station Tr. 303 Entry No. 1 (6.38 t ha^{-1}) **Check-** DHM117 (5.54 t ha^{-1}) Vivek Hybrid 51 (5.7 t ha^{-1}) Station Tr. 304 Entry No. 4 (6.83 t ha^{-1}) and 17 (6.34 t ha^{-1}) **Check-** DHM117 (5.56 t ha^{-1}) Vivek Hybrid 51 (5.87 t ha^{-1}) Station Tr. 305 Entry No. 6 (6.75 t ha^{-1}) and 9 (6.84 t ha^{-1}) **Check-** DHM117 (5.4 t ha^{-1}) Vivek Hybrid 51 (5.64 t ha^{-1}) Station Tr. 306 Entry No. 1 (6.59 t ha^{-1}), 15 (6.42 t ha^{-1}), 18 (6.58 t ha^{-1}), 17 (6.43 t ha^{-1}) and 24 (6.79 t ha^{-1}) **Check-** DHM117 (5.46 t ha^{-1}) Vivek Hybrid 51 (5.54 t ha^{-1})

QPM	154	Station Tr. 301(QPM) Entry No. 10 (6.43 t ha^{-1}), 15 (6.42 t ha^{-1}), 18 (6.58 t ha^{-1}), 22 (6.20 t ha^{-1}) and 27 (6.37 t ha^{-1}) **Check-** DHM117 (5.25 t ha^{-1}) VQPM 9 (5.7 t ha^{-1})

Availability of germplasm:

- No. of Kernel in a row: 39
- Cob length: 15.6 cm

D. Rapeseed &Mustard Research Improvement Programme

- The Rapeseed-mustard improvement programme is underway with the objectives of (1) development of Indian mustard varieties for timely and late sown conditions, (2) development of early/extra early toria varieties, and (3) development of high yielding, biotic and abiotic resistant yellow sarson varieties.
- To achieve these objective, following activities were commenced such as collection and maintenance of Germplasm, creation of genetic variability, advancement of F_1 generation and handling of segregating materials (F_2 to F_6) and selection, station trials of promising entries, AICRP Trials, and seed multiplication of promising entries. The progresses so far made are as follows:

1. Rapeseed & mustardbreeding trials:

- One yellow seeded plant was identified in F_3 of cross combination Pusa Jaikisan X Pusa Bold (Rai X Rai)
- One short statured with small pod uniform progeny row identified having good yield in F_6
- Single plant selection (SPS) was doneforbasal branch (16 plants), hairy leaves (43 plants) andnon-hairy leaves (26) in F_7.

Figure 1: One yellow seeded plant was identified in F_3 of cross combination Pusa jaikisan X Pusa Bold (Rai X Rai)

2. Breeding materials of Toria generated:

- Inbred line development: 07 S1 generations were raised and selfed again for further S2 generation
- Population Improvement: 7 inter-crossed parents (36 crosses) were raised in 2019-20 and superior selected plants were inter-crossed again

3. Breeding Materials of Yellow Sarson generated: 50 **F_1** were advanced to F_2

4. Indian Mustard: high yield, early, bold seeded for timely/late sown:

i. Generation Advancement: 106 F_1

ii. Handling of Segregating Generations:

Generation	No. of crosses grown /progeny rows (PR)	No. of selections			Objectives
		Cross	SPS	Bulk	
F_2	28	28	120	-	• High yield (timely & Late sown) • Early & medium height • Basal branch & high yield
F_3	447 PR		757	-	
F_4	674 PR	**16**	801		
F_6	**15**	**-**	**26**	**03**	
F_7	**39 PR**			**11**	

iii. 58 (diallel) (Rai X Rai)

iv. Wide cross: 05 (Rai X Cauliflower, Rai X Chinese cabbage)

v. Hybrid development: 07 cross combination (Restorer-line X selected parents) 05 (A X R)

vi. Ogura based CMS conversion of heterotic parents/ varieties: BC_1: 11, BC_2: 18

5. Yellow Sarson: for high yield, resistant to biotic and abiotic stress and earliness and high oil

Following crosses were made:

- ✓ 40 (**diallel**)
- ✓ Double crosses: 12
- ✓ Random: 38

6. Toria: high yield, earliness and extra early

- ✓ 47 (population improvement) + 17 fresh
- ✓ Toria X Brown Sarson: 11

7. Introgression of *Rfo*gene (fertility restorer gene for ogura CMS) inheterotic female lines of *B.juncea*

- ✓ BC_1 (06) and fresh crosses (01) were made

Parents involved: Male parent: R-Line,Recurrent parent: Rajendra Suflam, Pusa Bold, Laxmi, RH-30,Rajat, RLM 1359, EC 394300

8. Germplasm maintenance:

Following Germplasm are being maintained:

i. Total 134(109- *B.juncea*; 03- *B. carinata*; 01-*B.fruticulosa;*Yellow Sarson:14; Toria: 07)

ii. Maintenance of male sterility (Ogura based CMS) lines(08) and R-lines (1)

Figure 2: Germplasm maintenance.**Figure 3:** Male sterile –maintainer lines (10 A-B pairs).

9. Introgression of Aphid resistant gene (s) in *Brassica juncea* through embryo rescue

- Direct shoot regeneration without intervening callus was obtained in M1, M2 and M7 media having 7.2 %, 2.3 % and 6.09 % of shoot regeneration.
- *In vitro* flowering was also observed in M8 (74.4 % callus induction & 72.83 % shoot regeneration) and M9 (84.9 % callus induction & 31.11 % shoot regeneration) media
- The highest no. Of callus induction was obtained in M9 (84.9 %) whereas lowest was observed in M3 (2.2%).
- Highest shoot regeneration was obtained in M8 media (72.83 %) and lowest in M16 (2.3 %)
- The hybridity of the regenerated plantlets was confirmed by the two different gene specific primers of *Brassica rapa* (male parent):

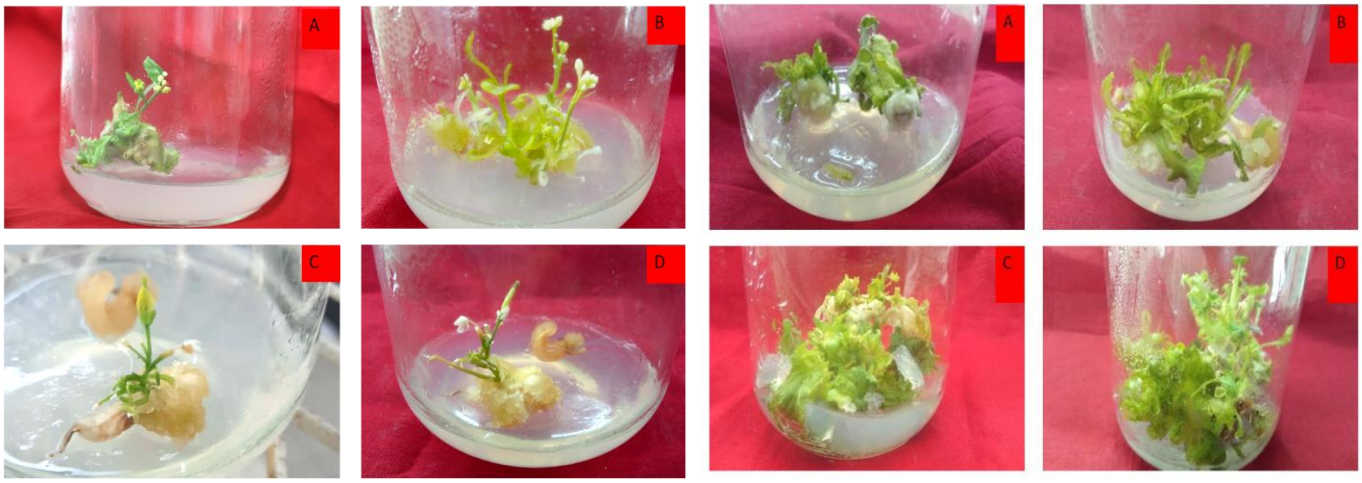


Figure 4A: Callus and shoot bud induction from siliqua (B)Shoots regeneration (C)Shoot bud elongation (D)Shoot multiplications of *Brassica fruticulosa* X *Brassica rapa;* **B** *In vitro* flowering induction in plants of *Brassica fruticulosa* X *Brassica rapa:* (A & B) Flowering (C) siliqua formation (D)

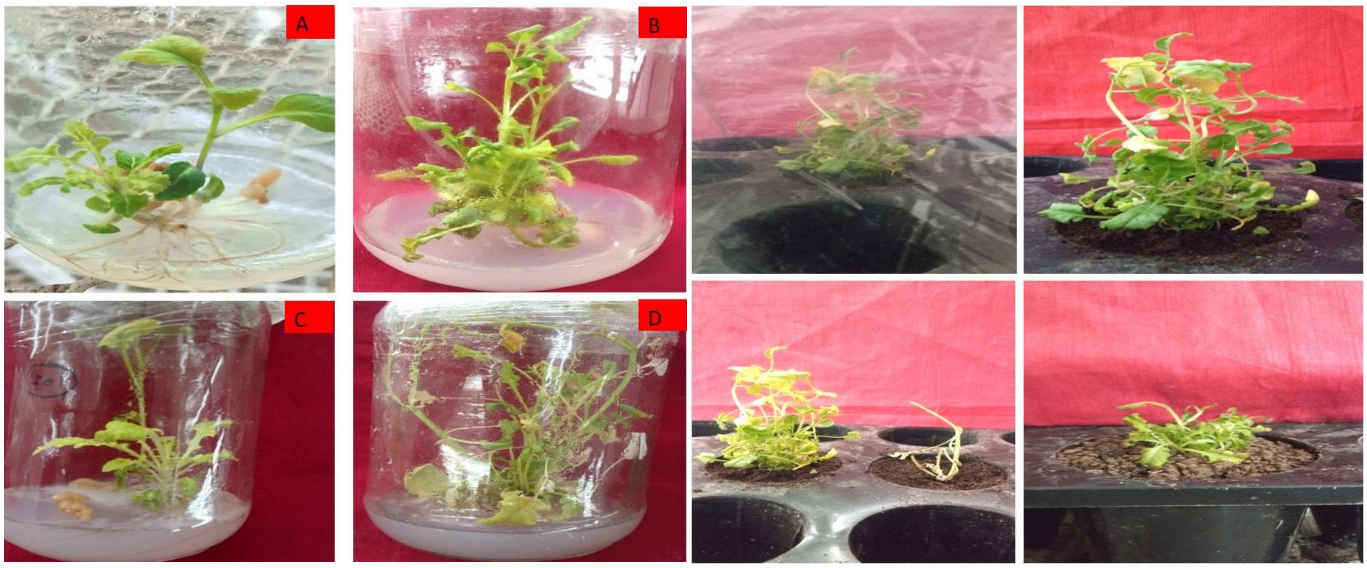


Figure 5: Plants of *Brassica fruticulosa* X *Brassica rapa: a.*Root induction, b. Acclimatization of plants.

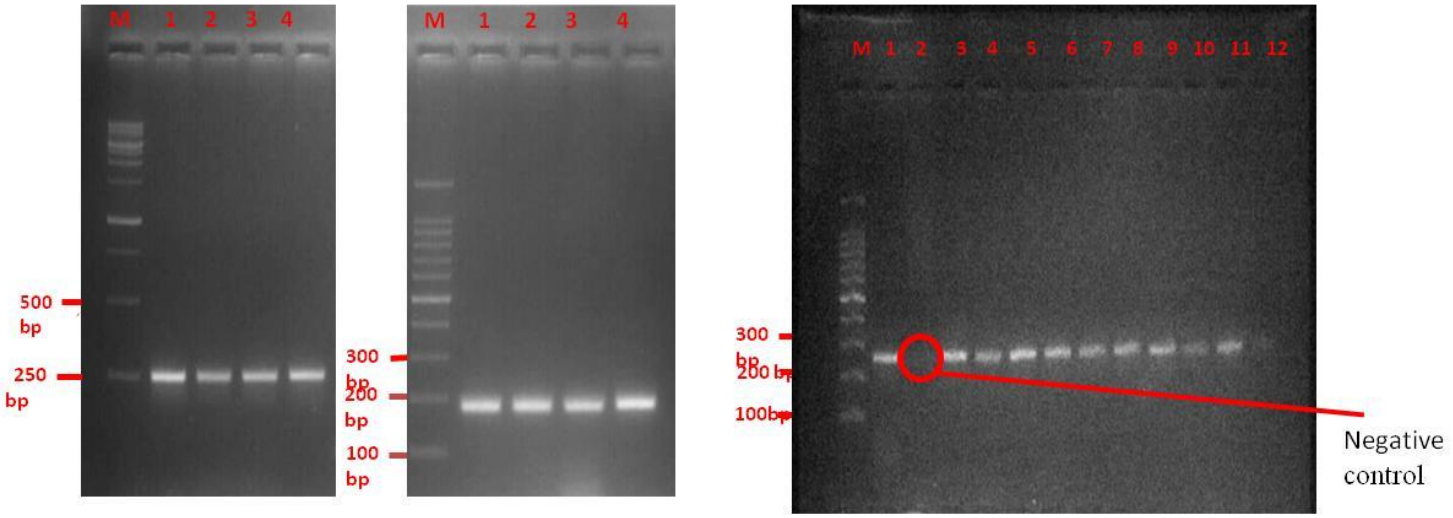


Figure 6: PCR amplification of crosses DNA with one positive and negative control. Primer specific to the Brassica AA genome was used in the PCR with1000 bp and 100 bp DNA marker: a. Lane 2 (male parent),Lane 1,3 & 4 (crosses DNA) with primer 1; b. Lane 2 (male parent),Lane 1,3& 4 (crosses DNA) with primer 2; c. Lane1 (male parent) positive control, lane 2 (female parent) negative control & Lane 3- 12 (crosses DNA).

Research Highlights of Sesame, 2020

1. **"Development of High Yield and Short duration varieties of Sesame for Bihar"**

   - Thirty- three crosses were successfully made during 2020 with various combinations involving twenty different parents. Twelve crosses has been advanced to F1 namely BRT10 x Kalika,BRT-08 x Kalika, BRT-10xBRT08,BRT-09x Kalika, BRT09x BRT10, BRT09x BRT08,AT 336x AT 255, JLS-120xAT 255,AT336x BRT06,JLS120xTKG 523, TKG22x TKG 523 and AT-255xTKG 523.

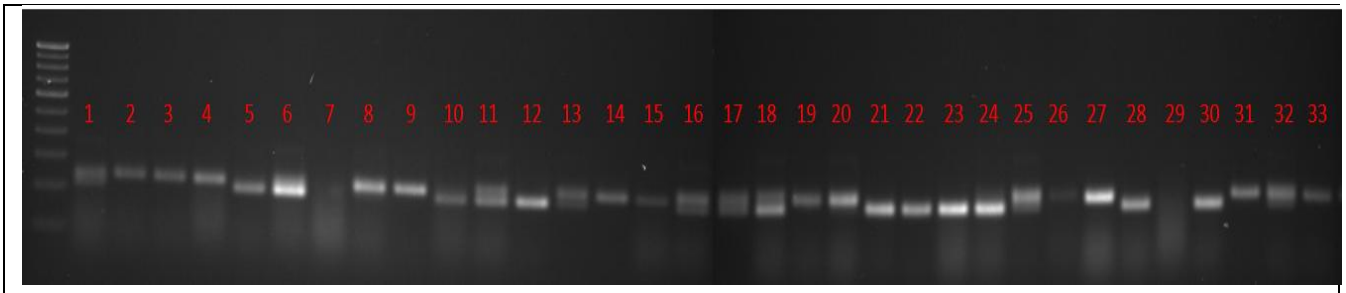
- Three F3 crosses (BRT06×AT201, BRT01×BRT06 and AT255×BRT06) were advanced to F4 generation. F4 crosses were advanced to F5 generation which are VS10-57×OSM170, AT234×BRT04, BRT04×VS10-57, VS10-57×OSM22, OSM22×OSM170 and BRT04×NIC8253.
- Twenty-seven different germplasms and local collections of white and black sesame were evaluated at BAC, Sabour. Germplasm were morphologically characterized as per DUS.
- Multiplications and maintenance of seed of BRT 04, BRT-08, BRT-09, BRT-10, TKG-22, JTS 08, GT-10.

2. "Morphological & Molecular Characterisation of *Sesamum indicum* L. of Bihar"

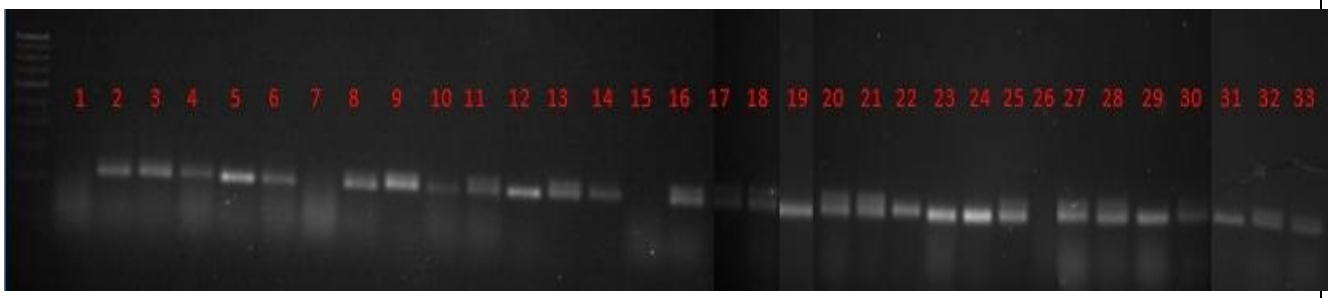
- Twenty one SSR primers were used to assess molecular diversity and interrelationship in thirty-three sesame genotypes. All 21 SSR primers generated clear banding patterns but only 5 primers gave polymorphic profile. Polymorphism percentage was 27.20. A total of 11 polymorphic alleles were detected through 5 polymorphic primers and displayed clear size differences.

Table 1: Primers showing polymorphism across sesame genotype

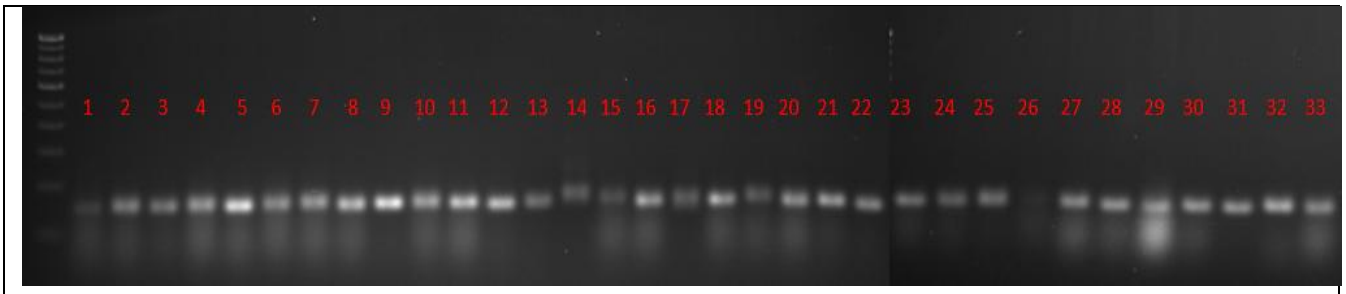
SSR locus	Approximate product size amplified (bp)	Total number of alleles	Total number of polymorphic alleles	PIC value
SSR-ES-12	200-248	2	2	0.36
SSR-ES-15	200-236	2	2	0.28
CUSSR1	152-198	2	2	0.15
CUSSR13	160-180	2	2	0.34
SSR 46	250-286	3	3	0.23



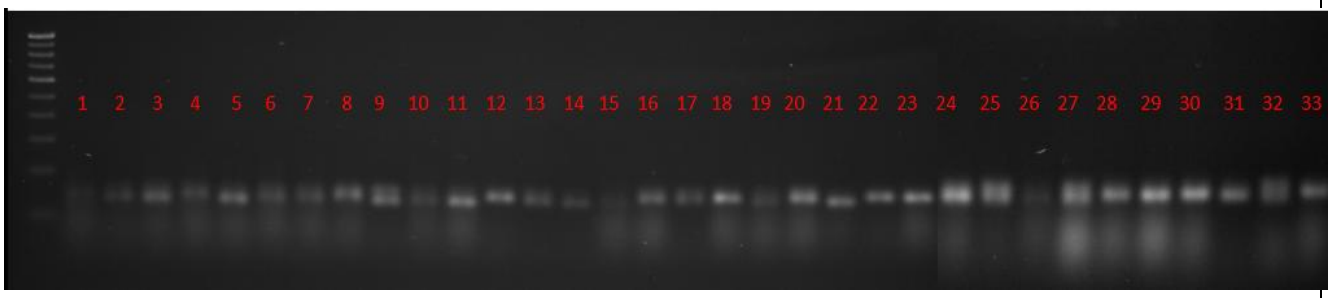
SSR-ES-12



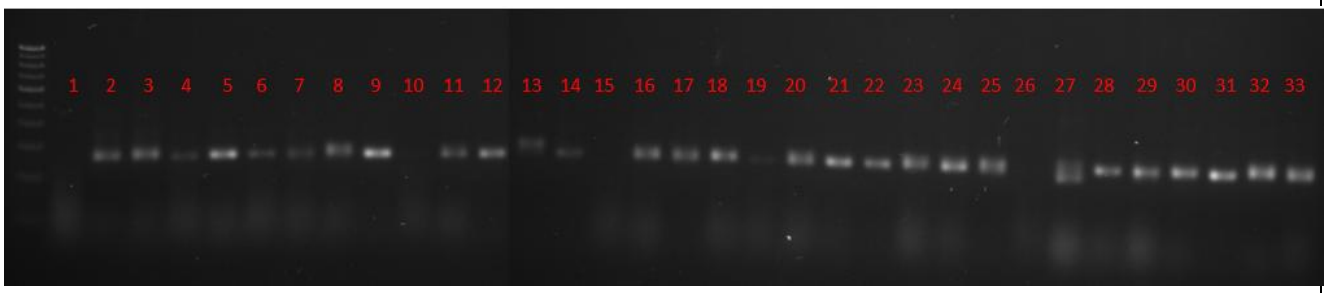
SSR-ES-15



CUSSR1



CUSSR13



SSR 46

3. **AICRP Trials -** AVT and IVT were conducted and the data was sent to PC unit, Jabalpur. Twelve genotypes including two local checks were evaluated for AVT while nineteen entries which consisted of two checks were evaluated for IVT. Among IVT highest yielder (1926 kg/ha) was Suprava with 88 days maturity and IVTs-19-7 was found earliest among all entries having 72 days maturity with 1516Kg/ha productivity. In AVT, no any entries was superior yielder than suprava with 1136 kg/ha yield and LC 1 lowest days days to maturity.

4. Promising sesame entry BRT-04 from BAU, Sabour center promoted from IVT to AVT in AICRP, sesame.

E. Pulse improvement programme

1. Chickpea Improvement Programme:

Name of the Project	**:**	**AICRP on Chickpea**
No. of Experiment Conducted	:	11
Proposed no. of experiments	:	10
No. of F.L.D. Conducted	:	10
Proposed no. of F. L. D.	:	15
Distinguished Visitors	**:**	**University Monitoring Team, BAU, Sabour**

- During the season *rabi,* 2019-20, total eleven no. of experiments (AICRP-05, ICRISAT-02 & station trials-01, Germplasm maintenance -01 and Breeding material maintance-01) were conducted viz; collection, maintenance and utilization of germplasm, IVT (Desi), AVT-1(Desi), IVT (Desi) M.H., IVT (Late sown), AVT-1 (Late sown), ICVT (Desi), ICVT (M.H.), Station Trial, National crossing programme and germplasm maintenance & evaluation. F.L.D. were conducted in 10 ha, area.

Promoted Entry:

Trial	Entry	Parentage
AVT-1 (Desi) Late Sown	BRC-9-14	SAKI 9516 x GNG 1958

AICRP Trials:

- **Collection, Maintenance and utilization of Germplasm:** 140 germplasm were evaluated and categorized on the basis of maturity, plant height, 100-seed weight and grain yield.
- **I.V.T. (Desi):** 42 entries were tested for different traits in alpha lattice design with three replications. Varietal differences for seed yield were found to be significant. Three entries namely, IPCD 2016-44 (2319 kg/ha), BRC 9-14 (1944 kg/ha) and GJG 1707 (1932 kg/ha) were found to be significantly superior over the best check BG 3043 (1608 kg/ha).
- A**VT-1 (Desi):** 05 entries were evaluated for different traits in RBD under four replications and found that varietal differences for seed yield to be significant. But none of the entrywas recorded significantly superior to the best check BG 3043 (1942 kg/ha).
- **IVT (Desi) M.H.:** 28 entries were evaluated for different traits in RBD with three replications and varietal differences for seed yield were found to be significant. Three entries namely, RG 2016-84 (2068 kg/ha), H 12-63 (2065 kg/ha) and RVSSG-86 (1984 kg/ha) were observed significantly superior over the best check HC 5 (1676 kg/ha).
- **I.V.T. (Late sown):** 37 entries were tested for different traits in RBD with three replications. Varietal differences for seed yield were found to be significant. None of the entries was found to be significantly superior over the best check GNG 2299 (1474 kg/ha). However, two entries namely, BRC 9-14 (1657 kg/ha) and RG 2016-31 (1585 kg/ha) were recorded significantly at par to the best check GNG 2299 (1474 kg/ha).
- One entry, BRC 9-14 has been promoted for AVT-1(Desi) Late Sown, *rabi* 2020-21 to NEPZ.
- A**VT-1 (Late sown):** 05 entries were evaluated for different traits in RBD with four replications and found that varietal differences for seed yield to be significant. None of the entrywas found to be significantly superior to the best check **BG372 (1391 kg/ha)**

ICRISAT:

- **ICVT (Desi):** 20 entries were evaluated for different traits in RBD with two replications. Varietal differences for seed yield were found to be significant. None of the entries was observed significantly superior to the best check JG16 (1936 Kg/ha). But only one entry ICCV19115 (1947 kg/ha) showed numerically at par with the best check JG16 (1936 Kg/ha).
- **ICVT (MH):** 20 entries were tested for mechanical harvesting traits with high yield in RBD design with two replications. Varietal differences were found to be significant and only one entry namely, ICCV191602 (2030 kg/ha) was found to be significantly superior over the best check Sabour chana-1 (1705 kg/ha).

State Trial:

- **Station Trial (Desi):** 15 entries were evaluated in RBD design with three replications for yield and yield attributing traits. The varietal differences for seed yield were found to be significant. Four entries, namely, BRC-2 (1859 kg/ha), BRC-08-2016 (1755 kg/ha), BRC-5-2016 (1732 kg/ha) and BRC-3 (1709 kg/ha) were recorded significantly higher yield over the best check GCP-105 (1650 kg/ha).
- **FLD–**Ten (10) nos. of F.L.D. on chickpea with variety GCP 105 was conducted in the farmer field of Bhagalpur and Banka district with full package technology. The highest seed yield was recorded 1610 kg/ha. The range of increase of improved variety over local variety varied from 23% to 36% and average % increase grain yield was 39%.
- National crossing programme and evaluation of crossed breeding material (F_1, F_2, F_3, F_4& F_5 generation).

Crossing Programme

- Twenty fresh crosses were attempted under national crossing programme. The details of the crosses attempted are given below:

National Crosses:

Sl. No.	Crosses	Sl. No.	Crosses
1.	GCP105 x BRC-3	6.	GCP 105 x GNG 2264
2.	GNG2264 x GNG2304	7.	BRC-1 x ICCV 19117
3.	GNG2207 x BRC-1	8.	GNG2207 x GCP105
4.	GCP105 x BRC-1	9.	RSGD-1017 x RSGD 1080
5.	PG186 x GCP105	10.	GL16063 x RSGD 1071

Station Crosses:

Sl. No.	Crosses	Sl. No.	Crosses
1.	BRC-1 x GCP105	6.	GNG2264 x GNG2207
2.	DCP92-3 x GNG2207	7.	BG372 x DCP92-3
3.	BG372 x DCP92-3	8.	IPC2010-134 x BRC-1
4.	GNG2207 x DCP92-3	9.	RSGD1080 x BRC-1
5.	KPG59 x GNG2207	10.	RSGD-1071 x GL16063

Status of breeding material:

Generation	No. of crosses	SPS	Progenies
Fresh cross attempted	20	-	-
F_1	06	-	-
F_2	18	211	-
F_3	16	110	-
F_4	09	-	-
F_4 Bulk-IIPR	08	-	95
F_5 Bulk-ICRISAT	21	-	126

- **Development of short and medium duration varieties resistant to Prevailing diseases and insect-pest:** Shuttle Breeding programme, National crossing programme and evaluation of crossed breeding material (F_1, F_2, F_3, F_4& F_5 generation).

Seed Multiplication, Rabi 2019-20

S. No.	Varieties	Quantity(Kg)
1..	Sabour chana-1 (B/S)	215
2.	Sabour chana-1 (N/S-I)	125

State Co-ordinated Varietal Trial of *Desi* chickpea (Rabi 2019-20)

- State Coordinated Varietal Trials of *Desi* chickpea was conducted in two different environments viz., normal sown and late sown at eight different locations under different Agro-climatic zones of Bihar during Rabi 2019-20. The experiment was carried out at six locations viz. Saharsa (Zone-II), BAC, Sabour and Tilaundha (Zone-III A), PRC Mokama & BRC Islampur and VKSCoA, Dumrao (Zone III B) under the jurisdiction of Bihar Agricultural University, Sabour (Bhagalpur) while two locations viz. TCA, Dholi and Gopalganj (Zone-I) were under the jurisdiction of RPCAU, Pusa (Samastipur). Normal sown trial comprised of 09 genotypes and significant differences were observed among the genotypes. The experiment was conducted in randomized block design with three replications with a plot size of 4.8 m^2. On the basis of pooled mean data of grain yield, the top three promising entries identified were GNG 2207 (1649.14 kg/ha), BRC-5 (1619.52 kg/ha) and BRC(1533.64 kg/ha). None of the genotypes were found significantly superior over best check GNG 2207(1649.14 kg/ha). Late sown experimental material comprised of seven genotypes of *Desi* chickpea. The experiment was conducted in randomized block design with three replications with a plot size of 4.8 m^2. Significant differences observed among the genotypes. On the basis of pooled mean data of grain yield, the top three promising entries identified were BRC-5 (1725.38 kg/ha), KPG 59 (1551.36 kg/ha) and DC16-2 (1549.77 kg/ha). The genotype GNG 2207 was found significantly superior over best check KPG 59 (1551.36 kg/ha) .

Identification of collor rot resistant lines in chickpea through mutation breeding Uniform, dry and healthy seeds of two varieties of chickpea viz., GCP 105 and PG 186 were irradiated with 10, 20, 30, 40, 50 and 60 kR doses of gamma-rays (Source-^{60}C) at BARC, Trombey. Effects of mutation were observed for germination percentage, radical and plumule length (cm), number of pods per plant and grain yield per plant. The root length was measured since it is a very rapid method of assessing the mutagenic influence in addition to shoot length. Germination percentage, radical and plumule length decreased with the increase in the doses of gamma rays. Maximum germination %, seedling root and shoot length were observed in 10 and 20 kR doses of gamma rays while, minimum in 60 kR. Effects of mutations on yield components showed that number of pods per plant and grain yield per plant was reduced in the higher doses of gamma-rays. LD 50 of gamma rays is 40 KR.

2. Lentil Improvement:

Identification of heat tolerant and early maturing lines of lentil (*Lens culinaris* Medik L.) for late sown condition (SNP/CI/KH/2016-09)

- **Duration of the project:** Four years
- **No. of experiment conducted:** 09

Salient findings

1. State Varietal Trial (Govt.of Bihar) Rabi, 2019-20

- A trial consisting eighteen genotypes including two checks (with coding) was conducted at 11 locations (all zones of Bihar) to test the performance for its adaptability in different ecological regions of Bihar. Experiment was conducted in Randomized Complete Block Design (RCBD) with three replication with 6 metre row length with 5 lines along with spacing of 30×10 cm (R×P) .Data has been analyzed from all zone except Zone-I as no data was provided by the Zone-I for inclusion in RCM. Data from Madhepura was not included to calculate the pooled mean as the average yield was found below state average yield.On the basis pooled mean data SVTLR(19)-13 was found highest yielder (1389 Kg/ha) followed by SVTLR(19)-1 (1319 Kg/ha), SVTLR(19)-16 (1287 Kg/ha),SVTLR(19)-18 (1255 Kg/ha), SVTLR(19)-3 (1173Kg/ha) and SVTLR(19)-12 (1148 Kg/ha).

2. Station trial timely & late (non-plan) Rabi, 2019-20

- Station trial consisting 10 entries including 3 checks was conducted in Randomized Complete Block Design (RCBD) with three replication with 4 meter row length with 4 lines along with spacing of 30×10 cm(R×P).Data has been recorded on various traits and analyzed.HUL 57 (1213 Kg/ha) was found best check and Pusa Ageti has yielded out highest (1589 Kg/ha), followed by BRL-3 (1556 Kg/ha), in normal sown condition, while HUL-57 (813Kg/ha) was found best check BRL-1 has yielded out highest (1190 Kg/ha).

3. Screening & validation trial (non-plan) Rabi, 2019-20

- Germplasm screening trial of lentil consisting 232 lines excluding 4 checks was conducted in Augmented Block Design with 1 meter row length with two rows along with spacing of 30×10 cm(R×P) to validate the results of previous year trials.Data has been recorded on various traits and analyzed and Out of 232 germplasm, lines with higher yield PL6 (1811 Kg/ha) fallowed by *P.vaibhav* (1762 Kg/ha),BRL-2 (1743 Kg/ha),W717 (1722 Kg/ha) and 20013-L (1698) were observed to be superior for seed yield. The yield of the best check was KLS 218 (1285 Kg/ha).

4. ICARDA International nurseries

From ICARDA nurseries small seed & early lines were evaluated and SPS were selected from different nurseries

Sl.No.	Trial (International nurseries) ICARDA	No. of cross combinations	Promising entries
	SINGLE PLANT SELECTION F3 -(LIEN-MN) F4-(LIPBN) F4 (LIDTN) F5(LIENE) SPS	15 17 13 21 12	Lines were bulked from Single plant progeny showing extra early maturity and early maturity (90-108 days) with a yield range of 1252-1692 Kg/ha
	SINGLE PLANT	44	Lines were bulked from Single plant progeny showing extra

I	SELECTION F6 (LIENE) F7(LIENE) F5(LIENE)	35 45	early maturity and early maturity (90-105 days) with a yield range of 1333-1637Kg/ha
II	SINGLE PLANT SELECTION F8 F9 Bulked F8-F9	55 45 45	Lines were bulked from showing extra early maturity and early maturity (91-109 days) with a yield range of 1350-1730 Kg/ha will be evaluated in station trial I Rabi 2020-21

Breeding material generated

Sl.No.	Crossing programme	No. of cross combinations	Remarks
I	F1	17	Fresh cross combinations made, High yield × Earliness, Heat tolerant ×High yield and high yield ×wilt resistant
II	F1	33	Random cross combination
III	F2	08	F1 raised and backcrosses made
IV	Back crosses	05	

5. Biofortification of lentil –Harvest Plus, BAU, Sabour

- Twenty entries of lentil were evaluated in Randomized Complete Block Design (RCBD) with two replication with 3 metre row length with 4 lines along with spacing of 30×10 cm(R×P).Data has been recorded on various traits and analyzed. Yield range was found from 1328Kg/ha -1806Kg/ha. Samples are sent for Zn analysis. Result is awaited.HUL 57 was found best check (1328 Kg/ha). Two entries were found significantly superior namely IC55965 (1806) fallowed by GP2585 (1785).

6. Biofortification of lentil –NBPGR, New Delhi

- Ten entries of lentil were evaluated in Randomized Complete Block Design (RCBD) with two replication with 1 meter row length with 2 lines along with spacing of 30×10 cm(R×P).Data has been recorded on various traits and analyzed. Yield range was found from 1310Kg/ha -1999Kg/ha. Samples are sent for Zn analysis. Two entries were found high yielder namelyL4727(1999 Kg/ha)fallowed by IPL81(1955 Kg/ha),DPL 81(1570 Kg/ha),KLS 218(1570 Kg/ha),DPL 15(1547 Kg/ha) and IPL 406 (1496 Kg/ha).

7. AICRP on MULLaRP on Lentil and Lathyrus 2019-20

23 coded entries of lentil were evaluated in IVT in Randomized Complete Block Design (RCBD) with three replication with 3 meter row length with 4 lines along with spacing of 30×10 cm(R×P).Data has been recorded on various traits and analyzed. Yield range was found from 704 Kg/ha -1434 Kg/ha. While **07 coded entries of Lathyrus were evaluated in IVT** in Randomized Complete Block Design (RCBD) with three replications with 3 meter row length with 4 lines along with spacing of 30×10 cm(R×P).Data has been recorded on various traits and analyzed. Yield range was found from 553 Kg/ha to 1012Kg/ha.

3. Mungbean Improvement Programme:

Development of short duration, high yield & Synchronous maturity Mungbean (*Vigna radiata*) genotypes for Bihar

- **Duration of the project:** Four years
- **No. of experiment conducted:** 05

Salient findings

Screening trial (non-plan) Summer, 2020

- Germplasm screening trial of Mungbean consisting 134 lines including 4 checks was conducted in Augmented Block Design with 2 metre row length of two rows along with spacing of 30×10 cm (R×P) to screen & evaluate against Yellow Mosaic Virus, earliness, higher yield and and synchronous maturity in Augmented Block Design. Samrat was found best check (1022 Kg/ha). Genotype namely; IPM-2-3 (1490 Kg/ha) fallowed by IC369233 (1372 Kg/ha), MH 52L (1295 Kg/ha), IPM4103 (1190 Kg/ha) and MH1464 (1168) moderately resistant with high yield

Station trial (non-plan) Summer, 2020

- Station trial consisting 17 fixed lines including 1 checks was conducted in Randomized Complete Block Design (RCBD) with three replication with 4 metre row length with 4 lines along with spacing of 30×10 cm(R×P).Data has been recorded on various traits and analyzed.PDM-139 (1307 Kg/ha) was found best check and BRM14 (1658 Kg/ha) fallowed BRM13 (1648 Kg/ha), BRM12 (1667 Kg/ha), BRM10 (1533 Kg/ha) and BRM06 (1444 Kg/ha).

Crossing programme-Breeding material generated and evaluated

Sl.No.	Breeding material	No. of cross combinations	Remarks
1	F1	05	Fresh cross combinations made,F1 raised and backcrosses made
2	F2	19	
3	Back crosses	-	02
4	Bulked (F6)	-	66
5	SPS (F7)	-	26
6	Bulked (F7)	-	32

F. Tissue Culture and Molecular Biology

1. Understanding the mechanism of genome packaging and translocation in small plant viruses

- A novel classification system for viral genome packaging has been proposed for the first time and this work was recognised by Australasian Plant Pathology Journal (Ranjan et al., 2021) (DOI: 10.1007/s13313-020-00772-y).
- A model for genome packaging in plant viruses has also been proposed.
- Our bioinformatics analysis fetched several novel ATPase and DNA binding domains on the polypeptide chain of capsid protein in several plant viruses.
- The *cp* gene of potato virus X has been cloned in bacterial expression system.

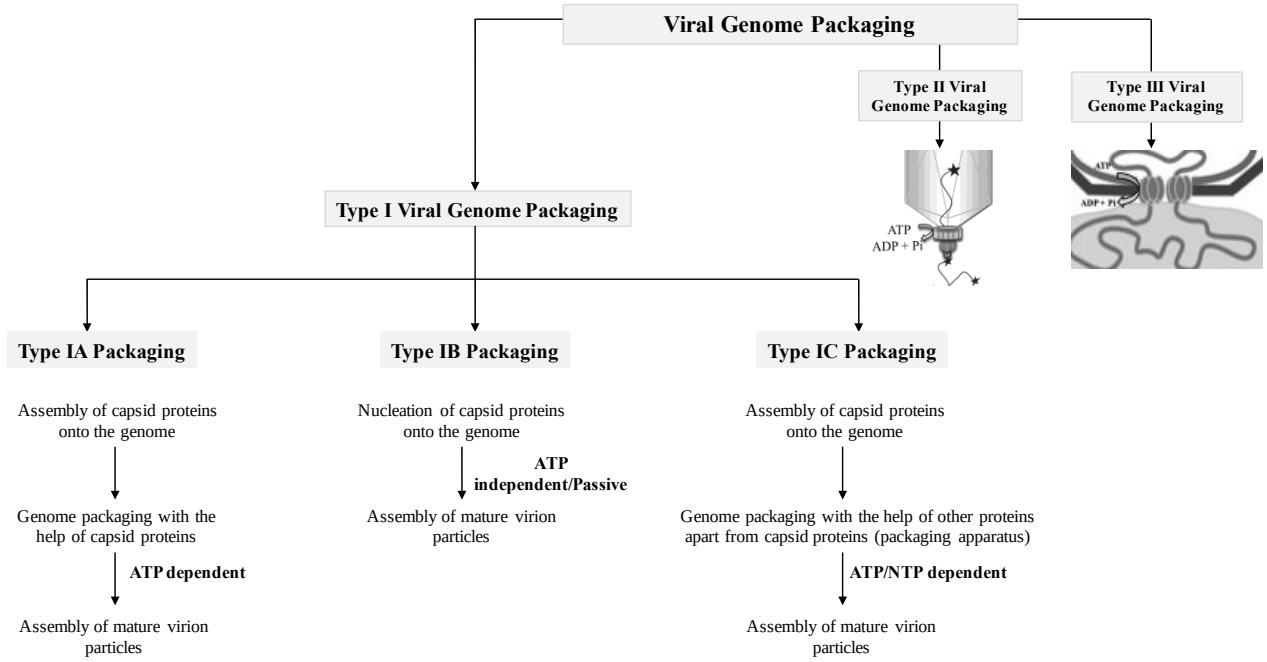


Figure 7: Proposed classification system for viral genome packaging.

Genome packaging system and their proposed sub-types:

Types I Packaging system	Major component	Other critical factors required for genome packaging	ATPase activity needed for genome packaging	Genome configuration	Typical Examples
Type IA	CP	CP standalone has ATPase activity	Yes	ssRNA/dsDNA	Potexvirus, Potyvirus, Cypovirus, Bromovirus, Cow Pea Mosaic Virus, Potato leaf roll virus, Caulimovirus, Beet necrotic yellow vein virus, Cucurbit aphid-borne yellows virus, Beet western yellows virus, Turnip yellows virus etc.
Type IB or Passive	CP	There is no requirement of any of ATPases	No	ssRNA, dsRNA, ssDNA, dsDNA	Tobacco mosaic virus (TMV), Fabavirusa, Nepovirusa, Luteovirus, Carmovirus, Human immunodeficiency virus (HIV), λN, Flock house virus (FHV), Togavirus, Rous sarcoma virus, Simian immunodeficiency virus (SIV), Lentivirus, Bovine leukemia virus, Rabies virus, Influenza A virus etc.
Type IC	CP	NSP2, P4 NTPase, Chaperon (Hsp70 and DnaJ), P10 ATPase, VP3 ATPase, Rep, Replication enhancer protein such as C3, AC3, L3, or AL3	Yes	ssRNA, dsRNA, dsDNA	Tombusvirus, Sesbania mosaic virus, Geminivirus, Begomovirus, Curtovirus, Topocuvirus and Mastrevirus, Turncurtovirus, Capulavirus, Eragrovirus, Becurtovirus, Reovirus, Rotavirus, Alphavirus, ds RNA bacteriophages, Picornavirus etc.

2. Evaluation of tomato lines carrying different combinations of Ty genes for resistance against begomovirus infection

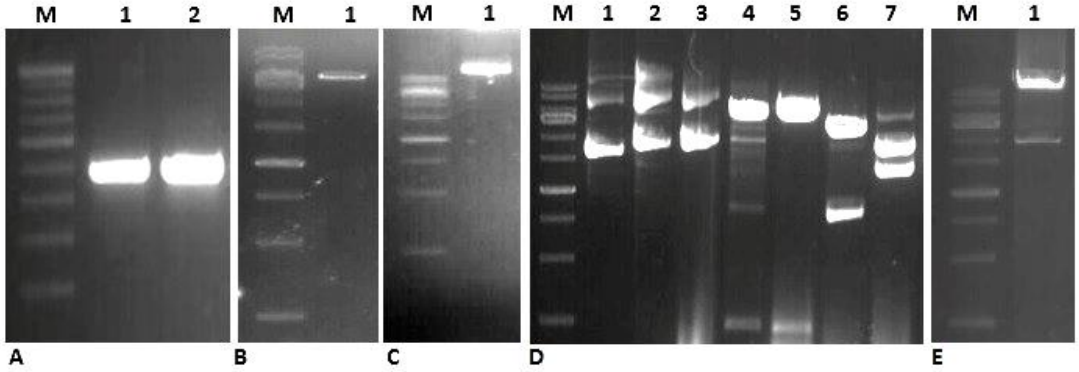
- A set of 105 tomato genotypes has been evaluated for tomato leaf curl virus disease in field condition during Rabi 2019-20. The tomato genotypes with *Ty3* gene performed well.
- A set of selected 20 tomato genotypes from Rabi 2019-20 trial were also evaluated for tomato leaf curl virus disease in field and protected condition during summer 2020 as the peak season for whiteflies and leaf curl disease pressure locally. The disease incidence was found low compared to summer 2019 as

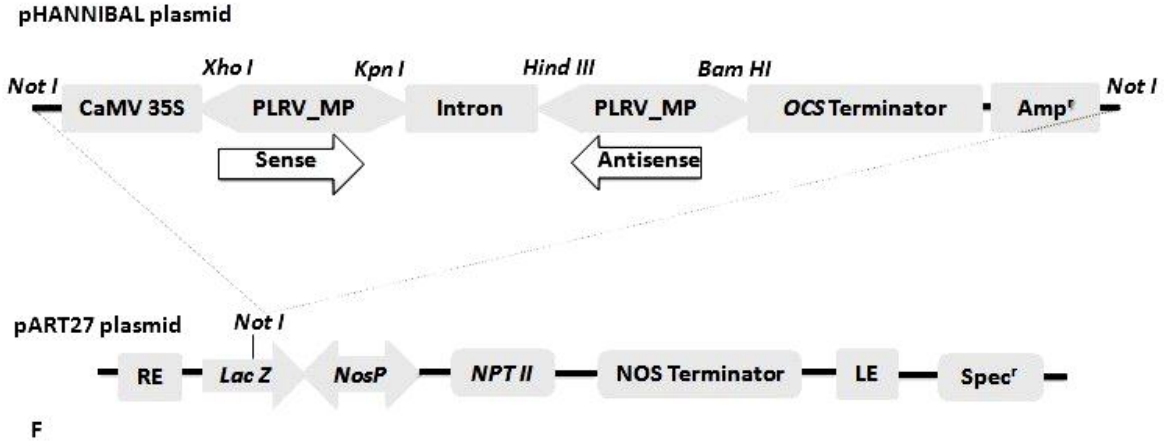
whitefly pressure was low. There were symptoms of tomato leaf curl virus disease on susceptible varieties and *Ty2* containing lines both in field and protected condition.

- Fifty samples of tomato genotype showing symptoms of virus infection (very mild to severe) from trial were collected from field. Total genomic DNA was extracted and each sample was tested by Polymerase chain reaction (PCR) withuniversal begomovirus primers to test for the presence of leaf curl (begomovirus) infection. Out of 50 samples, 38 revealed presence of begomovirus infection. The sanger sequencing data of 15 samples showedmaximum identity with monopartite begomoviruses.
- Syntheses of crosses involving Ty genes were done and true F_{1s} were identified using *Ty* linked markers.

3. Knockdown of movement protein of potato leafroll (PLRV) virus using RNA interference technology

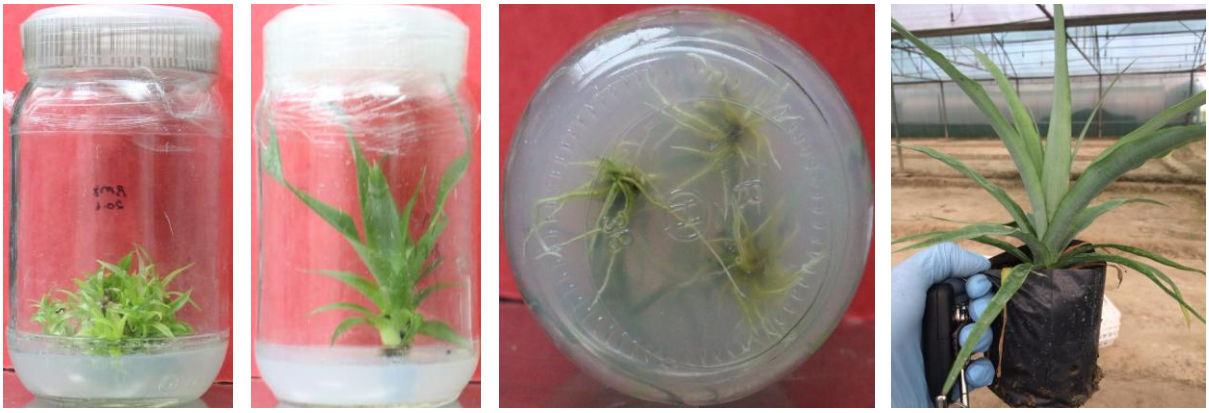
- An efficient methodology for viral gene knockdown has been optimized using RNAi technology.
- siRNA constructs against movement protein of potato leafroll virus were developed and cloned into pART27 binary vector.
- These siRNA constructs were later on transferred (agroinfiltration) into potato plants, naturally infected with PLRV.
- The developed siRNAs were found to be a potent inhibitor for PLRV multiplication and systemic translocation.
- This results were further confirmed using RT-PCR and Northern Blotting.





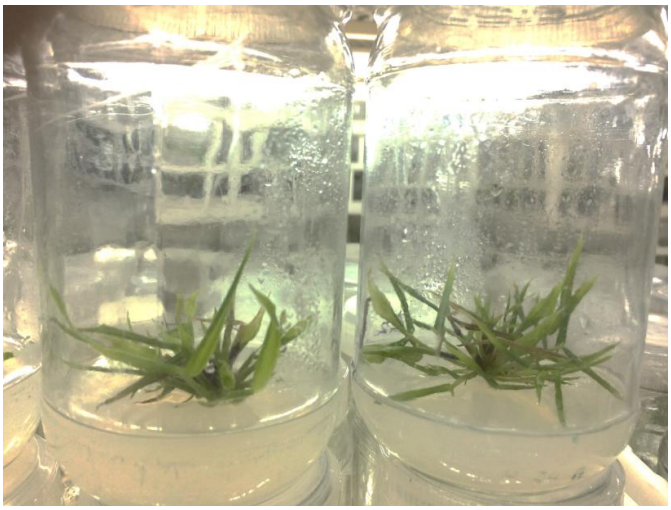
4. Standardization of micropropagation protocol in pineapple for production of disease free planting materials

- An efficient micropropagation protocol employing somatic embryogenesis was established.
- Protocol for shoot induction, shoot proliferation, multiplication and rooting were optimized.
- Methods of hardening and field transfer were optimized.
- Tissue culture raised plants were planted in field condition at DKAC, Kishanganj and data were recorded, which showed equivalent growth or fruiting to normal pineapple plants.



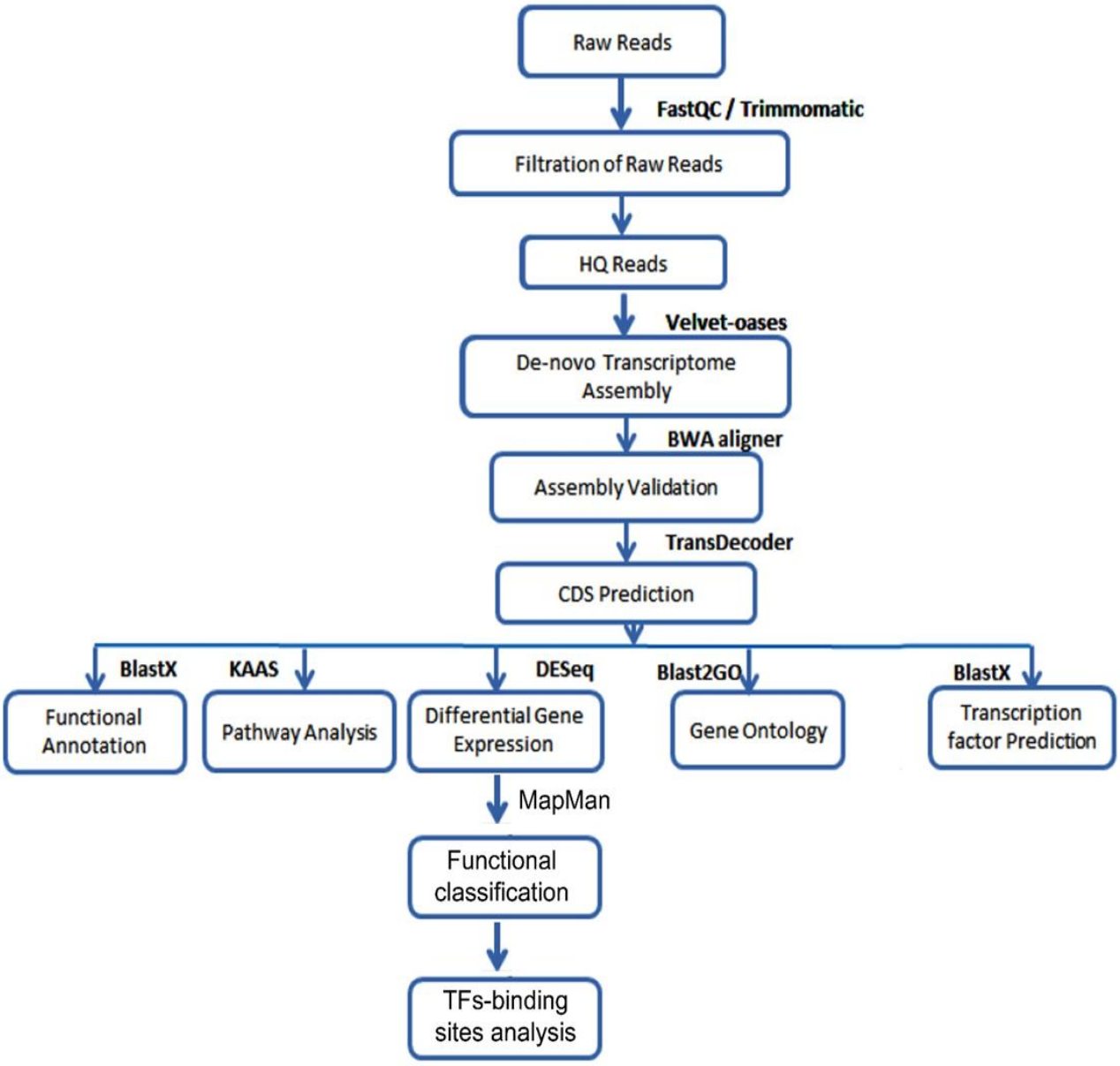
5. Bamboo planting materials production through tissue culture

- Bamboo has tremendous utilization viz. construction purpose, paper and pulp industries, medicinal, edible, ornamental, boarder fencing etc.
- Its timber is blessing to rural people and thus it is called as the poor man timber.
- For fulfilling the availability of bamboo planting materials to bamboo growers, a technology was developed breaking the constraints of different types for its production through tissue culture technique.
- Innovative methods have been deployed at shoot establishment, in vitro shoot proliferation and rooting stages, multiplication at hardening stage and field transfer.
- The new media formulations along with their physical states and the growth conditions of the plantlets for effective shoot multiplication and rooting have not been reported elsewhere.
- The technology involves cost effective methods and is beneficial for farmers, entrepreneurs, industries and researchers.
- The availability of tissue culture bamboo plants among stake holders will definitely uplift the status of both rural and urban society.



6. Understanding the bearing habit in Mango using Next Generation sequencing

- The irregular bearing habit of mango is one of the major hurdles for its commercial cultivation for getting expected productivity
- RNA was extracted from the bud of mango samples namely Amrapali, Barahmasi and Langra (Vegetative and Flowering buds).
- Next Generation sequencing was performed for four samples.



- In total 28,325 transcripts were obtained.
- 293 SSR markers were observed in all the four samples.
- Several SNPs has been identified in this study.
- KEGG pathway analysis showed Biosynthesis of secondary metabolites pathway is significantly upregulated in analyzed sample.

G. Seed Science and Technology:

1. Seed dormancy and its influence on storability of Makhana Seed (*Euryale ferox* S.)

- The germination test was conducted in a beaker by taking water as growth media under three different temperature i.e15^{0}C, 20^{0}C and 25^{0}C under controlled conditions**.** Three lots of makhana seed were taken for standardization of germination test. The mean value of germination was found 35 percent. There was nonsignificant difference in germination between makhana seed lots.
- The effect of temperature was found significant on number of days taken for germination. The seed lots placed for germination at 20^{0}C was taken minimum time to germinate i.e. 30 days. The germination test was also taken by placing seeds in paper tower at above mentioned temperature (20^{0}C), but till 35 days no germination was reported.
- This may be happened due to non-availability of sufficient moisture content around the seed. The germination data also revealed that there was a very low germination (i.e. 35%) of makhana seed even in freshly harvested seed lots, this may be due to physical hardiness of seed coat.
- The lot were divided into three sublots based on seed size and 100 seed weight which was large (1.4-1.6 cm and 84.2 g), medium (1.0-1.4 cm and 68.3 g) and small (0.5-1.0 cm and 40.5 g) respectively. The studies revealed germination was found significantly higher in large seed (60.0 %), followed medium seed (40.0 %) and small seed (20.0%). It reflects that by grading we can improve the germination percent of makhana seed lots from 35 to 60 percent.
- The house recommended that PI should mentioned detailed procedure for dormancy breaking of Makhana seed and used other method of seed germination test like sand method.

2. Prediction of Seed Viability through Developing Seed Longevity Chart

- Due to lack of facility at our Centre and difficulties faced in purchase of key equipment i.e. Accelerated Ageing Chamber, signing of an MoU between Bihar Agricultural University (BAU) Sabour and Indian Institute of Seed Science (IISS), Mau (UP) had been initiated and being under process. Hopefully, we will start it with support of them.
- After facing problems in purchase of key equipment i.e. accelerated ageing chamber, it was decided to avail the facility of ICAR-Indian institute of Seed Science, Mau (UP) and then run the project in collaborative way by assigning Co-PI from this institute also, but they have inform us to also sign an MOU between Bihar Agricultural University (BAU) Sabour and Indian Institute of Seed Science (IISS), Mau (UP).
- Accordingly, approval from competent authority has been taken, and MOU has been drafted by concerned PI and submitted through proper channel to IISS for signing it. Few more procedural steps required and it will come in action very soon.

3. Seed Treatment with Carbon Nanoparticles for Seed Enhancement in Pulse

- The seed lot of chickpea (*var.* PG186) and lentil (*var.* HUL 57) was soaked in sufficient amount of dispersion with carbon-based nanoparticles at different concentration (50, 100, 125, 150 mg/l) then

seed became dried under shade at room temperature to the initial seed weight to maintain original or near to safe moisture content. Both the crops were treated with different carbon-based nanoparticles *viz*., graphene (G) and graphene oxide (GO) single walled carbon nanotube (SWCNT) and multi walled carbon nanotube (MWCNT) with different concentrations (dispersant) as mentioned above.

- It was found that in both the crop all seed quality parameters are significantly improved up to the concentration of 125 mg/l but after that there was a reduction in germination, vigour, relative storability of seed lot. Carbon nanoparticles improved the seed germination, vigour, root and shoot length, seedling dry weight and membrane permeability and dehydrogenase activity.

4. Study on effect of nanopriming on Seed quality in finger millet (*Eleusinecoracana.*)

- The seed lot of finger millet was given treatment with certain defined temperature (41^{0}C and 60 ^{0}C) and 40 percent RH for several hours (96,144, 210) for the purpose of accelerating the ageing of seed of VL 149 and GPU 67. After accelerated ageing at 41° C and 40 % RH for 210 hr, the germination percentage of both the variety was recorded below 50 percent.
- Seed treatment with carbon nanoparticles with different concentration and seed quality parameters assessment has been done.Aged seed lot having germination percentage between 30 and 40 were given seed invigoration treatment with carbon nanoparticles viz., Graphene, Single walled carbon nanoparticles (SWCT), multiwalled carbon nanotube (MWCT) and graphene oxide along with hydropriming (distilled water for 4 hour). The result showed that though carbon nanoparticle enhanced the vigour of finger millet seed lot, but hydropriming was far better than carbon nano priming for improvement of all seed quality parameters.

5. Seed quality enhancement using botanicals in pulses vis-a-vis analysing biochemical and molecular changes associated with it

- **To assess the seed quality of pulse crops (Lentil and Chickpea) collected from different Agro-climatic zones of the state.**

- **Sample collection from different agro-climatic zones of Bihar**

◊ Seed samples were collected in November-December, 2017 covering total 15 districts of different agro-climatic zones of Bihar. It was taken in clean, moisture free polythene bags from the farmer's and KVKs Farms.

- **Physiological and biochemical evaluation of collected chickpea and lentil seed samples**

❖ The physiological evaluation of collected chickpea and lentil seed samples were done as per standard methods prescribe by ISTA, (ISTA, 2015) and vigour index by Abdul-Baki and Anderson, 1973.

❖ The antioxidant enzymes activity viz catalase, peroxidase and superoxide dismutase were analysed on all seed samples of both crops. Based on the physiological and biochemical evaluation of chickpea and lentil seed samples collected from different districts; sample collected from Sheikhpura and Mokama was found superior among all in chickpea and lentil respectively.

❖ The seed samples collected from Begusarai and Katihar district were having the minimum germination percent, seedling length, seedling dry weight and vigour indices in chickpea and lentil respectively. All seed lots of chickpea and lentil have been categorized into high, mid and low vigour seed lots based on physiological assessment.

- **To optimize & compare the efficacy of different botanical treatments involved in enhancing seed quality**
- **Selection of duration of priming**

❖ On the basis of study of imbibition curve of all botanicals and first radicle protrusion of chickpea and lentil, the duration of botanicals priming have been decided for different concentrations. The duration of priming was kept 4 hours before the radicle protrusion of each combination of priming treatment. The chickpea and lentil seed were imposed to different botanicals priming for finalized durations (hours).

❖ Based on the water uptake pattern by the seed, imbibition curves were plotted for all the concentrations of each botanical. In fig. 4 (A-B), the imbibition curves of selected concentrations of each botanical have shown which was showing higher enhancement in the physiological parameters like germination and vigour in the case of chickpea and lentil. There are three phases of seed germination; in this study also three different phases of seed germination have been clearly seen. The radicle protrusion took place after 18-24 hrs and 14-20 hrs of imbibition in chickpea and lentil respectively. Since the radicle protrusion is prevented in seed priming and after completion of phase II, primed seeds are dried back to original moisture content Therefore, the priming duration for different concentrations of botanicals was finalized 4 hrs before radicle protrusion i.e. 14-20 hrs and 10-16 hrs of imbibition's in chickpea and lentil respectively.

❖ Phase I: Rapid uptake of water, which is totally physical process.

❖ Phase II: It is metabolically active phase, in which seed is preparing for germination.

❖ Phase III: Germination begins and water uptake again resumes due to seedling growth.

- **Effect of different concentrations of botanicals priming on physiological parameters**

❖ The effect of different concentrations of all botanicals priming on physiological parameters viz germination percent, seedling length, seedling dry weight, vigour index I and vigour index II was studied in both chickpea and lentil. On the basis of physiological parameters, the best performing concentrations of each botanical in both crops have been selected for further study. In chickpea, 5 % concentration of datura and papaya and parthenium, 10 % concentration of lantana, turmeric, garlic leaves and garlic bulb and 15 % concentration of neem and ginger have shown the best results.

❖ Whereas in lentil,5 % concentration of datura, lantana, parthenium and garlic leaves, 10 % concentration of neem, papaya, turmeric, and garlic bulb and 15 % concentration of ginger have shown best results. The best performing concentration of each botanical was selected for further study. With increasing concentration, germination in both crops was reduced. The growth of root and shoot was also adversely affected by the increase in concentration and in case of parthenium primed seed the effect was very prominent.

- **Compare the efficacy of botanicals priming in chickpea and lentil under laboratory condition**

❖ The priming with selected concentration of each botanical was imposed on chickpea and lentil seed and they were evaluated on physiological parameters under laboratory condition. In chickpea, seed primed with turmeric was having highest significant increase in germination percentage by 9.5 %, seedling length by 15.5 %, seedling dry weight by 4 %, vigour index I by 26.5 % and VI II by 14 %. However, in case of lentil, all botanicals were able to enhance germination percentage significantly over control and the highest increased was observed in turmeric primed seed, which was at par with papaya, neem, garlic leaves and ginger.

- ❖ Papaya primed seed showed the maximum significant increase in seedling length, seedling dry weight, vigour index I & II followed by turmeric and neem. Parthenium priming adversely affected the seedling length and seedling dry weight, whereas significant increase in germination percentage was observed.

- ➢ **Compare the efficacy of botanicals priming in chickpea and lentil under field condition**
- ❖ During this rabi season (2019-20) we took our laboratory findings to the field to further validate our research findings under field condition. All the botanicals primed seeds (datura, garlic bulb, garlic leaves, lantana, neem, papaya, parthenium, turmeric, ginger) were planted into field following RBD design into three replications with row and plant spacing 30x10 cm.
- ❖ The same set of experiments was carried out for low, medium and high vigour seed lots of chickpea and lentil. The effect of botanicals priming had been clearly seen in the case of medium vigour seed lots of chickpea and lentil with regards to field emergence, early seedling establishment and seedling growth. We could not interpret the true effect of this technique in later stages of the crop because both the crops were severely affected by collar rot, dry root rot, fusarium wilt, untimely rain and pod borer during the entire crop period. So, on the basis of previous year's findings on early field emergence, establishment and seedling growth, we selected the best performing botanicals (neem, turmeric primed seed in chickpea; neem, papaya, turmeric and ginger primed seed in lentil along with control and bavistin treated seed as positive control) and we took this experiment in the present ongoing rabi season 2020-21 also on medium vigour seed lots of chickpea and lentil. Since the field experiments are still underway, so the final conclusions on the field experiment would be made only after the completion of the season.

- ➢ **Objective 3: Comparative analysis of biochemical changes associated with seed treatment during storage**
- ➢ **Comparative analysis of biochemical changes associated with seed priming during storage**
- ❖ To study the effect of priming on activities of enzymes and free radicals during seed storage, we have stored the seed primed with best performing botanicals along with non-primed seed as control in plasticlinedalumium foil pouches for 12 months. The observations on physiological and biochemical parameters have been taken at each 3 months time interval. To carry out this study, neem, turmericprimed seed in chickpea and neem, papaya, turmeric and ginger primed seed in lentil have been used along with control.
- ❖ The storage was done during May, 2020 and the comparison of physiological and biochemical activities can be done only after completion of storage period of 12 months.

H. Vegetable Improvement Programme:

1. Marker assisted breeding for different disease resistance alleles in tomato

- ➢ Heterozygosity of different F_1 combinations has been tested using molecular markers.
- ➢ MAS in different F_2 populations in field condition were carried out to genotype promising lines.
- ➢ A repulsion phase linkage between *Ty3* and *Mi1.2* disease resistance alleles has been detected through MAS.
- ➢ A 4 parentalpopulation was screened for the presence of disease resistance alleles and improved fruit quality.

- Single plant selections (on the basis of MAS) and selective bulks with promising lines in different cross-combinations have been made for generation advancement.
- Through molecular markers, different fruit colour mutant alleles have been identified in tomato germplasm.
- Different cross-combinations have been attempted for stacking of fruit pigmentation mutant alleles.
- A simultaneous detection method for *Mi1.2* and *Ph3* resistance genes in tomato has been optimized.
- A PCR-based perfect marker has been developed and validated for identification and introgression of $hp2^{dg}$ mutant allele.
- A PCR-based perfect marker has been developed and validated for identification and introgression of *ovate* mutant allele for fruit shape selection in tomato.
- EMS mutagenesis has been done in the genotype H-86 to raise the M_1 plants.
- Through MAS, *Ty3/Mi1.2/Ph3*, *Ty3/Ph3*, *Ty3/Tm2* disease resistance allele stacked tomato lines have been identified in different segregating populations.

2. Development of brinjal hybrids for summer season

- For spring-summer trial, a set of 10 genotypes were planted with December, 2019 transplanting in which BRBL-01 (260.04 q/ha) at par with Pusa Purple Long (256.05 q/ha) were the highest yielders followed by Pusa Purple Cluster (226.76 q/ha) and BRBL-02 (196.47 q/ha).
- For summer trial 2020, a set of 25 genotypes were planted with February, 2020 transplanting and BRBL-04 (267.35 q/ha) at par with BRBL-01 (265.35 q/ha) were the top performers followed by Pusa Purple Cluster (181.77 q/ha), BRBL-02 (168.55 q/ha) and Pusa Purple Long (160.90 q/ha).
- In summer 2020, 20 hybrids were also evaluated with checks Pusa Hybrid-6 and Pusa Hybrid-9 of which BRBL-01 x Haritha (342.35 7 q/ha) was the most promising followed by Pusa Purple Cluster x Haritha (297.12 q/ha), Pusa Purple Cluster x BRBL-02 (227.85 q/ha) and Pusa Purple Cluster x BRBL-07 (225.41 q/ha).
- In the main season of 2020-21 (autumn-winter trial), 24 genotypes were planted and BRBL-01 (438.21 q/ha) was the highest yielder at par with BRBL-04 (413.41 q/ha).
- Thirteen hybrids in the long segment were evaluated in main season with check Pusa hybrid-6 and 71-19 x Rajendra Baingan-2 was the best performer (470.83 q/ha) at par with Pusa Purple Cluster x Muktakeshi (419.91 q/ha), Muktakeshi x Rajendra Baingan-2 (405.53 q/ha), BRBL-07 x Pant Samrat (397.31 q/ha) and Muktakeshi x BRBL-07 (396.39 q/ha).
- Another six hybrids in round segment with check Pusa Hybrid 6 were evaluated in main season of 2020-21 and IIHR-563 x PH-6 female (362.25 q/ha) at par with BRBR-01 x IIHR-563 (342.11 q/ha) and PH-6 Female x BRBL-07 (324.52 q/ha) were the best performers.
- Selection and advancement of segregating population has been carried out.
- A separate trial for field screening against *Sclerotiniasclerotiorum* has also been planted in August, 2020 and data recording is in progress.

3. Development of parthenocarpic gynoecious lines in cucumber for protected cultivation

- Seven parthenocarpic gynoecious lines (stable) and two gynoecious lines have been developed.
- Hybrids have been developed utilising these lines for both polyhouse and open field conditions and some have shown promising results.

4. Development of gynoecious lines in bitter gourd

- Mutation breeding is under progress using EMS and gamma radiation treatments and the M_2 plants are being evaluated in polyhouse.

5. Breeding for prolycopene rich tomato

- The mutant allele for improving prolycopene content in mature fruit was identified in one tomato genotype.
- This genotype was used as a donor to make plant hybridizations.
- Among the 3 F_1 combinations, heterozygosity of 6 plants of a cross-combination was validated through molecular markers.

6. Development of tomato genotypes suitable for processing purpose

- Morphological characterization of 20 genotypes collected from BCKV, Mohanpur, WB and 11 from Dr. YSPUHF, Nauni, Solan, HP and other genotypes available from BAU, Sabour has been done besides biochemical characterization quality traits like TSS, acidity and lycopene of the genotypes has been carried out.
- The genotypes IIHR-2614, Pusa Rohini, Kashi Chayan, SolanVajr and BRDT-2 have been found promising in terms of TSS and pericarp thickness which are important traits for processing tomatoes.
- Crosses have been attempted using these and also some other important lines with Punjab Chhuhara, a variety identified for processing and mutant lines obtained from BCKV containing *dg*, *Aft*, *og* and *rin*genes.
- Morphological characterization of 14 hybrids available from BAU as well as study of processing related fruit traits and TSS of these lines have been carried out.
- The F_2 population of one hybrid was planted in July for harsh field screening for ToLCV and bulking of seeds of 6 disease free plants and advancement to F_3 have been done. The F_3 population has been planted.
- The F_1s IIHR-2614 x Purple Tomato and IIHR-2614 x Alisa Craig *Aft* were planted in polyhouse for generation advancement in July, 2020. Molecular validation of the F_1 plants was carried out. F_2 and BC_1 seeds have been developed and planted for generation advancement.
- Besides, 27 F_1s have been planted in polyhouse and in open field also for morpho-biochemical characterization and molecular validation of some have been done. F_2 seed development and backcrossing is in progress.
- A T-ARMS primer for detection of *dark green* (*dg*)mutant allele has been developed by the Co-PI and validation of the marker on six of these hybrids has been carried out.
- In October 2020, twelve lines that were most promising of the genotypes available and also used as parental lines in breeding programmes have been planted in replicated trial to study their yield performance at Sabour condition.
- Seven F_2 population have been planted in November, 2020 and selection of promising plants has been done and advancement to F3 has been done.
- Two F_2 populations have been planted in for identifying lines for summer season.

3.2.3.2. Natural Resource Management (NRM)

A. Agronomy

i. AICRP on IFS

Experiment No. 1:Identification of cropping systems module for different farming systems

- The experiment was initiated in the year 2019-20 where ten rice based cropping systems were evaluated for their production potential and economics in randomized block design with three replications.
- Among different treatments, it was found that rice – potato + onion was found most efficient and profitable cropping system producing rice equivalent yield of 27.4 t ha^{-1} and net returns of Rs. 1,92,980 ha^{-1} .This system was closely followed by rice – cabbage – ladyfinger (25.9 t ha^{-1} and Rs. 2,08,224 ha^{-1}).The system productivity and profitability of these two systems were 75.03 and 70.93 kg $ha^{-1}day^{-1}$ and Rs. 528.7 and 570.5 $ha^{-1}day^{-1}$, respectively.

Experiment No. 2: Permanent plot experiment on integrated nutrient supply in rice-wheat crop sequence

- After 36th crop cycle, substitution of 50% N through F.Y.M.+50% NPK through inorganic fertilizers in rice and 100% recommended dose of N P K in wheat (T_6) produced the highest grain yield of rice (52.8 q ha^{-1}), wheat (41.4 q ha^{-1}) and rice-equivalent yield (110.7 q ha^{-1}) as well as net return (Rs.96,942 ha^{-1}) of the system. This T_6 treatment being was at par with substitution of 50% N through green manuring and wheat straw proved significantly superior rice equivalent yield over the treatment receiving 100% recommended fertilizer dose. Organic carbon status and P-balance in soil was positive in all the treatments except control plot and plots getting 50% NPK through fertilizers and its accumulation was higher when organic matter was incorporated in the soil. A marginal decline in available N and K status of soil was observed in the treatments receiving nutrients through fertilizers. Substitution of either 50% or 25% N through organic sources also helped in reduction in bulk density, better aggregation and improving microbial population and dehydrogenase activity of soil.

Experiment No. 3: Development of Integrated Farming System Model for Livelihood Security of Small and Marginal Farmers of Bihar

- The net income of Rs. 3,42,721 was realized from cropping+ dairy+ goatry + fishery including fruits + duckery + boundary plantation+ vermicompost.
- Net income obtained from cropping systems, dairy unit, goat unit, fishery, duckery, boundary plantation and recycling of farm waste contributed 23.04, 40.30, 11.52, 8.36, 0.18, 5.31 and 11.29% respectively to the total net income of the system.
- The IFS model also generated employment (677 man days/year) and regular income (Rs. 939/day) throughout the year to farm family.

ii. Site specific N management using chlorophyll meter and leaf color chart in rice and wheat

- The SPAD based N management treatments i.e. T_8 against the SPAD 38 and 42 for rice and wheat, respectively received 250 kg N ha^{-1} which was 4% higher than that of received under fixed time N management (FTNM) (240 kg N ha^{-1}) but resulted higher system yield and economics (19%) over the FTNM.
- Among the LCC based treatments the N fertilizer response was noticed up to <4.0 with 30 kg N ha^{-1}.
- The correlation between SPAD index and grain yield followed by N dose and grain yield resulted the optimum and N dose 38.8 and 107.7, respectively.

iii. Integrated Potassium management for optimum system productivity, profitability & sustainability of Rice-Wheat system in Bihar

- The significant variation in grain yield among the main plots i.e. puddle transplanted rice and direct seeded rice was not noticed at first year of experiment. Whereas, among the potassium managements treatment having 60 kg ha^{-1} in two equal split (at basal and at active tillering) recorded the maximum grain yield which was significantly superior to the 40 kg potassium ha^{-1} as basal.
- Just after the first season of the experiment, advantages of KSB (potassium soluilizing bacteria) was not prominent but integrated potassium management through vermicompost and seed treatment with KSB recoded similar grain yield with 60 kg K_2O ha^{-1} in two equal split.
- Zero till wheat after puddled transplanted rice with residue retention performed significantly higher yield and economics over the zero till wheat after DSR.
- In rice wheat system the two split potassium @ 60 kg K resulted highest equivalent yield and economics over the recommended dose

iv. Developing Agro-techniques for Improving of Quality Fodder Production in Bihar

Experiment No. 1: To find out the suitable perennial forage based cropping system for quality fodder production

- As per two years pooled data, among the all cropping systems, the Tri Specific Hybrid (TSH) + Dhancha + Sorghum + Cowpea – Maize cropping system perform batter and produced significantly higher Green Fodder Yield (1629 q ha^{-1}) in a year in irrigated condition followed by Tri- Specific Hybrid (TSH) + Stylo Grass + Pearl millet (M) – Barley cropping system (1581 q ha^{-1}) again followed by Hybrid Napier + Maize-Oat (MC) cropping system respectively
- The highest net return (Rs. 2,43827 ha^{-1}), benefit cost ratio (2.97) was recorded from Tri Specific Hybrid (TSH) + Dhancha + Sorghum + Cowpea – Maize cropping system followed by Tri- Specific Hybrid (TSH) + Stylo Grass + Pearl millet (M) – Barley and Hybrid Napier + Maize- Oat (MC) cropping systems.

Experiment No. 2: Performance of dual-purpose Sorghum for quality fodder production under different fertility levels

- Significantly higher fodder equivalent yield was found in dual purpose sorghum followed by fodder purpose sorghum in comparison to grain purpose sorghum.

v. Development of Millet Agro-technique in Bihar

Experiment No. 1: Effect of plant population and weed management practices in transplanted finger millet.

- Transplanting close spacing at 20 X 20 cm recorded significant grain yield (27.70 q/ha) and net return Rs (64969 /ha) over wider planting at 25X 25 and 30x30 cm. Weed management treatments, weed free recorded significantly higher grain yield (25.75q ha-1) but remained comparable to hand hoeing twice (25.41q/ha) and application of either Pendimethalin @ 750 g ai ha-1, fb Bispyribac sodium @ 20 g ai ha-1 or Pretelachlore @1000 g ai ha-1, fb Bispyribac sodium@20 g ai ha-1 (25.24 and 24.93 q ha-1) but net return was significantly higher (Rs 61488 /ha and 60534) with application of either Pendimethalin @ 750 g ai ha-1, fb Bispyribac sodium @ 20 g ai ha-1 or Pretelachlore @1000 g ai ha-1, fb Bispyribac sodium@20 g ai ha-1 .
- Interaction effect resulted that application of either Pendimethalin @ 750 g ai ha-1, fb Bispyribac sodium @ 20 g ai ha-1 or Pretelachlore @1000 g ai ha-1, fb Bispyribac sodium@20 g ai ha-1 recorded higher yield (29.90 and 29.66 q/ha) and net return (Rs 74980 and 74234/ha) at same level 20x20 cm of planting.

Experiment No. 2: Effect of plant population, fertility level and age of seedling on transplanted pearl millet

- Highest grain yield (35.17 q/ha), stover yield (84.65 q/ha) and net return Rs 56827 ha-^{1}was recorded at 50x20 cm over at 50 x25 cm planting.
- Application of 120: 60: 60 kg NPK ha^{-1} found optimum dose for significantly higher pearl millet grain yield (34.50 q/ha), straw yield (79.56 q/ha) and net return Rs 54871 ha^{-1}.
- Transplanting of 20 days old seedling gave highest grain yield(35.12 q/ha), stover yield (82.20 q/ha) and net return (Rs 56569/ ha).

Experiment No. 3: Evaluation of different pearl millet varieties during summer season

- Among different nine hybrids/varieties of pearl millet hybrid 860M 64 recorded significantly higher grain yield (47.14 q/ha) net return (Rs79769/ha) over remaining varieties but at par to, ProAgro 9444.

Experiment No. 4: Effect of osmolytes on different cultivars of summer pearl millet

- Among different nine hybrids/varieties of pearl millet hybrid 86 M 64 recorded significantly higher grain yield (44.33 q/ha) net return (Rs74431/ha) over remaining varieties but at par to, ProAgro 9444.
- Different osmolytes spray showed significant result and 1 % KNO3 with full irrigation noticed higher yield(43.03 q/ha) and net return (Rs70999 /ha).

vi. AICRP on Rice (Volunteer centre)

Experiment No. 1:Nutrient response trials on selected AVT-2 rice cultures under high and low input management

- The experiment was conducted in a split plot design with three replications. The treatments were two levels of fertilizer input (50% and 100% RDF) as main plot and genotypes/varieties assigned to sub plots. The AVT-2 entries (IET 27869 and IET 27883) compared with national check (Narendra 97), zonal check (Sahbhagidhan) and local check (Sabour Harshit). The performance of IET 27869 (4880.73 Kg/ha) followed by IET 27883 (4298.06 Kg/ha) were better over other entries. The application of 100% RDF recorded higher grain yield (4397.25 Kg/ha) it showed superior over 50% RDF (3922.94 Kg/ha). Interaction effects of nutrient levels x cultivars on grain yield was found non-significant.

vii. Studies on split application of potassium for higher productivity, profitability and improved soil health in rice based cropping system

- After harvest of third year crop (Rice-Wheat, Maize). Cropping system did not influence the grain and straw yield of rice, where different dose of potassium, 150% recommended dose potassium (RDK) (K2) recorded more grain and straw yield which is statically at par with 200% recommended dose potassium (RDK) (K2) and regarding split potassium application result found that, the grain and straw yield of rice, more with two equal split application of potassium i.e. 50% as basal + 50 % at maximum tillering/knee high stage (S2) which is statically at par with 50% as basal + 25 % at maximum tillering/knee high stage + 25% at panicle initiation/booting/tassiling (S3) and 50% as basal + 50 % at maximum tillering/knee high stage (S2) and 75% as basal + 1% foliar spray at maximum tillering/knee high stage and 1% foliar spray at panicle initiation/booting/tassiling (S4). Rice followed by maize gave the more economical than the Rice followed by wheat.

viii. Organic based Nutrient Management in Katarni Rice and its Residual Effect on Chickpea

- The Three years of the project i.e. the conversion period of plot from inorganic to organic has been completed. The performance of Katarni rice during Kharif ,2019 revealed that the treatment **T5** [75% N (FYM) basal + 25% N (VC) at 25 DAT + Azospirillum + PSB + KSB] recorded the highest grain yield (31.9

q/ha),straw yield (50.96q/ha) and HI (38.50%).However,it was found statistically at par with**T1**[control (100% RDF)]and**T2**[1/3 N(FYM) + 1/3 N (VC) + 1/3 N (NC)],**T4**[50% N (FYM) as basal + 50% N (VC) at 25 DAT] and **T6**[75% (FYM) as basal + 25% N (VC) at 25 DAT + Panchagavya by foliar application]. The highest net return of Rs.83362/ha was recorded with treatment T5 but the highest B:C ratio (2.29) was recorded T1 i.e.control. In case of Chickpea (JG14) during Rabi 2019-20,the treatment **T9**recorded significantly higher grain yield (13.12 q/ha),straw yield (20.25q/ha) and HI (39.23%) over **T1**[control (RDF)].However, it was found statistically at par with **T2**,**T5**,**T7**and**T10**.The highest net return (net return (Rs.92393/ha) and B:C ratio (4.16) was recorded with treatment T9 while the lowest net return (Rs.59849/ha) and B:C ratio (2.69) was recorded under control (T1).

ix. Crop residue management strategies for rice – wheat cropping system of Bihar

- The rice yields varied within 4.2 – 4.5 t/ha among the locations. There was no significant difference on rice yield as the treatments were implied after rice harvest. 2.8 – 3 t/ha rice residue were retained on soil surface in ZT wheat and incorporated in CT wheat. Additional 25 kg N added for decomposition followed by RDF resulted in 7 – 11% higher wheat yield followed by additional 5 kgN/ha spray for decomposition. The cost of cultivation was 4% lower in PTR – ZT system with 7.5% higher System Rice equivalent yield.
- The net returns were 6 – 17% higher in PTR – ZT wheat system At Sabour, the system net returns of *Aspergillus* significantly outperformed *Trichoderma*& EM but at Dumraon there was no significant difference among the decomposers. Among the microorganisms, *Trichoderma* application resulted in lower CO2 emission as compared to EM solution or *Aspergillus* however the trend was reversed with increasing maximum temperature. After a 150 days placement cycle of rice residues, 70% of the residue was decomposed under CT while only 50% was decomposed under ZT.

x. Life Cycle Assessment of Pre-dominant Irrigated Cropping Systems of Bihar

- Nutrient management did not show any significant influence on grain as well as straw yield after first season of experimentation, however, highest yield was obtained in SPAD based nutrient management along with the application of Butachlor 50 EC @ 1.5 l a.i. ha-1 at 2-4 DAT and Seed treatment with Bavistin @ 2.5g kg-1 seed.
- Application of organic manures augmented the CH_4 and CO_2 emission, whereas, inorganic fertilization aggravated higher N_2O emission.
- Direct greenhouse gas emission from the crop field attributed highest contribution in life cycle assessment of rice crop, while among indirect emission the contribution from fertilizer input was the maximum.
- Apparently, application of organic manures influenced the proliferation of microbes in soil as compare to sole inorganic fertilization.
- The data need to be validated in subsequent year of experimentation.

xi. AICRP on IFS (OFR Centre, Nalanda)

Experiment No. 1:On Farm crop response to plant nutrients in predominant cropping systems

- Grain yield of both the crops in the cropping systems increased significantly by applying nutrients over farmer practice and control.

- Maximum grain yield of rice (50.35 q/ha) and wheat (44.27 q/ha) were recorded with the application of recommended dose of fertilizers along with zinc in rice, followed by application of N P K, farmer practice, N P and N K in descending order.
- It shows that application of all three nutrients along with Zn in balance dose recorded most promising in rice-wheat cropping system. It is obvious that application of both P and K were essential to crops but P proved to be more effective than K.
- The highest rice equivalent yield (98.90 q/ha) and was achieved with the application of recommended dose of fertilizer to both the crops along with Zn in rice which significantly excelled over all other treatments.

Experiment No. 2: Diversification of existing farming systems under marginal household conditions

- Twenty four farmers of marginal household were selected in Nalanda District having the two farming system i.e Crop + Horticulture and Crop +Dairy were identified having mean holding size 0.75 h and 0.64 ha respectively.
- The bench mark status, the mean total net income from crop + Horticulture and Crop + Dairy system was Rs.58504/ and Rs.74403/ respectively.
- Crop +Dairy, Farming system getting highest return (Rs.125086) which was 63.7 % higher over benchmark(Rs.76403) followed by Crop+ Horticulture. The lowest net return (Rs.99324) found in the farming system of Crop+ Horticulture which was 69.7% higher over benchmark (Rs.58504).

Experiment no. 3: On farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers

- Twelve small and marginal household were selected toevaluate the farming system in Nalanda District. The two farming system i.e. Crop + Dairy and Crop + Dairy + Fishery were identified having mean holding size 1.16 and 0.79 ha respectively.
- The bench mark status, the mean total net income from crop + Dairy and Crop +Dairy+ Fishery farming system were Rs.63945/ and 78958/respectively.
- Farming system Crop + Dairy+ Fishery(area-1.16 ha) getting highest net return Rs.136328/ which was 72.6% higher over bench mark (Rs.78958/) followed by farming system Crop + Dairy (Area-0.79 ha) Rs.116245 which was 81.7% higher over benchmark (Rs.63945/).

xii. AICRP MAP and Betel vine, BRC, Islampur (Nalanda)

Experiment No. 1:Influence of irrigation scheduling on growth, yield and water use efficiency in Tulsi (*Ocimum sanctum*)

- Among the different irrigation schedules, irrigation with T_3: (IW $_{30\ mm}$/CPE= 1.0) exhibited maximum value of growth and yield attributes with highest green leaf yield (9689.60 kg/ha) and dry leaf yield (2010.80 kg/ha it was statistically at par with irrigation scheduling at IW $_{30\ mm}$/CPE= 0.8 (T_2) and IW $_{40\ mm}$/CPE= 1.0 (T_6) but significantly superior than rest of the treatment.
- Irrigation scheduling with IW $_{30\ mm}$/CPE= 1.0 (T_3) exhibited highest value of WUE (1.70 kg/ha-mm) which was statistically at par with T_1 (IW $_{30\ mm}$/CPE= 0.6), T_2 (IW $_{30\ mm}$/CPE= 0.8), T_5 (IW $_{40\ mm}$/CPE= 0.8) and T_6 (IW $_{40\ mm}$/CPE= 1.0).Based on WUE and economicreturn, itwasfoundthatirrigationscheduling at IW $_{40\ mm}$/CPE= 0.8 (T_5) was more beneficial (B:C ratio 2.90) with less number of irrigation (9) for obtaining optimum yield of Tulsi.

Experiment No. 2: Effect of planting method and irrigation scheduling on growth and yield of Aloevera *(Aloe barbadensis)*

- Different planting method of planting caused significant differences on growth and yield parameters of Aloevera. The highest fresh leaf yield (6.75 kg/plant) and WUE (3.02 kg/ha-cm) was noted under Ridge and furrow method of planting (M_3) which was statistically at par with Raised bed system of planting (M_2) but both of the planting methods proved significantly superior over Flat bed method (M_1) where fresh leaf yield was 5.06 kg/plant, and WUE 2.41 kg/ha-cm.
- Among the different irrigation scheduling, crop irrigated at IW: CPE= 1 (I_3) exhibited highest value of fresh leaf yield/plant (7.17 kg) which was statistically at par with irrigation scheduling at IW: CPE= 0.8 (I_2). However, both these treatments were showed superiority over I_1: IW $_{30\ mm}$/CPE= 0.6 and rainfed conditions (I_4). But WUE was found at par when irrigation was given at IW/CPE = 1, 0.8 and 0.6 at same depth (30 mm). However all these treatment significantly superior than control (Rainfed condition).

Experiment No. 3: Integration of different sources of nutrients for enhancing herbage and oil yield of *Menthaarvensis*

- A field trial was conducted with objective to find out the suitable integration of different sources of nutrients for enhancing higher herbage and oil yield of Menthaarvensis. The results revealed that the herbage and oil yield of mentha were significantly influenced due to the integration of different nutrient sources. Significantly maximum Plant height (64.27 cm), number of branches/plant (19.47), fresh herbage yield (180.04 Q/ha) and oil yield (122.47 kg/ha) were recorded in plots where 90:40:30 kg NPK/ha was applied along with 2.5 t vermicost/ha (F8). This treatment was found at par with 90: 40: 30 kg NPK +5 t FYM ha-1(F6), 120 : 60 : 40 kg NPK ha-1 (F4),and 90 : 40 : 30 kg NPK + 5 kg Azotobactor ha-1 (F10).

Experiment No. 4:Selection and identification of promising lines of ShyamTulsi (Sabour OS-1) for evaluation of higher leaf

- One entry of ShyamTulsi (Sabour OS-1) was identified for high leaf yield and its performance was compared with National check (Anjana) along with other three entries (Black Tulsiand Green Tulsi from AAU Anand & DOS-1 from DMAPR, Anand) as per technical programme of AICRP MAP & Betelvine project in 7 different location of the country and other 2 location in Bihar (VKSCOA, Dumrao and RRS Tilaundha).
- From the MLT results, it was found that Sabour OS-1 exhibited at par result in terms of green, dry leaf yield, seed yield and oil yield with National check Anjana. Sabour OS-1 gave 50.51 q/ha green leaf yield and 11.35 q/ha dry leaf yield incomparison to National check Anjana which yielded green leaf 62.90 q/ha and dry leaf 14.25 q/ha. Sabour OS-1 gave 266. 76 kg/ha seed yield and 14.72 kg/ha oil yield i.e. (0.33 % oil) incomparison to National check Anjana which gave seed yield of 310.60 kg/ha and oil yield 12.66 kg/ha i.e. (0.24%)

Experiment No. 5:MLT-AVT-II Evaluation of promising lines of for high yield and quality: 3 MLT on basil (AB-series, OB-series and OS-series)

- Three Multi Location Trial under AICRP MAP &Betelvine project have been conducted for evaluation of promising lines of basil AB-series (20 entries), OB-series (24 entries), and OS-series (25 entries) for high yield and quality. From the experimental result it was found that different promising lines of AB-series, OB-series and OS-series of basil reflected range of green leaf yield which was in order of 63.25 to 95.48 q/ha with AB-4 & AB-16, 46.22 to 115.84 q/ha with OB-14 & OB-11 and 55.32 to 98.21 q/ha withOS-11

& OS-13 respectively. However their average green leaf yield of 75.93, 64.89 and 63.91 Q/ha with AB-series, OB-series and OS-series respectively.

Experiment No. 6: MLT-IVT Evaluation of promising lines of Lemon grass (*Cymbopogonflexousus* var. flexousus) for high yield and quality

- Seven entries (CF1-CF20 and HLG1-HLG 9) of Lemmon grass was tested under Multi Location Trial of AICRP MAP &Betelvine project for evaluation of promising lines of Lemon grass. The crop was still under field condition.

xiii. Effect of different doses of Sulphur on Growth, Yield, S-Uptake and Oil Content in Mustard- Soybean cropping system in Koshi region

- 1st year crop cycle is completed with harvesting of Soybean crop. Second year Mustard crop is standing in the field. Data analyzed and following salient achievements observed w.r.t Soybean Crop.
- Yield-Different doses of Sulphur with time application cause significant variation in seed yield in Soybean crop. The higher seed yield (kg/ha) was obtained with the treatment of 40 kg per ha (S3) Sulphur use along with T3 due to mutual effect of dose and time application which was statistically superior over S2. As the dose of sulphur was increased, the yield gradually increases significantly.
- Oil Content and S- uptake-Oil content (%) and S uptake by plant gradually increased as the dose of S increases and it was recorded maximum in S_3T_2 (19.62 % and 3.27 kg ha^{-1} respectively) which was significantly superior over rest of the treatment combination.
- Economics-The net return and B: C ratio was also maximum in S_3T_2 (47672.00 Rs. ha^{-1} and 2.78 respectively) which was significantly superior over rest of the treatment combination.

xiv. Crop Residue and Nitrogen Management under Rice-Wheat Cropping System in Zone-III B of Bihar

- Grain yield of wheat during first year of experiment was found significantly higher under rice straw management along with decomposer EM solution as compare to other treatments and in nitrogen management 125 % RD of N treatment was found superior. The agronomic efficiency was recorded highest in the treatment of surface mulching and retention plus EM solution where as significantly higher in recommended dose of nitrogen.

xv. Development of Organic Farming Package for high Value Vegetable Crops

- Onion-Onion-Bottle gourd was found significantly superior in term of net return over Okra-Cabbage-Bottle gourd during first year, but, became at par during second, third and fourth year of study.
- During first and second year of study the 100 % Inorganic fertilizer treated plots recorded highest net return but found at par with T2-50%NPK as IF+50%N as FYM. But in third and fourth year, this 100 % Inorganic fertilizer treated plots became significant over T2-50%NPK as IF+50%N as FYM also in terms of net return and B C ratio.
- Although, among organically treated plots, T6 (50% N as FYM+50% N as VC + PSB and Azotobactor) recorded significantly higher net return and BC ratio over T5 during first and second year. But during third and fourth year, T6 became significant over all other organic plots.
- Yield of organically treated plots are still declining in Kharif onion, Rabi onion (except T6 in 3rd year) and in bottle gourd (except T6 in fourth year) in Cropping system I.
- Cropping system II, the yield of okra is remain constant or started to increase in organically treated plots as compared to previous years and yield became non- significant during third and fourth years of study.
- Organic carbon, available N, P and K differed significantly after three year in Onion-onion-bottle gourd crop sequence, while in Okra-cabbage bottle gourd only available K differed significantly.

xvi. To select a suitable intercropping system for finger millet with different legumes in zone II

- Experiments results revealed that grains as well as straw yield of finger millet were recorded significantly higher in sole finger millet than all other treatments, however finger millet equivalent yield was remarkably high in all intercropping system as compared to sole crops. Among all intercropping system, finger millet inter cropped with black gram were recorded significantly higher grain as well as straw yield of finger millet followed by groundnut and soybean. Grain yield of different inter crops were recorded maximum in 4:2 than 6:2 row ratio , however finger millet equivalent yield were recorded maximum in 6:2 row ratio of almost all inter cropping system . Net income and benefit- cost ratio were also found maximum in finger millet with black gram inter cropping system in 6:2 row ratio than all other inter cropping system including sole finger millet.

xvii. Evaluation of crop establishment and weed management practices for enhanced resource use efficiency and crop productivity in soybean(*Glycine max* L. Merrill)-maize (*Zea mays* L.) cropping system

- T_3 (Ridge and furrow)performed best among other land configuration treatments in both tested crops. The infestation of weeds is recorded higher in flat bed whereas less infestation is recorded in T_3 (Ridge and furrow) in both the season.
- On the basis of weed control efficiency in Soybean T_8 [Pendimethalin 30 EC @1kg a.i./ha (PE) *fb*Imazethapyr 10% SL @ 60g a.i/ha was found effective than the other treatments Whereas in Maize,Atrazine 50%WP @ 0.5kg a.i./ha+ HalosulfuronMethyl 75% WG @ 0.0675 kg a.i./ha (EPOE) *fb* One hand weeding shows effective control of weeds in the crop.

xviii. AICRP on weed management

Experiment No. 1: Efficacy of different post-emergence herbicides in chickpea (*Cicer arietinum*)

- The results revealed that the lowest weed density (2.72/m^2) and weed dry weight (1.54 g/m^2) were recorded under Clodinafop-propargyl+Na-aciflurofen 220 g/ha (Readymix) which were at par with topramezone (6.10/m^2) & (3.68 g/m^2).
- The highest weed control efficiency at 60 DAS (95.16%) was recorded with Clodinafop-propargyl+Na-aciflurofen 220g/ha (Readymix) but it caused phytotoxicity upto 06 level followed by two hand weedings at 30 and 50 DAS (91.73%), topramezone (88.43%).
- The weed Index % was recorded lowest in treatments topramezone (3.32%). Maximum grain yield (1.69, 1.63 and 1.32 t/ha) recorded under treatments two hand weeding, topramezone and imazethapyr respectively.
- The highest gross return (Rs. 82,290/ha) and net return (Rs. 48,824/ha) were recorded by two hand weeding which was statistically at par with topramezone (Rs.79,560) & (Rs.47,404) and followed by imazethapyr (Rs.64,496) & (Rs.37,7790). The highest B:C ratio (Rs.1.47) was recorded by topramezone followed by two hand weeding (Rs.1.46), imazethapyr (Rs.1.42) and lowest net return (Rs.16,705/ha) and B:C ratio (0.65) was recorded under weedy check.

Experiment No. 2: Herbicides combinations for control of complex weed flora in wheat (*Triticumaestivum*)

- The results revealed that the lowest weed density (5.36/m^2) and weed dry weight (2.12 g/m^2) were recorded by two hand weeding which were significantly superior over rest of the treatments.
- Among different herbicides, the lowest weed density (16.13/m^2) and weed dry weight (10.55 g/m^2) were recorded by Pendimethalin 1.0 kg/ha (PE) fb sulfosulfuron 0.018 kg/ha (30-35 DAS).
- The highest grain yield of Wheat (4.49 t/ha) was recorded by the treatment two hand weeding which was statistically at par with Pendimethalin 1.0 kg/ha (PE) fb sulfosulfuron 0.018 kg/ha (POE) (4.26 t/ha)

followed by Mesosulfuron+Iodosulfuron-methyl (RM) (12 g+ 2.4g) POE (4.17 t/ha) and Clodinafop 0.06 kg/ha + metsulfuron 0.004 kg/ha at 30-35DAS (3.93 t/ha).

- The highest weed control efficiency was recorded in two hand weeding (96.22 %) which was closely followed by Pendimethalin 1.0 kg/ha (PE) fb sulfosulfuron 0.018 kg/ha (POE) (81.21%).
- The highest gross return (Rs.81,426/ha) and net return (Rs.39,526 /ha) were recorded by two hand weeding which was statistically at par with Pendimethalin 1.0 kg/ha (PE) fb sulfosulfuron 0.018 kg/ha (POE). The highest B:C ratio (Rs.2.01) was recorded by Pendimethalin 1.0 kg/ha (PE) fb sulfosulfuron 0.018 kg/ha (30-35 DAS) and Mesosulfuron+Iodosulfuron-methyl (RM) (12 g+ 2.4g) POE (Rs.1.96) and lowest economics were observed in un-weeded control.

xix. AICRP Wheat

Experiment No. 1: Performance of new wheat genotypes under restricted irrigation conditions

- Six wheat genotypes K1317 (C), HD3171 (C), DBW252 (C), HD3293, HI1612 (C) and HD2888 (C) were evaluated under restricted irrigation i.e. without irrigation, one irrigation at CRI stage and two irrigation at CRI and Boot leaf stage and it was observed that mean grain of all the six genotypes were significantly higher at two irrigation levels (42.88 qt./ha) being statistically at par with one irrigation (40.63 qt./ha)and significantly higher than without irrigation. Among different wheat genotypes maximum grain yield (43.83 qt./ha) was obtained by HD3171 followed by DBW 252 (41.13 qt./ha).Genotypes K1317 was found to performed not so good under restricted irrigation as compared to rest of the genotypes.

Experiment No. 2: Exploring timely sowing of wheat in NEPZ through surface seeding, seed priming and seed rate under rice-wheat system

- Under this trial different materials of seed priming like KNO3 and $CaCl_2$ were used along with three rates of seed i.e. 100kg, 125 kg and 150 kg seed /ha for which variety HD 2967 was used. From one year of experimentation it was observed that all the seed priming materials were found to have non-significant effect on grain yield of wheat. Although maximum grain yield was observed when seed was used @ 100 kg/ha and seed priming with 1% $CaCl_2$ which was statistically at par with remaining treatments.

Experiment No. 3: Optimisation of nitrogen doses for high yield potential under different zones

- This trial was conducted to maximize the wheat productivity by optimizing the doses of nitrogen fertilizer only. Variety DBW 187 was used under this experiment. From the experimental data it was observed that maximum grain yield was produced when crop was fertilized with 150 % of NPK (51.71 qt. /ha) which was at par with the 100 % of NPK (49.23 qt. /ha) only. Regarding the lodging, maximum lodging by crop was reported when 150 % RDF of N only was applied. Lodging was reduced when plant growth regulators (Chloromequat chloride and Tebuconazole) were applied at first node and boot leaf stage.

Experiment No. 4: Maximizing the wheat productivity by fine tuning of sowing time and fertilizer rates

- In this trial 4 fixed dates were selected/given for sowing i.e. 25 Oct 2019, 5 Nov 2019, 15 Nov and 25 Nov 2019. But this was not possible to conduct on given date as there was heavy rainfall during the last month of Oct 2019. The same has been reported to PI of AICRP, Kernal also.

xx. Technology validation: Performance of normal maturing wheat varieties (NMWV) & early maturing wheat varieties (EMWV) under late sown condition in Bihar

- This experiment was conducted under restricted irrigation with six wheat varieties namely HD 2967 (125 days), HD 2733 (130 days), SabourSamriddhi (125 days), PBW 373 (125 days), HI 1563 (110 days), HD 2985 (115 days) at Sabour, Dhangain and Agwanpur to observe the performance of these varieties

under late sown condition. It was found that at all the centres early maturing varieties performed better (HI 1563, 34.02 qt/ha and HD 2985, 34.28 qt./ha) than those normal maturing varieties.

- The effect of restricted irrigation was found to have non-significant effect on yield at all the centre. Among varieties also non-significant difference was observed except at Dhangain centre. Pooled data of yield also found non-significant although higher yield was found of early maturing varieties.

xxi. Evaluation of different super absorbent polymers as moisture controlled release agents in agriculture under dry land regionsof Bihar

- Among the superabsorbent polymers, solid rain hydrogel @ 6.0 kg acre^{-1} recorded significantly highest economic yield of crops which was found at par with nano hydrogel @ 8.0 kg acre^{-1}.
- Among the irrigation levels, significant increase in economic yields of the crops was found with increasing number of irrigation levels.

xxii. Nutrient and weed management in mustard under rice-mustard cropping system

- Application of pendimethalin 30 EC @ 1.0 kg a.i. ha^{-1} as pre emergence followed by quizalofop 5 EC @ 60 g a.i. ha^{-1} as post emergence with 125% of recommended dose of fertilizers in mustard recorded significantly highest seed yield, net returns, and weed control efficiency as compared to rest other treatments.

xxiii. Exploring the suitable sowing windows of *rabi* maize crop and crop modelling in changing climate scenario of Bihar

- Among different dates of sowing, maize sown in fourth week of October to second week of November recorded the highest seed yield. However, among the varieties, long duration variety reported better seed yield as compared to medium duration variety.

xxiv. Product CFG and Oorjatesting in Rabi maize

- It was concluded that highest grain yield and Net return was noticed with application of 180:112:75:5:30 kg N:P:K:Zn:S ha^{-1} + 375 kg CFG+50 kg Oorja ha^{-1} + 5 Boond+258 Urea which was at pat to treatments T1, T3 T4 and T6 at both location BAC Sabour and JRS Katihar

xxv. Response of potassium on growth and productivity of wheat in zone –III B of Bihar

- Leaf Area Index at 80 DAS significantly higher in 75 % RD of K +1/3rd paddy crop residues incorporation (T5) followed by 75% RD of K + 25% K through FYM (T6).
- Number of tillers at maturity significantly higher T5-75% RD of K + 1/3rd paddy residue incorporation followed by T3-125 % RD of K as basal.
- Significantly higher grain yield was found in 75 % RD of K +1/3rd paddy crop residues incorporation (T5) followed by 125 % RD of K as basal (T3).
- Highest K-use efficiency found in 75% RD of K + 1/3rd paddy residue incorporation followed by 75% RD of K + 25% K through FYM(T6) and T7-75 % RDK as basal + 25 % RDK at 45 DAS.
- Highest potassium and nitrogen uptake in wheat grain were found highest in T4-150 % RD of K as basal followed by T5-75% RD of K + 1/3rd paddy residue incorporation.

xxvi. Effect of micronutrient and sulphur application on productivity of maize in kosi region

- The results indicates that the growth parameters and yield attributes increased with subsequent increase in sulphur, zinc and boron with causes beneficial effect on grain yield. Application of sulphur @ 20kg/ha, zinc @ 30 kg/ha and boron @ 1kg/ha individually increases 10.5, 7.6 and 6.1 percent, respectively in grain yield of maize over without its application.

- The maximum grain yield (90.5 q/ha) was observed in S30Zn30B2 But it was statistically at par with all combination of treatment dose of zinc and born with sulphur at 30 kg/ha.

xxvii. Production potential of early, mid and late sown potato under different potassium levels

- Results of the second year study revealed that late variety of potato *viz*., KufriSindhuri proved significantly better in terms of growth, yield and economics over early and mid-varieties.
- Among potassium treatments most of the growth parameters, yield attributes, yield and economics of potato have increased significantly with increasing levels of potassium up to 187.5 kg K_2O/ha. Further increase in potassium level up to 225 kg K_2O/ha also increase these parameters but the magnitude of increase was not up to level of significant. Application of potassium to potato also brought significant impact on quality and various losses incurred during storage.

xxviii. Yield maximization and lodging management in wheat under different tillage options

- Results of the first year study revealed that application of RDF + One spray of NPK (19:19:19) @ 1.0% + Two spray of chlormequat chloride @ 0.2% proved the significantly superior treatment in terms of growth parameters, yield attributes, yield, economics and quality of wheat along with negligible lodging of crop as compared to control and sole RDF treatment.
- Among different tillage options Zero-tillage with residue retention proved the significantly better with respect to net returns from wheat over conventional method of sowing.

xxix. Effect of irrigation method and fertilizer dose on yield of boro rice

- The experimental results of the first year study revealed that grain yield of boro rice was found to be significantly superior in irrigation based IW/CPE ratio (52.9 q/ha) over the conventional method of irrigation (44.0 q/ha) and this increment was observed to be 18.2 %. However, variation in grain yield due to irrigation based on 20% depletion of available soil moisture (DSM) and IW/CPE ration were observed non-significant. The variation in grain yield was also found significant due to fertilizer doses.
- The fertilizer application based on nutrient expert based fertilizer recommendation and 120:60:60:20 kg N P_2O_5 K_2O and Zn ha^{-1} produced statistically similar grain yield and significantly superior over 80:40:20:20 kg NPK& Zn/ha

xxx. Effect of crop establishment and potassium management in boro rice

- In crop establishment method, transplanted rice was produce significantly higher yield as compared to direct seeded rice and among the potassium management 45 kg K_2O from Potassium sulphate + 45 kg K_2O from FYM, produced significantly higher yield over control and 60 K_2O kg/ha from Potassium sulphate but it was at par with 90 K_2O kg/ha from Potassium sulphate and 60 K_2O kg^{-1} from 50 % Potassium sulphate +50 K% from FYM.

xxxi. Effect of pre and post emergence herbicides for control of Smell melon (Ghurmi) {*Cucumismelo* var. dudaim (Naud.)} in summer green gram for Koshi region of Bihar

- Treatment **(T_3)** Pendimethalin (PE) 1 litre a.i. /ha *fb*Imazethapyr (POE) 40g a.i./ha recorded higher weed control efficiency (in all growth stages). Whereas higher Yield and B:C ratio (2.29) was recorded in (T_4) at Supaul location**.** Weed index was found higher in Treatment **(T_4)** i.e. Pendimethalin (PE) 1 litre a.i. /ha *fb*Imazethapyr (POE) 60g a.i. /ha at Saharsa location only.

xxxii. Effect of different doses of Sulphur on Growth, Yield, S-Uptake and Oil Content in Mustard- Soybean cropping system in Koshi region

- The higher seed yield (q/ha) was obtained under the treatment combination of S3T2 (12.35) which was statistically superior over rest of the treatment S2T2 (12.01) and S1T2 (11.96). While seed yield was

minimum in S0T1 (9.15). As the dose of suslphur was increased, the yield gradually increases significantly.

- The oil content (%) and S uptake by plant gradually increased as the dose of S increased and it was recorded maximum in S3T2 (42.10 %) and 21.10 Kg /ha respectively which was significantly superior over rest of the treatment combination.
- The net return and B:C ratio was also maximum in S3T2 (32648.00) Rs/ha 2.42 respectively which was significantly superior over rest of the treatment combination.

xxxiii. Effect of feed block feeding on milk yield and milk composition of cross bred cow

- A total of 35 lactating cows selected and divided into 7 groups (1C+6T). As per this observation the average milk production for the group T4 & T5 was highest with 8.8 l /day & 9.7 l /day while it was 4.6 for T0. Milk will be recorded for next 1-2 month period for one lactation period.

B. Soil Science and Agricultural Chemistry

i. Development of liquid microbial inoculants (biofertilizers) formulations (Non-Plan)

Four Technologies were developed (04):

1. Production technology of liquid *Rhizobium* biofertilizer
2. Production technology of liquid Phosphate Solubilizing Bacteria (PSB) biofertilizer
3. Production technology of liquid *Azotobacter* biofertilizer
4. Co-Inoculation of liquid biofertilizers for N and P supplementation in Rice-wheat cropping system.

a. Shelf life of developed liquid Bio-fertilizer:

In case of *Rhizobium* the liquid medium maintained good number of cells (Log 9.292 at 210 days after inoculation) whereas in charcoal solid formulation it came down to a level of log 8.46 at 210 days after inoculation and in case of charcoal solid inoculants by 360 days it came down to zero (Fig 1 and Fig 2). In case of PSBthe liquid medium maintained good number of cells (Log 8.720 at 210 days after inoculation) whereas in charcoal solid formulation it came down to a level of log 8.00 at 210 days after inoculation and in case of charcoal solid inoculants AT 360 days it came down to zero (Fig 1 and Fig 2). In case of *Azotobacter* the liquid medium maintained good number of cells (Log 8.735 at 210 days after inoculation) whereas in solid formulation it came down to a level of log 8.00 at 210 days after inoculation and in case of charcoal solid inoculants by 360 days it came down to zero (Fig 1 and Fig 2).

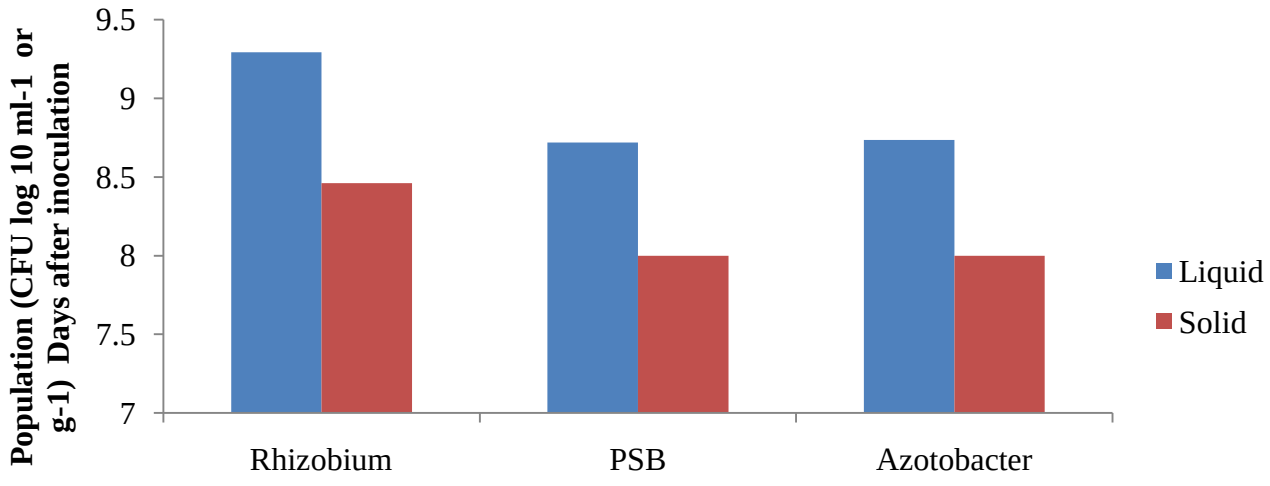


Fig.1: Shelf of Rhizobium, PSB and Azotobacter at 210 days after inoculation

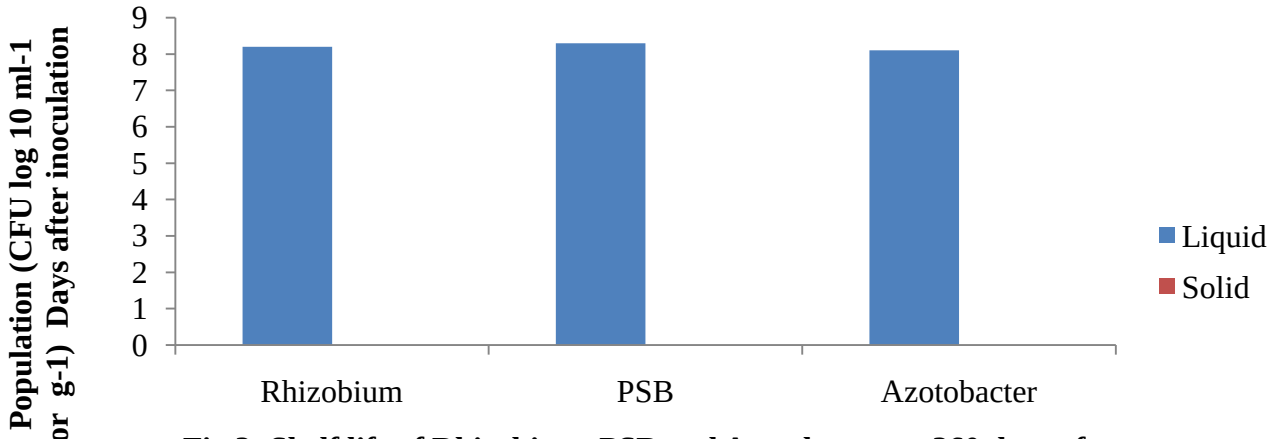


Fig.2: Shelf life of Rhizobium, PSB and Azotobacter at 360 days after inoculatuion

The developedformulation of liquid *Rhizobium* (YEM-3) had been evaluated in the field for two consecutive years (2018 and 2019). The nodule number, nodule fresh weight (mg plant^{-1}) and nodule dry weight (mg plant^{-1}) was recorded maximum under the developed liquid formation among all the treatments (Fig. 3).

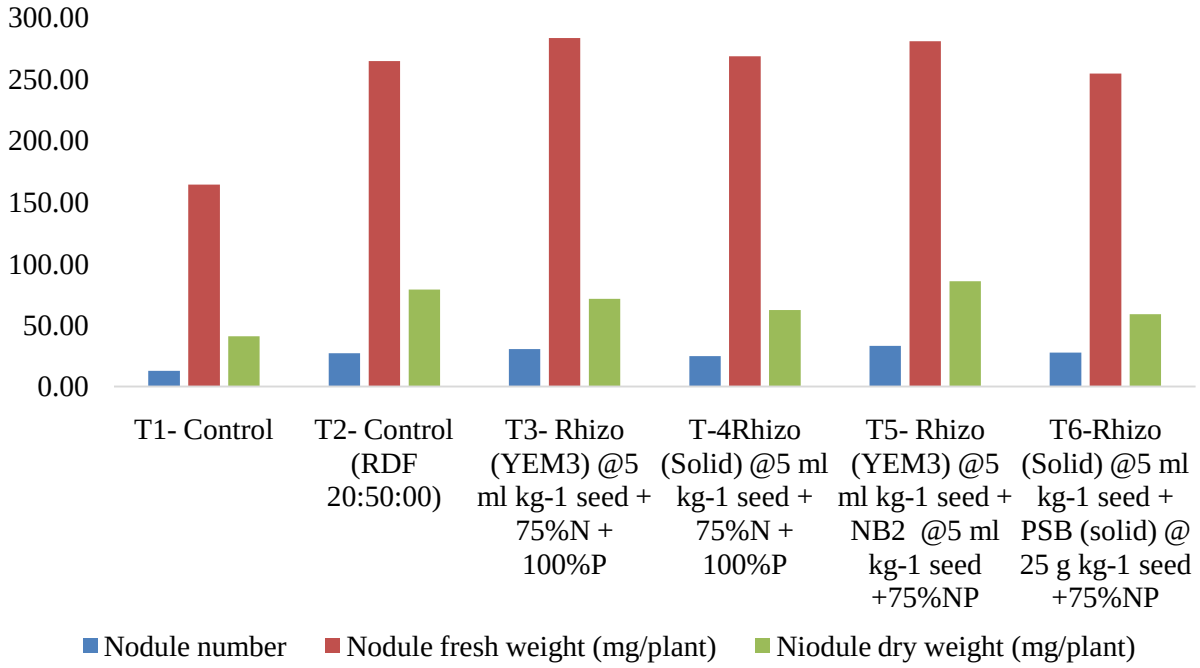


Fig 3: Effect of liquid *Rhizobium* formulation on nodulation of chickpea

b. Field evaluation of developed PSB and *Azotobacter* liquid biofertilizer

The application of liquid PSB @750.0 ml ha^{-1}by substituting 25% application of phosphorus increased 17.69% significantly higher grain yield in rice and 16.24% higher grain yield was found in wheat when compared with 100% RDF. Likewise, the application of liquid *Azotobacter* @750.0 ml ha^{-1} by substituting 25% application of nitrogen increased 20.54% significantly more grain yield in comparison with 100% application of RDF in rice crop. In wheat crop the grain yield found to be 14.72% higher over application of 100% RDF (Table 14). However, the developed formulations were also evaluated in co-inoculation of nitrogen fixer and phosphate solubilizer. The results of field experiment for two consecutive years showed that the application of co-

inoculation with liquid *azotobacter*@750.0 ml ha^{-1} and PSB@750.0 ml ha^{-1}significantly increased grain yield by 19.56% and 22.43% in rice and wheat when compared with 100% application of chemical fertilizers (Table 1). Similarly, when it was compared with co-inoculation of solid preparations and found that the grain yield of rice and wheat was also higher by 13.06% and 9.96% respectively, when compared with the application of solid*azotobacter*@2.5kg ha^{-1} and PSB@2.5kg ha^{-1}.

Table 1: Effect of Azotobacter and PSB liquid biofertilizers formulation on yield of rice and wheat (pooled data, 2019 and 2020)

Treatments	Rice Grain yield (Q ha^{-1})	Wheat Grain yield (Q ha^{-1})
T_1- Control (RDF 100:40:20)	37.93	35.25
T2- NB2 @750 ml ha^{-1} + 100% RDF	40.62	40.92
T3- NB2 @750 ml ha^{-1}+ 75%P + 100%NK	44.64	41.04
T4- B1 @750 ml ha^{-1}+ 100%RDF	41.50	39.12
T5- B1 @750 ml ha^{-1}+ 75%N + 100%PK	44.11	40.55
T6- PSB @ 2.5 kg ha^{-1} (Solid based) + 100%RDF	39.27	38.55
T7- PSB @ 2.5 kg ha^{-1}(Solid based) + 75%P + 100%NK	44.97	37.58
T8- Azotobacter @ 2.5 kg ha^{-1} (Solid based)+100%RDF	39.74	39.15
T9- Azotobacter @ 2.5 kg ha^{-1} (Solid based) + 75%N + 100%PK	43.35	38.15
T_{10} NB2 @750 ml ha^{-1} +B1+ 75% (NP) + 100%K	45.34	43.16
T_{11}- PSB @ 2.5 kg ha^{-1} (Solid based)+ Azotobacter @ 2.5 kg ha^{-1} + 75% (NP) + 100%K	40.10	39.25
CD (0.05)	6.57	7.42

ii. Determination of safe limit of arsenic in soil and exploration of potential mitigation options

A pot experiment was conducted to determine the safe limit for As contaminated irrigation water with two soil types (alluvial and red) using ten levels (of contaminated irrigation water (0, 0.25, 0.5, 0.75, 1.0, 1.25, 1.50, 1.75, 2.0, 2.25 mg L^{-1}), applied5 times in rice (Variety: Sushak Samrat),used as a test crop. The results reveal that the different fractions of arsenicin terms of its profusion followed the order F4 > F2 > F5 > F3 > F1 and F4 > F3 > F2 > F5 > F1across all the doses of As for alluvial soil and red soil respectively. The safe limit of irrigation water in terms of risk assessment expressed as Hazard Quotient (HQ) was at 0.75 mg L^{-1} and the solubility FIAM can effectively predict the As content in rice grain in both the soils. The Tobit Regression Model in alluvial soil quantified the safe limit for As in irrigation water from 1.20 to 0.10 mg $L^{-1}$for soil As 0.25 to 3.0 mg Kg^{-1}andin red soil, the range was from 0.10 to 0.40 mg $L^{-1}$for soil As 1.0 to 0.25 mg Kg^{-1}provided that the As content in rice grain is <0.4 mg Kg^{-1}.This can be used as an effective protocol for estimation of safe limits for irrigation water in the contaminated areas.

The Table 1 depicts the soil pH, OC, available total as and the inorganic fractions in alluvial soil and red soil. In alluvial soil pH ranged from 7.60 to 7.63 and in red soil from 6.26 to 6.29 and was found to be statistically

non-significant. A decrease in pH in alluvial was observed from the initial status whereas in red soils the increase in pH towards neutrality was observed and this may be due to submerged condition. The production of Carbon mono-oxide (CO) due to bacterial respiration along with its accumulation is the main reason for decrease in pH in alluvial soils. The Organic Carbon content in alluvial soil and red soil ranged from 0.52 to 0.55 and 0.14 to 0.16 respectively which statistically non-significant. The OC of both alluvial and red soils at all levels of as doses decreased with respect to the initial status of the soils. The available arsenic increased from 0.35 mg Kg^{-1} in As_0 to 3.43 mg Kg^{-1} in $As_{2.25}$. The total Arsenic also increased with the increase of as in the irrigation water. The maximum 10.38 was observed in $As_{2.25}$ and the lowest was found against treatment As_0. In case of red soil, the available arsenic increased from 0.08 mg Kg^{-1} in As_0 to 1.66 mg Kg^{-1} in $As_{2.25}$. The total Arsenic also increased with the increase of as in the irrigation water. The maximum 11.35 was observed in $As_{2.25}$ and the lowest, 1.11 was found against treatment As_0. The effect on water soluble fraction (F1), Aluminum bound arsenic (F2), amorphous iron bound arsenic (F3), crystalline iron bound arsenic (F4) and Calcium bound arsenic (F5) for both the soils has been depicted Table 1. The results reveal that the different fractions of arsenic in terms of its abundance followed the order F4 > F2 > F5 > F3 > F1 across all the doses of As. The ranges of different fractions were F1 (0.14-1.31), F2 (0.16-1.96), F3 (0.22-1.91), F4 (0.24-2.16) and (0.10-1.83). The effect of the As dose on the different fractions were found to be statistically significant. In case of red soil the different fractions of arsenic in terms of its abundance followed the order F4 > F3 > F2 > F5 > F1 across all the doses of As. The ranges of different fractions were F1 (0.03-0.45), F2 (0.15-1.77), F3 (0.13-2.51), F4 (0.12-4.74) and (0.11-0.60). The effect of the As dose on the different fractions were found to be statistically significant.

iii. Alternative management based approaches for enhancing Zn and Fe bioavailability in a Rice-Lentil system- A comprehensive comparative study on potential and prospects

- Seed nutripriming at different doses of Fe and Zn for time duration of 6 h and 12 h has been done. This was necessary to standardize the nutrient concentrations through germination tests before the proposed pot experimentation.
- Effective micronutrient solubilizing microorganisms have been isolated and screened for efficacy before initiation of pot experimentation.
- Germination tests for standardizing nutripriming dose completed
- Pot experimentation with Lentil is underway.

iv. Persistence behaviour and risk assessment of propineb in jute

- Propineb dissipates quickly in jute plants and soil with half-life values ranged from 2.16-3.36.
- Consumption of jute leaves as vegetable after 5 days of propineb application at recommended dose could be treated as safe
- Propineb residues may not have any impact on the next crop.

v. Monitoring and risk assessment of pesticide residues in market vegetable samples of Bihar and possible decontamination options

- Establishment of Pesticide Residue Analysis Laboratory is under progress.

vi. Evaluation of N containing superabsorbent hydrogel in Wheat, Chickpea, Lentil and Linseed

Novel superabsorbent hydrogel: Novel superabsorbent hydrogel development protocol has been designed having equilibrium water absorbency (ranging from 350 g g^{-1} to 500 g g^{-1}). Products are biodegradable, can withstand high salinity level (100 Mm NaCl solution). These are being processed for patent filing and subsequently will be licensed for commercial production

3.2.3.3. Crop Protection:

A. Plant Pathology

i. Enhancement of Microbial Bio-pesticides' Shelf-life

The study came out with enhanced shelf life of 18.5 months charcoal based biopesticide of *Trichoderma asperillum* Tvb1 conidia formulation encapsulated with 1.5% molasses followed by coating with nano hydro gel @ 100 mg/kg conidia and then formulation was prepared with application of cellulose (Carboxy methyl cellulose) @10 mg/kg formulation at 14% moisture level. This technology may be utilized in commercial production of Trichoderma based biopesticides to solve the problem of short shelf life in favour of farmers' community.

ii. Survey for emerging insect pests and diseases of maize, pulses, mango and banana in context of climate change

The survey came out with some emerging insect pests and diseases like in maize, 'Fall armyworm' and 'Late wilt', in banana different races of Fusarial wilt pathogen (*F.oxysporum*f.sp. cubense), and in mango 'Red banded mango caterpillar' and 'Die back/gummosis disease'. All these information may be utilized as a key researchable issue to solve and to minimize the loss in favour of farmers' community.

iii. Nanoparticles Mediated Altered Melanin Biosynthesis in Fungal Pathosystem

Cultural assay helped in identifying the concentration of the nanoparticles effective to inhibit the mycelial growth of *Bipolarissorokiniana*. The poisoned food assay revealed that a concentration of 100 ppm of ZnNP and 150 ppm of TiNP checked the growth of pathogen. Similarly, spore germination was observed using different nanoparticles and their concentration. Nearly 50% or more than 50% inhibition of spore germination was detected at 100 ppm concentration of ZnNP for both the isolates. However, the results varied between isolates when the examination was made with TiNP. Measurement of aggressiveness components upon application of nanoparticles was performed for assessing the impact of nanoparticles on disease development. ZnNP and TiNP reduced the sporulation intensity by 25%. Average size of lesion in nanoparticle applied at 100 ppm leaves was reduced by ~45% as compared to pathogen inoculated leaf paving way for nanoparticle to be used in future. Assessments of biochemical parameters were taken to understand the impact of nanoparticles in inhibiting disease. In comparison to only pathogen inoculated leaves (Path), higher level of phenol expression (~19%) was seen in the leaves applied with nanoparticle prior to pathogen inoculation (Ag or Zn + P). Higher amount of Chlorophyll a, Chlorophyll b and β carotene was observed in leaves applied with nanoparticle (Ag or Zn) when compared to only pathogen inoculated leaves (Path). The relative melanisation decreased at 150 ppm concentration of TiNP and 100 ppm of ZnNP. There is regular decrease in relative melanin content with the increase in nanoparticle concentration in broth. Assessments for reduction in mycelium dry weight (%) and relative melanisation was done to observe the effectiveness of nanoparticles. There is a continuous decline in dry weight of mycelium with increase in concentration of both the nanoparticle. In silico analyses and designing of primers have been done which will be further helpful for the molecular work. Field evaluation of nanoparticles on barley and mustard was done. The study is still under progress to draw a conclusion.

iv. Prevention of Charcoal Rot through Mushroom Waste Amendment in Chickpea

Disease incidence, disease severity and area under disease progress curve calculated, and trend of disease development was observed. The mean values of disease incidence in different treatments ranged from 1.3 to 4.7 % during 2017-18, from 2.2 to 15.1% during 2018-19, and from 2.6 to 12.5% during 2019-20. Indication of temperature, particularly minimum temperature, in charcoal rot disease development is recognised. Weekly sampled rhizospheric soil revealed deterioration in population of *M. phaseolina* in treated plots compared to non-amended plots. Deviation in chemical properties detected in amended plots compared to non-amended

plots. The low cfu detected with amendment of mushroom waste @ 3 tons per ha + *Trichoderma* @ 2 g/ kg seed. *In-vitro* test of *Trichoderma asperellum* and *M. phaseolina* revealed with suppression of mycelial growth of the pathogen. Yield assessment revealed that the amended plots, particularly with *Trichoderma*, rendered maximum harvest. The plots applied with MW6+T and MW8+T rendered 35.6% and 38.8% greater yield, respectively compared to the control plot. Application of carbendazim rendered 56.5% greater yield than control. *In-vitro* test of *Macrophominaphaseolina* with residue of mushroom waste and other organic amendments was performed. The residual decoction of mushroom waste showed inhibitory property of *M. phaseolina* isolate. Overall, the experiment indicates for a suppression of chickpea charcoal rot with mushroom waste amendment. This is possibly due to enhancing rhizospheric activity of beneficial microorganism.

v. Analyzing *Alternaria brassisicola*-Brassica interactions at an elevated temperatures

Later dates of sowing promoted the development of Alternaria blight in mustard. Test weight was also found lower at the later date of sowing. Test weight was found maximum at second and third dates of sowing. There were significant differences between primary and tertiary branching of mustard under different dates of sowing. However secondary branching shows non-significant differences.

vi. Exploration and characterization of native *Pseudomonas fluorescence* for biological control activity

- 15 Isolates obtained from rhizosphere soils including Rice, Turmeric, Mustard-1, Mustard-2, Okra, Pea, Barley, Brinjal, Wheat, Bean, Chickpea, Mango, Brinjal(New), Cauliflower and one commercial isolate of Pantnagar were characterised.
- Molecular and morphological characterization of isolates revealed the prevalence *P. fluorescens* and *P. aeruginosa* as fluorescent pseudomonadsassociated with rhizosphere.
- It was found that the isolates of *P. aeruginosa* were robust in comparison to *P. fluorescens* in bio-control activity.
- An isolate each of *P. fluorescens* and *P. aeruginosa* were identified as superior for bio control activity based on *in vitro* bio-crontrolagainst fungal and bacterial phytopathogens, P-solubilization, Siderophore production, IAA production and other PGPR attributes.

vii. Epidemiology and Management of Yellow Mosaic Disease of mungbean

- Majority of the isolates were found to be MYMIV
- Based on the degenerative primer amplification, few samples were found positive for ToLCNDV
- The weather parameters like Maximum temperature and Humidity seems to have maximum correlation with the disease
- Among the different germplasm evaluated against the disease BRM-8-1 was found highly Resistant at high disease pressure. Whereas, Meha, IPM-409-4 and IPM-2-14 was found moderately resistant
- Among the various disease management modules evaluated chemical intensive module (Seed treatment with Imidacloprid followed by two sprays of Thiamethoxam@0.5% after 20 and 0 days after sowing) followed by Adoptive module (Seed treatment with Imidacloprid + Yellow Sticky Traps + One spray of Thiamethoxam @ 0.5%)

viii. Site specific crop pest and disease diagnostics and management using Unmanned Aerial Vehicle and Artificial Intelligence

- Established linkages with Western Sydney University, Australia and Sanjay Ghodawat university, Kolhapur for work on Artificial Intelligence and machine learning
- Signed MoU with SGU, Kolhapur
- 2 Mobile applications (Android) have been developed (Agrikanti& Pest id & management applications)

- 'Agrikanti' android app is a simple application for data collection and aggregation which will be further developed into a real time farmer advisory service tool
- More than 50000 images of various pest and diseases of rice and maize have been collected
- The work is underway for building deep learning algorithms for identification of pest and diseases

ix. AICRP (Fruits)

- **New and Emerging Diseases of Mango.**

  Major diseases of mango were Anthracnose, malformation, blossom blight and red rust followed by dieback whereas powdery mildew, bacterial canker and black tip were recorded as minor diseases of mango. Incidence of Powdery mildew and blossom blight showed increasing trend this year.

  New and emerging diseases of guava

Wilt and stylar end rot appeared during pre-monsoons and Anthracnose, dieback, Canker and wilt appeared during monsoon period in severe forms. Red rust, anthracnose and stylar end rot severity increased during post monsoon period

x. Evaluation of bioagents and organic based products for management of leaf spot and foliar diseases of *Aloe vera*

- Small, circular, dark brown or charcoal,sunken lesions (1-3mm) are appeared on leaves (symptoms) caused by *Colletotrichumgloeosporioides.*
- First appearance of leaf spot incidence was noticed on *Aloe vera* on 4th Jan 2021 (at end of 1st week of January incidence was 10% with 5% severity and its incidence were reached 100% in February (1st week) in control plot with 45.0 % severity
- Out of 8 treatments applied for management of foliar disease in *Aloe vera*, treatment- T5: Soil application of FYM (1.0 kg/m2) enriched with *Trichoderma + Pseudomonas* talc based formulation each @ 2.0% at planting time and On the onset of disease symptoms three spray of *P. fluorescence* @ 2.0% of talk based formulation and Neem oil @ 300 ppm; was found superior for management of leaf spot diseases in *Aloe vera*and reduced the disease by 77.6% followed by other treatment–T6: Soil application of FYM (1.0 kg/m2) enriched with *Trichoderma + Pseudomonas* talc based formulation each @ 2.0% at planting time. On the onset of disease symptoms three spray of Tebuconazole+Trifloxystrobin @ 0.1% at 15 day interval reduced the diseases severity by 63.8% respectively.
- Significant difference was found in fresh weight of leaf per plant in different treatments (p=0.05). The fresh weight of leaf per plant was higher (4.4 kg) in treatment T5 as compared to control (2.9 kg).

xi. Evaluation of bio-agents and organic based products for management of diseases of *basil* (*Ocimumbasalicum*)

- Small, irregular shaped brown spot of 1-2 mm size are appeared on the leaves and stem (symptoms) caused by *Alternariaalternata.*
- First appearance of leaf spot incidence was noticed on basil (Tulsi- *O.basalicum*) after 2nd week of October and its incidence was reached 100% in January (2nd week) in control plot with 40.0 % severity.
- Out of 7 treatments applied for management of foliar disease in Basil, treatment- T5: Soil application of FYM (1.0 kg/m2) enriched with *Trichoderma + Pseudomonas* talc based formulation each @ 2.0% at planting time. + On the onset of disease symptoms three spray of Tebuconazole + Trifloxystrobin @ 0.1% at 15 days interval; was found superior for management of leaf spot diseases in Basiland reduced the disease by 83.64% followed by other treatment–T6: Soil application of FYM (1.0 kg/m2) enriched with *Trichoderma + Pseudomonas* talc based formulation each @ 2.0% at planting time and on the onset of disease symptoms

three spray of *P. fluorescence* @ 2.0% of talk based formulation and Neem oil @ 300 ppm at 15 days interval; reduced the diseases severity by 76.56% respectively.

- The green leaf yield was also high in the best treatment T5; (84.40 Q/ha) as compared to control (71.40 Q/ha).

Survey, surveillance and cataloging of diseases in medicinal and aromatic plant in Bihar

Table 1: Diseases recorded in Medicinal & Aromatic Crops (2020-21)

Sl.N.	Crop	Disease	Causal agent	Affected part	PDI (%)	period
1.	*Aloe barbadensis* (Dhrit kumari)	Anthracnose leaf spot	*Colletotrichumgloeosporioides*	Leaf	45.0	Dec-Feb
2.	*Coleus aromaticus* (Coleus)	Leaf spot	*Corynesporacassiicola*	Leaf, stem	15.0	July
3.	*Crinum latifolium* (Sudarshana)	Leaf blight	*Drechslera sp.*	Leaf	30.0	August
4.	*Chlorophytumborivilianum*(Safed musli)	Leaf Blight	*Colletotrichumcapsici*	Leaf	20.0	July
5.	*Cymbopogon martini* (Palmarosa)	Red Leaf spot	*Colletotrichumgraminicola*	Leaf, stem	25.0	July-August
6.	*Sennaalexandrina* (Senna)	Leaf spot	*Alternariaalternata*	Leaf, stem	32.0	December-January
7.	*Urgeniaindica* (Vanpayaj)	Leaf blight	*Drechslera sp.*	Leaf	36.0	November-December
8.	*SaracaIndica (*Ashoka)	Leaf spot	Cercospora sp.	Leaf, stem	20.0	November
9.	*Menthaarvensis* (Mentha)	Leaf spot	*Alternariaalternata*	Leaf	12.0	December-January
10.	*Ocimumbasilicum (Basil)*	Leaf spot	*Alternariasp*	Leaf, stem	36.0	Oct-Dec
11.	*Centelaasiatica* (Madukaparni)	Cercospora Leaf spot	*Cercospora* sp.	Leaf	15.0	Dec-January
12.	*Bryophyllumpinnatum*(Patherchur)	Leaf rot	*Phytophthora* sp.	Leaf	20.0	December
13.	*Stevia* sp.	Leaf spot	*Alternaria*sp.	Leaf	20.0	January
14.	*Acoruscalamus*(Bach)	Rust on leaf	*Uromycesacori*	Leaf	40.0	February

Leaf spot disease status in different MLT Trial of Tulsi:

Tulsi species	*Oscimumbasalicum*		*Oscimum sanctum*
MLT-AVT-II trial	OB series	AB series	OS series
No. of entry evaluated	24	20	25
Disease initiation time	10th of October	10th of October	10th of October
Highest disease severity time	2nd week of January	2nd week of January	2nd week of January
Disease severity of leaf spot –Range (%)	6.0 - 30	5.0 - 28.0	3.0 - 10 .0
Lowest and highest disease in entry	OB-02& OB-14	AB-16 & AB-6	OS-03 & OS-23
Average severity of leaf spot (%)	18.3	17.0	7.4
Green leaf yield (Range)-Q/ha	46.22 - 115.84 (OB-14 & OB-11)	63.25 - 95.48 (AB-4 & AB-16)	55.32 - 98.21 (OS-11 & OS-13)
Average green leaf yield (Q/ha)	64.89	75.93	63.91

B. Entomology

i. Molecular characterization of brinjal shoot and fruit borer (*Leucinodesorbonalis*Guenee)

After the sequencing of Primer I and II, a phylogenetic tree was prepared. After preparation of the phylogenetic tree it revealed that three clusters were formed. Under cluster 1, Araria, Purnia, Banka and Bhagalpur isolates are fallen, in cluster 2, Katihar and Munger isolates are fallen and in cluster 3, Munger, Katihar and Banka isolates are fallen. Maximum genetic similarity was 100 % and minimum genetic similarity was 89.91 %. It shows that the diversity is very less. Phylogenetic relationship between collected samples and reported isolates revealed that the isolates from Bihar were not very diverse and it seems to be originated from a common ancestor. Single management strategy can be adopted against *L. orbonalis* for the entire state of Bihar.

ii. Evaluation of ITK based pest management against sucking pest of okra and chillicrops

Okra

Among the different treatments, thiamethoxam 25 WG was found to be the most effective treatments against jassid and whitefly population. However, among the different ITK products, cow urine + cow dung slurry was recorded the most effective treatment against jassid and whitefly population and it was followed by *Lecanicilliumlecanii* and cow urine. The identified key natural enemies were coccinellids, spiders and syrphids.

Chilli

Among the different treatments, fenpropathrin 30EC was found significantly superior in reduction of thrips and mite population. However among the different ITKs, cow urine + cow dung slurry was found to be the most effective treatments against thrips and mite population and it was followed by *Lecanicilliumlecanii* and cow urine. The identified key natural enemies were coccinellids, spiders and syrphid.

iii. Promotion of eco-friendly management of yellow stem borer among katarni rice growers by application of trichocards (*Trichogrammajaponicum*)

Collecting and identifying native *Trichogrammajaponicum*from Sabour

- Laboratory rearing of *Corcyra cephalonica* as laboratory host of the trichogramma
- Mass multiplication of Trichogramma on the eggs of *Corcyra cephalonica*

- Preparation of trichocards
- Distribution of trichocards among katarni growers

Table 1 (Tarak): Efficacy evaluation of distributed *trichocards* among *Katarni* growers against Yellow Stem Borer

Treatments	% Dead Heart			Mean	%White earheads			Mean
	Deshri	Bade	Jagdishpur		Deshri	Bade	Jagdishpur	
Farmers' practice ##	5.3	4.0	5.5	**4.9**[a]	5.5	5.0	6.0	**5.5**[a]
T.japonicum#	6.0	5.8	4.5	**5.4**[a]	4.0	3.5	3.0	**3.5**[b]

##Cartap Hydrochloride (Padan 4G) at 25kg ha $^{-1}$ each at 40 and 60 DAT

6 releases of *Trichogrammajaponicum* @ 100,000^{-1} ha at weekly interval

Means in a column having the same letters are not significantly different at P=0.05

iv. Network Project on Fall Armyworm in Bihar

Experiment I:Survey and surveillance on fall armyworm

The average Per cent damage to the crop was in the range of (22 to 38 %) at farmer field in Purnea and adjoining districts. Data showed that the larval population and per cent damage has slowed down in the month of 15 Dec to 15 Jan because of low temperature and or otherwise the temperature, humidity may not be within the range of suitability for their life cycle. In survey, farmer responded that all these four insecticides are quite effective for controlling FAW. Among all these insecticdesThiomethaxam+Lambdacyhalothrin (12.6 % +9.5 %) is easily and cheaply available in the market compared to other insecticides However farmer also reported that Thiomethaxam+Lambdacyhalothrin and Emamectin Benzoate 5SG are very effective at early stages of FAW larvae while spinotoram and chlorontroliliprole were effective even against late instar larvae. During first week of June 2020, infestation of fall army worm on Kharif Maize was observed at Chakani village, Simari Block, Buxar district. However, incidence was restricted to areas near to south bank of river Ganges in Buxar district. During survey conducted on fall army worm in Sahpur under Sonbarsa Block , Bhelwa, Telwa, Birgawn, Baghwa,Manovar under Mahisi block, Chakbhro in Simri block of Saharsa district fall armyworm was found causing damage to maize crops.It was also reported from Maharas, Sarbela, Sahuriya, Itahari panchayat of BanmaItahari Block. FAW infestation was found raning 1-2 % in Bara Khurd, Narai, Purandarpur, Muzaffarpur, Chandasi and Noorsarai block.

Experiment II:To screen the tolerant varieties/hybrids against fall armyworm on maize

Maximum FAW infestation was found 18.22 with the hybrid 5x11 and least infestation was 7.40 % with the variety SHM-1 at BAC, Sabour, FAW infestation was found least with the hybrid 9135 (9.63%) and maximum with 13x7 (22.45%) at BPSAC, Purnea while FAW infestation was found least with the hybrid 3392 (6.17%) and maximum with 4249 (25.25%) at MBAC, Agwanpur, Saharsa. The infestation was found about 1% in Rabi maize at COH, Noorsarai.

Experiment III:Evaluation of some insecticides against fall armyworm

Module IV comprising collection and destruction of egg masses and larvae feeding in groups at initial stage (15-25 DAS), Application of sand + fly ash in 1:1 ratio (After whorl formation), Ist spray with Indoxacarb 14.5 SC@1ml/l after 5 days of application of sand + fly ash, Spraying of Thiamethoxam 12.6% + Lambdacyhalothrin 9.5% @ 0.5ml/l at 15 days after Ist spray was found most effective in reducing number of damaged leaves/ 10

plants (2.65),number of larva/10 plants (2.04) and number of holes/windows/10 plants (2.88) with highest yield 78.12 q/ha

v. Insect fauna of maize with special reference to management of maize stem borer

Soil Insect fauna *viz*.; Cricket, Spodoptera larvae, black ants, Beetles, cutworm, earwig, ant, *Gonocephalum* spp. were found during the year 2018-19 and 2019-20. A new invasive pest, Fall Armyworm was also found during the year 2019-20. Maximum population of stem borer of 2.75/10 plants was found at 37th standard week, 15.57 pentatomid bugs/10plants at 45th standard week, 2.25 ichneumonid wasps/128m^2 at 44th standard week and 1.02 cobworm larvae/10plants at 45th standard week during Kharif 2018. Maximum population of pink stem borer of 2.45/10 plants was found at 7th standard week, 16.75cutworm/50 m^2 at 6th standard week, 2.40 shoot fly/50m^2 at 5th standard week and 8.45 cobworm larvae/10plants at 17th standard week were found during Rabi, 2018-19. Maximum population of stem borer of 3.44/10 plants was found at 39th standard week, 8.23 pentatomid bugs/10plants at 45th standard week, 3.10 ichneumonid wasps/128m^2 at 44th standard week and 4.78 cobworm larvae/10plants at 46th standard week during Kharif, 2019. Maximum population of pink stem borer of 3.76/10 plants was found at 7th standard week, 3.26 cutworm/50 m^2 at 5th standard week, 2.08 shoot fly/50m^2 at 3rd standard week and 7.74 cobworm larvae/10plants at 15th standard week were found during Rabi, 2019-20. Pooled data of the two years showed that the treatment, spraying of Emamectin Benzoate 5 SG @250 g/ ha was found effective in reducing leaf damage 3.98, and 1.77 per cent cob damage whileFipronil 5 SC @125 ml/ ha was found reducing the dead heart (1.83%). Yield was highest 54.72 q/ha in this treatment. Population of natural enemies was found higher in the treatment.

vi. Incidence of emerging pest of paddy and management of army worm in Koshi Region of Bihar

The Incidence of Army worm reported on 25/11/2020from Makuna and Bihra village under Satarkatahiya Block of Saharsa district. Caterpillars are reared in laboratory for study their life cycle and found pupa and adult of this insect.Some species of spider found in rice field working as predator.The significantly highest grain yield was obtained in Emamectin benzoate treated plots (3.92 mt/ha) followed by Chlorpyrifos 50%+Cypermethrin 5%EC@1 ml/lit (3.64), Cartaphydrochloride 50WP @1 g/lit of water(3.32mt/ha), Chlorpyrifos 20EC@2.5 ml/lit(3.23mt/ha), Azadirachtin(0.1 %) @ 5 ml/lit(2.5mt/ha), Garlic extract+vegetableoil+liquid soap(85g:50ml:10ml)for 20litre solution(2.36mt/ha) and Wood ash(2 Kg)+ ripe chilli powder(25 ml)(2.22mt/ha).From this study, it was concluded that Emamectin benzoate is the most viable option for armyworm outbreak management.

vii. Management of Rhizome weevil of organic banana in Koshi region of Bihar

Plantation of G9 variety of Banana from B.A.U.,Sabour was done on 20.02.2020 in MBAC,Agwanpur farm.Organic Banana planted in field was in good condition.Pheromone (cosmolure) trap@10 trap/ha+ Longitudinal split banana trap@ 100/ ha with Entomopathogenic fungus (*Bauveriabassiana)*@ 20 g/per trap + Soil drenching with Azadirachtin @3ml/lit was found most effective in management of Rhiuzome weevil in organic banana and found highest bunch weight was 27.32 kg/bunch.

viii. Survey and management of Mango bark eating caterpillar in Koshi region of Bihar

The poorly managed orchards of mango were more prone to attack with an incidence of 88 and 92 per cent in comparison to 20 and 24 per cent in well managed orchards, respectively. Young orchards were less prone to bark eating caterpillar infestation with an incidence of 16 and 20 per cent in comparison to 88 and 80 per cent in old orchards of mango respectively. Neglected and shady orchards are more prone to attack by this pestThrusting of wire + pouring of carbon bisulphide+ plugging holes with mud causes maximum mortality(93.19%) due to holes plugged with mud.Clean the infected hole + hole fill with micronutrients such as

zinc, iron etc+ Lantana camera leaf extracts causes,90.19% mortality,it is Eco Friendly and also help in packing and healing of bark.

ix. Eco-safe management of Bihar hairy caterpillar (*Spilosomaobliqua* walk.) of jute

Bihar Hairy Caterpillar Damage %

Treatments	Pre - Spray 3 Days 35 DAS	Post-Spray 9 Days 35 DAS	Pre - Spray 3 Days 50 DAS	Post-Spray 9 Days 50 DAS	Pre-Spray 3 Days 65 DAS	Post-Spray 9 Days 65 DAS	Yield Q/ha
T_1	8.65 (17.07)	12.03 (20.28)	23.03 (28.66)	29.45 (32.86)	34.63 (36.03)	36.9 (37.39)	20.94
T_2	8.52 (16.95)	12.24 (20.41)	25.42 (30.21)	28.46 (32.21)	33.56 (35.38)	37.08 (37.46)	20.16
T_3	8.4 (16.79)	3.19 (10.28)	26.92 (31.21)	12.66 (20.76)	24.95 (29.91)	12.4 (20.54)	23.49
T_4	8.37 (16.75)	2.07 (8.25)	21.95 (27.9)	10.71 (19.06)	24.73 (29.76)	10.73 (19.08)	26.39
T_5	9.18 (17.49)	1.73 (7.53)	25.72 (30.45)	30.3 (33.39)	33.21 (35.18)	33.21 (35.18)	20.60
T_6	7.57 (15.97)	0.86 (5.32)	26.55 (31)	6.14 (14.23)	24.47 (29.61)	6.8 (15.09)	28.64
T_7	9.36 (17.8)	12.94 (21.06)	25.89 (30.54)	32.15 (34.53)	34.36 (35.87)	36.17 (36.96)	19.34
CD (P=0.05)	**3.189**	**2.266**	**6.844**	**4.782**	**6.706**	**6.250**	**3.483**
CV (%)	**20.883**	**19.776**	**15.339**	**12.548**	**12.564**	**14.184**	**8.585**

***Data within parentheses are arc sine transformed value**

Katihar: Thetreatment differed significantly and found to be superior over control. Among the treatment T6 was found superior over all treatment which is at par with T4 and T3, to control Bihar Hairy Caterpillar population. Also treatment T4 was found effective control of Bihar Hairy Caterpillar. The highest yield was observed in T6 28.64 q/ha which is at par with T4, and T3.

x. Population dynamics, loss assessment and bio-efficacy of various insecticides against pest complex of cabbage

1. The highest population of Cabbage Butterfly was noticed in last week of February. Maximum infestation of Diamond back Moth was observed in first week of April. Maximum population of Tobacco leaf eating caterpillar was recorded in third week of February. Infestation of Cabbage Head borer was highest in first week of April.
2. Minimum temperature ,Moring relative humidity and Rainfall showed significantly positive correlation with the population of cabbage butterfly ,Diamond back moth and Tobacco caterpillar, where as Maximum temperature and Bright sunshine hours showed non-significantly negative correlation with the above three pests of cabbage . Morning relative humidity, rainfall and bright sunshine hours showed significantly positive correlation with the population of cabbage head borer.
3. For controlling pest complex of cabbage, all the treatments were significantly superior over control. Spinosad (0.3ml/lit.) was the most superior treatment followed by Indoxacarb (0.5 ml/lit.) The treatments Novaleuron (T1), Flubendiamide (T3), Enamectin Benzoate (T5) and Profenophos(T6) were at par with each other . The

bio-pesticide, NSKE 5% (T7) showed poor result as compared to chemical pesticides in controlling cabbage pest complex.

4. All the treatments recorded significantly higher yield over control. The highest yield of cabbage was recorded in Spinosad (0.3 ml/lit.)treated plot followed by Indoxacarb (0.5 ml/lit.).Regarding yield performance the treatments,Novaleuron (T1), Flubendiamide (T3),Emamectin Benzoate (T5),Profenophos (T6) were at par with each other . In general, it can be concluded that spraying with Spinosad(0.3 ml/lit.), Indoxacarb(0.5 ml/lit.) and NSKE(5%) were effective measures for the control of Cabbage butterfly, Diamond back moth, Tobacco caterpillar and cabbage Head borer.

xi. Biotic stress management through organic amendment and bio-pesticide in Makhana (Euryale*ferox*)

Soil Amendment with 100 % vermicompost and application of bio-pesticide gave highest yield (35.45), B: C ratio (5.65:1) and lowest population of insect pest in Makhana. The lowest insect pests were observed in the treatment having different doses of vermicompost compared to plot receiving chemical fertilizer. Application of vermicompost increases secondary metabolites such as total phenol, SOD, which reduces the pest population, but peroxidase enzyme showed almost similar in all the treatments. The experiment was further taken to the farmers' field with the treatment which was given the best result in our experiment i.e., Soil amendment with 100 % vermicompost and application of bio-pesticide.

xii. Population Dynamics of Insect Pest and their management in Boro paddy

Among all the treatments Module-IV comprised Pheromone trap with 5mglure@20 trap/ha + release of % trichocard/ha of *Trichogrammajaponicum* for mass trapping from 20 DAT at 15 days interval + NSKE @ 5%was highly effective in the management of yellow stem borer in Boro rice with least dead hearts (6.08% at 30 DAT and 6.28% at 50 DAT and also white ear (6.18 % at 90 DAT) was found significant compared to the control.

xiii. Biotic stress management through organic amendment and bio-pesticide in Makhana (*Euryale ferox*Salisb.)

Soil Amendment with 100 % vermicompost and application of bio-pesticide gave highest yield(35.45), B:C ratio (5.65:1) and lowest population of insect pest in Makhana.The lowest insect pest were observed in treatment having different doses of vermicompost compared to plot received chemical fertilizer. Application of vermicompost increases secondary metabolites such as total phenol, SOD, which reduces the pest population, but peroxidase enzyme showed almost similar in all the treatments.The experiment was further taken to farmer field with the treatment which was given the best result in our experiment i.e., Soil Amendment with 100 % vermicompost and application of bio-pesticide.

xiv. Biodiversity of Plant Parasitic Nematodes in Koshi region of Bihar

Total 111 samples were collected from different districts of kosi region of Bihar out of which only 18 samples (16.21%) were infected with root knot nematodes at the time of survey.Out of 111 samples 56 samples are infected with root knot population (50.45%) samples were infected.On the basis of community analysis of soil samples,among the all different districts of kosi region of Bihar,two nematodes were majorly found **(*Meloidogyne spp. and Helicotylenchuss*pp.and*Hoplolaimus*Spp.)** with high prominence value.Panama Wilt of banana is may be due to the presence of *Meloidogyne* as well as *Helicotylenchus* population.Pathogencity of Root knot Nematode experiment revealed that as the population of J2 increases in pot the infection i.e, No. of Galls are also increased and it is inversely proportional to the fresh root weight of the plant. This experiment also revealed that 100 J2 per kg soil is significant to cause damage to the plant.

3.2.3.4. Product Development and Monitoring:

A. Agricultural Engineering

i. Design, Fabrication and Testing of a Battery operated Rotary Tiller

- Design of the machine has been completed.
- Purchase process for the assembly items like battery, controller etc. has already been initiated.
- AC current based rotary tiller has been developed.
- Now it requires to be operated by battery.

ii. Design and development of one/two row reaper for paddy and wheat.

- Design and development of the machine has been completed.
- Review and Literature regarding paddy and wheat reaper has been done.

iii. Design development of a Mechanical Palmyra palm fruit pulp extractor

- Design work has been completed.
- Collection of review materials regarding palmyra pulp characteristics has been done.
- Construction of machine is under process.

iv. Design and Development of Agricultural Reciprocating Sprayer

- Design of the machine has been made.
- Review and Literature work has been done.
- Construction work is under progress.

v. Design and Fabrication of Solar Energy Powered Insect Trap

- Study of different type of insect trap has been done
- Study of solar cell and UV bulb required, conducted.
- Selection of battery and solar panel has been made

vi. Establishment of 3D printing Facility at BAU, Sabour

- Course on 3D printing has been prepared.
- Lecture on 3D printing including their PPT have been prepared for teaching UG students.

vii. Farm Machine Testing Centre

- Letters has been sent to GoI officials for visiting our test centre for its recognition.
- All the machines procured have been installed successfully and regular checking of machines has been done for their working.

viii. Integrating Postharvest Technologies into the "Scaling up Climate Smart Agriculture (CSA) through Mainstreaming Climate Smart Villages (CSVs) in Bihar

- Three numbers of modified STR dryer has been placed in the villages at Tilakpur (Sultanganj Block, Bhagalpur), Longai (Kahalgaon, Bhagalpur) and Raghunathpur(Bariyarpur Block, Munger) and more than 1000 quintal grains has been dried by the farmers of nearby villages. All the dryers been used by the farmers at community level. Another one modified dryer has been kept at department and it will be placed in another village after testing.
- More than 5000 (Five Thousands) numbers of hermetic bag has been distributed in all the 25 villages of Bhagalpur and Munger districts of Bihar for the prevention of storage losses in cereal and pulses crops. 10 bags per village (total 250 bags) have been kept for research study with traditional method of storage as well as comparison with metal silos. In nine month of experimental data, no losses have been recorded in hermetic bag storage.
- As well comparative study on storage behaviour of maize in different storage metal bin modes was made to assess the qualitative and quantitative loss and to validate the advantages of hermetic made metal bins over the conventional metal bins used in the region.

3.2.3.5. Social Science

A. Extension Education

i. Assessment on Student Retention, Attrition and Destination Survey of Passed out Students of Bihar Agricultural University

To identify the factors influencing students' retention in different academic programmes of the colleges:

a) To identify the contributing factors in students' attrition in different academic programmes of the colleges.
b) To conduct destination survey of passed out students of the colleges.

Research project is conducted in Bihar Agricultural University,Sabour and all its colleges. The respondents were Under Graduate, M.Sc(Ag) & Ph.D. Students. The respondents were selected randomly. The major objectives of the study were Assessment on Student Retention, Attrition and Destination Survey of Passed out Students. The student retentions were studied based on students' enrolment factors, students' first entry factors, students' life situation factors, academic services provided to the students and non-academic services. The major enrolment factors contribute in students retention were career opportunities and development of self confidence. Major factors contribute in students dropout/attritions are Student employment opportunities and Student educational aspirations and goals. Destination survey of PG and PhD students were conducted. It is noted that 54.19% and 71.42% PG students and PhD students are employed in government sectors (Assistant Professor, Nationalized Bank, FCI, SMS, ATM, BTM, Agril. Coordinators, Jeevika). Destination survey of passed out students should be done in regular basis and special cell /nodal officer should be placed for this purpose.

ii. Designing and development of Branding strategies for selected released technologies of BAU, Sabour

In this study we found that there is a mixed attitude of the farming community towards advertising. Majority of them considered that advertising increases the prices of the product as well as they are skeptical about credibility. At the same time, they feel that advertisements create competition among different firm which will ultimately help in getting quality products. As far as the different medium is concerned News and Magazine are the most credible source of advertisement followed by television. Internet is having least credibility as far as advertisement is concerned. In the context of brand value, the majority of the respondents are having favourable attitude towards functional value followed by the conditional value. They reported that branded products are costly but having quality assurance. Majority of them also reported that they use to prefer different brands for different products. The quality of advertisement depends on branding strategies, we have to follow the same colour, same music, name, and design for different products. Assured quality and continuous supply are two important parameters which need to take care during the brand strategies. In the coming future, online marketing could be a potential way to sell university products. Further, micro-entrepreneurs could act as a market channel at the grassroots level for the university products.

iii. Understanding Farm-Household Management Decision making for Increased Productivity in the Eastern Gangetic Plains

Farmers are not 'Homo-economicus' their decision-making process is also driven by social norms, heuristics, cognitive biases, loss aversion and other factors. We have conducted focus group discussions and 80 key informant interviews at five nodes of Purnea district. Most of the times farmers don't want to break their status quo situation. By proper tailoring of messages the adoption process could be accelerated. Majority of farmers are in small and marginal category, micro-incentives are also helpful in the adoption process. Continuous

reminder and push also affect the adoption process up-to a great extent. Based on KIIs and FGDs potential choice experiments will be designed and executed in the coming days.

iv. Reasons and Effect of Migration on Farm Household Level in Seemanchal Area of Bihar

The predominant stream of migration in India has involved rural-to-rural migration of labour. However, rising levels of stress on agriculture-based incomes and livelihoods and the urban centric nature of economic growth combine to change patterns of migration, with rural to urban migration rising in significance. In this backdrop, the project was designed to find out the reasons, pattern and effect of migration on farm household as well as livelihood vulnerability of farm household in Seemanchal area which is happened to be very less developed area of Bihar. The locales of study are Kishanganj, Purnea, Araria, Katihar district of Seemanchal area of Bihar. Initial results showed migration has major contribution in farm household's income and members mostly migrated to outside state for earning income. Utilization of remittances sent by migrant family member's shows similar pattern of farm family expenditure. However, ownership of assets and act of decision making predominantly rests with non-migrant members.

v. Assessing the Impact of BSDM Training Imparted by BAU Sabour on Practicing Trainees in their Activities

Under the Bihar Skill Development Mission(BSDM), Bihar Agricultural University, Sabour is imparting training under Bihar Skill Development Mission(BSDM) for the last three years. So it becomes imperative to know the impact of this training to the trainees in their enterprise activities accomplishment. Three trades viz. Beekeeping, Mushroom and Gardener were selected for this purpose. Sixty successful trainees were interviewed and it is noted that important characteristics of successful trainees are passion for success, determination for success, confidence in target achievement, stability in business output, optimism in business and risk bearing ability. However, the major constraints faced by the trainees were lack of fund, lack of land for the centre establishment, complicated and difficult institutional loaning procedure and unawareness on institutional credit facilities in some cases.

vi. Impact Assessment of Innovative Extension Approaches Adopted by Bihar Agricultural University, Sabour

The innovative approaches like Videoconferencing, Kisan Helpline, YouTube, Micro-SD card-based Transfer of technologies were studied. It was found that in case of Videoconferencing, the extent of interactivity (77.00%) and ease of usage were very high (80.00%) whereas ease of accessibility (12%) and extent of learning (33.00%) were very low. It was also observed that in case of YouTube, the extent of learning retention (87%) however cost of accessing services were perceived to be moderate (80%) by majority of respondents. It was also found that ICT interventions have reduced cost of reaching farmers by around 80%. This is further expected to reduce as the subscriber base increases.

vii. Assessment of Production System Constraints and Development of Research and Recommendation Domain Priorities for the Major Farming Systems of Agro-Climatic Zones II and IIIA of the Bihar

The cropping systems viz. Makhana cropping system in the flood prone areas, Maize cropping system in Diara region and Katarni rice production system in the Bhagalpur region have been delineated. The production constraints and to study their intensity, distribution pattern and their interaction pattern with natural and socio-economic factors have been carried out in case of Katarni rice and Makhana based cropping system.The major research and extension domain recommendations have been developed for Katarni Rice, Diara Maize and

Makhana based production systems. Locations specific technology needs profiles and to priorities the research and extension activities have been developed for all the three production systems.

viii. Intervention opportunities in Agriculture and allied areas for the livelihood security of tribal farmers of Bhagalpur district of Bihar

The project is implementing in two Tribal villages, namely Sheetalpur and Bermasia of Pirpaintee block in Bhagalpur districts. Group approach is adopted for the sustainability of interventions viz. farming, poultry, and backyard kitchen gardening for tribal farmers Livelihood security rather individual approach. With the several meetings; as well as telephonic talk due to COVID-19 Pandemic the tribal women farmers have been motivated to develop SHG, having twelve (12) women in this group is being strengthen. Simultaneously, rural youths are also being motivated for developing FPO of the 25-40 age group ; having 10 tribal farmers in this group.

ix. Study on Adoption Behaviour of Organic Growers and their Market Linkage in Koshi Region of Bihar

Project is being implemented in Saharsa, Supaul and Madhepura districts of Bihar with the objectives to study knowledge and adoption behavior, constraints faced, Participatory Guarantee System (PGS) in organic farming and market linkage of farmers produce. From the study it is noted that farmers grow Cauliflower, Tomato, Onion and Brinjal under organic farming programme. It is noted that most of the farmers are small and marginal and middle age group. Farmer wants more training on organic farming and more field visit by experts for advisory on organic farming. Farmers find it difficult to get remunerative price of organic vegetables from the market. Farmers were using Vermicompost, *Trichoderma*, neem oil, PSB and Azotobacter as inputs for organic farming. PSB and Azotobacter was also distributed among farmers to motivate farmers towards organic farming. As far as constraints is concerned, the major constraints in the adoption was lack of marketing network for organic products and public awareness followed by lack of acceptability of its high price at the cost of hygienic value and difficulty in the management of pest & insect damage.

x. Post Flood Agro-economic Behavior of Farmers in Regularly Flooded Villages of Purnea District

The major find of the project was Social participation; Information Source and Holding size have contributed in causing Perception on social vulnerability in village Chandragama.Habitation, Education, Transportability, Social participation, cropping intensity and Agricultural income have contributed in causing Perception on social vulnerability in village, Nukani.Perceptions on occupation, Gender ratio, Social participation, and information source have contributed in causing Perception on social vulnerability in village MilikTola.Perception on occupation, Vulnerable members, Information source, Cropping intensity, Agricultural income, Irrigation index and Holding size have contributed in causing Perception on social vulnerability in village Dargahiganj.Age, Education, Perception on occupation, Family size, vulnerable members, Social participation and credit load have contributed in causing Perception on social vulnerability in village Harerampur.Age, Family size, Gender ratio, Divyang, Vulnerable member, Social participation and Irrigation index have contributed in causing Perception on social vulnerability in all the selected villages pooled together.Social vulnerability index was found highest in village Nukani (134 %) followed by Dargahiganj (124.71 %), Harerampur (72.94%), Chandragama (68.50 %) and MilikTola (48.49 %). Social vulnerability index for the pooled village (Chandragama + Nukani + MilikTola + Dargahiganj + Harerampur) was found 76.27 %.

B. Agricultural Economics

i. Computation of vulnerability indices in the context of climate change in Zone II of Bihar

The present study on Computation of vulnerability indices in the context of climate change in Zone II of Bihar has been planned to find out the determinants of vulnerability and its sources in second zone of Bihar. The study is based on collection, tabulation and analysis of secondary data on identified factors like population density, literacy rate, infant mortality rate under demographic sources and variance in annual rainfall as well as minimum and maximum temperature variance under the climatic sources of vulnerabilty,however production, productivity and cropping intensity were the most important determinants of vulnerability under agricultural sources and data on different indicators were collected from Directorate of Economics and Statistics,Government of Bihar for the period from 1975-2015and IMD,Pune thereafter index for selected districts were prepared by using Patnaik and Narayanan's method of the equal weight and simple average score methods.

Results revealed that, the population density of the district was hypothesized to be positively related to the vulnerability in the context of climate change *i.e.,* with the increase in the number of persons per sq. km., the vulnerability to climate change would increase due to its direct impact on global warming. However the literacy rate was hypothesized to have a negative relationship with demographic vulnerability. Other determinants were variance in annual rainfall as well as minimum and maximum temperature, indicated that increase in the variability of these climatic indicators would increase the vulnerability of the districts to climate change.Sources wise analysis at particular point of time, indicated that agricultural vulnerabilty followed by occupational vulnerabilty were major sources of vulnerabity to climate change in zone II of Bihar. District- wise analysis over the period from 1975-2015 indicated that, Kishanganj district were placed at the first ranked followed by Khagaria, Saharsha and Purnia in context to climate change. Data pertaining to overall percentage contribution of different components of vulnerability indicated that agricultural vulerabity were the major sources followed by occupational vulnerabilty in Kishanganj followed by Khagaria supaul and purnea districts of Bihar. Therefore it is important to focus on the impacts of climate change on level of income / productivity of crop, level of education, cropping intensity, and re-establish the links with poverty, livelihood and environment. It could also be seen that appropriate crop planning with the help of index would led to higher incomes of the farmers and thereby increasing their risk bearing ability to various shocks.

ii. Economic Opportunity of the Technologies Developed and Transferred by BAU, Sabour

Major outcomes of the project are:

1. Managements of weeds in zero tilled wheat: The weed control was done by applying Glyphosate which the Govt. of India has recently restricted its use and recommended only for non cropped areas or during the non crop growth period banned. The management of rice residue is a severe problem. The wheat residue after harvest is not used. Therefore, alternate herbicide application that may be effective in similar manner (technology dissemination). The residue management technology shall be incorporated in the technology capsule and disseminated

2. Sabour Nirjal (Wheat Variety): The sowing to be done in late October to 1st week of November when most of the field is not free. Management of residue is a severe problem. The wheat residue after harvest is not used. Small size of field hinders machinery operation especially the big harvester. The yield is much lower than HD-2967. The weed control was done by applying Glyphosate which the Govt. of India has recently banned. The introduction of straw reaper may help in management of residue. Weed control to be done by Sulfosulfuron 25

gm a.i./ha after 30-35 DAS. Small size of harvester may be affordable. The yield is quite lower than the potential yield of the variety. The balance dose of fertilizer use may increase the yield.

3. Agro Technique of Dry- Direct Seeded Rice (DSR) in Bihar: The sowing to be done in June when the moisture conditions do not permit. Infestation of weed is a great problem, only successful when weed is controlled properly. The specific machine for DSR is not available. They are forced to apply DAP though they don't want to otherwise seed rate shall be very high. Calibration of machine is also problem. Only the input subsidy attracts the technology in practice. Due to new technology and less knowledge, adoption is less. The low cost weed management techniques to be disseminated. The whole technology to be disseminated in a single technology capsule for Rice-Wheat system and balance dose of fertilizer use is needed.

4. Integrated nutrient management in rice-wheat system: Farmers are not known to the technology, they are practicing it traditionally. Fodder/straw for animal is very scarce, so maintaining animal for FYM is very tough. The fertilizer applied is not in balance dose and environmental consciousness is very poor. The quantification of environmental benefit is tough. The technology for integrated nutrient management for Rice-Wheat system shall be disseminated in a single package. The environmental benefits shall be quantified in value terms and farmers may be motivated to promote application of organic manure to the maximum extent.

C. Statistics, Mathematics and Computer Application

i. Development of Weather Based forecasting models for food grain production in Zone III of Bihar

Forecasting models have been developed using ARIMA, ARIMAX, ANN and NARX methods in Rice, Wheat, Maize, Pigeon Pea and Chick Pea data. Based on RMSE, RMAPE, MAD values of all models, best model has been chosen in respective crops. NARX model was used for forecasting productivity in case of Rice, Maize and Pigeon Pea. ARIMA and ANN models were used for forecasting in case of Wheat and Chick pea respectively.

3.2.3.7. New initiatives

Development of climet resilient crops employing genome editing tool

- Genome editing (also called gene editing) is a most recent tool in molecular biology, which have superseded the limitations of traditional breeding methods starting a new era of crop improvement.
- These technologies allow usage of engineered site-specific nucleases (SSNs) for precise manipulation in the genome. Several approaches to genome editing have been developed. A recent one is known as CRISPR-Cas9, which is short for clustered regularly interspaced short palindromic repeats and CRISPR-associated protein 9. The CRISPR-Cas9 system has generated a lot of excitement in the scientific community because it is faster, cheaper, more accurate, and more efficient than other existing genome editing methods.
- Rice (*Oryza sativa* L.) is the major food source for more than three billion people of the world. However, stagnation in rice yield has been reported in recent decade owing to several factors including the emergence of pests and phyto pathogens, climate change, and other environmental issues posing great threat to global food security. Controlling these diseases has largely relied on breeding resistant cultivars and applying chemical fungicides. However, the frequent appearance of new races of the pathogen has reduced the effectiveness of resistant cultivars in the field.

- Thus, there is an urgent need to have more advanced and improved technologies that can develop new rice varieties with higher yield potential and improved resistance to major pests and pathogens. Therefore, we are going to use the CRISPR-Cas9 technology in rice to enhance disease resistance against pathogens. Our primary target is Calmodulin binding proteins as calcium/calmodulin (Ca^{2+}/CaM) complex plays vital roles in plants in sensing various biotic stresses.

Molecular Breeding for Fusarium Wilt and DRR resistance in chickpea

- Donors for Fusarium wilt and dry root resistance will be crossed with elite chickpea cultivars. Backcross breeding populations for Fusarium Wilt and DRR resistance will be developed through marker assisted selection.
- Identification of promising high yielding, wilt and DRR resistant lines will bone through MAS. These lines could be released as high yielding, wilt and DRR resistant chickpea cultivars.

Mapping of QTL(s) associated with waterlogging tolerance at early vegetative stage in pigeon pea (*Cajanus cajun* L.)

- In this project molecular mapping of QTL(s) associated with waterlogging tolerance will be done by developing mapping populations.
- This will help in identification of potential candidate genes and markers associated with water logging tolerance.
- These QTLs could be introgressed in elite pigeonpea cultivars through marker-assisted breeding to develop improved cultivar having waterlogging tolerance.

Development of a virus resistant crops through RNA silencing approach

- Potatoes are susceptible to Potato leaf roll virus (PLRV) and causing severe economic loses. The escalating economic losses caused by PLRV demands for an accurate detection and identification procedures through rigorous research focusing on the biology, diversity and epidemiology of the virus.
- This will further help in designing viable and effective management strategies. Breeding for tolerance/resistance appears to be the best approach to control this disease. But, absence of resistant sources against PLRV disease leads to tremendous crop yield losses every year. Therefore, the hunt for newer sources of disease resistance needs to be intensified.
- To develop the resistance against plant viruses, the RNA interference (RNAi) strategy has been used successfully to knock-down the mRNA expression of target viral genes.
- The target of this study is to provide a highly robust and concise methodology for inhibition of PLRV multiplication and their spread in plants by knocking down the movement protein.

Molecular breeding for prolycopene-rich tomato lines

- As new initiative, we have started molecular breeding for prolycopene-rich tomato lines. Tomato is mainly consumed for the lycopene content in the fruit.
- However, the absorption of prolycopene, the biosynthetic precursor of lycopene has been found to be more than lycopene in human system.
- Naturally, breeding for prolycopene-rich tomato should be a regarding area of research.

Development of *Fusarium* wilt resistance in banana (*Musaparadisiaca* cv. Malbhog) through *In vitro* mutagenesis

- Banana cultivation is an important source of income and employment for marginal as well as large category growers of Bihar. But the productivity and area of banana production is declining day by day as is being threatened by the occurrence of devastating *Fusarium* wilt, popularly called as Panama wilt, caused by *Fusarium* spp.
- The incidence of Panama wilt disease reaches up to 70% in India and 80% in Bihar. Therefore, development of *Fusarium* resistant lines in banana is inevitable.
- Malbhog is the most popular cultivar of Bihar having sweet firm flesh, thin yellow skin and distinct aroma with good keeping quality, known for its excellent fruit quality. This variety is highly susceptible to panama wilt with severe loss upto 76 % and thus is on the verge of extinction.
- Banana is asexually propagated crop so once we get the desired lines the same can be multiplied in vitro and distributed to the farmers.
- *In vitro* mutagenesis mediated improvement of banana can be employed to develop varieties tolerant to diseases. Here, we would like to initiate in vitro mutagenesis in variety Malbhog for developing resistance against Fusarium wilt.

Development of mutant line of Indian mustard (*Brassica juncea*Czern&Coss) against aphid resistance through gamma rays irradiation

- Among the oilseed crops, mustard is more vulnerable to a wide variety of insect pests from sowing to till harvesting. The invasion by insect pests are one of the important factors responsible for low yield such as; mustard aphid, *L. erysimi* (Kalt), mustard sawfly, *A. proxima* (Klug), cabbage butterfly, *P. brassicae*(Linn), painted bug, *B.picta* (K), mustard leaf eater, *S. Litura* (F).
- Among them, *L. erysimi*Kaltenbach, (Aphididae: Homoptera) is the mostdevastating pest in India and is distributed in many other countries also found most preferredcrop to sucking complex and six species of mustard. mustard aphid causing yield loss up to 65-96% and 15% oil reduction.
- In Bihar uneven rainfall creates situation of late harvesting of riceand forces farmers for delayed sowing of mustard in the month of November-December. The delayed condition generally favours aphid infestation and reduces yield drastically.
- There are few lines which are cultivated in late sown condition in Bihar, among which Rajendra Suflam has comparatively good yield potential but like other varieties it is also susceptible to aphid infestation.
- With the lack of identified reasonable resistant source in Brassica juncea till date, hazardous chemical pesticides are the only practical tool to contain this dreaded pest, despite the fact that they are associated with harmful side effects including emergence of pesticide resistance and aggravating environmental pollution, can also be toxic to friendlyinsects.
- One of the wild crucifer, Brassica fruticulosa is known to be resistant to mustard aphidbut introgressive breeding is a difficult, random and rare process, success of whichdepends a lot on the existence of homology between donor and recipient genomes.
- The problemis still complex if one or both species in question are amphiploid, requiring specialcrossing schemes. Therefore, due to unavailability of aphid resistance gene(s) in cultivatedgermplasm there is urgent need to create new variability so that allelic forms may be identifiedfor aphid resistance in cultivated mustard.

- Thus, development of aphid resistant lines in mustard(*Brassica juncea*) is the very much required to revive their cultivation.

Yellow Seeded Indian mustard:

- Efforts are being carrying out (at BAU, Sabour) to develop genotypes of Indian mustard having yellow seeded seed coat colour. We have identified a yellow seeded natural segregant/variant Indian mustard in F 3 generation (single plant) of a cross between brown seeded parents Pusa Jaikisan as female & Pusa Bold as male parent. Materials are being handled for next generation for precise selection. The fixed line will be characterized for yield and quality component traits.
- Seed coat of Indian mustard are generally found as reddish brown, brown, dark brown or black in colour
- Yellow seeded varieties of rapeseed mustard are in great demand due to high oil and protein content with fewer fibres in meal than the brown seeded varieties.

Development of hybrids in Indian Mustard:

- 07 fresh cross combinations has been attempted using early maturity high yield genotypes with Ogura based restorer. F 1 will be evaluated for non-sterile plants with good yield component traits.
- Diversification of A and R lines: 18 BC 2 and 11 BC 1 generation of A line diversification whereas 06 BC 1 & 01 F 1 generations for diversification of R-line were attempted.

Breeding for oil quality:

- Breeding for improved oil quality genotypes having ‘0’ (low erucic acid) or ‘00’ (low erucic acid & lowglucosinolates) oil quality will be implemented as new initiatives.

EXTENSION EDUCATION

4. EXTENSION EDUCATION

During 2020 – 21, the directorate of Extension Education has served services to the stakeholders as per the mandate. The brief details of various activities performed are provided hereunder:

4.1 Details of Frontline Line Demonstrations, On Farm Testing, Cluster Frontline demonstrations

Front Line Demonstrations is a unique approach to provide a direct interface between the researcher and the farmers as the scientists are directly involved in the planning, execution and monitoring of the demonstrations of the technologies developed by the. The scientists also receive direct feedback from the farmers' field about the crops like wheat, rice and pulses production in general and technology being demonstrated in particular. This helps the scientists to improvise upon the research programmes accordingly. In FLD, the subject matter specialists (SMS) provides the technological inputs to extension scientists to organize the demonstrations. Thus, FLD provides the opportunity to researchers and extension personnel for understanding the farmers' resources and requirement to fine tune or modify the technology for easy adaptability on the farmer's field. The details of various FLDs being conducted is provided in Table 4.1 and 4.2. The total number of demo plots in FLD was 4766 covering an area of 1266.03 ha.

Table 4.1. FLD on cereals, oilseed, pulses, vegetables, folder crops etc. conducted by different KVKs

Name of KVK	Cereals		Oilseeds		Pulses		Vegetables		Others		Fodder Crop	
	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)
Araria	25	10	0	0	0	0	0	0	2	37	0	0
Arwal	61	19.3	0	0	0	0	60	1.8	0	0	67	3
Aurangabad	34	15	0	0	0	0	0	0	40	6	0	0
Banka	188	74.1	0	0	0	0	700	10	100	73.14	0	0
Bhagalpur	29	12	0	0	23	7.8	0	0	12	0.6	0	0
Amas Gaya												
Gaya	51	20.5	60	10	196	42.35	23	1	0	0	20	0.1
Jehanabad	60	17.5	0	0	0	0	0	0	0	0	0	0
Katihar	60	24	0	0	0		30	4	25	10	10	4
Khagaria	20	8	100	40	75	30	50	2	92	35	13	2
Kishanganj	20	4	0	0	0	0	20	8	0	0	0	0
Lakhisarai	42	19.9			274	72.25	66	2	0	0	0	0
Madhepura	5	10.4			1	0.2	5	15.5	1	4	0	0
Munger	62	11.4	0	0	13	5.2	0	0	0	0	22	1.9
Nalanda	60	18	174	60	52	20	93	6.85	35	0	0	0

Patna	53	132.5	0	0	0	0	0	0	0	0	0	0
Purnea	25	100	0	0	0	0	50	3.5	25	10	50	18
Rohtas	25	5	0	0	10	2.5	30	3	16	5.25	0	0
Saharsa	24	9	0	0	50	11.7	70	4	10	2.4	0	0
Sheikhpura	45	18	0	0	10	4	86	12	60	0.75	0	0
Supaul	156	61.5	0	0	0	0	700	10	100	73.14	0	0
Total	**1045**	**590.1**	**334**	**110**	**704**	**196**	**1983**	**83.65**	**518**	**257.28**	**182**	**29**

Table 4.2. FLD on Livestock and Home Science conducted by different KVKs

Name of KVK	Enterprise		Livestocks		Implements		Women Empowerment	
	No. of Demo	No. of Unit	No. of Demo	No. of Unit	No. of Demo	No. of Unit	No. of Demo	No. of Unit
Araria	0	0	2	406	0	0	0	0
Arwal	250	500	75	150	0	0	0	0
Aurangabad	0	0	10	10	0	0	0	0
Banka	0	0	0	0	32	12.6	0	0
Bhagalpur	50	50	10	50	0	0	0	0
Amas Gaya	25	50	0	0	0	0	0	0
Gaya	400	400	155	310	3706	5706	130	1850
Jehanabad	0	0	70	70	65	65	0	0
Katihar	0	0	0	0	0	0	1	30
Khagaria	75	75	0	0	0	0	40	40
Kishanganj	0	0	0	0	0	0	0	0
Lakhisarai	42	42	0	0	0		70	70
Madhepura	0	0	0	0	0	0	0	0
Munger	0	0	0	0	8	1264	2	35
Nalanda	0	0	0	0	0	0	0	0
Patna	0	0	1	26	0	0	3	25
Purnea	75	75	50	50	0	0	0	0
Rohtas	100	100	0	0	50	50	0	0
Saharsa	0	0	0	0	0	0	60	0.1
Sheikhpura	25	25	0	0	0	0	25	1
Supaul	0	0	0	0	32	12.6	0	0
Total	**1042**	**1317**	**371**	**666**	**3893**	**7110.2**	**331**	**2051.1**

4.2 On Farm Testing (OFTs)

Agricultural research has traditionally been undertaken on research stations where facilities for experimentation are usually available and accessibility to researchers is favourable. It is assumed long time that the best

technology in research stations is also the best on farmers' field. Number of On Farm testing (OFTs) are conducted in various KVKs of the university in different areas thematic areas, viz., ICM, IDM, IPM, INM, varietal evaluation, weed management, water management, farm technology, and technologies related to livestock and home science. A total of 153 OFTs were conducted during the year 2020-21 by different KVKs which is mentioned in Table 4.3.

Table 4.3. OFTs conducted by different KVKs during 2020 – 21.

Name of KVK	Thematic Area															
	ICM	IDM	IPM	INM	Varietal Evaluation	Weed Mgt.	Water Mgt.	Storage Technique	RCT	Farm Technology	Evaluation of Sowing time	Crop Production	Protected Cultivation	Nursery Raising	Others	Total
Araria	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Arwal	0	0	4	1	0	1	0	0	0	0	0	0	0	0	1	7
Aurangabad	1	0	1	0	0	0	0	0	2	0	0	0	0	0	2	6
Banka	1	0	0	1	0	0	0	0	0	0	0	4	0	0	0	6
Bhagalpur	2	1	4	0	0	0	0	1	0	1	0	0	0	0	0	9
Amas Gaya					1	1									2	4
Gaya	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Jehanabad	0	1	2	1	1	0	0	0	1	0	0	0	0	0	2	8
Katihar	2	0	0	3	1	0	0	0	0	0	0	0	0	1	0	7
Khagaria	0	1	3	1	0	0	0	1	0	2	0	0	1	0	1	10
Kishanganj	0	2	3	1	0	0	0	0	0	1	0	0	1	0	0	8
Lakhisarai	1	2	2	0	0	4	0	0	0	0		2	0	0	0	11
Madhepura	0	1	1	3											2	7
Munger	1		0	1	0	1	2	0	0	0	0	0	0	0	1	6
Nalanda	1			1					2		1	1			4	10
Patna	1	1	1	0	0	1	0	1	0	0	0	1	0	0	2	8
Purnea	1	2	1	3	1	2	0	0	0	0	0	0	0	0	0	10

Rohtas	1				1	1									2	5
Saharsa	1	1	2	1	2	4	1		1						1	14
Sheikhpura	1	1	1	3											2	8
Supaul	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Kaimur																0
Total	**20**	**14**	**26**	**20**	**7**	**15**	**3**	**3**	**7**	**4**	**1**	**8**	**2**	**1**	**22**	**153**

Results of OFT conducted using rice varieties at Rohtas, Jehanabad and Arwal districts

Experiments to assess the performance of newly released rice varieties from Bihar Agricultural University and other centers was conducted through On-Farm Trials (OTFs) at Rohtas, Jehanabad and Arwal districts of Bihar. Thirteen (13) OFTs were conducted in the farmer's field at Rohtas district using test varieties comprising of Sabour Shree, Sabour Sampanna, Sabour Harshit, Swarna Samridhi, Swarna Shreya, Swarna Shakti, Shambha Sub-1, Rajendra Sweta, DRR 44 and the check varieties MTU 7029 and BPT 5204, most popularly grown rice varieties in the district. Grain yield ranges from 31.5 to 68.0 q/ha for Swarna Shakti and Swarna Samridhi, respectively. Swarna Samridhi (68.0 q/ha) was tested at one location where it has out yielded the check BPT 5204 (61.0 q/ha). Sabour Sampanna was tested at four locations where it was statistically at par with the checks at their respective location. Out of 13 locations, BPT 5204 was top performing genotype at seven locations and MTU 7029 was top yielder at three locations.

At Jehanabad, five varieties *i.e.*Rejendra Sweta, Swarna Sreya, Sabour Harshit, Sabour Shree, Sabour Sampanna were tested at 15 locations. Check varieties used either released from public and private sectors as MTU 7029, Rajendra Mashuri, Super Moti, Laxmi Gold, ARIZE 6444, PAN 831 and Katarni. Experiment at each center was conducted using one test and one check variety. Grain yield ranges from 30.0 to 62.0 q/ha for Laxmi Gold and Sabour Shree, respectively; whereas MTU 7029 also yielded 62.0 q/ha at one of the centre. Sabour Shree was tested at two locations (60.4 and 62.0 q/ha), where it has out yielded both the checks RaendraMashuri (58.0 q/ha) and ARIZE 6444 (55.0 q/ha) at their respective location. Rajendra Sweta was tested at three locations, being ranges from 52.0 to 53.0 q/ha performed better than their checks ARIZE 6444 (52.0 q/ha) and Komal (40.0 q/ha).

Five genotypes were tested at eight centers of Arwal district with Rajendra Sweta at three, Sabour Harshit at two locations and Sabour Sampanna, Sabour Shree and Swarna Shreya at one location each. Among the check varieties BPT 5204 and Dhanyarekha were used at five and two locations, respectively; while MTU 7029 were used at one location. Grain yield ranges from 42.0 to 62.0 q/ha for Swarna Shreya and MTU 7029, respectively. Highest yielding test variety was Sabour Shree (58.0 q/ha) but not surpassing its corresponding check MTU 7029 (62.0 q/ha). None of the test varieties out yielded its corresponding check in any of the location at Arwal.

4.3 Cluster Frontline Demonstrations

The KVKs conducted cluster frontline demonstrations (CFLDs) to demonstrate the potential of newly released oilseed and pulses technologies on farmers field at different locations in a given farming system. It also organized farming and extension activities for the dissemination of various technologies. The details of CFLD conducted is provided in Table 4.4 and 4.5.

Table 4.4. CFLD on oilseeds conducted by different KVKs

Name of KVK	Oilseeds									
	Rapeseed & Mustard		Sesame		Soyabean		Linseed		Sunflower	
	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)
Araria	250	100	75	30	0	0	50	20	75	30
Arwal	53	20	-	-	-	-	-	-	-	-
Aurangabad	50	20	0	0	0	0	0	0	0	0
Banka	50	20	0	0	0	0	0	0	0	0
Bhagalpur	280	150	0	0	0	0	0	0	0	0
Amas Gaya	250	100					50	20		
Gaya	75	30	0	0	0	0	0	0	0	0
Jehanabad	75	30	0	0	0	0	0	0	0	0
Katihar	50	20								
Khagaria	0	0	0	0	50	20	0	0	50	20
Kishanganj	75	30	0	0	0	0	0	0	0	0
Lakhisarai	75	30	0	0	0	0	0	0	0	0
Madhepura	26	10							54	20
Munger	108	30	0	0	0	0	74	20	0	0
Nalanda										
Patna	250	100	0	0	0	0	0	0	0	0
Purnea	50	20	225	90	0	0	0	0	0	0
Rohtas	250	100	50	20	0	0	50	20	0	0
Saharsa	80	30					60			
Sheikhpura	56	20	0	0	0	0	0	0	0	0
Supaul	325	130	23	10	0	0	0	0	90	30
Total	**2428**	**990**	**373**	**150**	**50**	**20**	**284**	**80**	**269**	**100**

Table 4.5. CFLD on pulses conducted by different KVKs

Pulses												
	Lentil		Green Gram		Pigeon Pea		Field Pea		Chick pea		Black Gram	
Name of KVK	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)	No. of Demo	Area (ha)
Araria	25	10	50	20	0	0	25	10	0	0		
Arwal	25	10	26	10	-	-	-	-	25	10		
Aurangabad	25	10	25	10	25	10	0	0	25	10		
Banka	25	10	25	10	25	10	0	0	25	10		
Bhagalpur	23	10	15	10	30	10	0	0	21	10	25	10
Amas Gaya												
Gaya	25	10	0	0	25	10	25	10	25	10		
Jehanabad	25	10	0	0	0	0	25	10	26	10		
Katihar	25	10	25	10								
Khagaria	25	10	50	20	0	0	0	0	0	0		
Kishanganj	0	0	75	30	0	0	0	0	0	0		
Lakhisarai	25	10	25	10	25	10			25	10		
Madhepura	129	30	63	20	29	10						
Munger	40	10	42	10	41	10	35	10	36	10		
Nalanda												
Patna	25	10	0	0	0	0	25	10	25	10		
Purnea	25	10	50	20	0	0	25	10	0	0		
Rohtas	0	0	25	10	25	10	25	10	25	10	25	10
Saharsa	55	20	50	20								
Sheikhpura	27	10	55	10	32	10	0	0	55	10		
Supaul	48	20	45	20	28	10	27	10	0	0		
Total	**597**	**210**	**646**	**240**	**285**	**100**	**212**	**80**	**313**	**110**	25	10

4.4 Scientific Advisory Committee Meeting (SAC) meeting

Scientific Advisory Committee meeting is an important event of Krishi Vigyan Kendras. The KVKs must organize regular meetings of SAC members to get their action plan modified and approved incorporating newer areas of functioning. As the members of SAC represent interdisciplinary field of agricultural development including

finance and mass media, mutual exchange of ideas and experiences helps the KVKs in carrying out the activities in a focused manner. The members of SAC are also taken to visit to get an insight of KVK functioning in the farm. Hence, conducting SAC meetings is of immense importance by all the KVKs of BAU, Sabour. An appraisal of SAC meeting conducted by KVKs indicates that almost of the KVKs of BAU, Sabour fulfilled the requirement by conducting at least one SAC meeting during the year. A total of 20 SAC meetings were organized with a participation of 883 participants during the year 2020 – 21 as tabulated in Table 4.6.

Table 4.6. Scientific advisory committee meetings organized by various KVKs

S.No.	Name of the KVK	Date of SAC meeting	No. of Participants
1.	Madhepura	07.09.2020	39
2.	Saharsa	08.09.2020	37
3.	Supaul	09.09.2020	43
4.	Araria	10.09.2020	45
5.	Banka	18.09.2020	48
6.	Bhagalpur	19.09.2020	47
7.	Munger	25.09.2020	51
8.	Lakhisarai	26.09.2020	43
9.	Patna	14.10.2020	51
10.	Jehanabad	15.10.2020	43
11.	Manpur, Gaya	16.10.2020	41
12.	Amas, Gaya	16.10.2020	38
13.	Aurangabad	17.10202	58
14.	Arwal	17.10202	27
15.	Khagaria	02.12.2020	32
16.	Katihar	03.12.2020	38
17.	Purnea	04.12.2020	41
18.	Kishanganj	05.12.2020	33
19.	Sheikhpura	21.12.2020	31
20.	Nalanda	22.12.2020	41
21.	Rohtas	23.12.2020	56
Total			**883**

4.5 Soil Health Card Scheme

The soil health card is a complete evaluation of the quality of the soil right from the functional characteristics, to water and nutrient content and other biological properties. It provides information on nutrient status of farmer's plot, fertilizer and nutrient recommendation, and other required activities. It also contains corrective measures that a farmer should adopt to obtain a better yield. The KVKs of Bihar Agricultural University are helping the farming community in the following ways:

- The farmers get a well monitored report of soil which is chosen for cultivation of crops
- The monitoring is done on a regular basis.
- The farmers are guided by experts to come up with solutions to improve the quality of the soil.

The soil health card helps the farmers to get an idea on the crop-wise recommendation of nutrients and fertilizers required in each type of soil. This could help in increase of yield from the soil. A total of 10521 samples were analyzed from 9633 farmers of 1040 villages from 20 district of the state during the year 2020 – 21 as mentioned in Table 4.7.

Table 4.7. Soil health card distribution and coverage

Soil Health Card 2020-21				
Sl. No.	**Name of KVK**	**No. of Samples**	**No. of Farmers**	**No. of Villages**
1	Araria	521	395	43
2	Arwal	0	0	0
3	Aurangabad	548	405	51
4	Banka	1037	924	11
5	Bhagalpur	1240	1240	12
6	Gaya	75	75	8
7	Gaya (Amas)	0	0	0
8	Jehanabad	117	117	18
9	Katihar	1385	1215	35
10	Khagaria	175	175	11
11	Kishanganj	455	455	15
12	Lakhisarai	230	230	22
13	Madhepura	385	385	10
14	Munger	306	306	24
15	Nalanda	1145	1145	65
16	Patna	542	542	25
17	Purnea	448	448	38
18	Rohtas	1052	956	62
19	Saharsa	225	245	10
20	Sheikhpura	60	360	5
21	Supaul	575	15	575
	Total	**10521**	**9633**	**1040**

4.6. World Soil Day Programme

World Soil Day was celebrated on 5th December, 2020, at the university headquarters as well as in all the colleges, KVKs, and other institutions of the university. The KVKs also organized Kisan Gosthi on the occasion on the importance of soil. The programme was graced by public representatives, district level officers of the administration and department of agriculture. The KVK wise participation of farmers and important dignitaries in mentioned in Table 4.8.

Table 4.8. Participation of farmers and dignitaries in various KVKs on world soil day

S.No.	Name of KVK	No. of Farmers Participated	Dignitary attended
1	Araria		
2	Arwal	22	0
3	Aurangabad	90	3
4	Banka	90	0
5	Bhagalpur	156	4
6	Gaya	98	0
7	Gaya (Amas)	64	1
8	Jehanabad	61	0
9	Katihar	112	0
10	Khagaria	135	2
11	Kishanganj	62	0
12	Lakhisarai	71	0
13	Madhepura	43	11
14	Munger	94	0
15	Nalanda	55	1
16	Patna	98	1
17	Purnea	200	3
18	Rohtas	136	1
19	Saharsa	234	0
20	Sheikhpura	78	0
21	Supaul	150	0
Total		**2049**	**27**

4.7 Kisan Call Center

The Kisan Call center is an effective medium to solve the queries of the farmers through telephonic conversation as well as over Whatsapp platform. It is not always possible for the farmers to visit the scientists on the campus/ university due to several constraints in relation to logistic issue, time factor, etc. In order to make the advisories reach the farmers effectively on time, kisan call center is performing a major role in timely dissemination of information to the farming community. The scientists from different disciplines in agriculture and allied sciences regularly provide the advisories to the farmers from the call center from the university headquarters at Sabour, Bhagalpur. The toll-free number to reach the call center is 1800-345-6455 and Whatsapp number is 7004528893. The details on farm advisories provided by the Kisan Call center (from April 2020 to March 2021) over telephone and Whatsapp is provided in Fig. 4.1 and 4.2. The table 4.9 and table 4.10, shows that a total of 1126 advisories were provided through the kisan call center while 707 advisories were provided through Whatsapp platform in different disciplines of agriculture during the time period.

Table 4.9. Advisories provided through the kisan call center

Sl.No.	Department	April 2020	May 2020	June 2020	July 2020	Aug. 2020	Sept. 2020	Oct. 2020	Nov. 2020	Dec. 2020	Jan. 2021	Feb. 2021	Mar. 2021	**Total**
01.	Crop Protection	-	03	02	01	05	09	07	05	08	06	10	11	**67**
02.	Fruits	01	04	12	21	12	12	11	08	08	07	11	25	**132**
03.	Vegetable	01	07	03	06	05	10	11	08	01	09	14	10	**85**
04.	Agronomy	01	09	06	02	07	05	10	08	13	05	06	08	**80**
05.	Animal Husbandry	-	10	09	10	07	24	17	07	06	09	09	10	**118**
06.	Plant Breeding and Genetics	-	07	23	06	02	11	16	06	20	05	19	12	**127**
07.	Beekeeping	01	01	02	01	01	01	02	-	-	02	04	-	**15**
08.	Soil Science	01	02	08	04	04	09	03	03	08	07	05	03	**57**
09.	Social Science	02	25	31	24	25	40	24	17	58	39	40	44	**369**
10.	Plant Pathology/ Mushroom	-	04	03	03	05	12	15	04	12	06	04	08	**76**
	Total	**07**	**72**	**99**	**78**	**73**	**133**	**116**	**66**	**134**	**95**	**122**	**131**	**1126**

Table 4.10. Advisories provided through Whatsapp platform.

Sl. No.	Department	April 2020	May 2020	June 2020	July 2020	Aug. 2020	Sept. 2020	Oct. 2020	Nov. 2020	Dec. 2020	Jan. 2021	Feb. 2021	Mar. 2021	**Total**
01.	Soil Science Agricultural Chemistry	-	-	01	-	01	04	-	05	01	05	18	09	**44**
02.	Agronomy/ Weather	02	02	07	05	09	13	07	09	10	05	41	10	**120**
03.	Plant Breeding and	-	01	04	01	01	-	-	-	02	02	02	01	**14**

	Genetics													
04.	Plant Pathology/ Mushroom	02	-	01	02	-	15	09	09	06	01	08	04	**57**
05.	Entomology	01	02	03	02	03	06	05	-	08	01	16	11	**58**
06.	Vegetable Science	04	11	10	04	04	21	15	01	04	05	26	26	**131**
07.	Fruit Science	09	20	08	14	08	11	06	04	04	02	23	23	**132**
08.	Seed Technology & FST	-	-	03	01	-	-	01	-	-	01	-	-	**06**
09.	Agricultural Economics and Agricultural Engineering	02	-	-	-	-	-	-	-	-	-	-	-	**02**
10.	Extension Education & Others	01	94	13	02	02	02	04	02	06	02	14	01	**143**
Total		**21**	**130**	**50**	**31**	**28**	**72**	**47**	**30**	**41**	**24**	**148**	**85**	**707**

4.8. Extension Activities organized

4.8.1 e-Kisan Chaupal

Covid-19 pandemic led the world to try alternate forms of technology to reach the interested participants. In the same way, Bihar Agricultural University launched a comprehensive training program through online platforms to reach the interested farmers online. The university has started e-Chaupal for farmers in plant protection measures, crop management, IFS, Horticulture crop management, animal husbandry, poultry and other subject areas. In this programme, farmers connect virtually with experts and raise their problems. The advisories are delivered to the farmers by experts from reputed organizations. The chaupal to address farmers' queries on different realms of agriculture was provided through Zoom and Youtube platform from November 2020 to March 2021. A total of 50,831 farmers benefitted through these online sessions as shown in Table 4.11

Table 4.11. e-kisan chaupal on various topics organized by the university

Sl. No.	Date	Topic	Farmers benefited through Zoom platform	Farmers benefited through Youtube platform	Total farmers benefited online
1.	12-11-2020	e-fisheries chaupal (e- मत्स्य चौपाल)	180	2770	2950
2.	18-11-2020	e-horticulture chaupal (e- उद्यान चौपाल)	110	2250	2360
3.	24-11-2020	e-kisan chaupal (e- किसान चौपाल)	95	0	95
4.	27-11-2020	e-animal husbandry chaupal (e- पशुपालन चौपाल)	80	2300	2380
5.	05-12-2020	e-fisheries chaupal (e- मत्स्य चौपाल)	55	2050	2105
6.	11-12-2020	e-horticulture chaupal (e- उद्यान चौपाल)	35	1150	1185
7.	19-12-2020	e-kisan chaupal (e- किसान चौपाल)	105	1954	2059
8.	28-12-2020	e-animal husbandry chaupal (e- पशुपालन चौपाल)	90	3133	3223
9.	06-01-2021	e-mushroom chaupal (e- मशरूम चौपाल)	232	4186	4418
10.	11-01-2021	Medicinal plants e-chaupal (e- चौपाल: औषधीय पौधों की खेती)	280	4041	4321
11.	21-01-2021	e-kisan chaupal (e- किसान चौपाल)	162	1978	2140
12.	28-01-2021	e-honeybee rearing chaupal (e - मधुमक्खी पालन	86	2500	2586

		चौपाल)			
13.	05-02-2021	e-fisheries chaupal (e- मत्स्य चौपाल)	74	5220	5294
14.	11-02-2021	e-animal husbandry chaupal (e- पशुपालन चौपाल)	45	4893	4938
15.	17-02-2021	e-horticulture chaupal (e- उद्यान चौपाल)	15	3748	3763
16.	26-02-2021	e-kisan chaupal (e- किसान चौपाल)	72	1260	1332
17.	08-03-2021	e-women empowerment chaupal (e- महिला सशक्तिकरण चौपाल)	44	1100	1144
18.	15-03-2021	e-horticulture chaupal (e- उद्यान चौपाल)	26	2931	2957
19.	20-03-2021	e-kisan chaupal (e- किसान चौपाल)	9	1572	1581
Total no. of farmers benefited			1795	49036	50831

4.8.2 National Initiative on Climate Resilient Agriculture (NICRA project)

Climate variability is one of the major challenges before agricultural production in India. The frequent droughts, high-intensity erratic rainfalls, floods etc., have already been the main reason for hampering crop and livestock production. Again, delay in the onset of monsoon and its early cessation pose a great threat to agricultural production and productivity. Therefore, a nationwide project, "National Initiative on Climate Resilient Agriculture" (NICRA), launched by ICAR in 2011, is a step towards climate-smart agriculture that includes applying proven practical technologies in major areas of Natural resource Management, Crop production, Animal Husbandry and others. NICRA project was started in Aurangabad, Jehanabad, Supaul and Nawada district under Bihar Agricultural University in the first phase and later on Banka district has been included under this project in the second phase. The technology Demonstration Component (TDC) of this project has addressed the issues of enabling farmers through the demonstration of climate-resilient technologies based on climatic vulnerability. Furthermore, the formation of VCRMC (Village Climate Risk Management Committee) and setting up custom hiring centers under NICRA in the adopted villages added to the grassroots monitoring of the project, followed by initiating farm mechanization as per the suitability of smallholdings.

4.8.3 Tribal Sub Plan (TSP)

The project entitled “Enhancement of Livelihood Security of Scheduled Tribe Communities through Agro-Technological Interventions” was introduced as Tribal Sub Plan (TSP) scheme in the districts of Banka, Kishanganj

and Katihar by Bihar Agricultural University, Sabour to achieve inclusive and sustainable development of the tribal communities through the introduction of recently developed farm technologies and development of vocational skills among rural resource poor scheduled tribes and ensuring availability of quality technological input material to the farmers. The details of on-campus training, off-campus training and other extension activities organized on various thematic areas by the three KVKs is mentioned in Table 4.24, 4.25 and 4.26, respectively.

Table 4.12. On campus training organized by the KVKs under different thematic areas under TSP

Sl. No	Thematic Area	Topic	Venue (Off/On)	Beneficiaries						Grand Total
				SC		ST		Other		
				M	F	M	F	M	F	
KVK Banka										
Agronomy										
1	Resource conservation technology	Resource diversification n for higher income	ON	-	-	10	20	-	-	30
2.	Crop production	Rabi fasalo ki unnatkheti	ON	-	-	2	28	-	-	30
3.	Crop Residue Management	Crop Residue Management under Resource conservation technology	ON	-	-	25	05	-	-	30
4.	Climate Resilient Agriculture	Importance of climate resilient practices in today's Agriculture	ON	-	-	15	15	-	-	30
Soil Science										
5	World water day	More crop per drop (Drip Irrigation)	ON	10	85	0	65	15	0	175
Animal Science										
6	Dairy farming	Clean Milk Production	ON	-	-	10	14	43	0	67
7	Goat farming	Goat farming	ON	-	-	11	24	-	-	35
8	Goat farming	Goat farming	ON	-	-	11	0	30	2	43
9	Poultry farming	Backyard poultry farming	ON	-	-	35	0	-	-	35
10	Dairy farming	Dairy entrepreneur	ON	-	-	17	6	7	0	30
11	Dairy farming	Dairy entrepreneur	ON	-	-	12	4	12	2	30
12	Dairy farming	Dairy farming	ON	-	-	13	7	10	0	30

13	Goat farming	Management of backyard goat farming	ON	-	-	0	30	0	0	30
14	Goat farming	Management of goat	ON	0	18	0	12	0	0	30
		Total		**10**	**103**	**161**	**240**	**117**	**4**	**625**
KVK Purnea										
1	Goat Farming	Goat farming	ON	14	2	3	2	0	0	21
2	Nutrition	PoshanVatika	ON	10	2	3	1	15	21	52
3	Nutrition	Poshan me Pashuaon ki Bhumika	ON	3	21	6	15	18	20	83
4	Nutrition	PoshanVatika	ON	3	7	2	20	6	20	58
5	Nutrition	Animal husbandry	ON	4	7	9	17	5	14	56
6	Nutrition	Kitchen gardening	ON	0	0	0	30	0	0	30
7	Vegetable production	*Garmasabjiutpadanewam kit prabandhan*	ON	0	0	1	34	0	0	35
8	Goat Farming	Scientific method of goat rearing	ON	6	3	8	2	0	0	19
9	Dairy farming	Feeding management of dairy animal	ON	2	0	18	4	3	0	27
10	Poultry farming	Backyard poultry farming	ON	6	0	23	0	7	0	36
11	Dairy farming	Clean milk production	ON	4	0	18	9	1	0	32
12	Dairy farming	Scientific method of dairy farming	ON	3	2	27	3	4	2	41
13	Goat Farming	Common breed of goat	ON	3	0	28	2	12	2	47
14	Goat Farming	Feeding management of goat	ON	4	0	18	7	0	8	37
15	Goat Farming	Scientific method of goat rearing	ON	2	0	18	3	1	0	24
16	Dairy Farming	Scientific method of dairy farming	ON	4	2	13	0	2	0	21
17	Poultry Farming	Backyard poultry farming	ON	6	0	17	2	0	0	25
18	Soil & Health Management	Soil & water testing	ON	0	0	27	0	0	0	27

19	Fodder management	Fodder management in animal	ON	0	0	25	0	0	0	25
20	Vermi compost	Vermi compost production technique	ON	4	0	21	0	0	0	25
21	Crop production	Rabi pulses production technique	ON	3	0	0	0	19	6	28
22	Animal Husbandry	Importance of vaccination in animals	ON	1	0	18	3	0	0	22
23	Dairy farming	Common breed of cattle & buffalo	ON	6	3	12	8	6	0	35
		Total		**88**	**49**	**315**	**162**	**99**	**93**	**806**
KVK, Katihar										
1	Weed Management	Weed Management	ON	4	0	5	0	17	0	26
2	Integrated Farming	Integrated Farming	ON	3	12	7	10	15	38	85
3	Fodder production	Fodder production	ON	7	12	12	10	32	38	111
4	Layout and Management of Orchards	Layout and Management of Orchards	ON	0	0	0	0	25	0	25
5	Production and Management technology	Production and Management technology	ON	0	0	0	0	56	0	56
6	Soil and Water Conservation	Soil and Water Conservation	ON	5	0	5	0	18	0	28
7	Integrated Nutrient Management	Integrated Nutrient Management	ON	11	2	13	3	127	7	163
8	Household food security by kitchen gardening and nutrition gardening	Household food security by kitchen gardening and nutrition gardening	ON	0	03	0	02	0	45	50
9	Mushroom Production	Mushroom Production	ON	0	40	0	70	0	110	210
10	Leadership development	Leadership development	ON	4	0	3	2	34	2	45
11	Formation and Management	Formation and Management of SHGs	ON	16	0	8	2	71	8	105

	of SHGs									
12	Entrepreneurial development of farmers/youths	Entrepreneurial development of farmers/youths	ON	7	0	9	0	33	0	49
		Total		**57**	**69**	**62**	**99**	**428**	**248**	**953**

Table 4.13: Off campus training organized by the KVKs under different thematic areas under TSP

Sl. No	**Thematic Area**	**Topic**	**Venue (Off/On)**	**Beneficiaries**						**Grand Total**
				SC		**ST**		**Other**		
				M	**F**	**M**	**F**	**M**	**F**	
KVK Banka										
Agronomy										
1	Weed Management	Integrated weed management in Paddy	OFF	-	-	8	12	-	-	20
2.	Crop production	Improved Agronomic practices in Rabi crops	OFF	-	-	7	14	-	-	21
3.	Organic Farming	Importance of organic inputs	OFF	-	-	15	9	-	-	24
4.	Crop Residue Management	Importance of mulching and crop residues in crops	OFF	-	-	15	7	-	-	22
Soil Science										
1.	Vermicompost production	Vermicompost production	OFF	-	-	20	-	13	2	35
Animal Science										
1.	Disease Management	Disease management of animal	OFF	1	0	6	13	10	0	30
2.	Goat farming	Entrepreneur oriented goat farming	OFF	0	0	2	0	33	0	35
3.	Integrated farming system	Integrated farming system	OFF	0	0	10	8	12	0	30
4.	Feed Management	Green fodder production in kharif	OFF	8	0	7	1	15	0	30
5.	Quail farming	Management of quail farming	OFF	-	-	26	4	0	0	30
6.	Feed Management	Green fodder production	OFF	-	-	-	33	-	-	33

7.	Disease Management	Disease management of goat	OFF	-	-	8	47	-	-	55
		Total		**9**	**0**	**124**	**148**	**83**	**2**	**366**
KVK, Katihar										
1.	Weed Management	Weed Management	OFF	4	13	8	1	14	26	66
2.	Resource Conservation Technologies	Resource Conservation Technologies	OFF	15	0	0	0	102	0	117
3.	Production and Management technology	Production and Management technology	OFF	10	0	0	0	81	31	122
4.	Soil fertility management	Soil fertility management	OFF	4	1	2	1	15	2	25
5.	Integrated Nutrient Management	Integrated Nutrient Management	OFF	14	6	5	5	117	14	161
6.	Nutrient Use Efficiency	Nutrient Use Efficiency	OFF	6	2	3	2	38	4	55
7.	Designing and development for high nutrient efficiency diet	Designing and development for high nutrient efficiency diet	OFF	0	0	0	0	0	110	110
8.	Women and child care	Women and child care	OFF	0	0	0	0	0	80	80
9.	Formation and Management of SHGs	Formation and Management of SHGs	OFF	0	0	0	0	27	23	50
10.	Entrepreneurial development of farmers/youths	Entrepreneurial development of farmers/youths	OFF	5	4	11	0	90	30	140
				58	26	29	9	484	320	926

Table 4.14: Other extension activities organized by the KVKs under different thematic areas under TSP

Nature of Extension Activity	**No. of Activities**	**Farmers**		**Extension Officials**		**Total**		**Grand Total**
		M	**F**	**M**	**F**	**M**	**F**	
Field Day	6	52	192	25	10	77	202	179

Farmers Seminar		-	0	0	0	0	0	16	16
Advisory Services		92	0	0	0	0	0	0	92
Scientific visit to farmers field		68	59	62	8	3	97	65	162
Farmers visit to KVK		428	327	101	0	0	327	101	428
Consultancy through mobile/telephone		1155	897	258	0	0	897	258	1155
Diagnostic visits		56	41	15	0	0	0	0	56
Soil health Camp		3	27	41	12		29	41	80
Animal Health Camp		4	37	45		45	37	82	119
Celebration of important days		1	30	16	0	0	30	16	46
Newspaper coverage		8	0	0	0	0	0	0	8
Any Other (Specify)	Leaflets	1524						Mass	1524

4.8.4. The Farmer First Project

The Farmer First Project entitled "Cross Sectional Livelihood Improvement and Income Enhancement through Agro-Enterprise Diversification" was implemented at BAU, Sabour during 2016-17. The project was implemented in the Birnaudha and Barhari villages of Goradih block and in the tribal village, Sheetalpur of Pirpainti block of Bhagalpur district. As a part of this project, a number of interventions were carried out on the aspects of conservation agriculture in rice-wheat cropping system, crop diversification and intensification for sustaining productivity, profitability and soil health, enhancement of cropping intensity, increasing farm profitability through off-season vegetable production and scientific management of vegetable crops as well as through promotion of cultivation of high value horticultural crops, additional income generation through small scale enterprises like backyard poultry, goatry, piggery, mushroom cultivation, bee keeping etc.

It is expected that these interventions will be instrumental in bringing about progressive change in the agricultural production, productivity, resource use efficiency, income stability as well as the quality of life of rural farming communities and other rural households who are indirectly dependent on agriculture and allied sectors for livelihood.

The details of interventions carried out under different modules are here under:

A. Under crop based module-1, five interventions were carried out in the project areas covering three villages:

1) Direct Seeded Rice (DSR) under rice – wheat cropping system has been demonstrated at two villages, Birnaudha and Barhari of Goradih block in 10.0 hectares land covering six households.
2) Medium duration rice varieties (Sabour Shree, Sabour Harshit and Rajendra Sweta) to facilitate timely sowing of wheat have been introduced in areas of 6.60 hectares covering 12 households in all three villages.
3) Raising of community nursery for timely rice establishment has been made in Birnaudha and Barhari villages covering 3.35 hectares of land and 24 households.
4) Zero tillage technology in wheat has been promoted for its timely sowing in Birnaudha and Barhari villages covering 13.0 hectares of land and 23 households.
5) Promotion of high yielding variety of wheat (HD-2967) and introduction of new wheat varieties (Sabour Samridhi and Sabour Nirjal)) have been done in all three villages as a part of seed

replacement in two hectares of land covering eight households.

B. In crop-based module - II, scientific cultivation of rabi pulses (Lentil and Chickpea) has been given importance to made area expansion of rabi pulses besides increasing production and productivity. This activity conducted in 10.0 ha covering 42 households of the three villages.

C. In crop based module - III, summer moong cultivation has been promoted for increasing cropping intensity of the project area in 12 hectares of land covering 41 households.

D. In horticulture based model following activities have been conducted:

1) Off-season production of vegetables and their scientific management (Cauliflower, vegetable pea, tomato etc.) have been done in 2.5 hectares of area covering 95 households in all three villages.
2) Kitchen Gardening (Brinjal, Bottle gourd, Sponge gourd, Amaranthus, Bitter gourd and Cauliflower) has been demonstrated in all the three villages covering 67 households.
3) Varietal improvement demonstration has been conducted in project area to promote improved varieties of vegetable Pea (Azad P-3 & Punjab - 89) and Tomato (Kashi Vishesh) in 1.6 ha of land covering 10 households.

E. Under enterprise-based model, three interventions viz., mushroom cultivation, fruit and vegetable preservation and bee keeping have been undertaken to generate additional income. Capacity building of farmers and landless labourers has also been made in the field of processing of fruits & vegetables for value addition to achieve household nutritional security (20 persons); different aspects of button mushroom cultivation and on post-harvest management of button mushroom (25 farmers). Capacity building of farmers and landless labourers have also been made in the field of processing of fruits and vegetables for value addition to achieve household nutritional security (22 persons); different aspects of button mushroom cultivation and on post-harvest management of button mushroom (25 farmers); on different aspects of bee keeping**,** honey extraction, processing, packaging, labeling & marketing (30 trainees).

F. In livestock-based model, following activities have been performed:

1. Development of para-vet professionals (6 youths) in Birnaudha and Barhari village.
2. Immunization programme in all three villages on PPR in goats (covering 185 animals and 72 households) and on FMD in dairy animals (241 animals and 210 households).
3. Animal Health Camp has been organized in all three villages (covering 258 animals & 174 households).
4. Introduction of improved poultry breeds has been made in tribal village, Sheetalpur and 570 chicks were distributed to 19 families.
5. Feed management activity through feeding of feed blocks to dairy animals has been done in 54 households of all the three villages.
6. Deworming of 450 large animals is also done in these villages covering 370 families.

G. In soil health management interventions, soil testing has been done and fertility map of all the three villages has been developed. Soil health cards were also distributed to 250 families of Birnaudha and Barhari villages of Goradih block.

H. In drudgery reduction activities, demonstration and distribution of tools such as sickles (sets of five) suitable for small farm holders have been made to 60 farmers to promote mechanization.

Salient findings/achievements of these interventions:

1. Direct seeded rice cultivation and transplanting of rice through community nursery raising increased rice productivity up to 12% and enhanced profitability up to 38-40 %.
2. Due to introduction of medium duration varieties of rice, the crop duration of rice has been deceased by 10-12 days facilitating early sowing of wheat crop. To avoid delayed sowing of wheat, the sowing of wheat was done by zero tillage technology. This intervention resulted in increase in yield (16 - 18 %), income enhancement (39 %) and curtailment of cost of production (16%) besides energy (fuel &labour) conservation, more microbial population and reduction in weed population &CO2 emission over conventional practice.
3. Crop diversification by growing high yielding varieties of rabi pulses (Lentil & Chickpea) resulted in area expansion of rabi pulses restoring soil fertility besides 40 % seed replacement.
4. Promotion of summer crop cultivation intensified traditional rice-wheat cropping system and increased cropping intensity by 30% in majority of farmers' fields.
5. Due to introduction of scientific vegetable cultivation practices, yields of vegetable crops (Cauliflower, Brinjal, Bottle gourd, Sponge gourd, Vegetable pea, Tomato etc.) have been increased and farmers obtained more income due to FFP interventions over traditional growing (farmers practice) of vegetables. The increase in income were 121% in cauliflower, 46% in Brinjal, 68% in Bottle gourd, 54% in Sponge gourd, 64% in Vegetable Pea and 54% in Tomato. In addition, kitchen gardening has ensured availability of vegetables in the rural households round the year.
6. Developed Para-vet service providers in three villages for delivering primary animal health services including Artificial Insemination and emergency primary treatment. Activities involving immunization, organization of animal health camp, deworming of large animals, nutritional management through feeding of CFBs, back yard poultry certainly resulted in improvement of health status of livestock and income enhancement of the farmers.
7. Collected and analyzed soil samples from various farm fields in the project area and delivered soil health card to 200 plus farmers. The soil fertility maps have been prepared and displayed in the project areas to create awareness among farmers regarding fertility status of respective soil. This intervention ultimately will help the farmers for application of balanced use of fertilizer.
8. With the introduction of interventions like fruit and vegetable processing and mushroom cultivation among the households in the project area, the net household income in the project area increased. The adoption of mushroom farming technology is 30% and income enhancement by its adoption is up to Rs.10, 000/-.
9. With the introduction of drudgery reducing tools/equipment such as ring cutter, sickles and maize shellers, the working efficiency of farm women was increased by 40%, 24% and 45%, respectively, which in turn helps mechanization.

Table 4.15: DSR crop at FFP village

Direct seeding of rice	**DSR crop at FFP village**
Community Nursery at FFP village	
Training on soil testing at project site	**Storing natural pollen in wax comb by bees**

4.8.5 Attracting and Retaining Youth in Agriculture (ARYA)

To realize the importance of the rural youth in agricultural development and in a bid to create interest and confidence among rural youth in agriculture. Various skill development training programs to encourage them to pursue farming as a profession, generate additional employment opportunities to absorb underemployed and unemployed rural youth in secondary agriculture and service-related activities in rural areas, Indian Council of Agricultural Research initiated a programme "Attracting and Retaining Youth in Agriculture" through 25 identified KVKs of this country. In continuation, the project was started in two districts of the state, namely, Bhagalpur and Aurangabad.

rednu sesirpretnE defitinedI this projects were fish production, poultry production and Nursery raising KVK ta ruplagahB and m ,noticudorp moorhsug gnimraf taoandp gnimraf yrtluoat dabagnaruA KVK. All the interventions were hub-based, with the main focus on employment generation. These centres motivate and attract several youths from in and around the village to adopt the enterprise for self-employment.

Nursery raising: In KVK Bhagalpur, 164 youths were trained and formed 11 farmers' group with the establishment of 21 entrepreneurial. Five thousand saplings were provided to 45 beneficiaries under Nursery raising and project assistance to construct 45 low cost shed nets for entrepreneurial development. Participants were exposed under training-cum-exposure visits to RCER, Plandu, Divya KVK, and Ramkrishan Mission, Ranchi, on 14-16th March 2021.

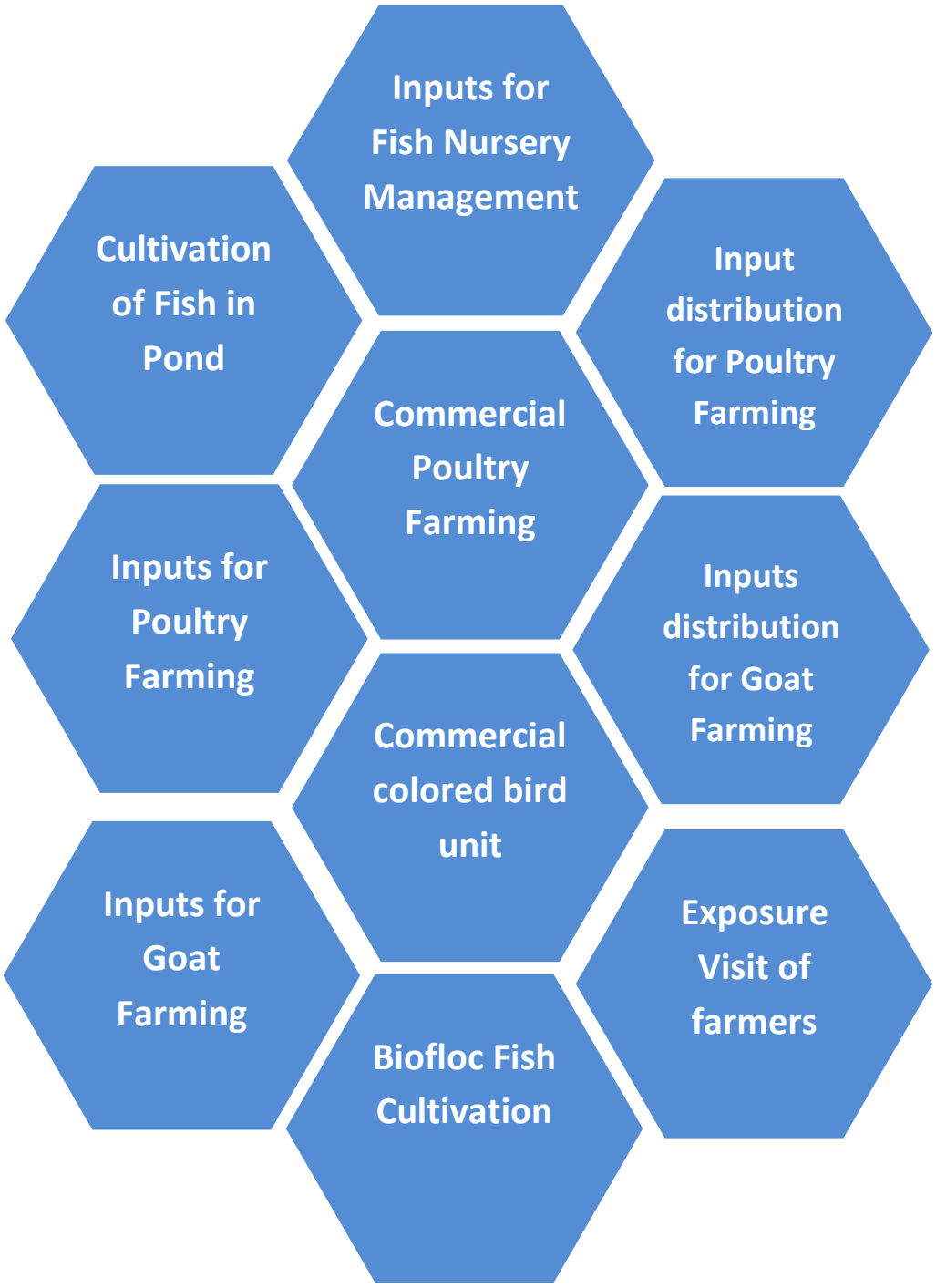
Fish production: 160 youths were trained, and 15 groups were formed in fish production with the assistance of 17,50,000 fish fingerling (70 beneficiaries) in the Bhagalpur district. Trained youths established 57 fish ponds and 12 bio-floc fish production units under this project. Participants were exposed under training-cum-exposure visit to CIFRI, Barackpore, Kolkota on 18-19th March 2021.

Poultry Production: 309 rural youths were selected and trained under poultry production. Out of these 103 farmers were grouped among 21 farmers group and supported with 13600 chicks (along with other required inputs). 63 broiler production units and 35 desi/backyard farms are established in Bhagalpur and Aurangabad under this project. Participantswere exposed under training-cum-exposure visit to Ranchi Veterinary College, Ranchi on 25-27th March 2021.

Goat Production: htiw detroppus erew 43 hcihw fo tuo ,gniniart nevig erew shtuoy 120 fo latot Afive improved variety of goats each (along with other inputs) yehT .were grouped otni four puorg sremraf and regularly monitored for technical support. Presently 40 entrepreneurial units are established in Aurangabad under this project. Participants were provided training-cum-exposure visit to BAU, Sabour, on 20-22nd February 2021.

Mushroom Production: A total of 157 farmerswere trained for the enterprise. Out of this, 79 farmers were selected and supported with inputs. The farmers are grouped into two groups and developed 43 entrepreneurial units under this project in the Aurangabad district. Participants were exposed to training-cum-exposure visit to BAU, Sabour, on 20-22nd February 2021.

Glimpses of the activities:



4.8.6 Paramparagat Krishi Vikas Yojna (PKVY)

Krishi Vigyan Kendra, Patna

Under PKVY, a cluster consisting of a group of 49 farmers covering 50-acre area in village Aropur- Anantpur, Block Naubatpur, Patna has been formed by Chaitanya Bihar Vikash Manch, Hajipur as Regional Council.The group has been named as Naubatpur Krishi Vikash Samuh Group code: LGO300058407.The bank account of this group has also been opened and the group has been uploaded on Portal Participatory Guarantee System for India by the Regional Council.The operational area has cropping system such as wheat, pulses and vegetables in Rabi Green gram in summer and rice in Kharif. A total of eight training program has been conducted under this scheme.Soil Samples has been collected and analysis is in progress.In summer, green gram has been grown by the members of the group and seed has been provided to the group by BRBN through DBT. The financial achievement of KVK, Patna under the scheme is mentioned in Table 4.43.

Table 4.16. Expenditure during the year for KVK, Patna

Sl No	Sanctioned amount	OB	Fund Received	Total	Actual Expenditure
1	3,30,000.00	3,30,000.00	0.00	3,30,000.00	51,002.00

Krishi Vigyan Kendra, Rohtas

Under the program, the clusters were formed in different villages and shown in Table 4.17. The training under different topics is mentioned in Table 4.45. The details on different frontline demonstrations is mentioned in

Table 4.17. Details of PKVY conducted during the year 2020-2021

S. No.	Name of cluster	village	Area	Beneficiary
1	Mahamana Malviya farmers cluster1	Siwan	10ha	24
2	Mahamana Malviya farmers cluster1	Nimdihra and Akodhi	10ha	24

Table 4.18. Training under different topics conducted by KVK, Rohtas

S. No.	Date	Topic of training	Thematic area	Beneficiaries
1	16.10.2020	Formation of cluster	Formation and Management of SHGs	52
2	19.12.2021	Formation of cluster	Formation and Management of SHGs	51
3	12.03.2021	Scientific cultivation of Moong	Crop production	52
4	13.03.2021	Scientific cultivation of Moong	Crop production	55

Table 4.19 Frontline demonstration conducted

S. No.	Crop	Variety	Area (ha)/ No.		Beneficiary	
			Target	Achieved	Target	Achieved
1	Moong	IPM-205	20	20	48	48

Krishi Vigyan Kendra, Nalanda

A cluster consisting of a group of 32 farmers in the village Mattepur-Mokimpur, Block Chandi has been formed with the collaboration of Seal biotech as RC. The group has been named as Shiv Shankar Organic Grower Group Mattepur-Mokimpur and uploaded on NCOF, Gaziabad portal under Participatory Guarantee System for India. The operational area consists of 50 acres which is constituted by orchard crops in 18 acres, vegetable crops in 20 acres and 12 acres of cereal crops. A total of 32 vermicompost pits have been constructed by the farmers from the fund received from the scheme.The farmers have purchased organic fertilizers, drum for making waste decomposer, organic insecticides and pesticides.Two training pogrammes have been conducted under the scheme.The farmers have started using waste decomposer in vegetable crops as well as organic insecticides and pesticides in vegetable and orchard crops. The financial achievements of PKVY under KVK, Nalanda is mentioned in Table 4.20.

Table 4.20. The financial achievements of PKVY under KVK, Nalanda

S. No.	Sanction Amount	Opening Balance	Fund Receiived	Total	Actual Expenditure	Closing Balance as on 31.03.2021
1	2	3	4	5 (3+4)	6	7
1.	3,30,000/-	3,30,000/-	0.00	3,30,000/-	2,40,000/-	90,000.00

Krishi Vigyan Kendra, Supaul

Under the program, the thematic areas covered by KVK, Supaul is mentioned in Table 4.48. The training under different topics by the KVK is mentioned in Table 4.21.

Table 4.21. Report of PKVY during the financial 2020-21

Crop	Thematic area	Name of technology demonstrated	No. of farmers	Area (ha)	Farmers
Mentha	Organic cultivation (Production of organic inputs)	PSB, Aztobacter, Mustard oil cakes, Trichoderma viridee, Neem Oil and vermicompost.	20	20	Standing in the field as a good condition.

Table 4.22. Training program organized under PKVY

S. no.	Date of training	Topic	Thematic area	Venue	No. of Participants	Remarks
1.	24.06.2020	Organic cultivation of Potato	Production of Organic inputs	Gonha , Trivaniganj	29	
2.	06.10.2020	Application of Biofertilizers in Potato cultivation.	Biofertilizers	Gonha , Trivaniganj	26	
3.	30.10.2020	Organic cultivation of Potato cum next crop Mentha	Biofertilizers	Gonha , Trivaniganj	30	Respected Associate Dean-cum Principal MBAC, Agwanpur, Dr. Umesh Singh sir along with cluster of scientist presented
4.	12.11.2020	Organic cultivation of Potato cum next crop Mentha	Biofertilizers	Gonha , Trivaniganj	20	
5.	29.01.2021	Seed Production technology of Potato and development of PKVY Scheme	Seed production	Gonha , Trivaniganj	31	
6.	14.03.2021	Kisan mela cum exposure visits programme	-	Exposure visit of MBAC organic cultivated plots	50	
7.	16.04.2021	Organic cultivation of Mentha crop	Biofertilizers	Gonha , Trivaniganj	20	

Krishi Vigyan Kendra, Kishanganj

The physical and financial progress report of PKVY program under KVK, Kishanganj is mentioned in Table 4.23.

Table 4.23. Physical and financial progress report of PKVY Program

Sl. No.	Physical Achievement		Financial Achievement (Rs.)				Remarks
	Area (ha)	No. of farmers	O.B. 01.04.2020	Receipt during 2020-21	Expenditure during 2020-21	Balance	
1	20.00	50	3,30,000.00	0.00	1,66,550.00	1,63,450.00	Registration of farmers on PGS portal is yet to be done

4.8.7. Establishment of Biotech-Kisan Hub at Bihar Agricultural University, Bhagalpur

Project objectives are popularization of Grass pea(*Lathyrus sativus*) cultivation in Tal areas of Bihar and its value chain analysis and value addition. Two varieties(Ratan and Prateek) of the grass pea having less than 0.1 per cent *β*-ODAP(β-oxalyl-L-α,β-diaminopropionic acid) is popularized among the farmers through our partner institutions(KVK,Gaya; KVK,Patna and KVK, Lakhisarai). In rabi season(2019-2020), area under lathryrus demonstration is increased to 214 acres from 33 acres. Production of lathyrus is 1025 quintals(Rabi season 2019-2020). Per cent of *β* –ODAP in Ratan and Prateek varieties is assessed after its demonstration in farmers field and it ranged 0.042 to 0.063 which is within extra safe limit as per recommendation of ICMR. Soil sample of famers' field was analysed and no significant association was found between soil nutrient status and *β*-ODAP content variation in those varieties. The economics of lathyrus was calculated, it was noted that while B:C ratio of lathyrus is 3.36, however, it is1.94(B:C Ratio) in lentil and 2.27(B:C Ratio) in gram. The yield of lathyrus ranged between 12 -13 quintal per hectare. Package of practice for lathyrus is developed and included in BAU Kisan Diary-2021 and a booklet is prepared and circulated among the farmers both in hard copy and softcopy. The value chain analysis indicated that mostly lathyrus is used in mixing with arhar dal, followed by making of besan. Value addition of lathyrus is done in the form of Bari and Kurkure. Altogether seven training programme and three field days were conducted for farmers and leaflet on lahtyrus cultivation, technical film and two audio clips on lathyrus cultivation was developed and circulated(through SD card, social media) among the farmers.Three Farmers Interest Group(FIG) on participatory lathyrus seed production is formed (one each in each district) for sustainability of the project.Four bacteria strains were identified from the nodule of the lathyrus and its performance is evaluated. These will be used in bio-fertilizer making. A pilot study on lathyrus – tomato intercropping is under taken this year and result is encouraging. In this rabi season, the target area under lathyrus cultivation is 425 acres in the farmers field. The project is implemented since September,2018 with budget allocation of Rs.88.39 lakhs for two and half years.

Table 4.24: Distribution of area, number of demonstrations and yield of lathyrus in Rabi Season- 2019-2020

Name of Partner institutions	Number of Demonstrations Conducted		Variety wise Total Area (in Acres)		Total Area (in Acres)	Variety wise Production (In Quintal)		Total Production (In Quintal)
	Ratan	Prateek	Ratan	Prateek		Ratan	Prateek	
KVK, Lakhisarai	40	32	46	43	89	235	215	450
KVK,Patna	36	55	36	36	72	187	182	369
KVk,Gaya	26	26	26.5	26.5	53	106	100	206
Total	102	113	108.5	105.5	214	528	497	1025

Figure 1 : Full Grown Lathyrus Crop in Farmer Field

Farmer - Amarjeet Kr Sinha
Father Name - Kamta Pd Sinha,
Address - Lodipur , Danapur,Patna

Figure 2 : Making of Gahana Bari

Figure 3: Sun Drying of GahanaBori

Figure 4: Ghahana Bari(Lathyrus-50% & Black Gram- 50%). Ready to consume

Figure 5: Ghahana Bari(Lathyrus-100%) Ready to eat/cook

Figure 9: Drying of *Phul Bari*

Figure10 : *Phul Bari* ready for Cooking

Expansion of Activities of Biotech-KISAN Hub in Six Aspirational Districts (Purnia, Katihar, Khagaria, Banka, Araria and Aurangabad) of Bihar

Extended project for aspirational districts of Bihar is implementing by the university since December,2019 with budget allocation of Rs. 288 lakhs through the activities of Beekeeping, Tissue Culture Banana Cultivation, Goatry, Makhana cultivation and Mushroom cultivation. The project is implementing through the KVK Araria, Aurangabad, Banka, Katihar, Khagaria and Purnea and each KVK is implementing three activities. Following is the matrix of different activities in different districts -

Table 4.24: Activities Matrix of Different Aspirational Districts

Sl.No.	Name of the Aspirational district	Name of the Partner Institutions	Activities		
			1	2	3
1	Araria	Krishi Vigyan Kendra, Araria (Araria)	Demonstration of Makhana cultivation in farmers field with improved Var. **Area: 25 Hectare**	Field demonstration of tissue culture banana **Area: 10 Acres**	Promotion of scientific goatary **No. of farmers: 20**
2	Aurangabad	Krishi Vigyan Kendra, Aurangabad	Field demonstration of tissue culture banana **Area: 10 Acres**	Mushroom cultivation **No. of Farmers: 25**	Promotion of scientific goatary **No. of farmers: 20**
3	Banka	Krishi Vigyan Kendra, Banka (Banka)	Mushroom cultivation **No. of Farmers: 25**	Bee Keeping **No. of farmers:15**	Promotion of scientific goatary **No. of beneficiaries : 250**

4	Katihar	Krishi Vigyan Kendra, Katihar	Demonstration of Makhana cultivation in farmers field with improved Var. **Area: 25 Hectare**	Field demonstration of tissue culture banana **Area: 10 Acres**	Mushroom cultivation **No. of Farmers: 25**
5	Khagaria	Krishi Vigyan Kendra, Khagaria	Field demonstration of tissue culture banana **Area: 10 Acres**	Bee Keeping **No. of farmers:15**	Mushroom cultivation **No. of Farmers: 25**
6	Purnea	Krishi Vigyan Kendra, Jalalgarh (Purnea)	Demonstration of Makhana cultivation in farmers field with improved Var. **Area: 25 Hectare**	Field demonstration of tissue culture banana **Area: 10 Acres**	Mushroom cultivation **No. of Farmers: 25**

Activities wise salient Achievements of the project:

Activity: Makhana Cultivation

1. A total of 125 farmers are benefitting from this project.
2. Increased yield due to improved variety Sabour Makhana- 1 with 30-32 q/ha in comparison to local varieties with 19- 21q/ha. Also Area of Makhana Cultivation with Sabour Makhana-1 has increased in different blocks of Purnea district.
3. Proper use of organic manures (Neem cake) and Organic pesticides (Neem oil) by our farmers and its significant result has fetched the attention of several other non- biotech farmers and they too are bringing the same in use and that's definitely shows the positive impact of this project.
4. Mobilization for Farmer producer organization (FPO) formation. All the biotech and non-biotech farmers are included in FPO.
5. Training Organised for all 125 Makhana farmers in all the project districts.
6. A total of seven field days conducted.
7. Coordination is conducted with the line departments to bring more areas under Sabour Makhana-1 cultivation
8. Value added product development of Makhana is done.

Name of the Activity: Banana Cultivation

1. A total of 50 farmers are benefitting from this project.
2. Farmers are growing disease free tissue culture G-9 varieties of Banana Plants as comparison old suckers of old banana plantation
3. Farmers are getting suitable advices for crop and insect, pest and disease managements by scientists of KVK as well as University.
4. Timely application of Trichoderma and Neem cake by our farmers for managing Panama wilt and other dreadful disease.
5. Banana plant is good condition in farmers field.

6. Distributed input like Urea, SSP, MOP and other pesticide for plant protection and plant growth is done for all project farmers.
7. Registration with FPO is completed

Activity: Mushroom Cultivation

1. Total of 75 families is associated with Biotech-Mushroom Cultivation.
2. Trained farmers are growing Mushroom in Bulk with the Concern of KVK scientists who has fetched the attention of several other Non-biotech farmers and Businessmen.
3. Process is going on to link these farmers directly to Market
4. Registration with FPO is completed
5. Online training programme conducted for project beneficiaries.

Name of the Activity: GOATERY Farming

1. A total of 290 goat farmers are benefitting
2. Deworming,Vaccination,UMMB block and others inputs supports are doing regularly.
3. On-line training for project beneficiaries is conducted.
4. Local goat farmers are trained for preliminary health care of the goat.
5. Project scientists and Young Professional –II are regularly visiting the goat farmers' house.
6. A total of 5 field days conducted

Activity: Bee keeping

1. A total of 30 farmers benefitted through this intervention.
2. Online training for bee keepers were conducted
3. Inputs distributed amongst the bee keepers.
4. Regular visit to the bee keepers units are performing

A total of 88 villages and 422 farmers are reaching. In Each districts 3 activities and all together 18 activities is accomplishing through the Biotech KISAN Hub Project.

Table 4.25. Number of Villages Covered

Name of the District	January	February	March	April	May	June	July	August	September	October
Araria	0	11	14	16	17	18	19	19	19	19
Aurangabad	2	7	9	9	9	9	9	9	11	11
Banka	1	2	2	2	2	2	2	2	2	2
Katihar	0	14	16	16	17	21	22	22	22	22
Khagaria	0	1	2	5	5	6	6	8	8	8
Purnea	16	16	16	16	26	26	26	26	26	26
	19	51	59	64	76	82	84	86	88	88

Table 4.26. Number of Beneficiaries Reached

Name of the District	January	February	March	April	May	June	July	August	September	October
Araria	0	21	45	53	61	66	71	75	75	75
Aurangabad	7	18	35	35	35	42	42	42	46	46

Banka	25	55	60	81	218	290	245	124	235	101
Katihar	0	30	34	34	40	52	62	64	65	65
Khagaria	0	9	25	31	35	50	50	50	50	50
Purnea	50	50	50	50	85	85	85	85	85	85
	82	183	249	284	474	585	555	440	556	422

Table 4.27. Number of activities Demonstrated

Name of the District	January	February	March	April	May	June	July	August	September	October
Araria	0	1	1	2	3	3	3	3	3	3
Aurangabad	1	2	3	3	3	3	3	3	3	3
Banka	1	2	2	3	3	3	3	3	3	3
Katihar	0	1	2	2	2	3	3	3	3	3
Khagaria	0	1	1	2	2	3	3	3	3	3
Purnea	1	1	1	1	3	3	3	3	3	3
	3	8	10	13	16	18	18	18	18	18

Hon'ble CM Sri Nitish Kumar Ji distributing Sabour Makhana –I Seed among the Farmers in gracious presence of Prof(Dr).Ajoy Kumar Singh,Hon'ble Vice Chancellor & Dr R K Sohane,DEE of BAU Sabour

Dr. Mohd. Aslam,Advisor (Scientist 'G') launching Biotech KISAN Hub project in gracious presence of Prof(Dr).Ajoy Kumar Singh,Hon'ble Vice Chancellor & Dr R KSohane,DEE of BAU Sabour

Launching of Makhana Pop by Prof(Dr).Ajoy Kumar Singh,Hon'ble Vice Chancellor & Dr R K Sohane,DEE of BAU Sabour

Farmer Makhana Field at KVK ArariaDistrict

Harvested seed of Makhana at Purnea District

Distribution of G-9 variety of Banana at KVK Khagaria

Farmer's Banana Field

Spawn & PP bag distribution and training programme of Mushroom at KVK Khagaria

Farmer Mushroom unit

Baseline Survey of Goat in Araria District

Female Farmer Practices Vaccination at Banka District

4.8.8. Garib Kalyan RojgarAbhiyaan (GKRA)

COVID-19 pandemic has affected the lives of every person across the world. The pandemic has an impact on the workforce in general and migrant workers in particular. The Government of India launched the Garib Kalyan RojgarAbhiyaan (GKRA) initiative to tackle the effects of COVID-19 on shramik (migrant) workers in India. It is a rural public works scheme that was launched on 20th June 2020 with initial funding of ₹50,000 crores. GKRA aims to give 125 days of employment to migrant workers, approximately two-thirds of the total migrant labourer force behind rural areas. The scheme covers 116 districts in six states, Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan, Odisha and Jharkhand. The scheme is a joint effort by 12 different ministries/ departments and covers 25 categories of works/ activities. The prime objective of this scheme was to employ the migrant labourers, who have returned to their villages due to the nationwide COVID-19 lockdown which was imposed on 25th March, 2020.

In Bihar, 32 districts witnessed the highest number of migrant returnees from across the country during the lockdown. In order to address the hardship of many returnee migrant workers, more than 25,000 returnee migrant workers have been selected again under the scheme. GKRA has the following broad objectives:

i) Provide immediate employment opportunities to returnee migrant workers and similarly affected rural populations.

ii) Saturate villages with public infrastructure and assets.

iii) Set a stage for enhancing longer-term livelihood opportunities.

Table 4.28. Training program and budgetary allocation under GKRA

SN	KVK Name	No. of Training	No. of Participant	Fund Sanction & Received (Rs/-)	Expenceses (Rs/-)	Balance (Rs/-) 31.03.2021
1	Araria	16	560	328000	328000	36000
2	Aurangabad	16	560	328000	328000	0
3	Banka	16	560	328000	268224	59776
4	Bhagalpur	16	560	328000	320000	8000
5	Gaya	16	560	328000	327998	2
6	Katihar	16	560	328000	191584	136414
7	Khagaria	16	597	328000	328000	0
8	Kishanganj	16	560	328000	283000	45000
9	Madhepura	16	560	328000	328000	0
10	Nalanda	16	560	328000	328000	0
11	Patna	16	560	328000	272751	55249
12	Purnea	16	560	328000	223832	104168
13	Rohtas	16	594	328000	328000	0
14	Saharsa	16	560	328000	263000	65000
15	Supaul	16	560	328000	264327	63673
	Total	240	8471			

A total of 8471 participants have been trained under different thematic areas under the program as mentioned in Table 4.29.

Table 4.29. Training program under different thematic area conducted by the KVKs

S.No.	Title of Training/ Thematic area	No. of Training	No. of Participants
1	Fisheries & Animal husbandry	43	1525
2	Mushroom production	34	1226
3	Soil Testing	13	460
4	Farm Machinery Maintance/ FIM	12	420
5	Fruit & Vegetable Production	21	735
6	Nutri Garden/ PoshanVatika	6	210
7	Processing &Valua addition	13	455
8	Vermicomposting	26	920
9	Bee keeping	7	245
10	Crop Production & Protection	29	1015
11	Raising Modern Nursery	10	350
12	Organic Farming	16	560
13	Flower Cultivation & its Marketing	2	70
14	IFS	8	280
	Total	240	8471

4.9. Other flagship programmes

4.9.1 CIMMYT-CSISA Project

On-field trials on wheat conducted by KVKs during 2019-20 rabi season at Bhojpur, Rohtas, Lakhisarai, Muzaffarpur and Madhepura

Evidence generation through adaptive trials on farmer's field were continued in the current year. Four agronomic trials on wheat were conducted on almost six hundred farmer's field by five KVKs. Initiated in year 2016-17, these trials in the current season, revalidated the responses of planting time, critical irrigation, crop establishment methods and prior crop residue retention on wheat grain yield.

Trial-1: Performance of normal maturing wheat varieties (NMWV) and early maturing wheat varieties (EMWV) under different sowing schedules across ecologies.

Five sowing schedules were created by splitting November month into three groups and December month into two groups. These five groups were constituted as treatments (wheat seeding times). Last three treatment groups were planted with both types of cultivars (NMWV & EMWV) whereas first two seeding schedules had only NMWV. Results showed that grain yields were more than 5 MT/ha in initial two treatments. Under 01-10 Nov., the mean grain yield was 5.2 MT/ha and for 11-20 Nov., it was 5.1 MT/ha. In the next three treatments (seeding schedules), wheat grain yield significantly declined particularly under December schedules. In 21-30 Nov. duration, NMWV yielded 0.5 MT/ha additional compared to EMWV. In December sown cases also, NMWV performed better than EMWV wherein yield advantage with NMWV was around 0.3 t/ha. The trial results

Figure 4.3: Effect of sowing time and types of cultivars on grain yield of wheat

inferred that higher wheat yield can be realized by planting the crop before 20-November and through use of NMWV. Even if early planting is constrained in some pockets, NMWV can give yield advantage.

Trial-2: Assessing the role of additional irrigation during terminal heat stress period (during grain filling stage) to beat heat stress and its effect on wheat productivity.

Effect of critical irrigation was tested on both the types of wheat crop established through conventional method and through zero-tillage method. In both the methods, there were two treatments– irrigation at grain filling and no irrigation at grain filling. Results showed that crop with irrigation at grain filling always yielded higher. But quantum of yield gains was different in conventional and zero-tillage. In conventionally established wheat crop, additional irrigation resulted in yield gain of 0.5 MT/ha whereas in zero-tillage method, yield gain due to additional irrigation was recorded 0.7 MT/ha. The highest yield harvested under this trial was for zero-till with additional irrigation that on an average equalled 5.3 MT/ha. These results suggest that irrigation for wheat during grain filling stage is very beneficial. Benefit of this additional irrigation becomes more intense under ZT-seeding. Irrigation at this stage proven safeguards to minimize the yield dent from terminal heat at the stage from milky to dough grain and facilitates the crop with more time to accumulate photosynthates into grain. Farmers in Bihar rarely apply irrigation at late stage by the fear of crop lodging. There is need to educate farmers about benefits of additional irrigation at maturity stage. It can greatly augment overall wheat productivity of the Bihar state.

Trial-3: Quantifying the yield gain in wheat productivity through zero tillage mediated advance sowing of wheat (Ara and Rohtas)

Wheat crop seeding started from 1st Nov. to 31st Dec. and it has been divided into four seeding schedules 15 days each as shown in below figure. Higher yield harvested under ZT as compared to CT-seeding from 1-15 Nov. to 16-31 Dec. Highest yield (5.93 MT/ha) observed under first fortnight of Nov. followed by 16-30 Nov, 1-15 Dec & 16-31 Dec, respectively. The same trend observed under CT-seeding also. This means every 15 days advancement of wheat seeding under both the crop establishment method can contribute additional yield benefit from 31st Dec to 1st Nov. Wheat yield benefited from 3.333 to 4.76 and 3.77 to 5.93 MT/ha under CT & ZT-seeding, respectively.

Trial-4: Residue management in rice-wheat cropping system (Ara and Rohtas)

This trial designed to find out the benefits of residue retention with 50 and 100 per cent load and observed that 100 per cent rice residue plots were harvested lower yield than no residue plots. Wheat yield recorded 5.56, 4.57, 5.29, under 50%, 100% and no residue, respectively. It shows that 50 per cent residue is much more beneficial for the farmers. 100 per cent residue load may provide the shelter to organisms related to pests and diseases.

4.9.2. Swachh Bharat Mission

Swachh Bharat Mission is a significant cleanliness campaign by the government of India. It was launched on 2nd October, 2014 throughout the country as a national movement. In this context, KVKs under the jurisdiction of BAU, Sabour, organized a number of pragrammes in their operational area to make clean and green nation. The programmes organized under the mission and the participation of farmers is mentioned in Table 4.30.

Table 4.30. Participation of farmers in Swachh Bharat Mission

S.No.	Name of KVK	No. of Programme	No. of Farmers Participated
1	Araria		
2	Arwal	14	613
3	Aurangabad	21	295
4	Banka	11	407
5	Bhagalpur	18	941
6	Gaya	12	382
7	Gaya (Amas)	6	191
8	Jehanabad	16	486
9	Katihar	16	771
10	Khagaria	14	354
11	Kishanganj	23	647
12	Lakhisarai	12	595
13	Madhepura		
14	Munger	8	240
15	Nalanda		
16	Patna	9	220
17	Purnea	12	563
18	Rohtas	23	626
19	Saharsa	13	465
20	Sheikhpura	10	256
21	Supaul	9	253
Total			**8305**

4.9.3 Live Telecast of Agricultural Programme

The Prime Minister of India has interacted a number of times with the farming community/ farm women/ rural youth of the country. It has led to a widespread dissemination of information and policies regarding agriculture and allied sector to the masses. The KVKs has made necessary arrangement to provide benefits of such live telecast programme to the stakeholders. The number of such programmes along with the number of participants and dignitaries attended is mentioned in Table 4.31.

Table 4.31. Details of live telecast of agricultural information by different KVKs

S.No.	Name of KVK	No. of Programme	No. of Farmers Participated	Dignitary attended
1	Araria			
2	Arwal	7	254	1
3	Aurangabad	4	167	2
4	Banka	2	150	2
5	Bhagalpur	11	736	4
6	Gaya	9	715	1
7	Gaya (Amas)	1	50	2

8	Jehanabad	11	638	0
9	Katihar	6	118	0
10	Khagaria	5	412	2
11	Kishanganj	5	372	11
12	Lakhisarai	8	577	2
13	Madhepura	3	140	0
14	Munger	1	245	0
15	Nalanda			
16	Patna	2	220	4
17	Purnea	6	538	9
18	Rohtas	8	567	6
19	Saharsa	7	244	3
20	Sheikhpura	7	405	6
21	Supaul	7	180	1
Total			**6728**	**56**

4.9.4. Plant distribution

The sapling of trees as well were distributed to the farmers both at the respective KVKs (on-campus) and also at the farmer's field (off-campus). The details of the plant distribution activity are mentioned in Table 4.32.

Table 4.32. On campus and off campus distribution of plant saplings by the different KVKs

S.No.	Name of KVK	On Campus No. of Plant	Off Campus No. of Plant	No. of beneficiary	Total no. of Plant
1	Araria				
2	Arwal	750	250	100	1000
3	Aurangabad	50	950	250	1000
4	Banka	200	1000	1000	1200
5	Bhagalpur	1000	1785	595	2785
6	Gaya	12	7000	3500	7012
7	Gaya (Amas)				
8	Jehanabad	15	5000	50	5015
9	Katihar	94	3500	658	3594
10	Khagaria	35	3000	120	3035
11	Kishanganj				
12	Lakhisarai	238		60	238
13	Madhepura	2000	500	150	2500
14	Munger	1500	10000	1200	11500
15	Nalanda				
16	Patna	52	2500	22	2574
17	Purnea	250	1000	230	1250
18	Rohtas	100	5000	122	5100
19	Saharsa				

20	Sheikhpura	2000	5000	350	7000
21	Supaul	3000	4000	150	7000
Total		**11296**		**8557**	**61803**

4.9.5. RAWE programme

The Rural Agricultural Work Experience (RAWE) programme is a flagship activity for the final year B.Sc. (Ag.) students during the last semester. Building self-confidence in the agricultural graduates by honing their professional skills is the key objective of introducing RAWE at the undergraduate level by ICAR. Accordingly, this semester-long programme has been evolved. Due to the Covid – 19 pandemic, the students from other agricultural universities were also permitted to register for RAWE programme at their nearest KVK. As such, a total of 158 students attended the RAWE programme at different KVKs within the jurisdiction of BAU, Sabour during 2020 – 21. The distribution of the students in different KVKs is mentioned in Table 4.33.

Table 4.33. Participation of students in RAWE programme at different KVKs

Sl.No.	Name of the KVK	BAU, Sabour		Other than BAU		Total
		Male	Female	Male	Female	
1	KVK Araria	0	0	1	1	2
2	KVK Arwal	0	0	0	0	0
3	KVK Aurangabad	2	1	5	0	8
4	KVK Banka	4	2	1	0	7
5	KVK Bhagalpur	9	15	7	6	37
6	KVK Gaya Manpur	3	6	1	2	12
7	KVK Gaya Aamas	0	0	0	0	0
8	KVK Jehanabad	1	1	0	2	4
9	KVK Katihar	2	2	0	0	4
10	KVK Khagaria	3	1	0	0	4
11	KVK Kishanganj	2	1	0	0	3
12	KVK Lakhisarai	2	0	0	0	2
13	KVK Madhepura	2	1	3	0	6
14	KVK Munger	0	0	0	0	0
15	KVK Nalanda	3	3	8	8	22
16	KVK Patna	5	1	0	1	7
17	KVK Purnea	5	3	0	0	8
18	KVK Rohtas	3	6	3	3	15
19	KVK Saharsa	2	2	2	2	8
20	KVK Sheikhpura	1	1	0	0	2
21	KVK Supaul	6	1	0	0	7
Total						158

4.9.6. *Mera Goan Mera Gaurav* (MGMG)

An innovative initiative, "Mera Gaon Mera Gaurav," has been planned to promote the direct interface of scientists with the farmers to hasten the lab to land process. The participation of small and marginal farmers in Indian agriculture is very important. Small farmers need timely information on investment in agriculture, loans, market rates, extension, new research findings and technologies, etc. This scheme aims to provide farmers with required information, knowledge, and advisories regularly by adopting villages. Presently, six colleges of Bihar Agricultural University, Sabour, provide the technologies developed and refined to the farmers through MGMG programme. The colleges do the awareness among farmers about this programme. The brief details on the achievement of MGMG are given in Table 4.34. A total of 18 groups were formed in different colleges to cover 15 villages in which 1734 field activities were conducted involving over 8500 farmers.

Table 4.34 a. Summary of MGMG Programme in 2020-21

Name of institutes/ universities involved	No. of Groups formed	No. of Scientist Involved	No. of villages covered	No. of field activities conducted	No. of messages/ advisory sent	Farmers involved (No.)
Bihar Agricultural College, Sabour, Bhagalpur	03	22	03	337	141	1603
Bhola Paswan Shastri Agricultural College, Kasba Road, Purnea	03	21	03	308	136	1424
Mandan Bharti Agricultural College, Agwanpur, Saharsa	03	19	02	291	114	1393
Nalanda College of Horticulture, Noorsarai, Nalanda	03	18	02	289	97	1227
Dr. Kalam Agricultural College, Arrabari, Kishanganj	03	17	02	236	103	1420
Veer Kunwar Singh College of Agriculture, Dumroan, Buxar	03	21	03	273	123	1453
Total	**18**	**118**	**15**	**1734**	**714**	**8520**

Various programmes like creating awareness among the farmers, demonstrations, interface meetings/ *gosthies*, literature support, training, visit to the villages in teams, and mobile-based advisories were provided to the farmers, which is mentioned in Table 4.35.

Table 4.35 b. Activities organized by Institutes/ SAUs under MGMG

S. No.	Name of activity	No. of activities conducted	No. of farmers participated & benefitted
1.	Awareness created (No)	87	2104
2.	Demonstrations conducted	126	297

3.	Interface meeting/ *Goshthies*	29	596
4.	Literature support provided **(No)**	361	1809
5.	Training organized	24	720
6.	Visit to the village by teams	41	903
7.	Mobile based advisories (**No of message)**	1066	2091
	Total	**1734**	**8520**

Other notable activities under the MGMG programme are establishing linkages with other agencies, facilitation for new varieties, technology, seed and new crops, which is mentioned in Table 4.36.

Table 4.36. Other activities organized under MGMG

S. No.	Name of activity	Particulars	Numbers
1.	**Linkages developed with other agencies**	No. of agency (No.)	**22**
		Farmers benefitted (No.)	**338**
2.	**Facilitation for**		
	i. New varieties	Numbers	**60**
		Area (ha)	**08**
		Farmers Benefitted (No)	**72**
	ii. Technology (No.)	Numbers	**06**
		Area (ha)	**118**
		Farmers Benefitted (No)	**234**
	iii. Seeds (q)	Area (ha)	**06**
		Quantity (q)	**06**
		Farmers Benefitted (No)	**17**
	iv. New crops (No.)	Numbers	**-**
		Farmers Benefitted (No)	**-**
	v. Others (Seedlings, biofert., Poultry bird etc.)	Numbers	**6000**
		Area (ha)	**04**
		Farmers Benefitted (No)	**29**

4.9.7. Scheduled Caste Sub Plan (SC-SP)

In the year 2020-21, 13 Krishi Vigyan Kendras under BAU, Sabour organized 42 training programme on different topics for enhancing the livelihoods and socio-economic condition of schedule caste farmers under the SC-SP programme. Two thousand six hundred thirty-one farmers were benefited from these training, as mentioned in Table 4.37.

Table 4.37. No of Training/gosthi/exposure visit under SC- SP Programme

S.No.	Name Of KVK	No of Training	No. of Beneficiaries
1	Arwal	4	154
2	Aurangabad	1	35
3	Jehanabad	3	253
4	Khagaria	3	99
5	Gaya	10	275
6	Lakhisarayi	1	100
7	Madhepura	4	150
8	Nalanda	1	42
9	Patna	5	1147
10	Rohtas	0	0
11	Saharas	3	150
12	Supoul	4	135
13	Sheikhpura	3	91
Total		**42**	**2631**

A. Front Line Demonstration:

During 2020-21, Krishi Vigyan Kendra under Bihar Agricultural University, Sabour demonstrated new varieties and technology in 121.2 ha area, which benefited 450 SC farmers/farm women to enhance their nutritional/ food security and socio economic condition of farmers. The KVKs also demonstrated mushroom cultivation and poultry farming. Krishi Vigyan Kendra distributed 2392 unit of mushroom kit to 380 farmers and 4200 chicks among 420 farmers. KVKs also distributed 270 kg mineral mixture among 135 beneficiaries. Chocolate feed for animals was demonstrated to 44 farmers to increase the production of milk of dairy farmers. The frontline demonstrations of different crops under the programme is mentioned in Table 4.38 a – f.

Table 4.38. Front Line Demonstration on Oilseed/Pulse/other crops

Crop	Area(ha)	No of Beneficiaries
Mustard	15.0	54
chick pea	22.5	80
Lentil	20.0	66
Green Gram	21.7	113
Paddy	5.0	16
Wheat	32.0	104
Jute	5.0	14
Total	**121.2**	**447**

Table 4.38 b. FLD on dairy animal/chicks/Mushroom

Components	No/Unit	No. of Beneficiaries
Mineral Mixture	270	135
Animal Chocolate	44	44
Chicks	4200	420
Mushroom	2390	380

Table 4.38 c. Front line demonstration on oilseed pulses:

Crop	Name of the technology demonstrated	No. of Farmers	Area (ha)	Yield (q/ha)		% Increase	*Economics of demonstration (Rs./ha)				*Economics of check (Rs./ha)			
				Demo	Check		Gross Cost	Gross Return	Net Return	** BCR	Gross Cost	Gross Return	Net Return	** BCR
Mustard	Variety + seed treatment + sulphur @30kg /ha	54	15	15.36	12.23	25.59	16850	53760	36910	3.19	14900	42805	27905	2.87

Table 4.38 d. Frontline demonstration on pulse crops

Crop	Name of the technology demonstrated	No. of Farmers	Area (ha)	Yield (q/ha)		% Increase	*Economics of demonstration (Rs./ha)				*Economics of check (Rs./ha)			
				Demo	Check		Gross Cost	Gross Return	Net Return	** BCR	Gross Cost	Gross Return	Net Return	** BCR
Lentil	Variety (HUL-57)+Seed Treatment	66	20	12.12	9.36	29.49	16500	54540	38040	3.31	15900	42120	26220	2.65
Chick Pea	Variety (PG-186)+Seed Treatment	80	22.5	15.89	7.15	122.24	20200	63560	43360	3.15	17500	28600	11100	1.63
Green Gram	Variety(IPM 2-3)+Seed Treatment	113	21.7	Crop Standing										

Table 4.38 e. Front Line Demonstration other than oilseeds and pulses:

Crop	Name of the technology demonstrated	No. of Farmers	Area (ha)	Yield (q/ha)		% Increase	*Economics of demonstration (Rs./ha)				*Economics of check (Rs./ha)			
				Demo	Check		Gross Cost	Gross Return	Net Return	** BCR	Gross Cost	Gross Return	Net Return	** BCR
Paddy	Sahbgagi + seed treatment	16	5	40.87	33.15	23.29	30600	75610	45010	2.47	28900	61328	29170	2.12
Wheat	Variety (HD-2967)	104	32	38.23	31.56	21.13	28400	68814	40414	2.42	28100	56808	28708	2.02

Table 4.38 f. Frontline demonstrations on other enterprises

Category	Name of the technology demonstrated	No. of Farmer	No. of units	Major parameters		% change	*Economics of demonstration (Rs.) or Rs./unit				*Economics of check (Rs.) or Rs./unit			
				Demonstration	Check		Gross Cost	Gross Return	Net Return	** BCR	Gross Cost	Gross Return	Net Return	** BCR
Mushroom	Mushroom	380	2392	2.75kg/bag	2.0 kg/bag	75	85	275	190	3.24	60	180	140	3.00

Krishi Vigyan Kendra distributed 8317 plant/kitchen garden kits among 4567 beneficiaries. Plants of moringa, mango, guava, lemon, papaya etc., were distributed among the plants. The kitchen garden kit and plants ensure the nutritional security of poor farmer. The KVK wise list of distribution is mentioned in Table 4.38.

Table 4.38. Plants and Kitchen garden kits distributed among farmers

S.No.	Name Of KVK	No. of Plant and kitchen garden kits	No. of Benificeriaes
1	Arwal	0	0
2	Jehanabad	105	105
3	Gaya	7900	4150
4	Nalanda	42	42
5	Patna	170	170
6	Rohtas	50	50
7	Saharas	50	50
Total		**8317**	**4567**

Krishi Vigyan Kendras distributed 7566 agriculture and poultry feeder implement/equipment among 4724 farmers for drudgery reduction. The KVK wise distribution list of agricultural implements is mentioned in Table 4.39.

Table 4.39 Agricultural implements and tool distributed to farmers

S.No.	Name of KVK	Number of implements	No. of Beneficiaries
1	Arwal	423	143
2	Aurangabad	300	150
3	Jehanabad	223	223
4	Khagaria	61	20
5	Gaya	5711	3711
6	Lakhisarayi	100	100
7	Nalanda	336	42
8	Patna	50	50
9	Rohtas	62	60
10	Saharas	30	30
11	Supoul	150	75
12	Sheikhpura	120	120
Total		**7566**	**4724**

Photographs: Activities under SC-SP programme 2020-21 by different KVK

4.9.8.Climate Resilient Agriculture Program

"*Climate Resilient Agriculture (CRA) Program"* is a combined approach of Bihar Agricultural University (BAU), Sabour, Dr Rajendra Prasad Central Agricultural University (RPCAU), Pusa-Samastipur, ICAR-Research Complex for Eastern Region (ICAR-RCER), Patna and Borlaug Institute for South Asia (BISA) as a follow-up of the instructions of the Hon'ble Chief Minister of Bihar, Shri Nitish Kumar, for preparing a workable plan to cope up with current and future risks associated with climate change and demonstration of climate resilient technologies in all districts of Bihar, to provide climate-smart science-based solutions to the hard-working farmers of Bihar.

Bihar is on accelerated growth and development pathway. In recent years, it has acquired considerable attention throughout the country and even abroad for its remarkable performance on the development front. Nevertheless, maintaining this development is being challenged by the impacts of climate change.

The temperature in the region has been rising over the last few decades. The increase in temperature leads to the shrinking of favourable growing environments for major crops. The agricultural water demand is estimated to increase, whereas water availability is decreasing, though the number of rainy days showed a significant increasing trend. Growing trends of minimum temperature in the Eastern Gangetic Plains of Bihar have also been observed. There is evidence of the negative impact of changing climate on the yield of wheat, rice and other crops with variable magnitude in diverse ecologies of Bihar. The climate projections of Bihar for 2050 have further revealed increasing trends in both maximum and minimum temperatures (2-4°C), coupled with much more variability (± 25%) in monthly rainfall pattern, that are bound to have large implications on agriculture, food security and livelihoods of the rural masses. This situation in the state of Bihar points to the need for a call to action to counter the adversities of climate change in a proactive and pre-emptive manner.

Scaling up of Climate Resilient Agriculture (CRA) Program:

Based on the progress of the cropping system results, the Government of Bihar extended the program in all 38 districts of Bihar. The scaling up launching ceremony was held on 14th December 2020 in the presence of the Hon'ble Chief Minister of Bihar, Shri. Nitish Kumar. The program was organized with the assistance of the Department of Agriculture, Government of Bihar on virtual mode. In the first phase, Bihar Agricultural University has only two project sites (Banka and Bhagalpur). It will be scaled to 16 more project sites with the collaboration of the university. Bihar Agricultural University is the largest partners for Climate Resilient Agriculture Program currently.

Programme Goal:

To develop and introduce evidence-based response strategies for addressing the principal climate-based threats to the productivity and resilience of staple crop production systems in Bihar

Programme Objectives:

To achieve the programme goal, climate-resilient agriculture practices (CRAPs), a new futuristic cropping system (crop cycle) relevant to the needs of resource-poor farmers that can address climatic risks is being developed, validated and deployed through a community-led approach to make farming relevant, remunerative, and stable.

The specific objectives of the project are:

1. Baseline survey for identifying the suitable climate resilient technologies and impact assessment.

2. Improve the level of awareness and capacity of those involved with the farming system to strengthen farmers' ability to cope with climate change. Blend traditional practices and scientific approaches in a participative manner to encourage a high rate of farmer adoption on a voluntarily basis.
3. Development of on-farm innovation clusters of suitable climate-resilient and futuristic cropping system (crop cycle) modules in climate-resilient villages for technology evaluation, co-learning, and capacity development.
4. Foster institutional transformation backed by needed policy changes. Attain convergence with existing schemes of state departments of agriculture and rural development and ongoing programs of other agencies to ensure wider acceptance and roll out.
5. Pursue research to develop an improved understanding of climate change, adaptation and mitigation measures, and validation of the same for onward adoption in the field.

Challenges

Program Locations:

In the scaling up of the CRA Program, thirty eight Project Hubs is being established, one in each of the identified districts. Eighteen districts, namely, Bhagalpur, Banka, Araria, Arwal, Aurangabad, Khagaria, Bhojpur, Jehanabad, Jamui, Kaimur, Kishanganj, Lakhisarai, Madhepura, Patna, Rohtas, Saharsa, Seikhpura, and Supaul, are being managed by Bihar Agricultural University, and eleven by RPCAU, seven by BISA and two by ICAR-RCER.

Demonstration of Climate Resilient Agricultural Practices (CRA Practices)

Based on the existing climatic situations, different ecologies (low, mid and upland soils) and available resources, 14 different cropping systems (Rice – Wheat – Mung bean; Rice – Wheat; Rice – Potato + Maize; Rice – Winter maize; Rice – Mustard – Mung bean; Rice – Lentil; Maize – Wheat – Mung bean; Maize – Mustard – Mung bean; Maize – Lentil – Mung bean; Soybean – Winter maize; Soybean – Wheat – Mung bean; Pearl millet – Mustard – Mung bean; Pearl millet – Lentil – Mung bean; and Pearl millet – Wheat – Mung bean) were identified to demonstrated in the 38 project districts hub of Bihar. One long-term field experiment with 8-10 combinations of suitable cropping systems was established at KVK farm in each district. In each district, five villages were identified to demonstrate suitable climate-resilient cropping systems.

In Kharif 2020, the target was 790 demonstrations covering two districts (395 demonstrations per district) and achieved 750 demonstrations (~95%) covering two (Banka and Bhagalpur) districts. In the rabi 2020-21, target was 11214 demonstrations covering 18 districts (623 demonstrations per district) and achieved 9916 demonstrations (~85% in 18 districts).

Table 4.40. District wise cropping systems demonstrated during Rabi 2020-21

Sl. No	*KVKs*	*Area (acre)*	*No of Demonstration*
1	Araria	460.0	610.0
2	Arwal	594.0	594.0
3	Aurangabad	601.0	601.0
4	Bhojpur	605.0	605.0
5	Jamui	528.0	553.0

6	Jehanabad	502.5	505.0
7	Kaimur	385.3	386.0
8	Khagaria	387.0	437.0
9	Kishanganj	260.0	440.0
10	Lakhisarai	565.0	565.0
11	Madhepura	546.0	581.0
12	Patna	422.0	447.0
13	Rohtas	597.5	600.0
14	Saharsa	565.0	615.0
15	Sheikhpura	462.0	462.0
16	Supaul	555.0	625.0
17	Banka	560.0	630.0
18	Bhagalpur	590.0	660.0
	Total	**9185.3**	**9916**

For Banka and Bhagalpur, most farmers mainly adopted the two most popular cropping systems, Rice-Wheat-Mung bean and Rice-Lentil- Mung bean cropping systems, shown promising results compared with other cropping systems. Rice-Wheat-Mung bean cropping system recorded the highest grain yield (95.7 q/ha), followed by the Maize-Wheat-Mung bean cropping system and the lowest grain yield recorded in Rice-lentil-Mung bean cropping system (67.3 q/ha).

Figure 4.5. Average total system productivity of two cropping systems

Figure 4.6. Average productivity of rice – wheat – mung bean cropping system of Banka and Bhagalpur districts.

In the case of total system productivity, both the project sites have similar results. In Rice-Wheat-Mung bean, total system productivity was 87.79 q/ha in Banka and 87.50 q/ha in Bhagalpur.

Figure 4.7. Average total system profitability of two cropping systems of Banka and Bhagalpur districts.

These results suggested that CRA Program have the potential to increase the system productivity by 1.5 to 2.0 times. The main factors for higher cropping system productivity are timely sowing, climate-resilient crop varieties, planting techniques and timely crop management). In the case of grain yield and system productivity, Rice-Wheat-Mung bean cropping system recorded net returns of (147200 ₹/ha) followed Rice-Lentil-Mung bean (141792 ₹/ha) and other cropping systems.

Potato seed production: The Bihar Agricultural University is starting quality seed production of potato at Nalanda College of Horticulture, Noorsarai, Nalanda. Quality seed production is being started by using mini tuber under the CRA Program.

Crop Planted in Open Field

Crop Planted in Net House

Harvested Tuber

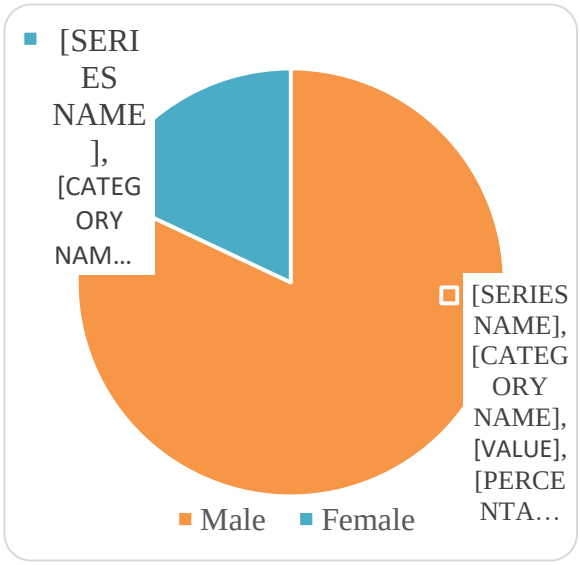
Tuberization (close view)

Figure 4.8. Potato seed production (BAU)

Crop Residue Management: In recent times, crop residue management gaining more attention in farming. By keeping this view in mind, this year, special emphasis was given on crop residue management using waste decomposer, happy seeder and straw baler for the benefit of the farming community. In the CRA program, various crop residue management is being followed like waste, decomposer, Happy Seeder, straw baler. A model for the preparation of a straw bundle with the help of straw baler by the KVK Rothas has been adopted. They prepared a straw bundle with the help of Straw Baler and sold it to the Sudha Dairy for animal feed. In this model, farmers can earn additional money by selling it as well as protect the environment.

Capacity Development/Traveling seminars

During this year (2020-21), 274 capacity development programs were conducted, including Exposure Visit, Training, Travelling Seminar, and field day covering 15113 beneficiaries (12393 males + 2720 females). 18% of females and 82% of males participated in capacity development programmes.



4.9.9. Biofortified High Zinc Wheat Varieties Testing (Harvest Plus)

Planting Season: Rabi 2020

Total number of Demos: 349

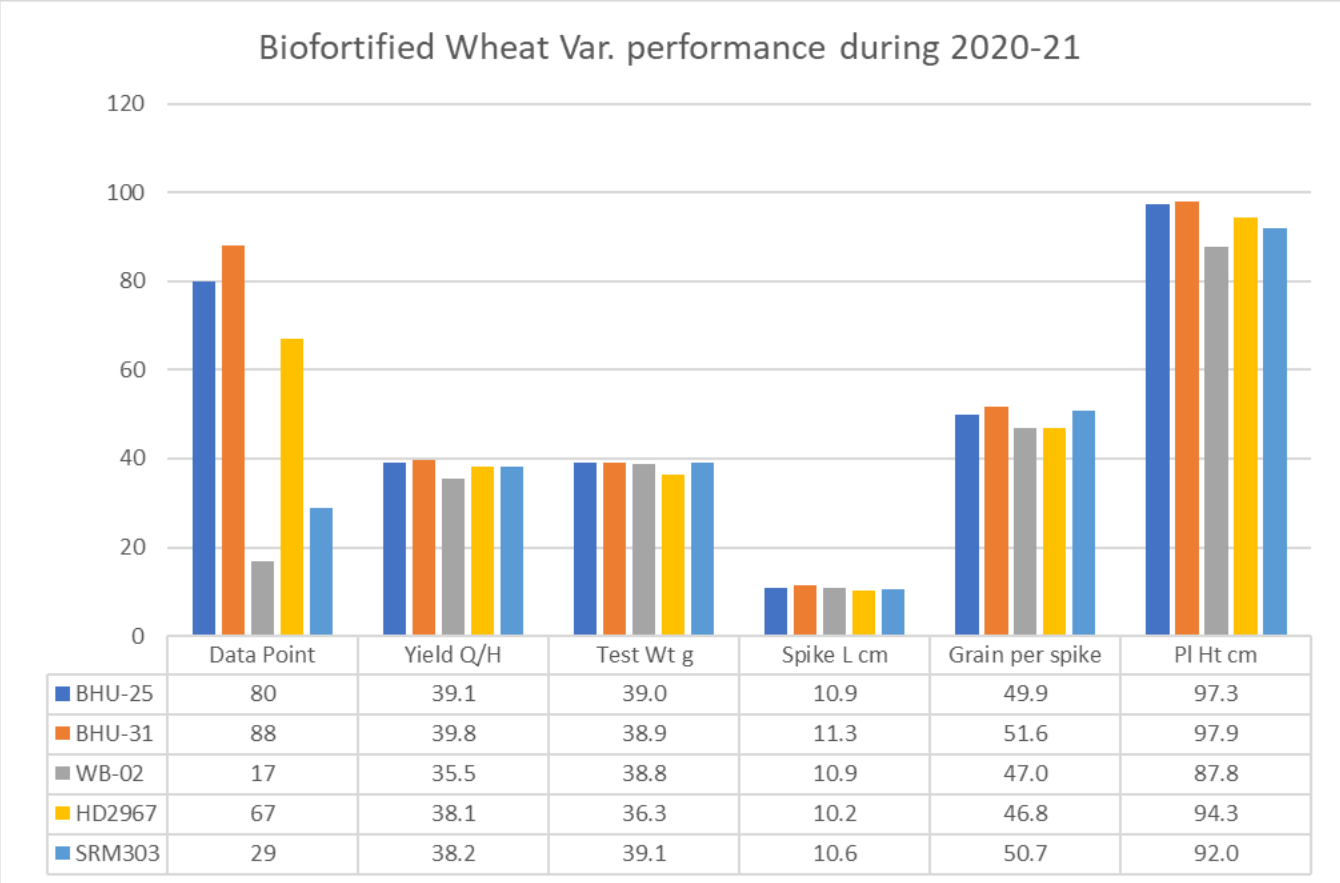
Total Seed Quantity: 7.5 MT

Location of test: 25 KVKs, ARI Patna and BAU main Campus Sabour.

HarvestPlus is a global leader in the development and deployment of biofortified crops worldwide to alleviate the micronutrient deficiencies. HarvestPlus has special project to fight the hidden hunger from the state of Bihar and in order to achieve this target HarvestPlus has developed strong partnership with Bihar Agricultural University, Sabour. This collaboration has proved very effective in developing and testing the best biofortified high zinc wheat varieties for the vast geography of the state. As a part of this collaboration BAU run collaborative biofortified wheat testing program though its extension centre during Rabi 2020. The testing proposal along with the varietal seed was shared by HarvestPlus for studying the varietal adaptation in different geographical areas and its yield potential. The other focus of this collaborative study was to create awareness about the benefits of high zinc wheat varieties among the farmer communities.

Testing details: During Rabi 2020 wheat season three potential zinc biofortified wheat varieties, namely BHU-31, BHU-25 and WB02 were tested. These varieties posses 60-70% higher zinc concentration compared to the conventional wheat varieties. Demo kits were comprised of 10 kg and 40 kg seed bags. The smaller kit was for the farmer exposure to the biofortified variety and the bigger one for testing biofortified wheat variety under CRA project. Along with these test varieties farmer was given free hand to use local check of his preference. Yield data and other agronomic traits were collected from test as well as check varieties. Key data points captured from the test plots were- 1. Plant Height (cm) 2. Panicle Length (cm) 3. Number of effective tillers 4. Test Weight (g) 5. Bundle Weight (kg) and 6. Grain Weight (kg).

Outcome of the testing: Due to COVID pandemic field data collection was hampered but still team could able to manage data gathering from 18 district locations. The summary of the data with respect to varietal performance for different important traits against commercial check is provided in graphical form in Fig. 4.9. The field data received from various the testing locations were compiled and analysed by HarvestPlus team. It is evident from the analysis that BHU-31 out-performed across all the test zones followed by BHU-25, the second biofortified variety. The best commercial checks, i.e. HD2967 and Sriram-303 were on 3rd and 4th rank. The another biofortified variety also performed well across but the yield potential was bit lower than BHU-31, BHU-25 and commercial checks. BHU-31 gave a gain of 4.5% over HD2967 whereas BHU-25 out-yielded HD2967 by 2.7%. Farmers loved the uniformity and adaptability of these biofortified varieties. All the biofortified varieties, under test belongs to early maturity group with a maturity range of 125-130 days. The data from late sown location suggests better performance of BHU-31 and BHU-25 under late sown conditions. These two varieties gave comparatively higher yields even when planted during second and third week of December. The disease rating for all the three biofortified varieties were tolerant for rusts. The micronutrient expression of biofortified varieties under different geographies will be analysed from the grain samples collected from the trial plots. For this analysis samples will be dispatched to HarvestPlus lab situated in ICRISAT Hyderabad.



	Data Point	Yield Q/H	Test Wt g	Spike L cm	Grain per spike	Pl Ht cm
BHU-25	80	39.1	39.0	10.9	49.9	97.3
BHU-31	88	39.8	38.9	11.3	51.6	97.9
WB-02	17	35.5	38.8	10.9	47.0	87.8
HD2967	67	38.1	36.3	10.2	46.8	94.3
SRM303	29	38.2	39.1	10.6	50.7	92.0

Fig. 4.9. Biofortified Varietal Performance Against Best Checks during 2020-21

Few field pictures of Biofortified wheat varieties along with some of the exposure visits of farmers and scientific community are provided below. These events were organized by HarvestPlus staff in collaboration with KVK or respective institution staff where the biofortified crop plot was located. The purpose of these meetings was to spread awareness about the potential and the benefits of the biofortified varieties.

Demonstration Field Pictures:

Biofortified Field visit by Farmers

Exposure visit of Farmers through KVKs

Crop Cutting for Yield Estimation

4.9.10 IRRI-BAU Collaboration for seed system and product management

In 2020, IRRI, South Asia Regional Centre, Varanasi, coordinated with Bihar Agricultural University to implement head to head trials in farmer's fields. Three Krishi Vigyan Kendra has been chosen and collaborated for the implementation. Head-to-head (H2H) trialis a unique and simplest on-farm trial method. It is executed on an individual farmer field. In this comparative method, two varieties are grown alongside the same plot under the same management practices. Out of these two varieties, one is a new variety, and the other one is a locally popular, old variety already grown by the farmer. Apart from generating evidence around varietal performances, these trials can also act as a unique way of demonstrating varietal performance in the farmer field and providing a comparative learning experience for farmers, neighbours, and more stakeholders visiting the plot.

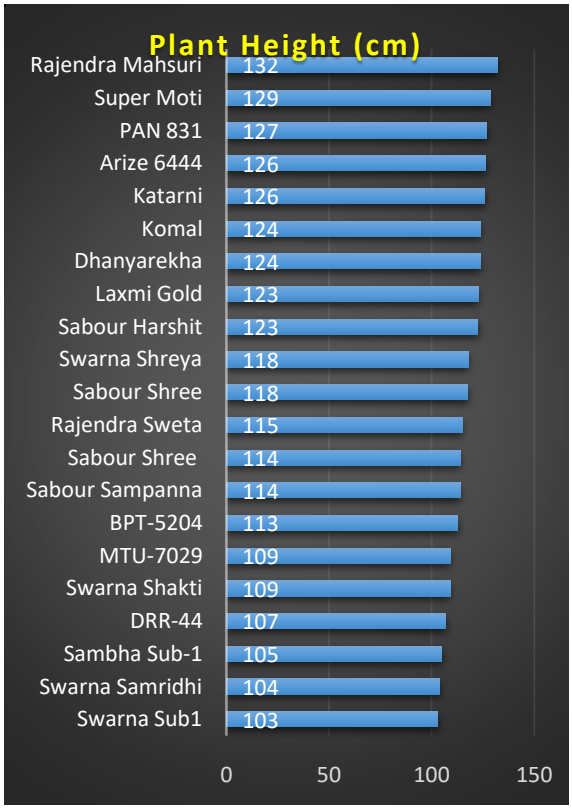
The primary aim of H2H trial is to accelerate varietal replacement. This in turn, can be achieved in multiple ways. These trials can help generate evidence, critical data around the performance of a new variety that is yet to be made popular in the seed chain. These data can validate the realistic performance of the variety under a farmer field condition. Generated data can be fed back to the breeding programmes for varietal development or improvement. Unlike other large scale demonstration approaches, these H2H trials can intensively generate varietal awareness and provides an enabling decision-making platform for a varietal replacement among farmers or other stakeholders. Since the management practices for both varieties are the same, any advantage gained (yield, grain quality, etc.) can be attributed to the superiority of the variety being tested or introduced.

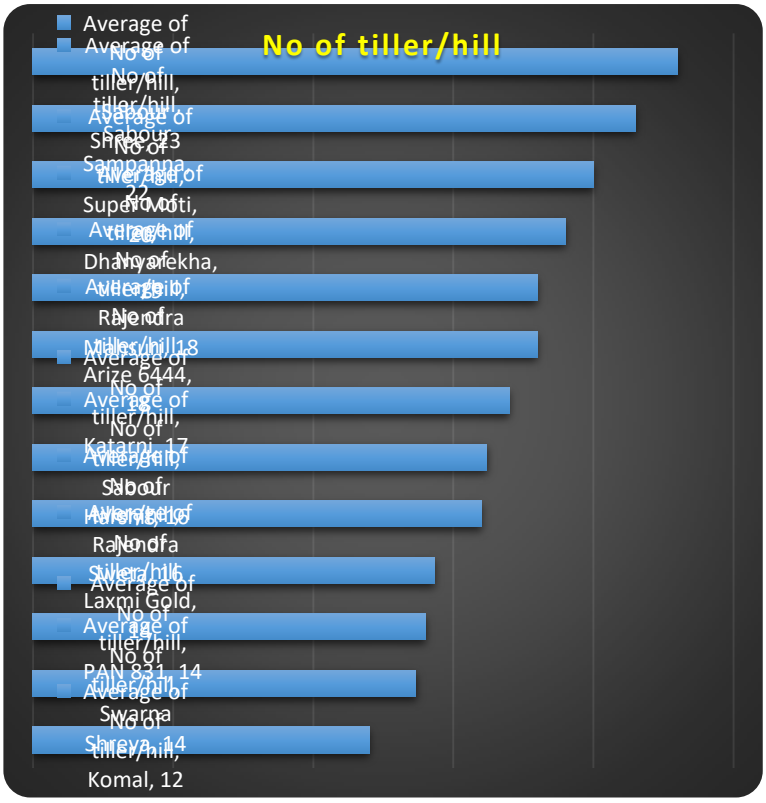
Fig. 4.10. Schematic representation of Head to Head trial layout. (B) Actual field establishment of Head to Head trial

In Kharif 2020 for Bihar state, several varieties have been tested, which are developed in BAU, Sabour; Dr. Rajendra Prasad Central Agricultural University, Pusa; ICAR Research Complex for Eastern Region, Patna. The nominated varieties from these institutes have been compared side by side with farmer's cultivated varieties, which are prominent in respective areas.

The table below represents the area that is covered under this collaboration.

District	Arwal		Jehanabad		Rohtas					
Block	Arwal	Kaler	Modanganj	Ghoshi	Bikramganj	Dawath	Nokha	Sasaram	ShivSagar	Surypura
Villages	Ranipur	Durgapur	Mustafapur	Sahpur	Shivpur	Dehgawa	Taradh	Sikariya	Raubenchar	Aabdhni bigha
		Jamuhari	Milkiper	Korma	Semra	Bodhari				
		Kanchan Bigha	Manibigha		Satharayen	Usari				
		Musepur	Gandhar		Parsa					
		Sohsa	Bandhuganj		Dhangai					
		Bakhtar	Anantpur		Aliganj					





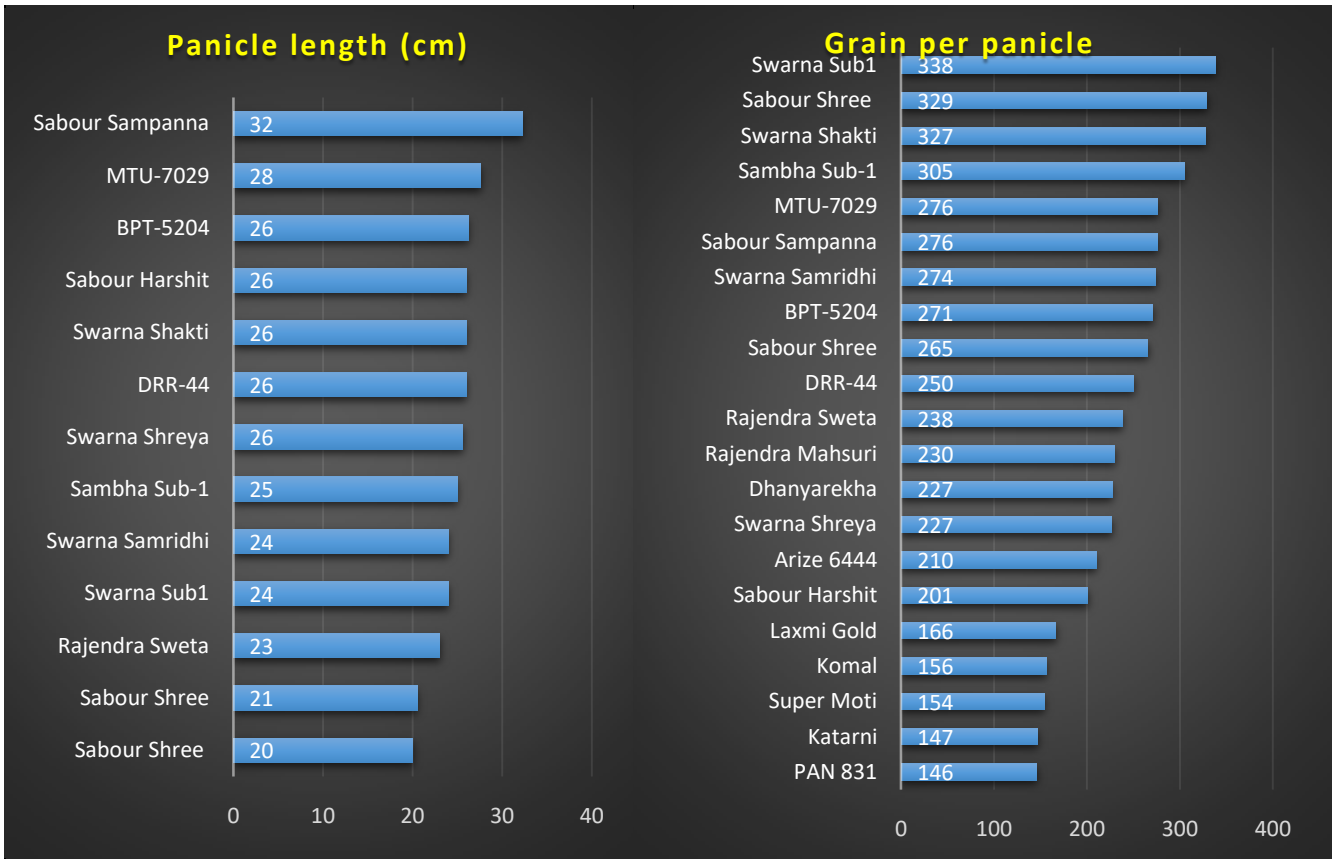


Fig. 4.11. Values represent an average of 3 districts considering ten blocks and 35 villages of head to head trials in Bihar in Kharif 2020.

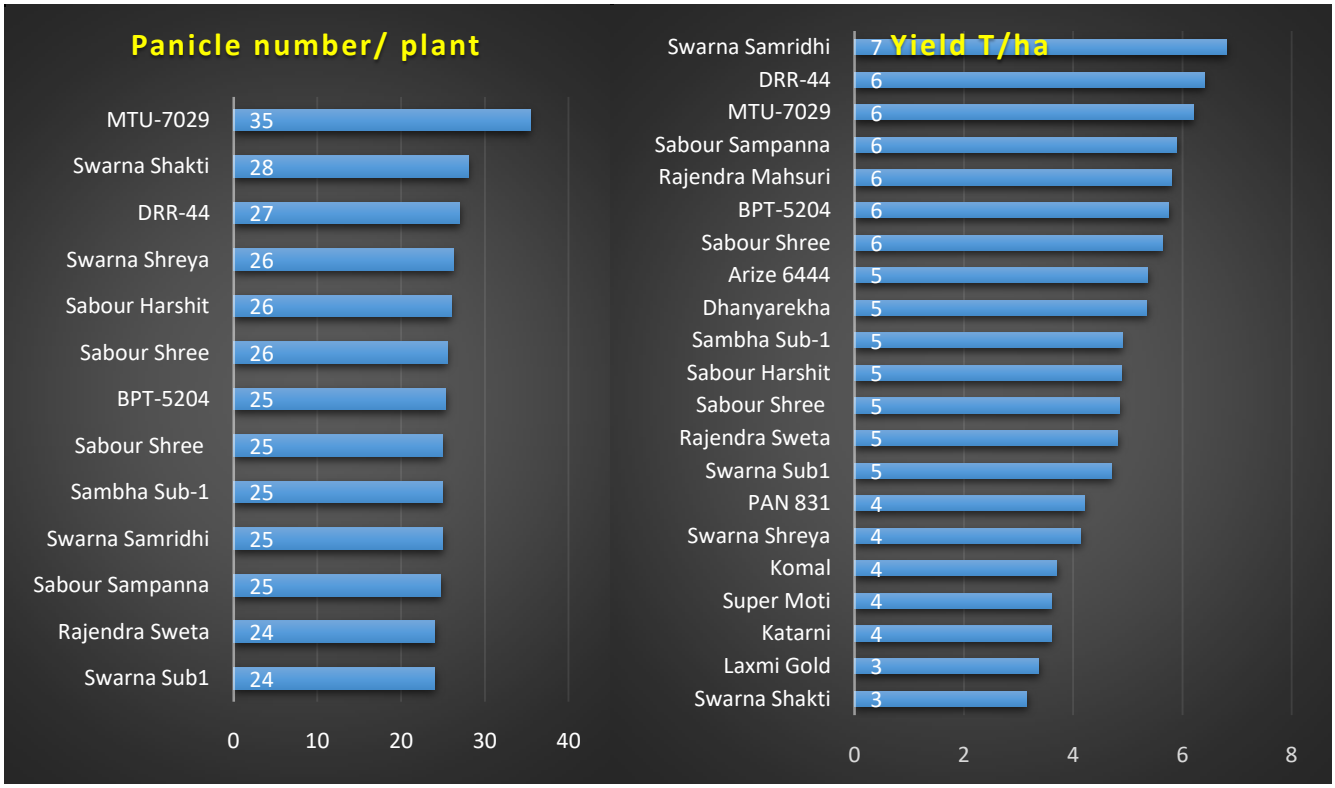


Fig. 4.12. Values represent an average of 3 districts considering ten blocks and 35 villages of head to head trials in Bihar in Kharif 2020.

Few inferences from the above data figures:

1. As plant height, Rajendra Mahsuri (132cm) followed by Sabour Harshit (123 cm) are the tallest plant type among the tested varieties. Rajendra Mahsuri was the tallest among all the tested varieties, including the farmer's checks whereas Swarna Samriddhi (104 cm) was found with dwarf plant type among tested varieties, which is nearly similar to Swarna Sub-1 (103cm). Sabour Shree, Sabour Sampanna was found with medium height plant type.
2. The number of effective tillers per hill was high in Sabour Shree (23) among observed varieties, followed by Sabour Sampanna (22). Swarna Shreya (14) was found with less effective tillers among tested varieties through Komal (12); a farmer variety was least in the lot.
3. Panicle length was recorded highest for Sabour Sampnanna (32 cm) followed by Sobaour Harshit (26 cm). However, Sabour Shree was found with less panicle length (20 cm) among observed verities.
4. Sabour Shree was found with more grain per panicle than other tested varieties, followed by Swarna Shakti. In contrast, Sabour harshit was found with less grain per panicle among tested varieties. Swarna Sub-1 as a farmer variety was found with highest number of grains per panicle among the whole lot.
5. The panicle number per plant was high in Swarna Shree (28), followed by Swarna Shreya and Sabour Harshit. While Rajendra Sweta and Swarna Sub 1 was found with less panicle per plant.

The figure below shows how the varieties that were nominated and evaluated were found superior against all the farmer checks tested previously. This proves the purpose of the introduction of newer varieties for the farmers to replace the older cultivated varieties.

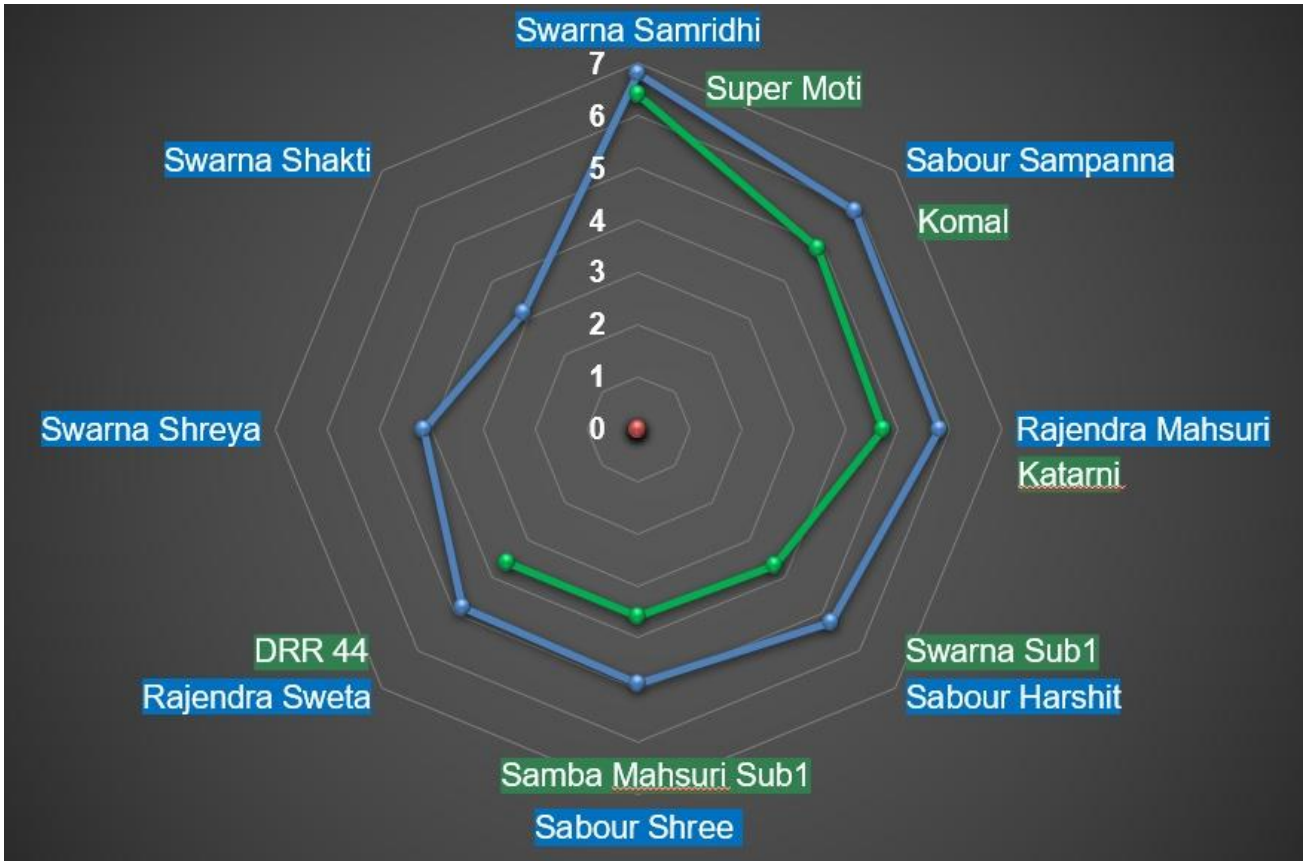


Fig 4.13. Blue line and blue text box are tested varieties, and green line and green text box are farmer choice varieties.

The yield advantages are calculated for each tested varieties against farmer varieties and depicted in the below table. Sabour Samridhi was found with a positive yield advantage against various farmer varieties.

Table 4.67. Values represent yield advantage (in percentage) of evaluated varieties (in column) over respective farmer check (in the top row). Values are average of three districts, considering 10 blocks and 35 villages for head to head trials in Bihar in Kharif 2020.

Row Labels	Yield T/ha	Super Moti	Komal	Katarni	Swarna Sub1	Sambha Sub-1	DRR-44
Swarna Samridhi	6.8	6	28	31	46	47	47
Sabour Sampanna	5.9	-9	17	20	37	39	39
Rajendra Mahsuri	5.8	-10	16	19	36	38	38
Sabour Harshit	5.2	-22	6	10	29	31	31
Sabour Shree	4.9	-31	0	4	24	26	26
Rajendra Sweta	4.8	-33	-2	2	23	25	25
Swarna Shreya	4.1	-55	-18	-14	11	13	13
Swarna Shakti	3.2	-103	-56	-49	-17	-14	-14

The trait parameters are analysed and correlated against each other, and yield was found strongly correlated with the number of effective tillers per hill followed by grains per panicle. In contrast, yield been found inversely correlated to plant height followed by spike number.

Table 4.68: Correlation of different varietal growth trait parameters and yield

	Plant Height (cm)	No of tiller/hill	Panicle length	Spike Number	Grain per panicle	Panicle number/plant	Yield (t/ha)
Plant Height (cm)	1.00						
No of tiller/hill	-0.24	1.00					
Panicle length	-0.05	0.09	1.00				
Spike Number	-0.11	-0.61	0.41	1.00			
Grain/ panicle	-0.80	0.55	-0.18	-0.31	1.00		
Panicle number/ plant	-0.08	0.36	0.29	-0.30	-0.03	1.00	
Yield (t/ha)	-0.37	0.61	0.16	-0.04	0.41	0.15	1.00

ODISHA:

IRRI conducted a trial on Sabour Ardhajal and Sabour Harshit in different districts of Odisha to understand the suitability. These are medium-duration aerobic/drought-tolerant varieties requiring less water, suitable for drought-prone areas of Odisha where water scarcity is a major issue. IRRI tested these new varieties in districts spread across two main ecologies—inland and lowland. From crop establishment to maturity and harvest, the growth pattern was recorded including important agronomic parameters to assess the desirability of these varieties in Odisha. Sabour Ardhajal has matured in 125 days with an average yield of 3.72 ton per ha. Sabour Harshit, another aerobic rice (126 days), yielded 3.93 ton per ha. Other agronomic parameters are quite preferable. These two varieties are targeted in water limiting areas and can be further evaluated against other aerobic segment varieties for their advancement in the seed chain.

Variety/District	No of observation	Tillers (no)	Duration (days)	Plant height (cm)	Grains/Panicle (#)	Grain yield (t/ ha)
Sabour Ardhajal	41	12	125	103.43	162	3.72
Sabour Harshit	37	13	126	104.21	157	3.93

4.9.11. Innovative Agri –Innovation under ICDS: National Nutrition Mission

India's policy has long been focused on self-sufficiency in food grains. However, this progress has been slow to translate from food security, focused on quantity of food, nutrition security, and quality of food. Agriculture is the largest livelihood provider in India—especially in the rural areas—and plays a critical role in alleviating poverty and undernutrition. The Indian government's twelfth five-year Plan (2012–2017) aims to accelerate the growth of agricultural production and includes food security as a high-priority research area of national relevance. Multisectoral interventions for nutrition highlight the immediate and underlying determinants of nutrition, calling for both nutrition-specific and nutrition-sensitive interventions. Nutrition-sensitive agriculture is a food-based approach to agricultural development that puts nutritionally rich foods, dietary diversity, and food fortification at the heart of overcoming malnutrition and micronutrient deficiencies.
The strategy approached with the following components:

- Nutrition Centric Planning
- Community mobilization
- Training and Capacity Development
- Technical support
- Communication and Monitoring

Despite a growing economy and several anti-malnutrition programmes, Bihar has the worst level of child malnutrition and nutritional deficiency in rural women. The majority of children in Bihar have underprivileged childhoods starting from birth. This initiative aims to bring together KVKs and Anganwadi centres and overcome the nutritional deficiency of protein and micronutrients to unprivileged infants and their mothers. To achieve the ultimate goal of alleviating malnutrition, three objectives have been formulated:
(i) Impact of nutrition education package on malnutrition among rural women and children through Community Radio Station (CRS);
(ii) Diversification of food intake among rural women and children by establishing nutri-garden under AWCs;

(iii) Ensuring quality nutrition among malnourished children and mothers through mushroom enriched food in their diets. The programme was conceptualized and implemented in 4 districts of Bihar on a pilot basis, viz., Nalanda, Patna, Purnea and Khagaria, to implement and examine the agri-based innovative model to address the perennial problem of malnutrition.Five villages have been selected in each district. This initiative aims to overcome the nutritional deficiency of protein and micronutrients through diversification for food and the creation of awareness among pregnant and lactating women in rural areas.

The programme has been implemented under four districts viz., Patna, Nalanda, Purnea and Khagaria through the existing Krishi Vigyan Kendras. A systematic approach was followed to bring the perceptible improvement in the nutritional security through a multipronged approach with a special focus on one specific approach at each district. Creation of awareness through nutrition education through CRS, Barh under KVK, Patna, incorporation of mushroom to daily diet at in Nalanda and enhancing diet diversity by establishing nutri-gardens at AWCs at Purnea and Khagaria was the core strategy. Five villages were selected at each district, and a strong linkage was established between respective KVK and AWC with the help of ICDS, and the government of Bihar. The nutritional garden were established at AWC to include green leafy vegetables/fruits in the diets of pregnant/lactating women and children. Community Radio Services was employed to boost up the nutritional and health awareness programme. Awareness through Community Radio Services is fascinating as the KVK has opted to reach the rural mass. Initiatives also encouraged the cultivation and inclusion of mushroom in diets to combat malnutrition in children. Mushroom cultivation was promoted at each selected AWCs, and the same was served as a supplement in the meal at selected AWCs. An extensive campaign was conducted to remove the stigmas and taboos related to food habits including mushroom consumption. Rural woman was empowered with technical knowledge of nutri-garden establishment, mushroom cultivation and diversified culinary. Nutrition education on selection of right food as per local availability, removal of taboos in food, causes of malnutrition and issues regarding micronutrient deficiencies were thoroughly discussed to bring about desirable changes in food consumption pattern.

4.9.12. Kisan Mela – 2021 at BAU, Sabour

The university organized Kisan Mela on February 20-22, 2021. The theme of the Kisan Mela was 'Empowering Youth for Technology–led Farming'. The Kisan Mela was Shri Amarendra Pratap Singh, Hon'ble Agriculture Minister, Government of Bihar. Thousands of farmers from nearby states including Bihar participated in this three-day Kisan Mela. In the inaugural speech, Hon'ble Agriculture Minister appreciated the university for its huge work for the farmers of Bihar. He also informed the farmers about the different programs of central and state government. He advised the Hon'ble Vice chancellor to take more activities for returned migrant labour. Dr RK Sohane, in his address informed the minister on the different farmer friendly activities of the university. He expressed his sincere thanks to Hon'ble Agriculture Minister for his gracious presence in this Mela. The attractions of this Kisan Mela were climate resilient agriculture techniques, workshop on organic farming, exhibition and marketing of agricultural produce, kisan goshthi, quiz, farmers visit to experimental field of the university, sale of seeds and sapling of the plant and cattle show. The message from the Kisan Mela- 2020 for farmers and all others was climate resilient agriculture with mission of 'Jal Jeevan Hariyali' every nook of the state. More than 160 stalls were exhibited from university departments, colleges, Krishi Vigyan Kendra, Private Companies, NGOs and Self-Help Group. On the first day of Kisan Mela, a garden exhibition will also be inaugurated by the Hon'ble Agriculture Minister. The flower and vegetable show was inaugurated by Hon'ble Agriculture Minister. The local MLA and MP were present in the inaugural programme. The cattle and animal show was organised in the ground of the university. Farmers participated this show enthusiastically with their reared animal. The farmers came with their cattle, buffalo, hen, duck and goat. There was a dog show within this

programme. The farmers was awarded in this occasion. In kisan goshthi, the scientists of the university deliver lectures before the farmers in the subject areas of fruit crops cultivation, vermicompost production, Azolla cultivation, strawberry cultivation and other topics. In the evening, the attractive cultural programme was organised in the main stage and the farmers, local people, students, scientists and all other enjoyed the programme. Dr RC Srivastava, Hon'ble Vice-Chancellor, DRPCAU Pusa was the chief-guest of the valedictory programme. The Dr RK Sohane, Vice-Chancellor was the main architect to organise the KISAN Mela-2021 with active support of the Dr RN Singh, ADEE, BAU Sabour. Dr RK Sohane expressed his sincere thanks to all the scientists, farmers and students of the BAC Sabour for their active support to complete the Mela in a successful way.

The mela was attended by more than 20,000 farmers from all 38 districts of Bihar and 6 districts of Jharkhand including farmers associated with ATMA/KVK/Kisan Club. Over 160 stalls have been presented in the fair.

Table 4.41: Participation of Stakeholders in Kisan Mela 2020

S.No.	Name of the Stakeholder	Participants
1.	Farmers adopted by KVKs in different district	11569
2.	Extension functionaries & farmers from districts ATMA	3124
3.	Stakeholders of different projects/programmes	2172
4.	SHGs/CIG/FIGs/Kisan Club/FPOs	3422
5.	Jharkhand & other states	1558
6.	NGOs	1211
7.	Others agencies	2104
Total		25160

Demonstration of Innovative technologies

Innovative technology stall drew attention of farming community and others during three days Kisan Mela organized at BAU. A team of scientist and postgraduate students across the disciplines participated in the stall under dynamic leadership of Directorate of Research. Arsenic Mitigation, Climate resilient agrotechniques, tissue culture propagated pineapple, bamboo, heat-tolerant Trichoderma, trichocard, dry flower products, Nutri-cereals (millets) and value-added products, soil intelligence system (XRF-based), remote sensing and GIS, nonfertilizer and Hatchery units etc were displayed and explained during three days programme. SABAGRI stall also displayed various products and technologies commercialized through agri-incubators in the mela. Innovative technologies were also evaluated and awarded during valedictory session of Kisan Mela.

Kisan Mela at MBAC Agwanpur, Saharsa

Two days Kisan Mela-cum-Workshop on ''Enhance Farmer's Income through New Agricultural Technology'' was organized at MBAC Agwanpur, Saharsa on 13th- 14th March. Dr RK Sohane, Vice-Chancellor and Mr Rahul Kumar Mahiwal, Commissioner, Saharsa jointly inaugurated the Kisan Mela. In his inaugural speech, Dr Sohane advised farmers not to burn paddy straw and adopts straw management technologies for environmental production. Dr RN Singh, ADEE, BAU Sabour hailed the farmers for their enthusiastic participation. A large number of farmers participated in this Kisan Mela and purchased seeds, pesticides and other agricultural equipment to get soil and water tested at a single platform and enhances their knowledge.

4.10. Seed production by KVKs

The seed production of KVKs during the year 2020 – 21 in cereals, pulses, oilseeds, vegetables, flowering plant, green manure and spices is mentioned in Table 4.75. A total of 4757.78 quintal of seed were produced.

Table 4.42.Seed production of all KVKs

Group	Row Labels	Sum of Quantity of seed (q)	Sum Group Total (q)
Cereals	Paddy	2935.64	4304.79
	Wheat	1366.92	
	Millet	2.23	
Pulses	Chickpea	154.41	263.71
	Lentil	65.99	
	Green gram	34.05	
	Pigeon Pea	7.26	
	Horsegram	1.5	
	Pea	0.5	
Oilseeds	Mustard	43.45	61.25
	Linseed	12.8	
	Sesame	5	
Vegetables	Potato	105	105
	Elephant Foot Yam	15.35	15.35
Flowering Plant	Lathyrus	3.58	3.58
Green Manure	Dhaincha	3	3
Spices	Turmeric	1.1	1.1
Total			**4757.78**

A total of 673307 planting materials for vegetable, fruits, ornamental plants, fodder crop saplings, forest species, and medicinal and aromatic plants was produced by the KVKs during the year 2020 – 21.

Table 4.43. Planting Material Production (All KVKs)

Group	Row Labels	Sum of no. of Planting materials	Group Sum
Vegetable	Onion	250000	599059
	Tomato	199425	
	Cauliflower	74276	
	Brinjal	28730	
	Chilli	18253	
	Cabbage	12340	
	Drumstick	7600	
	Broccoli	4635	
	Cucurbits	3200	
	Bottle Gourd	600	
Fruits	Mango	26913	52973
	Guava	13955	
	Lemon	6428	
	Papaya	2139	
	Litchi	2036	
	Dragon fruit	1220	

	Banana	100	
	Pomegranate	94	
	Jack fruit	88	
Ornamental plants	Marigold	7000	13100
	Ornamental Plants	3600	
	Flower	2500	
Fodder crop saplings	Fodder	6000	6000
Forest Species	Forest Species	1100	1100
Medicinal and Aromatic	Medicinal and Aromatic	1075	1075
Total		**673307**	**673307**

4.11 Extension Activities

Adoption of new technologies requires learning and decision making. These decisions are influenced by a number of factors other than technology, farmers, Knowledge, Skills, Values, Personal resources, environmental as well as socio – cultural backgrounds affects their decisions. Keeping these facts in minds KVKs under the jurisdiction of University Planned different Extension Activities for the betterment of farming community as mentioned in Table 4.77. A total of 3,93,013 farmers and extension officials participated in the extension activity during 2020 – 21 in various activities such as field day, kisan mela, kisan chaupal, exhibition, film show, method demonstrations and so on.

Table 4.44. Extension activities organized by different KVKs

Nature of Extension Activity	No. of activities	Farmer's attend	Extension Officials attend	Total
Field Day	202	6447	338	6785
Kisan Mela	43	25584	770	26354
Kisan Choupal	105	8336	272	8608
Exhibition	25	3430	151	3581
Film Show	148	5769	281	6050
Method Demonstrations	66	2473	80	2553
Group meetings	84	2514	84	2598
Advisory Services	40366	186130	3494	189624
Farmers visit to KVK	18550	23505	1312	24817
Diagnostic visits	1504	7226	359	7585
Exposure visits	103	5846	272	6118
Ex-trainees Sammelan	12	344	9	353
Soil health Camp	246	1599	87	1686
Animal Health Camp	26	1899	44	1943
Soil test campaigns	25	1311	35	1346
Self Help Group Conveners meetings	25	1013	29	1042
Live Telecast of Flagship programmes	193	9025	307	9332
Any Other (Specify)	456	91399	1239	92638
Total	**62179**	**383850**	**9163**	**393013**

Similarly, important days were celebrated in the KVKs with the organization of a number of activities in the same context. A total of 11,567 participants were benefitted through these activities. The days in which there was maximum participation from the stakeholders were International Women's Day (1523 participants), Mahila Kisan Diwas(1176 participants), and Kisan Diwas (1036 participants).

Table 4.45. Celebration of important days in KVK

Important Days	Number of activities	Total participants
International Women's Day (8th Mar.)	19	1523
Ambedkar Jayanti (14th Apr.)	3	58
World Environment Day (5th Jun.)	4	150
International Yoga Day (21st Jun.)	17	297
Independence Day (15th Aug.)	19	809
Parthenium Awareness Week (16th to 22nd Aug.)	50	486
Hindi Diwas (14th Sep.)	8	238
Gandhi Jayanti (2nd Oct.)	22	789
Mahila Kisan Diwas (15th Oct.)	11	1176
World Food Day (16th Oct.)	15	647
Vigilance Awareness Week (27th Oct. to 2nd Nov.)	36	912
National Unity Day (31st Oct.)	13	442
World Science Day (10th Nov.)	6	157
National Education Day (11th Nov.)	10	310
National Constitution Day (26th Nov.)	21	596
World Soil Day (5th Dec.)	19	1502
Kisan Diwas (23rd Dec.)	17	1036
8th Establishment Day of KVK, Khagaria (11th Feb)	1	25
Jal JeewanHariyali (14th Dec)	1	53
Krishi Shiksha Diwas (3rd Dec)	1	71
National Productivity week (12th to 18th Feb.)	7	62
Swachhatapakhwara KVK Campus/Adopted Village (16-31Dec)	8	228
Total		11567

TRAINING

5. TRAINING

All the State Agricultural Universities have three mandates (Teaching, Research and Extension), however, this university has four mandates, i.e., apart from the three mandates above, and we have training as the fourth mandate. The university provides training for capacity building of farmers, extension functionaries, rural youth etc., through the KVKs and various colleges. The technologies which are being developed through research work need to go out well among the stakeholders on time. In this changing context of technologies, innovations, market scenario, and farmers' educational level, agriculture has become more knowledge intensive and mitigates the challenges of 'Information – have' and 'information-have not'. For adopting innovation of farming, the farmers need updated knowledge, specific skill and skill promoting training.

TRAINING PROGRAMME

5.1 Skill Development Training Programmes organized by Directorate of Extension Education

Apart from regular capacity building programmes conducted by various KVKs, research stations and colleges situated under different zones, the directorate of extension education, BAU, Sabour also conducted training programmes sponsored by different agencies viz., Agriculture Skill Council of India (ASCI), Bihar Agriculture Management and Extension Training Institute (BAMETI), Agricultural Technology Management Agency (ATMA) and several other sponsored HRD training for farmers, scientists and extension functionaries.

The skill development training programme sponsored by ICAR/ BSDM/ RPL is mentioned in Table 5.1.1054 participants were trained for various job roles like mushroom grower, Assistant Gardener / Gardener, Dairy Farmer-Entrepreneur, etc.

Table 5.1. Skill development training programmes sponsored by ICAR / BSDM / RPL

Sl.No.	Job Role	No. of Training Programmes Organized	No. of Participants (ICAR / BSDM / RPL)
1	Mushroom Grower	10	219
2	Assistant Gardener / Gardener	14	398
3	Dairy Farmer-Entrepreneur	1	20
4	Organic Grower	1	20
5	Vermicompost Producer	5	134
6	Medicinal plant Grower	2	50
7	Quality Seed Grower	3	58
8	Beekeeper	5	135
9	Animal Health Worker	1	20
Total		**42**	**1054**

5.2 Skill Development Training Programmes conducted under ICAR (RKVY) scheme

Rashtriya Krishi Vikas Yojna (RKVY) is a scheme of the Indian Council of Agricultural Research (ICAR) that outlays financial assistance for various training programmes. During 2020-21.410 participants were trained during 2020 – 21 by different KVKs under the jurisdiction of BAU, Sabour for different roles like Assistant Gardener, Mushroom Grower, Vermicompost Producer, etc. the KVK wise training programme is mentioned in Table 5.2.

Table 5.2. Training Programmes being conducted through ICAR (RKVY) sponsorship

Sl. No.	Name of College/KVK	Topic (Job Role)	Date of Start	(Days) Duration	No. of Participant
1	KVK, Araria	Assistant Gardener	03.02.2020	25	20
		Mushroom Grower	03.03.2020	25	20
2	KVK, Arwal	Mushroom Grower	24.02.2020 completed on 14.01.2021 due to COVID-19	25	20
		Vermicompost Producer	18.02.2021	25	20
3	KVK, Banka	Dairy Farmer	22.02.2020	25	20
		Mushroom Grower	26.02.2020	25	20
		Assistant Gardener	01.03.2021	25	25
4	KVK, Jehanabad	Mushroom Grower	06.02.2020	30	20
		Animal Health Worker	10.02.2020	30	20
5	KVK, Katihar	Bee Keeping	27.03.2021	25	25
6	KVK, Lakhisarai	Assistant Gardener	15.03.2021	25	25
7	KVK, Munger	Mushroom Grower	01.03.2021	30	25
8	KVK, Nalanda	Organic Grower	15.03.2021	25	20
9	KVK, Patna	Mushroom Grower	17.02.2021	25	20
10	KVK, Purnea	Mushroom Grower	15.02.2021	30	25
11	KVK, Rohtas	Medicinal Plant Grower	15.02.2021 to 29.01.2021Due to Covid-19	25	20
12	KVK, Supaul	Quality Seed Grower	17.03.2021	25	25
13	MBAC, Saharsa	Mushroom Spawn Production	11.01.2021	10	20
		Mushroom Production Technology	02.03.2021	05	20
Total					**410**

5.3 Training programme sponsored by Bihar Skill Development Mission (BSDM)

Different KVKs and colleges trained a total of 376 participants under BAU, Sabour during 2020 – 21. The details of Bihar Skill Development Mission (BSDM)training programmes is provided in Table 5.3. the participants were trained for the role of Gardener, Vermicompost Producer, beekeeper, etc.

Table 5.3. BSDM training Programmes organized during 2020-21

Sl. No.	Name of College/KVK	Topic (Job Role)	Date of Start	(Days) Duration	No. of Participant
1	KVK, Araria	Gardener	03.03.2020	48	30
2	KVK, Banka	Vermicompost Producer	01.01.2021	48	30
3	KVK, Gaya	Vermicompost Producer	15.02.2021	35	24
4	KVK, Jehanabad	Bee Keeper	02.03.2020	30	30
5	KVK, Katihar	Vermicompost Producer	15.02.2020	30	30
6	KVK, Kishanganj	Quality Seed Grower	02.03.2020	30	18
7	KVK, Lakhisarai	Quality Seed Grower	02.03.2020 Restarted on 01.02.2021	30	15
8	KVK, Munger	Vermicompost Producer	01.02.2021	30	30
9	KVK, Nalanda	Bee Keeper	15.01.2021	35	20
10	KVK, Purnea	Mushroom Grower (small entrepreneur)	11.01.2021	30	29
11	KVK, Rohtas	Medicinal Plant Grower	15.02.2020 to 10.02.2021 Due to Covid-19	30	30
12	KVK, Supaul	Gardener	15.02.2021	43	30
13	DoEE, BAU, Sabour	Gardener	15.02.2021	43	30
14	MBAC, Saharsa	Gardener	15.02.2020	48	30
Total					**376**

5.4 Training programme sponsored by RPL (BSDM)

The details of training programmes sponsored by RPL (BSDM) is provided in Table 5.4. 298 participants were trained for the role of Agriculture Extension Service Provider, gardener, beekeeper etc., during the year 2020 – 21.

Table 5.4. RPL training Programmes organized during 2020-21

Sl. No.	Name of College/KVK	Topic (Job Role)	Date of Start	(Days) Duration	No. of Participant
1	KVK, Arwal	Agriculture Extension Service Provider	08.03.2021	10	30
2	KVK, Banka	Gardener	31.03.2021	10	30
3	KVK, Katihar	Bee Keeper	31.03.2021	10	30
4	KVK, Lakhisarai	Gardener	15.02.2021	10	28
5	KVK, Munger	Gardener	24.03.2021	10	30
6	KVK, Patna	Bee Keeper	23.03.2021	10	30
7	KVK, Purnea	Gardener	31.03.2021	10	30
8	KVK, Rohtas	Gardener	01.03.2021	10	30
9	DoEE, BAU, Sabour	Gardener	23.03.2021	14	30
10	BAC, Sabour	Gardener	31.03.2021	10	30
Total					**298**

5.5 Capacity building programme for KVK functionaries

The KVK functionaries need to upgrade their knowledge and skills to keep up with the ever-changing demands of the farmers. To improve the skills and knowledge of KVK functionaries, various programmes were organized during 2020-21, as mentioned in Table 5.5, which benefited 18 participants.

Table 5.5. Capacity building programmes conducted for KVK functionaries during 2019-20

Sl. No.	Topic	Participant	Duration	Days	No. of Participant	Sponsored
1	Management of KVKs farmers service providing unit-online and offline	Farm Manager /Programme Asst	19.02.2021 to 24.02.2021	6	18	DoEE, BAU, Sabour
Total					**18**	

5.6 Capacity building programmes sponsored by BAMETI/ATMA

Bihar Agriculture Management and Extension Training Institute (BAMETI) and Agriculture Technology Management Agency (ATMA) are the important agencies of the state involved in accelerating agriculture development through various programmes. During2020-21, a total of 34 skill development programmes under different domains were sponsored by these agencies, through which 1601participants were provided skill development training (Table 5.6.1, 5.6.2and5.6.3). BAMETI sponsored two programmes, and BAMETI sponsored 14 programmes on a virtual model. 18 programmes were sponsored by ATMA in different state districts, in which 549 participants were trained.

Table 5.6.1Training Programme for progressive farmer / Extension functioned sponsored by BAMETI

Sl. No.	Topic	Participant	Duration	Days	No. of Participant	Sponsored
1	Market LED Extension	ATM/BTM /Progressive Farmer	08.03.2021 to 10.03.2021	3	40	BAMETI
2	Adoption and implementation of recent existing technologies in agriculture and allied sectors	ATM/BTM /Progressive Farmer	15.03.2021 to 16.03.2021	2	162	BAMETI
Total				**5**	**202**	

Table 5.6.2. Virtual Mode Training Programme for Progressive farmer / Extension functioned sponsored by BAMETI

Sl. No.	Name of Training	Duration	Participant	Sponsored
1	Seed-cum-Soil Testing	09.06.2020 to 11.06.2020	30	DoEE
2	Scientific Cultivation of Pineapple & its Marketing	16.06.2020 to 20.06.2020	30	DKAC, Kishanganj
3	Scientific Cultivation of Fruits & its Marketing	23.06.2020 to 27.06.2020	30	NCOH, Noorsarai
4	Scientific Cultivation of Betelvine	25.06.2020 to 26.06.2020	40	Betelvine Research Station, Islampur, Nalanda
5	Scientific Cultivation of Tea & its Marketing	25.06.2020 to 29.06.2020	30	DKAC, Kishanganj
6	Scientific Cultivation of Betal Vine	09.07.2020 to 10.07.2020	30	Betelvine Research Station, Islampur, Nalanda
7	Recent advances in Plant Protection with special reference to Kharif Crops	13.07.2020 to 14.07.2020	30	DoEE
8	Production, Processing & storage of medicinal and Aromatic plants	20.07.2020 to 22.07.2020	40	Betelvine Research Station, Islampur, Nalanda
9	Training on Green Manuring for Sustainable Agriculture	24.08.2020	120	DoEE
10	Training on Straw management	04.09.2020 to 05.09.2020	60	DoEE
11	Training on ground water recharge	08.09.2020 to 09.09.2020	60	DoEE
12	Training on seed processing techniques and equipment	14.09.2020 to 15.09.2020	60	DoEE

	used in it			
13	Training on boiler and layer farming with emphasis on quality feed concentrate	21.09.2020 to 23.09.2020	250	DoEE
14	Training on Crop, vegetable, cultivation and dryland horticulture with life safety irrigation	28.09.2020 to 30.09.2020	40	DoEE
Total			**850**	

Table 5.6.3. Training Programme for progressive farmer / Extension functioned sponsored by ATMA

Sl. No.	Topic	Participant	Duration	Days	No. of Participant	Sponsored
1	Organic Vegetable Production	ATM/BTM /Progressive Farmer	04.01.2021 to 08.01.2021	5	40	ATMA,Samastipur
2	Mushroom Ki Kheti	ATM/BTM /Progressive Farmer	11.01.2021 to 15.01.2021	5	41	ATMA,Samastipur
3	Jal Jiwan or Hariyali	ATM/BTM /Progressive Farmer	18.01.2021 to 22.01.2021	5	40	ATMA, Samastipur
4	Mushroom Production Technique	ATM/BTM /Progressive Farmer	28.01.2021 to 30.01.2021	3	30	ATMA, Aurangabad
5	Organic Vegetable Production	ATM/BTM /Progressive Farmer	01.02.2021 to 03.02.2021	3	32	ATMA, Aurangabad
6	**l|uckxokuh ,oa j[kj[kko**	ATM/BTM /Progressive Farmer	04.02.2021 to 06.02.2021	3	33	ATMA, Aurangabad
7	tyok;qvuqdwyd`f'kdk;ZØe	ATM/BTM /Progressive Farmer	08.02.2021 to 12.02.2021	5	23	ATMA, Madhubani
8	Integrated Farming System	ATM/BTM /Progressive Farmer	08.02.2021 to 12.02.2021	5	22	ATMA, Madhubani
9	Mushroom Production	ATM/BTM /Progressive Farmer	17.02.2021 to 21.02.2021	5	22	ATMA, Madhubani
10	Organic Farming	ATM/BTM /Progressive Farmer	17.02.2021 to 21.02.2021	5	22	ATMA, Madhubani

11	Advance Technology of Vegetable Production	ATM/BTM /Progressive Farmer	22.02.2021 to 26.02.2021	5	23	ATMA, Madhubani
12	Integrated Farming System	ATM/BTM /Progressive Farmer	01.03.2021 to 04.03.2021	4	28	ATMA, Purnea
13	lCthmRiknu	ATM/BTM /Progressive Farmer	10.03.2021 to 13.03.2021	4	32	ATMA, Gaya
14	lCthmRiknu	ATM/BTM /Progressive Farmer	10.03.2021 to 13.03.2021	4	30	ATMA, Supaul
15	Integrated Farming System	ATM/BTM /Progressive Farmer	18.03.2021 to 21.03.2021	4	19	ATMA, Gaya
16	Integrated Farming System	ATM/BTM /Progressive Farmer	18.03.2021 to 21.03.2021	4	35	ATMA, Buxar
17	[kk| izlaLdj.krduhd	ATM/BTM /Progressive Farmer	23.03.2021 to 26.03.2021	4	41	ATMA, Rohtas
18	[kk| izlaLdj.krduhd	ATM/BTM /Progressive Farmer	23.03.2021 to 26.03.2021	4	36	ATMA, Begusarai
Total					549	

5.7 Certificate training program for Input dealers

Six programmes on the topic integrated nutrient management (INM) for agriculture input dealer were offered at BAU, Sabour during 2020-21 in which 62 particpants were trained.

Table 5.7. Details of a certificate training programme organized during 2020 – 21.

Sl. No.	Title of the Training programme	Place	Date	No. of participants
1.	15 Days certificate training Courses on INM for Fertilizer Dealers	SAC, BAC, Sabour	24.01.2021 to 07.02.2021	31
2.	15 Days certificate training Courses on INM for Fertilizer Dealers	SAC, BAC, Sabour	12.03.2021 to 26.02.2021	31
Total				62

5.8 Training programme for Extension Functionaries

Extension functionaries of the state government play a major role in the dissemination of agricultural technologies among the farming community. It is generally observed that majority of extension functionaries do not have adequate knowledge on evolving agricultural technologies. In this context, the KVKs play a major role in updating technical knowledge and skill upgradation of the extension functionaries. A total of 10527extension functionaries were trained in various domains like agronomy, horticulture, plant protection, etc. through 278 training courses. The participation details of the extension functionaries in different disciplines is mentioned in Table 5.8.

Table 5.8. Participation of extension functionaries in various discipline during the year 2020 – 21.

Discipline	No. of Courses	No. of Participants									Grand Total		
		Other			SC			ST					
		M	F	T	M	F	T	M	F	T	M	F	T
Agronomy(Crop Production)	58	1431	434	1865	319	110	429	19	10	29	1769	554	2323
Horticulture	44	825	662	1487	74	152	226	23	5	28	922	819	1741
Plant Protection	44	1143	211	1354	218	88	306	10	15	25	1371	314	1685
Agricultural Engineering	22	497	242	739	127	34	161	8	2	10	632	278	910
Home Science/ Women Empowerment	30	232	562	794	58	188	246	6	1	7	296	751	1047
Veterinary Science/ Livestock production	20	517	101	618	110	53	163	89	37	126	716	191	907
Soil Health/ Soil Science	13	316	34	350	49	5	54	14	14	28	379	53	432
Fishries	8	225	10	235	31	2	33	8	0	8	264	12	276
Extension education(Capacity building)	9	243	34	277	38	12	50	4	2	6	285	48	333
Plant breeding/ Seed production	5	39	54	93	1	12	13	0	0	0	40	66	106
Others	25	637	40	677	78	9	87	2	1	3	717	50	767
Total	**278**	**6105**	**2384**	**8489**	**1103**	**665**	**1768**	**183**	**87**	**270**	**7391**	**3136**	**10527**

5.9 Training programme for Practicing Farmers

The KVKs play a major role in updating technical knowledge and skill upgradation of the practicing farmers based on their need and interest. A total of 45696 practicing farmers were trained in various domains like agronomy, horticulture, plant protection, etc. through 1718 training courses. The participation details of the practicing farmers in different disciplines is mentioned in Table 5.9.

Table 5.9. Participation of practicing farmers in various discipline during the year 2020 – 21.

Discipline	No. of Courses	No. of Participants									Grand Total		
		Other			SC			ST					
		M	F	T	M	F	T	M	F	T	M	F	T
Agronomy(Crop Production)	434	7733	887	8620	1521	534	2055	246	152	398	9500	1573	11073
Horticulture	229	4215	704	4919	845	439	1284	44	36	80	5104	1179	6283
Plant Protection	196	3622	630	4252	749	352	1101	45	78	123	4416	1060	5476
Agricultural Engineering	162	3062	377	3439	485	131	616	27	26	53	3574	534	4108
Home Science/ Women Empowerment	184	1144	2112	3256	299	1018	1317	6	92	98	1449	3222	4671
Veterinary Science/ Livestock production	193	3091	653	3744	809	546	1355	170	100	270	4070	1299	5369
Soil Health/ Soil Science	126	2433	377	2810	302	185	487	133	119	252	2868	681	3549
Fishries	43	766	33	799	148	10	158	32	2	34	946	45	991
Extension education(Capacity building)	80	1043	342	1385	272	246	518	23	87	110	1338	675	2013
Plant breeding/ Seed production	18	353	56	409	23	16	39	0	0	0	376	72	448
Others	53	1182	218	1400	217	77	294	18	3	21	1417	298	1715
Total	**1718**	**28644**	**6389**	**35033**	**5670**	**3554**	**9224**	**744**	**695**	**1439**	**35058**	**10638**	**45696**

5.10 Training programme for Rural Youth

The KVKs play a major role in updating technical knowledge and skill upgradation of the rural youth based on their need and interest. A total of 14948 rural youth was trained in various domains like agronomy, horticulture, plant protection, etc. through 498 training courses. The participation details of the rural youth in different disciplines is mentioned in Table 5.10.

Table 5.10. Participation of rural youth in various discipline during the year 2020 – 21

Discipline	No. of Courses	No. of Participants									Grand Total		
		Other			SC			ST					
		M	F	T	M	F	T	M	F	T	M	F	T
Agronomy(Crop Production)	93	1925	426	2351	353	154	507	8	5	13	2286	585	2871
Horticulture	65	1420	220	1640	183	81	264	24	14	38	1627	315	1942
Plant Protection	79	1536	351	1887	406	267	673	21	8	29	1963	626	2589
Agricultural Engineering	39	595	95	690	161	46	207	17	9	26	773	150	923
Home Science/ Women Empowerment	60	679	756	1435	196	303	499	2	12	14	877	1071	1948
Veterinary Science/ Livestock production	74	1430	259	1689	285	90	375	118	42	160	1833	391	2224
Soil Health/ Soil Science	30	466	127	593	135	53	188	39	13	52	640	193	833
Fishries	27	599	72	671	102	16	118	8	0	8	709	88	797
Extension education(Capacity building)	28	409	93	502	126	71	197	37	12	49	572	176	748
Plant breeding/ Seed production	1	12	7	19	0	0	0	0	0	0	12	7	19
Others	2	38	2	40	11	0	11	3	0	3	52	2	54
Total	**498**	**9109**	**2408**	**11517**	**1958**	**1081**	**3039**	**277**	**115**	**392**	**11344**	**3604**	**14948**

DIRECTORATE OF SEED AND FARM

6. DIRECTORATE OF SEED AND FARMS

Directorate of Seed & Farms, BAU, Sabour

1. OVERVIEW

Seed is the carrier of new technology developed and at the same time it is the basic input of agricultural production on which the performance and efficacy of other input depends. Quality seeds of different varieties and hybrid suitable to different agro-climatic conditions in sufficient quantity, at appropriate time and at affordable price are basic factor for enhancing production and productivity. It is, therefore, imperative to place more emphasis for developing an efficient, effective and latest technology for quality seed production having involvement of farmers, which should be relatively low cost and affordable to the small and marginal farmers in the area under the jurisdiction of Bihar Agricultural University as well as state as a whole.

Seed Processing Plant, BAU, Sabour

Bihar is an agriculture-based economy. For sustainable increase in agriculture production and productivity in the state, it is necessary to develop new, improved varieties, efficient system of production and supply of quality seeds to farmers. The state is having lot of potential in order to enhance the production and productivity by increasing the availability of good quality seeds to the farmer consumer. Since, seed production and making availability of quality seeds is a multi tasking effort; hence Bihar Agricultural University, Sabour has taken tremendous effort, since its inception in August, 2010, to produce huge quantity of Nucleus, Breeder, Foundation and Certified seed of various agricultural and horticultural crops under the supervision of Directorate of Seed and Farms.

2. Network of the seed production or production of other material under the directorate

The production of quality seedof well adapted varieties/hybrids which belong toseveral field crops/ vegetables crops/ forage crops, planting material **(seedling)** of flowerand fruits, mushroom spawns and fish-fingerlings was carried out in the University farms as well as under Farmers' Participatory Seed Production programme. During the year 2020-21, the University had put impressive effort in production and distribution of various inputs like seed, sapling, seedling, mushroom spawn and fish-fingerlings.The sum total of **11740.52 quintal**quality seed of cereals, pulses,oilseedsand vegetable crops have been produced by different colleges(BAC, Sabour, MBAC, Saharsa, BPSAC, Purnea and DKAC, Kishanganj), RRS(Dhangai, Bikramganj, Islampur, Mokama, ARI, Patna, Tilloundha, Saharsa, Madhepura, Katihar, Araria, Jalalgarh) and 21KVKs(Araria, Arwal, Aurangabad, Banka, Amas Gaya, Manpur Gaya, Jahanabad, Katihar, Kishanganj, Khagaria Lakhisarai, Madhepura, Munger, Nalanda, Patna, Purnea, Rohtas, Sabour, Saharsa, Seikhpura, Supaul) under the University along with Farmers' Participatory Seed Production programme which was carried out by different centres.

3. List of input provided by the university during the year: The quality seed of different category (Nucleus, Breeder and Foundation) of seed, based on the requirement, was provided to different network production centre for the proper implementation of University Seed Production Programme during 2020-21. The University have produced the breeder seed of different varieties as per the indent received by Department of Agriculture, Cooperation and Farmers Welfare, MOA, GOI which had been lifted by the concerned agency to be utilised further in their seed multiplication programme.

4. Season and crop-wise seed productions data in tabular form are presented hereunder (Table 1-3).

Table 1: Seed Production Status: Rabi, 2019-20

(Production in quintals)

SN	Variety	Breeder Seed	Foundation Seed	Certified Seed	TFLSeed	Total
A	**Wheat**					
1.	S. Nirjal	108.61	340.53	131.00		582.32
2.	S. Samridhi	116.01	292.19	145.00		574.84
3.	S. Shrestha	95.52	338.90	182.90		637.32
4.	DBW 14	39.88		12.00	9.00	60.88
5.	DBW 187	80.86	96.27			192.58
6.	HD 2733	6.92	30.90			37.82
7.	HD 2967	45.87	466.70	267.80	3.90	784.27

8.	HD 2985	8.35		51.50		59.85
9.	HI 1563	45.67	44.20		11.20	101.07
10.	DBW 107	9.73	38.84			48.57
Total		**557.42**	**1648.53**	**790.20**	**24.10**	**3038.82**
B	**Lentil**					
1.	HUL-57	39.48	129.41	447.67		616.56
2.	IPL-316	8.00	11.00			19.00
3.	PAL 4717				3.45	3.45
Total		**47.48**	**140.41**	**447.67**	**3.45**	**639.01**
C	**Gram**					
1.	BRC-1	1.50				1.50
2.	GCP-105		84.34	76.12		160.46
3.	PG-186	3.00	103.97	565.72		672.69
4.	S. Chana-1				1.13	1.13
5.	RVG-202	8.11				8.11
6.	RVG-203	3.00				3.00
Total		**15.61**	**188.31**	**641.84**	**1.13**	**846.89**
D	**Pea**					
1	IPFD 12-2	18.86				18.86
2	IPFD 10-12	11.59				11.59
3	IPFD 6-3	3.90				3.90
4	Prakash				2.32	2.32
		34.35			**2.32**	**36.67**
E	**Lathyrus**					
1	Prateek				48.75	48.75
2	Ratan				21.00	21.00
					69.75	**69.75**
F	**Linseed**					
1	Ruchi			22.55		22.55
2	Sabour Tisi-1		6.90	13.86	2.40	23.16
3	Shubhra				2.89	2.89
			6.90	**36.41**	**5.29**	**48.60**
G	**Mustard**					
1.	R. Suflam			5.45	19.50	24.95
2.	RGN 48				24.30	24.30
3.	Uttra				1.00	1.00
Total				**5.45**	**44.80**	**50.25**
H	**Potato**					
1.	K. Khayati		105.00			105.00
			105.00			**105.00**
Grand Total (q)		**654.86**	**2089.15**	**1921.57**	**150.84**	**4834.99**

Table 2: Seed Production Status: Kharif, 2020 (Figures in qtl.)
(Production in quintals)

SN	Variety	Breeder Seed	Foundation Seed	Certified Seed	TFLSeed	Total
A	**Paddy**					
1.	S. Shree	208.7	1485.6	945.6		**2639.8**
2.	S. Ardhjal	128.8	225.2	342.6	13.7	**710.3**
3.	S. Surbhit	39.5	45.4		6.0	**90.9**
4.	S. Deep	50.3	38.5	29.5		**118.3**
5.	S. Harshit	45.3	93.4			**138.7**
6.	S. Sampann	25.2			25.2	**50.4**
7.	B. Katarni				28.1	**28.1**
8.	R. Sweta	40.5	855.3	1113.0	37.5	**2046.3**
9.	R. Mahsuri-1	60.5	285.6	273.0		**619.1**
10.	R. Kasturi	16.8	51.0	53.1	3.1	**123.8**
11.	R. Suwasini	13.8	26.5			**40.3**
12.	Sahbhagi				47.5	**47.5**
13.	Swarna Sub-1	11.9		133.1	21.6	**166.6**
14.	Sita	10.1				**10.1**
Total		**626.0**	**3106.5**	**2889.8**	**207.8**	**6830.1**
B	**Sesamum**					
1.	Krishna				7.7	**7.7**
C	**Soybean**					
1.	PANT 1241				0.4	**0.4**
D	**Arhar**					
1.	IPA-203	15.0	16.0			**31.0**
E	**Ragi**					
1.	A-404				1.8	**1.8**
2.	BBM-10				0.5	**0.5**
F	**Dhaincha**					
1	Local				3.0	**3.0**
G	**Moong**					
1	IPM 2-3	4.15				4.15
H	**Urd**					
1.	IPU-2-43	17.00				17.00
2.	PU-35	3.19				3.19
	Grand Total	**665.34**	**3122.5**	**2889.8**	**221.2**	**6898.84**

Table 3:Vegetable Seed Production: Summer, 2020; Kharif, 2020 and Rabi 2020-21

S.N.	Crops	Variety	Production (Kg)
Truthful label seed			
1.	Brinjal	Rajendra Baigan-2	2.975
2.		Pusa Hybrid 6	0.470

3.	Cauliflower	Sabour Agrim	24.360
4.	Cowpea	Kashi Kanchan	23.560
5.	Palak	Arka Anupma	13.120
6.	Tomato	KashiVishesh	2.385
7.	Okra	KashiKranti	31.77
8.	Garden pea	Azad Pea-3	208.50
		Punjab-89	101.00
9.	Radish	KashiShweta	8.825
10.	Turmeric	Rajendra Sonia	175.0
11.	Coriander	Pant Haritma	13.10
12.	Black cumin	Rajendra Shyama	10.00
13.	Bottle gourd	Rajendra Chamatkar	0.200
14.		Narendra Rashmi	18.70
15.		NDBGH-4	7.50
16.	Bitter gourd	Pusa do mousami	10.88
17.	Cucumber	Pusa Barkha	3.815
18.	Sponge gourd	Rajendra nenua-1	11.95
	Total		**668.11**
Breeder seed			
19.	Cauliflower	Sabour Agrim (B/S)	0.50
Total			**668.61**

5. Production and sales data on other inputs *viz.,* tissue culture, planting material etc.

During the year 2020-21, the total production and sale receipt of planting material, tissue culture banana, mushroom spawn and fingerlings was as per the details given table 4.

Table 4: Production of planting material, tissue culture banana, mushroom spawn and fingerlings

SN	Input	Quantity (in number)	Sale receipt (Rs.)
1.	Planting Material	1039361.00	14587932.00
2.	Tissue Culture Banana	405000.00	922740.00
3.	Mushroom Spawn	1204 kg	121920.00
4.	Fingerlings	230420.00	1020000.00
Total			**16652592.00**

6. New approaches/Modern tools/techniques employed in seed/plant propaguleproduction

Bihar Agricultural University, Sabour, Bhagalpur has been applying modern tools and techniques for productionanddistribution of seed/propagule belong to several varieties/hybrid of Agri-Horticultural crops. The newly established seed processing plant is well equipped with all modern facilities for processing of various seed category. The scientists and centres involved in seed/propagule production are well equipped with all the necessary infrastructures including a moisture-proof seed storage facility for storing nucleus/breeder seed stocks.

The University have established four new modern seed processing unit equipped with all modern facilities under two projects *viz.,*Enhancing Breeder Seed Production (EBSP, 1) and Pulse Seed Hubs (3). One seed processing unit, seed storage godown with transit-row storage have become functional at University Headquarters under EBSP with all modern facilities. Three small capacity independent seed processing unit with seed storage godown established at PRC, Mokama, KVK, Lakhisarai and KVK, Munger. The establishment of one more modern seed processing unit and storage godown is completed at BRU, Dhangai under Linseed Seed Hub project which will be functional in coming days.

Considering the demand of fruit trees in the state and to meet the requirement of State/ National Horticulture Mission, the University has developed infrastructures like shade net house, lath house and greenhouse to control the adverse environmental conditions for better plant growth and production of healthy saplings.

Banana is a major crop of Bihar and there is very high demand of quality planting materials in the state. To meet the high demand, it requireslarge production of banana planting materials.For this, the University established a tissue culture laboratory at BAU, headquarter and decided to operate under public-private partnership since 2019-20 with capacity of one million tissue cultured plantlets every year. The University has also started the production of tissue culture Pineapple and Bamboofor distribution to farmers. The nursery of fruit crops is well equipped with new technologies like green house and shade net for raising saplings during off seasons in order to meet the increasing demands. The nursery farm has been now well equipped with modern irrigation system like sprinkler.

7. Quality control steps taken by the Directorate

1. The University is committed to providingquality seeds/planting materials of well adapted variety/hybrid on time to farmers and other stakeholders.
2. Seed production, post-harvest operations, seed processing, up gradation and treatment of seed and other quality control procedure (from seed production to marketing) are supervised by the scientists working under different establishment.
3. Monitoring of breeder seed production is being carried out to ensure quality seed production as per norms prescribed under Seed act, 1966.
4. The germination, viability and vigour test of different seed lots are also being carried out in the seed testing laboratory of directorate/DSST with the help of standard procedure.
5. Scientists of department of Seed Science and Technology and breeders of various crop are also engaged to ensure quality seed production.

8. New Initiatives (if any) by the Directorate

In order to maintain seed quality of all seeds and planting material, university is establishing a seed testing laboratory for assuring, physical as well genetic purity of seed produced by the different units under university.

Based on present scenario of availability of quality seed or planting materials and demand in Bihar, undernoted initiatives are being undertaken by the University:

1. The directorate has put immense effort for seed production and distribution of a number varieties/hybrid belong different crops. The directorate is regularly received indent for breeder seed of newly notified variety in paddy, wheat, chickpea etc in both kharif and rabi season each year. The directorate have also received demand for breeder and foundation seed of wheat and paddy from Bihar Rajya Beej Nigam Limited (BRBN).

2. Till date54 (fifty four)seed dealers has been registered to enhancethe popularity and marketing of BAU produced seed and planting materials among farmers and other stakeholders.
3. A strategy has been formulated forpromotion of newly notified varieties from University, in which the stock seed available withconcerned breeder during notification year, 50 per cent of same will be utilized as Breeder Seed and remainingas Nucleus Seed to cut down one year gap in reaching quality seed at farmers door on time.
4. For the maintenance of the stock seed of University variety, financial support has been initiated for which both Directorate of Research and Directorate of Seed & Farms shall provideRs.10,000 per variety after recommendation from State Variety Release Committee (SVRC) and again Rs.10,000 per variety afternotification by Ministry of Agriculture Cooperation and Farmers Welfare, GOI.
5. The Capacity Building of Tribal Farmers related with seed production and certification under TSP Sub-Plan-ICAR Seed Project was organized. The training for human resource development was organized in collaboration with network centreson seed production, processing and storage of various crops for farmers and other stakeholders working seed sector.

9. A brief report of Important meetings/events/workshops/programmes etc. under the directorate

The Annual review meeting and QRT meeting of ICAR Seed Project was held under through virtual mode under Covid 19 protocol.

✓ Seed Production-cum-Cropping Programme meeting have organized every year during kharif and rabi season to thorough discuss and finalization of seed production target and acreageunder nucleus, breeder, foundation, certified and truthfully labelled seed (Fig. 1-2). This year this was organised through virtual mode under Covid 19 protocol.

Fig. 1-2: Hon'ble Vice Chancellor preside the Meeting on Seed Production Programme: Kharif 2020

2

✓ Breeder seed production carried out at the BAC farmwas monitored by Breeder Seed Monitoring Team of University during kharif, 2020(Fig.3-5).

3

Fig. 3-5: Visit of Breeder Seed Monitoring Team at Breeder Seed production plot

10. **Resource generation:** Details of total revenue generated during 2020-21 under different component is as given below.

(Rs. in lakh)

Component	**Total Receipt (Rs. in lakh)**
Seed sale	225.73
Planting Material	145.88
Tissue Culture Banana	9.23
Mushroom Spawn	1.22
Fingerlings	10.20
Total	**392.26**

UNIVERSITY
LIBRUARY

7. UNIVERSITY LIBRARY

The library was established in 1908 with the start of Agricultural Experiment Station and Agricultural School at Sabour. It continued with its basic activities of information resources development by collecting, processing, organizing, storage and retrieval of information; maintaining liaison with other related University libraries for resource sharing and exchange of information; providing need based current awareness, reference and bibliographic services and facilitating online access to wide range of information resources in print and electronic versions.Open access system is followed in the Library and the books are arranged as per Dewey Decimal Classification scheme and catalogued as per A.A.C.R.-II.

Some of the holdings (Books and Journals) are of the 17th, 18th and 19th centuries. Those are the rare documents of this University library. Library has acquired data bases like: AGRIS, AGRICOLA, CABSAC, HORT CD, CROP CD since 1973.

University Library Resource Development

During the Period 2020 – 2021, the following resources were added:

(I). Acquisition

Sl. No.	Particulars	Added during the year	Total collections
1.	**Books**		
	Books (General Section + Book Bank + SC/ST Book Bank)	296	40,404
	Theses	76	1,083
	Reports	87	1,268
	Gifted Books	37	513
	Total	**496**	**43,268**
2.	**Journals**		
	Foreign	14	
	Indian	58	
	Online Journals through CeRA	3,625	
	Online Journals of IndianJournals.com	85	
	Open Access Journals	490	
3.	**E-Resources**		
	CAB Abstracts	900 full text Journals	
	CABI e-Books Elsevier e-Books/Series	1,150 1,330	
	ASAP e-Books	112	
	Taylor & Francis e-Books	50	
	NIPAERS e-Books	135	
	KrishiKosh (Digital Repository)	Full Access	
	IndiaAgristat	Full Access	
	Turnitin Anti – Plagiarism Software	Full Access	
	Online Database of Agricultural &Horticultural Sciences	Full Access	
	CD-Rom Databases	Since 1973	

(II). Circulation of reading materials

1.	Books Issued	367
2.	Books Returned	814

(III). Library Visitors 1,315

Membership

All students, faculty members and employees of the University are member of the library.

Services

- **E-Access Service:** Online Access of Journals through CeRA, subscribed e-Journals, Online Access of IndianJournals.com, e-Resources of CAB Abstract, CABI e-Books, Elsevier e-Books / Series, ASAP e-Books, Taylor & Francis e-Books, NIPAERS e-Books, IndiaAgristat, e-Theses from Krishikosh, Turnitin Anti-Plagiarism Software, Online Database of Agricultural and Horticultural Sciences and open access journals are accessible in the University library.
- **CD-ROM Search Service:** University Library provides CD-ROM Database search facility. The following databases are available in the Library:
  - (i) AGRIS: 1975 - 2004
  - (ii) AGRICOLA: 1970 – 2004
  - (iii) CABSAC: 1973 – 1997
  - (iv) HORT CD: 1973 – 2010
  - (v) CROP CD: 1973 – 2005
- **Digital Service:** Digital service is available through scanning the documents in the library.
- **Reprography Service:** Photocopying Service is available to users.
- **Circulation Service:** Themembers are entitled for borrowing publications from the library as per the library rules and regulations.
- **Reference Service:** Reference service is provided in the library.
- **Book Bank Service:** In this scheme UG/PG students are given textbooks for the semester on rental basis at a very nominal cost and free of charge to SC/ST students.
- **Resource Sharing Service:** Resource sharing service is also available to other libraries.
- **Clipping Service:** Newspaper clippings service is available in the library.

Timing

The library hours are 07:00AM to 07:00PM in all working days, 09:30 AM to 01:30 PM on Sundays and remain closed on holidays.

Teaching Programme

Under P.G. Programme an introductory course of Library and Information Services has been introduced as Compulsory Course for Master's Programme in all disciplines and optional for Ph.D. scholars.

Modernization

The library has twenty five computer systems with internet facilities. We have acquired IP addresses and four Wi-Fi systems have been set up to online access of the e-resources. Modernization of University Library for setting up an e-library and digital library are available for the users.

E-Resources

The library has acquired online access of CAB Abstract with 900 full text journals, full access of 1,150 CABI e-Books, full access of 1,330 + Elsevier e-Books / Series, full access of 112 e-Books of ASAP, 50 e-Books of Taylor & Francis and 135 e-Books of NIPAERS. It has also online access of 3,625 full text journals through CeRA,access of 85 e-Journals of IndianJournals.com, online access of IndiaAgristat, 490 open access journals on Agricultural Science, access of Krishikosh, access of Turnitin Anti-Plagiarism Software and access of Online Database of Agricultural and Horticultural Sciences. All College Libraries of the University have also been given online access of all the e-resources.

During COVID-19 period, all the students and faculty members of the University have been provided online access of e-resources through remote access facility.

Automation and Digitization

Automation of University Library with RFID Systems and Technology has implemented. Digitization of library documents has been implemented and till date most of new arrivals have been entered in database. Web-OPAC of University Library and Digital Repository of BAU publications are available at BAU web site for end users. Our University has been included in Krishikosh for digital repository of BAU publications. For this, University had also been included in the NAIP Sub-project entitled: “Strengthening of Digital Library and Information Management under NARS (e-Granth)”.

Consortia

The University Library is a member of Consortium for e-Resources in Agriculture (CeRA) and Krishikosh. E-Journals of American Society of Agronomy, Annual Reviews, CSIRO, Elsevier, Oxford Journals, Springer Link, Taylor & Francis and Wiley are available through CeRA.

Looking Forward

New building of University Library with modern facilities will be built. E-resources and the subscription of Indian / Foreign Journals for University Library will be enhanced.

DIRECTORATE OF STUDENTS' WELFARE

8. DIRECTORATE OF STUDENTS' WELFARE

Establishment of the Directorate of Students' Welfare is a concept of Dr. Radha-Krishnen, Chairman, Education committee with a concept to work full- time upon the problems of students to plan their lines. It is concerned with hostel facility, assist the needy students in finding part-time work, if he requires financial aid, or recommends him for a scholarship or a loan if he is worthy. Directorate must be aware about the habits, health, morality or class-work of students and it should moves to assist him. It sees that he gets a fair opportunity to enjoy the social and recreational life. In short, the directorate is a place constantly on the alert to promote students-life, academic, social, moral and material and prepares to give advice on every subject.

The directorate provides ample scope, opportunities & facilities for the all round development of personality and leadership qualities of the students. Students should participate effectively in the management of hostel, food-services, games & sports, cultural and literary activities, professional societies for each college under the guidance of staff-counsellor. The students Welfare activities are divided into various activities related to professional societies, liberal education and Physical education.

Directorate of Students' Welfare was created in Bihar Agricultural University, Sabour to discharge the following important responsibilities in the University:

- To plan and promote the organization of students' extra-curricular activities e.g., sports, cultural, debating, and other recreational activities, National Cadet Corps (NCC) and other allied activities in the University,
- To monitor, supervise and co-ordinate the management of students' hostels, University / College cafeteria and arrangements of mess.
- To look after, all schemes relating to scholarship/ fellowship and stipend, part-time employment, free ships and such others financial assistance to deserving and/or needy students and travel facilities for the study tours of students.
- To monitor and promote discipline among students of the University.
- To plan and direct a programme of counselling and advisement to students; and
- To provide assistance in the placement of the graduates and students of the University.

On Account of CORONA PANDAMIC, during 2020-21, only the following achievements were made under the direction and management of this Directorate:-

8.1 Fellowships/stipend related activities

During the current year i.e. 2020-21, a total of 1645 students of different semesters (two semesters in a year) were given stipend/fellowships in the form of money amounting Rs. 494.29 Lakhs. Details of which are given in Table 8.1.

Table 8.1 Details of fellowships and stipend disbursed to the students of BAU, Sabour

Graduate Stipend (U.G.)			
2000/- per month + 6000/- Annum for Purchase of books (Rs. 30,000/ student/Year)			
S. No.	**Name of College**	**No. of Students**	**Total Amount (In Lakh Rupees)**
1.	BAC, Sabour	229	68.70
2.	BPSAC, Purnea	219	65.70
3.	VKSCOA, Dumraon	216	64.80
4.	MBAC, Agwanpur	203	60.90
5.	DKAC, Kisanganj	238	71.40
6.	NCOH, Noorsarai	95	28.50

BAU – Fellowship (P.G.)			
@ Rs. 2000/-per month (75% intake capacity of batch)			
S. No.	**College Name**	**No. of Students**	**Total Amount (In Lakh Rupees)**
1.	BAC, Sabour	110	26.40
BAU – Fellowship (Ph. D.)			
@ Rs. 3000/-per month (75% intake capacity of batch)			
1.	BAC, Sabour	72	25.92
N.T.S. (National Talent Scholarship)			
U.G. @ Rs. 3000/-per month			
S. No.	**College Name**	**No. of Students**	**Total Amount (In Lakh Rupees)**
1.	BAC, Sabour	4	1.17
2.	BPSAC, Purnea	12	4.32
3.	VKSCOA, Dumraon	8	2.64
4.	NCOH, Noorsarai	3	0.81
5.	MBAC, Agwampur	2	0.72
P.G. @ Rs. 5000/-per month			
1.	BAC, Sabour	25	9.60
RAWE Programme @ Rs. 3,000/- month (For 6 months)			
S. No.	College Name	No. of Students	Total Amount (In Lakh Rupees)
1.	BAC, Sabour	41	7.38
2.	BPSAC, Purnea	43	7.74
3.	VKSCOA, Dumraon	33	5.94
4.	MBAC, Agwanpur	19	3.42
5.	DKAC, Kisanganj	43	7.74
6.	NCOH, Noorsarai	19	3.42
J.R.F. - Junior Research Fellowship (P.G.)			
P.G. @ Rs. 12,640/-per month + 6,000/- year (contingency)			
S. No.	College Name	No. of Students	Total Amount (In Lakh Rupees)
1.	BAC, Sabour	6	7.97
Senior Research Fellowship (Ph. D.)			
Ph.D. @ Rs. 31,000/-per month + 10,000/- year (contingency)			
S. No.	College Name	No. of Students	Total Amount (In Lakh Rupees)
1.	BAC, Sabour	5	19.10
Total		**1645**	**494.29**

University and its constituent colleges observed various national and international events by maintaining the social distancing under COVID-19 guidelines**.** Some of the programmes were organized offline as well as through virtual mode for overall development of students during the academic session.

Table 8.2: Activities conducted during 2020-21

Sl. No	Date/Month	Observed Events/Regular Activities
1.	7th April, 2020	World Health Day
2.	14th April, 2020	129th Birth Anniversary of Dr. B.R. Ambedakar
3.	22 April, 2020	World Earth day
4.	01 May, 2020	World Labour Day
5.	31st May,2020	World No Tobacco Day
6.	1st June, 2020	Word Milk Day
7.	5th June, 2020	Word Environment Day plantation drive
8.	12 June ,2020	Child Labour Awareness Programme
9.	14th June, 2020	World Blood Donation Day
10.	16th June, 2020	10th Foundation Day of BPSAC, Purnea
11.	18th June, 2020	One Day Workshop under Makhana Development Scheme at BPSAC, Purnea
12.	21 June, 2020	Sixth International Yoga Day
13.	26 June, 2020	International Day against Drug Abuse
14.	13 August, 2020	Van Mahotsava Week plantation of tree in college campus in collaboration with Forest Department, Purnea, Bihar
15.	9th August, 2020	Bihar Prithvi Diwas/August Kranti Day
16.	12th August, 2020	Covid-19 Awareness programme on International Youth Day
17.	15th August, 2020	Independence Day
18.	5th Sept., 2020	Birth Aniversary of S.P. Radhakrishanan as Teachers Day
19.	9th Sept., 2020	Death Anniversary of Ex. C.M. Bihar Bhola Paswan Shastr iJi
20.	14th Sep., 2020	World Hindi Diwas
21.	21 Sept.2020	Birth Anniversary of Late Bhola Paswan ShastriJi Ex. C.M. of Bihar
22.	24Sept.2020	National Service Scheme (NSS) Day
23.	2nd Oct., 2020	151 Birth Anniversary of Mahatma Gandhi as Swachhta Diwas & Lal Bahadur Shastri (Swachhata Programme)
24.	16th Oct., 2020	World Food Day
25.	1st Dec., 2020	World AIDS Day (Rally for Awareness of HIV-AIDS) and drawing competition
26.	03 Dec., 2020	Agricultural Education Day as birth anniversary of Dr. Rajendra Prasad first President of India
27.	04 Dec., 2020	On the eve of World Soil Day quiz, drawing and debate competition

28.	5th Dec., 2020	World Soil Day
29.	07 Dec., 2020	Armed force Flag Day chaired by Mayor Smt. Sarita Devi
30.	10 Dec.,2020	Quiz Competition on World Human Right Day
31.	23 Dec.,2020	Farmers Day as Birth Anniversary of Ex. P.M. Chaudhary Charan Singh Jai Kisan Jai Vigyan Week
32.	25 Dec.,2020	Birth Anniversary of Ex. P.M. Atal Bihari Vajpayee
33.	29 Dec.,2020	Free Health Check-up Camp
34.	01 January,2021	New year Welcome Programme
35.	13 January,2021	Cashless Awareness Programme (VISAKA) for Account opening
36.	12 Jan.,2021	National youth Day (Birth anniversary of swami Vivekananda)
37.	13 Jan.,2021 12 to 19 Jan.,2021	National Youth Week
38.	15 January, 2021	Jal Jiwan Hariyali Awareness programme
39.	23 Jan.,2021	Des Prem Diwas as Birth Anniversary of Neta Ji Subash Chand Bosh
40.	25th Jan.,2021	National Voters Day
41.	26th Jan.,2021	Republic Day
42.	28 January,2021	Cashless Awareness Programme (VISAKA) for Account Opening
43.	30 January,2021	Sahid Diwas as death Aniversary of Mahatma Gandhi
44.	01 February, 2021	Mass Mask Distribution Programme in collaboration with Reliance Foundation Purnea
45.	12 February, 2021	Free Health Checkup camp COVID-19 Awareness Programme
46.	17 February, 2021	Welcome Agricose-Orientation Programme of Batch 2020-2021
47.	26 February, 2021	Orientation Programme of NSS Batch 2020-2021
48.	23 February, 2021	Cashless Awareness Programme (VISAKA) for Account Opening and Distribution of Welcome Kit
49.	04 March, 2021	Personality Development Programme of Students
50.	08 March, 2021	International Women's Day
51.	22 March, 2021	Jal Jiwan Hariyali Abhiya
52.	22 March, 2021	World Water Day & Bihar Diwas

MEETING AND WORKSHOPS

9. IMPORTANT MEETING AND WORKSHOPS

9.1 Review meeting with Hon'ble Agricultural Minister through Video Conference

On April 20th, the Hon'ble Minister of Agriculture and Veterinary, GoB - Dr Prem Kumar joins video conference with the Vice-Chancellors of Bihar Agricultural University, Sabour and Bihar Animal Science University, Patna. All the Senior Scientist and Head of different KVKs, under these universities, had attended this important meeting. The minister made discussion on the strategies to be implemented for scientific advisories in uplifting the farming issues under the conditions of coronavirus pandemic. He also made query about the seed availability in different KVKs in view of Kharif season plantation. A discussion took place on the strategies for having good production and productivity in the coming season. On the other hand, a discussion was also triggered on livestock, dairy and fisheries. He has given instruction to make them prepared for every possibility of Bird flu, Swine flu and fever. On this occasion, Prof(Dr.) Ajoy Kumar Singh, Hon'ble Vice Chancellor, Bihar Agricultural University, Sabour explained in details about the work done by the University for the benefit of farmers during the lockdown, viz. ensuring supply of Pulses (Moong and Urad), Oilseeds (Sesame, Sunflower),Jute Seed, plant sapling, animal care support. Hon'ble Vice Chancellor also told that University is taking special effort for skill development of labourers returned to home due to lockdown. Awareness drive on COVID-19 is done, through University Community Radio station and social media among the farming community. Hon'ble Minister reviewed the University for adopted strategies that are taken and preparedness in respect to management for diseases of livestock as well as the animal-borne diseases. Also, discussion on strategies was taken place to increase milk production by improving the breed in the state and to promote the breeding of indigenous battles. In the video conferencing meeting, apart from the H'ble Minister and Vice-Chancellors, Sri Vinod Singh Gunjiyal - Director, Animal and Fishery Resources, GoB; Dr RK Sohane - DEE, BAU Sabour; Dr Anjani Kumar - Director, ATARI Patna were present.

9.2 BAU Organised OFT Workshop for Bihar and Jharkhand KVK Scientists

Addressing the 4-day workshop of On-Farm Training, the Hon'ble Vice-Chancellor advised to focus on the development of teams that identify the local issues on the basis of farmers' problem and their need and income. Such teams (committees) will synthesise the research experiments and review the program whenever needed. He also made emphasis on the newly developed technologies that should be reached to the farmers so that their income can be increased. In the workshop, the Director Extension Education expressed his views that the KVK scientists should be available to the general peasants so that their maximum problems can be solved immediately. The panel of experts comprising with Dr HC Bhattacharya, former DEE of AAU, Assam; Dr Vishal Nath, Director of ICAR- NRC-Litchi, Muzzaffarpur; Dr JS Mishra, Principal Scientist, ICAR-RCER Patna; Dr DK Sahni, Soil Scientist, BAU, Ranchi; Dr Vikas Das, Principal Scientist, RCR, Plandu; Dr Amarendra Kumar, Principal Scientist, ICAR-ATARI, Patna has suggested the participating scientists of Bihar and Jharkhand for working on the recommended crops so that benefit to the local farmers can be maximised. The different KVK scientists showed their previous-year work and proposed the future actions that to be taken in the coming season(s). The scientists of BAU Sabour have suggested for promoting the research achievements to the farmers' fields. Dr RN Singh, ADEE of BAU stressed for reduction of the farmers' problem through scientific input. In the workshop, a total of 120 KVK scientists had participated.

9.3 Research Council Meeting Conducted at BAU Sabour

The 19thResearch Council Meeting (RCM) was organised during 16th and 17th of June at headquarter under the chairmanship of the Hon'ble Vice-Chancellor. In view of COVID-19 outbreak, limited participants were allowed to attend this very important meeting. Dr IS Solanki, Director Research, elaborated about all the current research works. He brought the notice that the University is having five Research Advisory Groups. Under the umbrella of these RAGs, 546 research projects are being operated. Among the external funders, DST, DBT, and BARC are from national origin, and IRRI, CIMMYT, IPNI etc are from international origin. Beside these, the consultancy projects are also operational in the university. Till the 18thRCM, the University has produced 22 varieties of different crops, and moreover, 42 technologies have been released for the benefit of famers. These varieties and technologies are proving their worth potentiality in upbringing the status of farmers. Additionally, the University registered four Geographical Indicators (GI) for different agricultural commodities originated from Bihar. Afterwards, the Principals and Zonal Director of Research showed the activities and progress came out from ZREAC (Zonal Research and Extension Advisory Committee) meetings in their respective zone. Principals of BAC Sabour and MBAC Agwanpur provided details about Zone IIIA and Zone II, respectively. Regional Director of Research delivered his presentation with the progress of the Zone IIIB. In the inaugural session, the Hon'ble Vice-Chancellor made focus his speech on climate change oriented research, and appraised the different research activities being operated in the University at its different units. Dr Sailabala Dei, Deputy Director of Research requested to the participant for following the guidelines of COVID-19.

9.4 University Conducts Extension Education Council Meeting

Dr Prem Kumar, Hon'ble Minister of Agriculture, Animal and Fisheries Resources, Govt. of Bihar inaugurated 18th Extension Education Council Meeting of the University on 11thJune. The Council Meeting was chaired by Prof (Dr) Ajoy Kumar Singh, Hon'ble Vice Chancellor of the University. Dr Prem Kumar, Hon'ble Minister of Agriculture and Animal Husbandry, Govt. of Bihar, in his inaugural speech told that climate change is one of the pressing challenges for agriculture and state is repeatedly facing the problem of recurrent flood and drought. Therefore, the Government of Bihar is implementing 'Climate Resilient Agriculture' scheme in the 38 districts of state. Presently, the Fall Army Worm in Maize, Panama Wilt in Banana and Potential Locust invasion danger are the big challenges to agriculture. He directed to all KVKs of the University to develop state of art demonstration units of horticulture crops, mushroom units, fishery, goatery, vegetable farming, organic farming, bee keeping, poultry etc. to inspire farmers to adopt modern technologies. Each KVK was directed to adopt IFS model. He also emphasized for formation and promotion of different Farmer Interest Groups (FIGs), Farmer Producer Organisations (FPOs) and other pro–farm groups for better market linkage of farm produces. Hon'bleMinister appreciated the University's ongoingKisanChaupal Programme, working on Bihar Krishi Map, climate resilient agricultural activities, working with the tribal farmers, activities accomplishment of Biotech KISAN Hub Project, ICDS activities and conducting online training programme for farmers. In Chairman Speech, Hon'ble Vice Chancellor was quite happy to say that first time in history, Agriculture Minister had inaugurated the Extension Education Council Meeting of the University. On his speech Prof (Dr) Ajoy Kumar Singh told that the University is implementing altogether 17 extension based flagship programmes. He told Biotech KISAN Hub Project received high appreciation in its review meeting by the Department of Biotechnology, Ministry of Science and Technology, Govt. of India. Government flagship programme, "CRAP" is running successfully. Laser Land leveller received huge attention from the farming community on its effective use. Farmers are quite happy with the voice advisory message delivered by the University. The University started online training programme for farmers during the COVID-19 pandemic. Welcome address was delivered by Dr RK Sohane, DEE BAU Sabour as he had highlighted the progress made by his Directorate, and it was highly appreciated by the Hon'bleMinister.

Dr Anjani Kumar, Director, ICAR–ATARI, Patna, requested all the KVKs to act on for engaging returned migrant labour in income generating activities through their capacity building. Dr Jitendra Kumar, Director–BAMETI told that there is a need to bring about convergence between ATMA and KVK of respective districts and there is also need to arrange regular visit at farmers' field. Dr PK Roul, Dean Extension Education, OUAT, Bhubaneswar,advised for creation of data base of returned migrant labour due to COVID–19 Pandemic and identify their skill and recognised their skill, and if require, a short term training may be imparted and certificate may be provided. All the Krishi VigyanKendras (KVKs) presented the progress report of their activities. It was decided that each KVK will speed up for creating University released technology cafeteria in their premises and give special emphasis for IFS and creating job opportunity for retuned migrant workers. Vote of thanks was delivered by Dr RN Singh, ADEE, BAU Sabour. In his speech Dr Singh expressed his sincere thanks and gratitude to the Hon'bleAgriculture Minister and Hon'ble Vice–Chancellor for their kind presence in the Council and guiding the directorate for working with farmers. He also lauded the activities accomplished by different KVKs.

9.5 International Web Conference on "Advances in Integrated Aquafarming for Sustainable Rural Development"

International Web Conference on Advances in Integrated Aquafarming for Sustainable Rural Development (AIASRD-2020) was organized during September 29th& 30th, 2020 at BPSAC Purnea. The lectures were delivered by Prof (Dr) AP Sharma, Former Director, ICAR-CIFRI, Barrackpore; Prof (Dr) BN Pandey, Former Dean-Faculty of Science, MU Bodh Gaya; Dr DRKanaujia, Formerly in Prawn Culture Unit, ICAR-CIFA, Bhubaneswar; Dr AK Pandey, formerly ICAR-NBFGR, Lucknow; Prof (Dr) PK Pandey, CAU, Tripura; Prof (Dr) Ram Kumar, CUSB, Gaya; Dr IS Singh, ICAR-RCM, Darbhanga; Dr Shailesh Saurabh, ICARCIFA, Bhubaneswar; Prof (Dr) Radha Choubey, BHU Varanasi; Dr Rajesh Kumar, ICAR-CIFA, Bhubaneswar; Prof (Dr) Binay Kumar Chakraborty, Dhaka University, Bangladesh; Prof (Dr) Dilip Kumar Jha; Dr Tek Bahadur Gurung, Ex-Executive Director, Nepal Council of Agricultural Research, Kathmandu, Nepal; Dr AK Singh, Faculty of Veterinary Sceince, Birsa Agricultural University, Ranchi; Prof (Dr) Mukesh Singh, Agriculture and Forestry University, Rampur, Chitwan, Nepal; Dr Anil Kumar, Makhana Research Project, BPSAC Purnea. In his conclusive remarks, Associate Dean-cum-Principal, BPSAC Purnea and convenor of this web conference presented in brief about research and development conducted by BPSAC Purnea. The Organizing Secretary namely, Dr Anil Kumar, & Dr TapanGorai, the Joint Organizing Secretary namely Dr PK Yadav and Dr Ravi Kesari, were actively associated with this webinar. The programme was hosted by Dr Ruby Saha and vote-of-thanks was extended to participants by Dr Ravi Kesari.

9.6 20thResearch Council Meeting (Rabi), 2020

Twentieth Research Council Meeting (RCM), Rabi 2020 was inaugurated on 16thOctober 2020 at Main Auditorium of the University under chairmanship of Prof (Dr) Ajoy Kumar Singh, Hon'ble Vice-Chancellor, BAU. Dr IS Solanki,Director Research formally welcomed the dignitaries and presented glimpses of university research activities. The University had five well-structured research advisory groups namely, Crop Improvement, Natural Resource Management, Crop Protection, Social Sciences and Product Development and Marketing. University had 206 research projects including state plan [171], Nationally funded (DST, DBT and Department of Atomic Energy) [16] and internationally funded projects (IRRI, CYMMYT, IPNI etc) [09] and other consultancy projects. The University had developed 22 crop varieties of various crops viz Rice (SabourSurvit, Ardhajal, Sabour Deep, Sabour Shri, Bhagalpur Katarni), Wheat (Sabour Shrestha, SabourNirhjal, SabourSamdhriri), Linseed (SabourTisi 1 and SabourTisi 2), Chana (Sabour Chana 1 and SabourChana 2), Cauliflower (SabourAgrim), Bael (Sabour Bael 1), Mango (Sabour mango 1) and Makahna (SabourMahana 1) and Brainjal (SabourSadabahar and SabourKrishnakali). Forty two technologies across various disciplines were also released by the University. The

institute also filed three patents entitled “A SUPERABSORBENT POLYMER (NSP) AND PROCESS FOR PREPARING THE SAME” “A MULTINUTRIENT NANOCLAY POLYMER COMPOSITE (MNCPC) AND PROCESS FOR SYNTHESIS OF THE SAME” “A PROCESS FOR FORMULATING PARTIALLY ACIDULATED NANOPHOSPHORUS FERTILIZER” to Controller General of Patents, Designs & Trade Marks, GoI. The University team was able to get Geographical Indication (GI) for Zardalu, Bhagalpur Katarni, Magahi Pan and Sahi Litchi which in long-run will help in increasing farmers’ income through commercialization of products.

9.7 19th Extension Education Council Meeting, 2020

The 19thExtension Education Council Meeting of Bihar Agricultural University was held in virtual mode on October 19th, 2020. The ECM was inaugurated and chaired by Prof (Dr) Ajoy Kumar Singh, Hon’ble Vice Chancellor of the University. The council started with the welcome address of Dr RK Sohane, DEE BAU Sabour. Dr Anjani Kumar, Director, ICAR–ATARI, Panta, Dr Ujjwal Kumar Director, ICAR-RCEP, Patna, Dr DP Tripathi, Joint Director Agriculture, Patna & Dr RK Jat, BISA Samastipur were Guest of Honour. Hon’ble Vice Chancellor appreciated all the KVKs for their stupendous performance carried out during the lockdown period, especially for implementing GaribKalyanRojgarYojana for returned migrant labours in different KVKs. He recognised the performance of the KVKs on CRA Programme implementation. He told that Gramin Krishi MausamSewa (GKMS) and Biotech KISAN Hub Project received special appreciation from the central level. He also told that KVKs did good job during the COVID-19 pandemic lockdown periods through the conduction of online training for the farmers, rural youth and farm women. Dr IS Solanki, Director Research of the University presented the technologies those released in the 20thRCM and requested DEE BAU Sabour for dissemination of these technologies among the farmers. Dr Anjani Kumar, Director ICAR-ATARI, Patna told that KVKs played important role during the lockdown period and performed well in GaribKalyanRojgarYojana for migrant labour. He asked all KVKs to concentrate more to Mandate activities. Dr Ujjwal Kumar Director, ICAR-RCEP, Patna told that multifaceted activities of KVKs are gradually increasing. Hence activities should be prioritizing for efficient manpower planning and KVK should give emphasis for revenue generation. Dr RK Jat, BISA Samastipur told that BISA is working well with BAU in CRA programme, University performed well during lockdown period and he advised KVK to become self sufficient through seed production and other items. All the KVKs and Colleges presented their progress report before the house. The council ended with the vote of thanks delivered by Dr RN Singh, ADEE, BAU Sabour.

FACULTY DEVELOPMENT

10. FACULTY DEVELOPMENT

Faculty development is a continuous process to update the faculty members on the recent development in teaching, research and extension to enhance the overall system efficiency. The faculty members of the university have been provided with opportunities to persue higher degree (Ph.D.) through transparent systems.

Table 10.1: List of faculty members selected for pursuing Ph.D. degree under Faculty Development Programme during 2020-21

Sl. No.	Name	Department	College
01	Mr. Mani Bhushan	Extension Education	BPSAC, Purnea
02	Mrs. Suman Kalyani	PBG	BPSAC, Purnea
03	Mrs. Anupama Kumari	Plant Pathology	BPSAC, Purnea
04	Er. Satish Kumar	Agril. Engg.	BAC, Sabour
05	Mrs. Anjana Arun	Plant Pathology	VKSCOA, Dumraon
06	Mr. Anupam Das	SSAC	BAC, Sabour
07	Er. Manish Kumar	Agril. Engg.	NCOH, Noorsarai
08	Er. Ashok Kumar	Agril. Engg.	BAC, Sabour
09	Mr. Pramod Prabhakar	Animal Husbandry	MBAC, Agwanpur
10	Mr. Jajati Mandal	SSAC	BAC, Sabour
11	Mr. Prem Prakash	FST	BAC, Sabour
12	Mr. Rajiv Padambhushan	SSAC	BAC, Sabour
13	Mr. Mukesh Kumar	Seed Tech.	BAC, Sabour
14	Mr. Anil Kumar	Entomology	JRS, Katihar
15	Mr. Shashi Kant Divakar	Extension Education	BAC, Sabour
16	Mr. Chandan Kishore	PBG	BAC, Sabour
17	Mr. Jai Prakash Prasad	PBG	BPSAC, Purnea

Due to covid pandemic situation, the faculty members of BAU, Sabour did not get the opportunity to participate in summer/ winter schools, short courses, seminar and symposia those usually occur at different SAUs/ ICAR institutes. However scientists have participated in various webinars/e-conferences through virtual mode.

AWARDS AND RECOGNITIONS

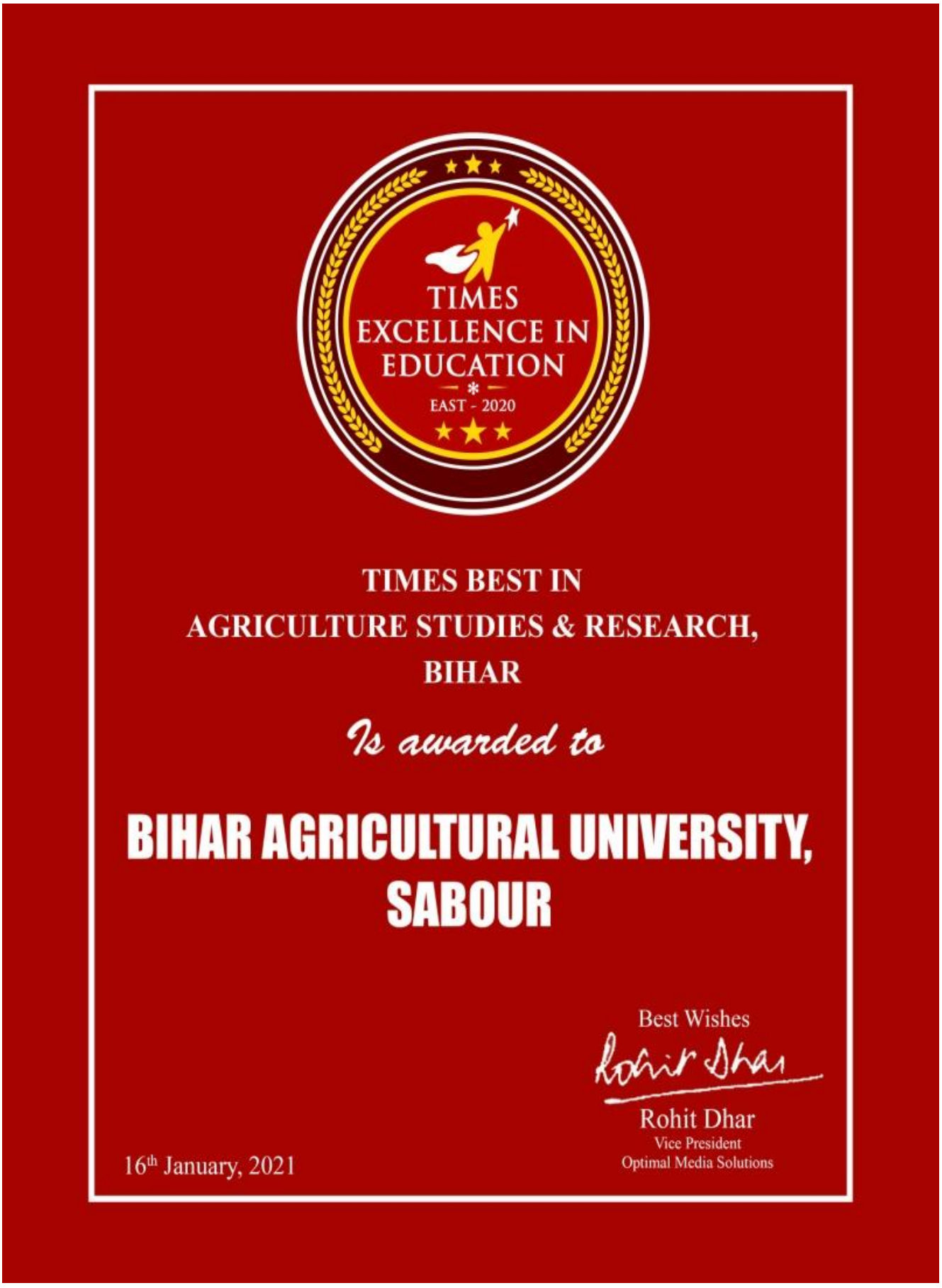
11. AWARDS AND RECOGNITIONS

The efforts of the university towards agricultural development in the state of Bihar through agricultural education, research and extension has been widely recognized by prestigious award and honor during 2020-21. Some of the major awards conferred to different constituent units of the university, progressive farmers and faculty members are summarized here under.

11. Award/recognitions conferred to the university during 2020-21

- University Awarded with SKOCH Silver Award for APNI KYARAI APNI THALI (AKAT)
- University Awarded with SKOCH Digital Gold for ICT-based Transfer of Technology and Capacity Building of Farmers, Farm women and Rural Youth
- Times Excellence in Education Award
- Agriculture Revolution Award 2021 by Agriculture Today Group
- Best Institute in Agriculture by Agriculture Innovation Congress Awards


SKOCH AWARD
HEALTH
SILVER
BIHAR AGRICULTURAL UNIVERSITY, SABOUR
FOR
APNI KYARI APNI THALI (AKAT): AN INNOVATIVE MODEL FOR NUTRITIONAL SECURITY OF RURAL WOMAN & CHILDREN
CONFERRED THIS HONEST INDEPENDENT HONOUR IN INDIA ON 28TH OCTOBER 2020 AT NEW DELHI
SKOCH GROUP
SAMEER KOCHHAR
CHAIRMAN, SKOCH GROUP
WWW.SKOCH.IN


TIMES
EXCELLENCE IN
EDUCATION
EAST - 2020
TIMES BEST IN
AGRICULTURE STUDIES & RESEARCH,
BIHAR
Is awarded to
BIHAR AGRICULTURAL UNIVERSITY,
SABOUR
Best Wishes
Rohit Dhar
Rohit Dhar
Vice President
Optimal Media Solutions
16th January, 2021

AGRICULTURE TODAY GROUP

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ALGAENERGY

AGRICULTURE REVOLUTION SEMINAR & AWARDS 2021

This Prestigious Award is Presented to

Krishi Vigyan Kendra, Rohtas, Dr RK Jalaj

for Excellence in the Category of

Leadership Role in Curbing Parali Burning

(Mamta Jain)
CEO & Group Editor, ATG

(Dr. MJ Khan)
President, ATG

AGRICULTURE INNOVATION
~ CONGRESS & AWARDS ~

BEST INSTITUTE IN AGRICULTURE

Presented to

BIHAR AGRICULTURAL UNIVERSITY

Bihar Agricultural University the only state agricultural university in Bihar is one of the youngest SAUs of the country. The universitywas established on 5th August 2010. The university is having five agricultural colleges, one horticulture college, 21 Krishi Vigyan Kendra and 12 research centresin the state. BAU provides leadership in conducting basic, strategic and need-based applied research In crop improvement, natural resource management, plant protection, product development, Socio-economic and overall economic welfare of the farmers in the Bihar state.

Presently, the university is having a total of 414 projects including 368 state plan projects, 18 AICRP and 28 externally funded projects. Within a span of nine years more than 20 crop varieties have been released. Presently, the university is scaling out climate smart technologies among the farmers through Climate Resilient Agriculture Programme (CRAP), Climate Smart Village and Sustainable and Resilient Farming System Intensification in Eastern Gangetic Plains.BAU has played the leadership role in agricultural education in India by imparting undergraduate teaching, post-graduate research, academic training and human resource development, which is recognized for quality and standards.

12th February, 2020 | Taj Lands End, Mumbai

Confered by

Dr. R. L. Bhatia
Founder, World CSR Day &
World Sustainability

Dr. Aalok Pandit
Executive Director
CMO Global

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INDIRA
DR. TARITA SHANKAR EXCELLENCE AWARDS

Endorsed by

WEBINARS AT BAU

12. WEBINARS AT BAU

The unprecedented lockdown due to Covid-19 has struck the traditional methods of classroom teaching as the pandemic forces schools and learning spaces to shut down completely. The proposed seminars, conferences, workshops etc. were also cancelled, which further exacerbate the learning process. These unprecedented situational has forced use to change the whole learning methodologies, which also includes a shift from traditional seminars to webinars. Bihar Agricultural University, Sabour has hosted series of interactive learning webinars on diverse topics to give momentum in learning process to different stake holders like students, research scholar, NOGs, Govt. officials and faculty members during this difficult situation. Several nationally and internationally renowned eminent scientists were participated and deliver plenary lectures in each webinar. At the end of each lecture, detailed discussions were made. The detailed lecture notes or power point presentation slides of plenary session were also shared to all participants via email. Participants were also encouraged to submit abstract. The abstract book for each webinar were made and published online. The proceedings of each webinar were also prepared and published. All the webinars were also broadcasted online through Facebook live and university YouTube channel. Details of each webinar are summarized in tabular form:

S. No	Topic of webinar with date	Date	Key Recommendation
1.	Arsenic mitigation: a nexus approach	29th May, 2020	❖ Arsenic pollution in majority of cases is geogenic in nature and over exploitation of ground water for drinking and irrigation has been implicated as a main cause of its pollution. Hence, now soil also has been a major sink as well source of As in polluted areas. ❖ Merely determining the total arsenic concentration is insufficient for accurate risk assessment so speciation of As in soil and plant is need of the hour. The use of different techniques for separation of arsenic species like ion-exchange, ICP-MS and by octapole collision reaction system and also by microwave-assisted extraction (MAE) is an option for extracting As species from soil. ❖ Optimum conjunctive use of ground water in the contaminated areas and to increase the use surface water (ponds, lakes, rivers etc.) and recharge of groundwater resources. ❖ Irrigation of crops should be done with pond-stored groundwater. ❖ Prefer low-water requiring farmer-attractive cropping sequences (especially for the lean period). ❖ Increased use of FYM, vermicompost, sugarcane bagasse and other manures + green manure crops, inclusion of pulses/other legumes as well as application of appropriate amendments Zn/Fe/Si salts as and where applicable). Efficiency Order: $FeSO_4$>$ZnSO_4$>$CaSiO_3$ irrespective of growth stages of crops. ❖ Identification/development of varieties /crops which accumulate less arsenic in the consumable parts & where ratio of inorganic to organic forms of arsenic is low. ❖ Cost-effective phyto- and bio-remediation options, identification of suitable microbes that can mitigate As in the agroecosystem.

2.	A decade of conservation agriculture in Eastern India – opportunities and challenges	4th June 2020	❖ Conservation Agriculture (CA) based technologies has been transforming agriculture in India, delivering productivity increase alongside environmental sustainability. ❖ CA based management practices can address a number of challenges including soil health, water scarcity, low farm profitability and changing climate. ❖ Besides increasing the food grain productivity it is also essential to ensure the nutritional security which could be possible through better farming and maintaining the soil health. ❖ There is need to synthesize the knowledge of conservation agriculture management strategies across ecologies for better defining the recommendation domains. ❖ Conservation agriculture is not a single management practice but provides a basket of options that needs to be tailored based on the farming scenario. There is also need for establishing long term CA research platforms for strengthening of the recommendations. ❖ Since the agriculture in South Asia especially in India is dominated by small farm holders commercial availability of scale appropriate machinery is critical factor for success of adoption of CA practice. ❖ There is also need to increase the farmer participatory approach through on-farm research cum demonstration to better identify the bottle necks in CA adoption in a broader scale. ❖ The changes in the soil bio-physical properties brought around through CA management needs to be quantified for different ecologies and there is also need for quantification of the competition for the crop residue used as soil cover and livestock fodder needs. ❖ Adoption of CA can be made effective through enhanced capacity building of all stake holders including farmers, service providers and policy makers. This could be also made possible through development of scalable business models and regular interaction and knowledge sharing with farmers.
3.	Locust Outbreak a wake-up call to the Indian Agriculture in changing climate scenario	15th June, 2020	❖ Locust is not a new pest but it is not studied well compared to other insects due to its rare occurrence. ❖ Collaboration of different ministries of Govt. of India is very much necessary as the locusts are international pests and need permissions from different ministries before taking up any work. ❖ The locusts are international pests and there should be co-ordination between adjoining states for better exchange of information ❖ The locust's studies are limited to only two or three institutes that needs to be widened as the locust problem is getting regular interval due to climate change ❖ Collaborative works with different institutes is the need of the hour and most of the post graduate students in many universities many be encouraged to conduct research on different aspects of locust and its management. ❖ Involvement of satellite data for effective sharing and control of the pests ❖ Use of drones can be maximised for the control of locusts

			❖ The nymphal stage is very easy to control rather than adults before attaining gregarious stage. ❖ There should proper identification of locusts as many people confuse with different types of grasshopper due to many resemblances.
4.	Return to root-possibilities and strategies for promotion of grassroots entrepreneurship	19th June 2020	❖ There is an urgent need for skill mapping and a road map for the growth of entrepreneurship can be planned accordingly. ❖ In addition to skill mapping, the knowledge mapping of grassroots people is also important for the development of entrepreneurship. ❖ The need to recognise local items, plants that could be marketed. There are several weeds that have medicinal value that could be used to grow value-added goods. ❖ There is also a need to develop a nutrient map of the soil and therefore fortified crops could be grown, which will help to achieve nutritional security. ❖ Innovation, Investment and Enterprise are the golden recipe for the growth of entrepreneurship. ❖ There are a number of local goods that need to be commercialized at grassroots level. This is a time to move 'land to lab to market'. Further focus needs to be put on the marketing skills of local entrepreneurs. ❖ Innovation is the secret to the growth of entrepreneurship. An effective eco-system needs to be built where local innovation could be created and promoted.
5.	Role of digital technologies in promotion of community based plant health management	26th June 2020	❖ Ensuring proper implementation of plant protection measures under small and marginal farmers is challenging task and need more emphasis at both research as well as administrative level ❖ Ensuring holistic plant health is very important in order enhance the farmers income and also to secure food and nutritional security ❖ There various entrepreneurial opportunities arising out of emerging ICT ecosystem which need to systematically exploited ❖ The machine learning and artificial intelligence has huge potential to transform the entire agricultural sector especially the way plant health is being monitored and managed. The thorough research need to conducted at an accelerated speed to deliver specific solutions ❖ The used of Drones especially need more emphasis in term of validating package of practices for various crops in light of drone based operations. ❖ Digitalization and Data management will be important challenges in agriculture sector considering the complexity of system. There is need to develop systems for digitalization and data management in areas of plant health management ❖ The field level application like *e-SAP* needs to customised for various geographies/regions ❖ In order promote climate smart and eco-friendly plant protection measures there is need explore digital tools extensively in various application like diagnosis, monitoring and management ❖ Community level pest management approaches like, Mating disruption, SIT etc, can be useful only if they are implemented at large scale with proper baseline data

			and real-time monitoring ❖ There is also need to have proper regulation of various mobile applications in the field agriculture in order to avoid misleading information loss to the farmers
6.	Managing Wetlands for Aquatic Crops: Opportunities and Challenges	29th June 2020	❖ Organized market for organic produce should be developed and subsidy on organic inputs should be apply. Focus should be on the Development of a robust supply chain management strategy for agriculture produce for their effective supply. ❖ Production per unit of water used can be increased by adopting makhana based cropping system. There is a need to work at micro level (at district and block level) for site specific estimation of soil health damages under wetland and also for management of resources. ❖ Water specific perennial plants should be included in waterlogged areas in integrated farming system by marginal farmers through Agroforestry to save environment, maintain sustainability and improve income from fallow and marginal bunds. There is an urgent need to save our natural resources. ❖ Makhana Crop residues are rich in various nutrients required for successive crop. Use of conservation agriculture and resource conservation technology is the need of the present day agriculture. ❖ Need of capacity building of women and youth in scientific methods of post-harvest practices and value addition of farm produce. The farmers should adopt makhana-cum-fish farming or makhana-cum-water chestnut farming, as this system of farming is remunerative for wetland area. There is a scope for research on some more intercropping system to get more from per unit of land area. ❖ Raised and sunken bed technique can be used in canal command area for the better management of wetland ecosystem
7.	Agricultural biotechnology for mitigating climate change	03rd July 2020	❖ Advanced biotechnological tools such as NGS in crop improvement programmes should be used. SNP chip may be used for identification of genes in pigeonpea improvement programme. ❖ Genome editing CRISPER tool may be used in developing climate resilient crops. ❖ Mutation breeding is an important potential tool towards development of biotic and abiotic resilient crops. ❖ Plant tissue culture, proteomics, genomics and bioinformatics play crucial role in accelerating crop improvement in the era of climate change.
8.	Opportunities of commercial exploitation of exotic fruits	04th July 2020	❖ The northern eastern belt of India is best suited for some of the exotic subtropical and temperate fruits and for few tropical fruits as well. ❖ Several exotic fruits with their specific varieties such as Rambutan, Longan, Plum, Peach, Thai apple, strawberry, Dragon fruits, Mangosteen, Avocado, Kiwi etc may be tried for the purpose. ❖ Number of participants attached from different fields of our country showing their interest towards such webinar proves their necessities to explore their knowledge. ❖ People are expecting such activities from the related organisations which provide an occasion for the scientists as well as students of the fields for adding their knowledge in such an interesting way without going outside.

9.	Good horticultural practices for quality production	10th July 2020	❖ The activities related to production, harvesting, post-harvest operations, packaging, transportation, and storage must be as per the norm of the country as well as exporting country for better price and consumer confidence. ❖ The waiting period of commercial used pesticide in horticultural crops must be in the knowledge of growers. ❖ Plant architecture and canopy management in fruit crops should be popularized among the farmer for quality produce and for enhancing income generation. ❖ "Enripe": an innovative product approved by FSSAI must be popularized among the local vendors for safe ripening of horticultural crops instead of carbide. ❖ The raw manure should be incorporated at least two week prior to planting or 120 days prior to harvest in the GAP system. ❖ The vertical farming with soilless hydroponics and aeroponics should be given priority for good horticultural produce. ❖ Under the Good Horticultural Practices (GHP), solarization is most impotent competent for better management of soil born disease. ❖ Promote low sugar grade potato under GHP for increasing farm income. ❖ Plot level traceability must be identify and marked on the boxes for better marketing in the country as well as outside of the country. ❖ ICT and wireless technology should be promoted to engaged younger generation in horticultural marketing ❖ Data bank of grower who are engaged in growing the horticultural commodities under GHP norm for smooth marking.
10.	Experimental Research in Social Science	13th July 2020	❖ There is an urgent need for exploring different statistical techniques in view of the agricultural field experiment. ❖ Multi Objective Programming is an useful tools in the experimental research in social science which needs to be elaborates among the social science researchers. ❖ Application of multiple criteria decision making (MCDM) approach in social sciences is another aspect in current research in social science which can be used in different areas. ❖ In addition to exploring different statistical tools different sources of knowledge bases are available which needs to be explore in a planned and systematic ways among the researchers especially in the Agricultural research system. ❖ Possibilities of Experimental Research in Extension Education need to be explored among the extension scientists.
11.	Challenges and recent initiatives on sustainable management on fall armyworm	16th July 2020	❖ For management of Fall armyworm (FAW), an app developed by FAO against FAW i.e. FAMEWS, which will be quite helpful to know the incidence pattern of Fall armyworm (FAW) and also helps to generate MAP. ❖ Ecological management options against FAW are as follows: • Tillage operation: Zero tillage operation is unfavourable for FAW • Deep Ploughing • Mulching: Minimum tillage operation especially when associated with surface mulch reduce FAW incidence

			• Intercropping: Intercropping of maize with pulse based crops like pigeon pea/ black gram minimize the FAW infestation. • Trap cropping: Napier can be used as a trap crop with maize against FAW. 3-4 rows of trap crops around maize field helps to minimize the infestation of FAW. ❖ Varietal selection: cultivation of maize hybrids with tight husk cover may reduce the ear damage by FAW. ❖ Regarding management through bio-control agent like parasitoid is concern, augmentative release of *Trichogramma pretiosum* or *Teleonomus remus* in the early crop growth stage @ 50,000 per acre is highly effective against FAW. Among the entomopathogens, *Metarrahizium anisopliae* @ 5 g/l, *Nomuraea rileyi* @ 3g/l and *Bacillus thuringiensis* var Khurstaki @ 2 g/l shows promising results against FAW. Bio-pesticides are highly effective at early whorl stage (15-25 DAS). ❖ A total of eight commonly used insecticides were used against FAW and those are Spinetoram, Spinosad, Chlorantraniliprole, Lambda cyhalothrin, Emamectin benzoate, Thiodicarb, *Bacillus thruringiensis*, Azadirachtin, Broflanilide and Fluxametamide. Last two chemical insecticides are under registration. Two combination products including Lufenuron + emamectin benzoate and Novaleuron + emamectin benzoate are also performed well against FAW.
12.	Recent trends in processing technologies for food quality and safety	20th July 2020	❖ There are huge postharvest losses (>30%) in crops in developing and underdeveloped world resulting in huge monitory loss. ❖ Research and development for reduction of postharvest loss in agri-horticultural crops should be strengthened. ❖ To ensure product safety and quality eco-friendly postharvest treatment must be standardised in which edible coating could be an efficient option. ❖ Considering health and environment, different physical treatments such as cold plasma and pulsed electric fields should be standardised and promoted. ❖ In the post COVID era, food processing industries should ensure sanitization of equipment, building, and workers to ensure safety and quality of products.
13.	Innovative Pedagogy and Effect Teaching Strategies and Carrier Opportunities in Present Scenario	22nd July 2020	❖ E-material prepared by ICAR and available for agricultural subjects should be exploited to its fullest. Students, researchers can use sodh-ganga, e-granth for their knowledge improvement and search for new research vistas. ❖ There is an urgent need of the virtual lab for each subject in order to strengthen practical aspects. ❖ Training for teachers are required to make the lectures more interesting and interactive so that students can perceive the lectures without classroom interaction. ❖ Maintaining regular routine for yoga, exercise and all other day to day activities including attending classes, study time is the first and foremost aspect during the COVID situation. ❖ Teacher can see an opportunity during pandemic with present education system by preparing e-materials for different courses. There are many government portals where one can use the opportunity by preparing new e-material in the form of

			audio as well as videos. ❖ For enhancing the career opportunities of Agri. Students a linkage must be created among organisations and the Universities.
14.	Stored product production in Era of Climate Change	23rd - 24th July 2020	❖ The research on rapid detection techniques of stored grain insect pests as well as mycotoxin in stored commodity and low cost storage structure should be made for farmers of Bihar. ❖ Research on Eco-friendly approaches for management of stored grain insect pests should be carried on. ❖ Implementation of Information and Communication Technology, Nanotechnology, Artificial Indulgency, preparation of resource map for stored product research. ❖ The coordinated research on postharvest management of cut flowers and also suggest the selling of cut flowers will play in doubling the farmer's income. ❖ Postharvest loses should be minimized for increasing farmers' incomes. ❖ Low cost techniques for enhancement of shelf life of horticultural produces should be practiced. ❖ X-ray and NIR methods for commercial scale detection of stored grain insect pests should be utilized. ❖ Formulation of nano emulsion and nano pesticides should be used for combat the problem of stored grain insects' pests. Behavioural management of insect pests is also important. ❖ Locally available materials for packaging and transportation of stored commodity. Low cost packaging techniques should be employed at farmer's level.
15.	Impact of Physio-biochemical research of Indian agriculture	28th July 2020	❖ Critical understanding of the basic and fundamental plants life using modern approaches like soil less culture, aeroponics, hydroponics, phytoronics and phenotyping techniques should be incorporated to make crop varieties more productive, resilient against a wide range of stresses and to solve the constraints of decreasing land for cultivation. ❖ High throughput phenotyping of plants involves high throughput, non-destructing, genomics, phenomics big data by using different image based sensor and computer vision phenotyping must be utlized. ❖ Understanding the physiology of pathogenesis and signalling mechanism especially those of quorum sensing among the bacterial pathogens and silencing these signalling among pathogens may stop their spread at root level. Understanding the pathogenicity determinants of *Rhizoctonia* is another approach for controlling the disease. ❖ Phytochemical substances from plant sources when used as biopesticides or insecticides save us from most of the tragic issues raised with conventional agriculture and thus are best suited for sustainable agriculture. ❖ Adoption of Hi-Tech agriculture including Hi-throughput phenotyping, phytotronics, underground cultivation, vertical cultivation, light based modification of crop production and soilless cultivation has immense importance and business opportunity in agriculture. ❖ Phytotronics support agriculture in improving productivity of cereals, pulses,

			oilseeds and horticultural crops through better understanding and thus must be employed in agriculture.
16.	Breeding of Oilseeds: A challenge for Self-Sufficiency	29th July 2020	❖ Increasing oilseed production through incorporation of high yielding varieties. ❖ Public awareness regarding daily recommended consumption in order to reduce over consumption ❖ Emphasis on oilseed crops, following proper package of practices, providing sufficient nutrition and irrigation, correcting deficiencies etc ❖ Government initiative to confirm food security in oilseeds through subsidies
17.	Plant Biological interventions for climate smart agriculture	30th July 2020	❖ Conservation agriculture based sustainable intensification of cropping systems can help reduced cost, increased incomes and make agriculture more sustainable for small farmers and the environment. ❖ Drought related problems of rice crop can be met by strengthening root phenotyping systems determining different stage drought. Roots show more dynamic responses in terms of osmotic gene expression responses that can be further explored using advanced molecular technology. ❖ A multidisciplinary approach is the only possible way to developed climate resilient crop and can only give world's food security. ❖ For weed management herbicides are not only option but optimizing crop efficiencies and intensification of crop system has potentials to mitigate changes in climate. ❖ Advancement in the physiological research has marked to increased crop potential and development of changing climate resilient crop through photosynthetic enhancement under raising CO_2 and temperature. ❖ Pulse breeding imperatives could be enhanced with more advanced interaction of traits defining components of environment and combining multiple stress research based on changing climate. ❖ The emergence of next-generation sequencing based high-throughput genotyping approaches have sufficient marker density and can be used successfully in crops for accelerating genomics-assisted breeding programs. ❖ Artificial intelligence (AI) is a novel and rapid methods for the timely detection of pests and diseases can/will guide surveillance strategies and have control measures applied in a more targeted and timely manner. Tumaini AI-powered app can help farmers in early identification of pest and diseases and their management.
18.	Maize Improvement for Stress Tolerance & Bio Fortification in Climate Smart	4th August 2020	❖ Promoting maize as a more impactful crop for mitigating the impact of climate change & meeting the demand of food, feed & livelihood security. ❖ Adoption of single cross hybrid technology in diverse types of maize (Sweet corn, Babycorn, Pop corn,QPM) is helpful in releasing stresses due to climate change ❖ Enhancing emphasis on biofortification, value addition of crop & promotion of nutritionally enriched maize varieties ❖ Creation of greater awareness about quality protein maize (QPM), high kernel Zn, iron and provitamin A-enriched maize hybrids

	Agriculture		❖ Stimulation of demand for nutritionally enriched maize products
19.	Ensuring Food safety, security and sustainability through crop protection	05th - 06th August 2020	❖ Push-Pull is just the kind of technology necessary to support the 'green revolution' that Africa needs because it increases productivity without requiring extra resources for hybrid seeds, crop protection and soil improvement. ❖ New discoveries relating to control of aflatoxin, fall army worm, soil health improvement, climate change mitigation, and drought resilience represent greater opportunities for further enhancing the effectiveness of the Push-Pull technology, extending its appeal to a wider range of farmer profiles in different agro-ecologies throughout Africa and beyond. ❖ Integration of vegetables and other high value crops to intensify push-pull farming system will make it highly attractive to youth. Increasing on-farm agricultural productivity, job creation and income generation will mitigate youth migration to cities and out of Africa. ❖ Integrated Pest Management: Judicious integration of appropriate technologies without any bias. Biotech crops are compatible with all other technologies. So, it can be a major component of IPM. ❖ Plant microbiome could be manipulated with probiotics to create crops that require less fertilizer and pesticides. Plants and their microbial symbionts need to be co-propagated as life-long partners in future strategies for plant breeding. Bottom–up approach to co-propagate the co-evolved, the plant along with the target microbiome. ❖ Nanoparticles and nanoscale processes need to be explored in developing improved formulations and delivery of pesticides.
20.	Biotechnological Interventions for Improvement of Pulse Crops	07th August 2020	❖ Lathyrus improvement programme should be started as it has vast potential to occupy rice fallow of Bihar. ❖ Genetic base of pulse crops should be enhanced and use of advanced technology like gene editing and speed breeding in pulse crop improvement programme should be implemented. ❖ There is need to reset the research priorities and strategies for the improvement of the pulse crops. Designing systemic research was emphasized for checking feasibility of short and medium duration pigeonpea varieties and hybrids in Bihar as farmers are losing interest in cultivation of long duration pigeonpea. ❖ Wild species of chickpea for mining of genes for drought tolerance should be explored. ❖ Molecular markers and genomics tools for the improvement of chickpea should be used in the breeding programmes for enhancing the pace of pulse crop improvement. ❖ Genetic gain in pigeonpea should be enhanced. Short and medium duration hybrid pigeonpea should be developed. ❖ Transgenic approach of Helicoverpa resistance in pigeonpea may be approached using wild relatives of pigeonpea for exploring genes for tolerance to pod borer.

21.	Advances in genomics tools for rice breeding	12th August 2020	❖ Wild germplasm must be exploited to assess novel QTLs for stress tolerance and yield. ❖ SNPs should be utilised in preparation of a high-density linkage maps, diagnosis of predisposition of genetic diseases in animals, diversity analysis and fingerprinting of genotypes, evolutionary studies, association studies and markers assisted selection. ❖ Emphasis should be given on understanding the issues properly and then designing the breeding strategy. ❖ Use of chemical fertilisers and pesticides induce stress on the plant rhizosphere and influence the important site for biological interactions. Over expression of 2-AP pathways genes by genetic engineering can be targeted to enhance the 2-AP content in aromatic rice. ❖ Genome editing has unprecedented ability to generate targeted and specific mutant every locus. These simple, versatile and efficient tools must be incorporated to accelerator of rice improvement programme. ❖ Whole genome re-sequencing of elite rice varieties and landraces is highly required to decipher the haplotype diversity, phenotyping of elite lines/landraces at targeted phenotypic environment which will benefit to find out the stable and consistent haplotype, haplotype based backcross breeding can be used for transferring superior halpotype
22.	Recent Advancement in soil microbiological research with a special thrust to biofertilizer technology	25th August 2020	❖ There are tremendous opportunities to extend biofertilizer usage more vigorously to stressed ecosystems, particularly into rainfed agriculture which occupies more than 50% of India's cultivated area; horticulture particularly vegetable crops. ❖ Policy initiatives like promotion of organic farming in niche areas, general desire for a gradual reduction of chemical fertilizer usage, support through various government schemes for manufacture of biofertilizers as well as supply to famers, have contributed to a steady rise in demand. ❖ The weakest link in expanding biofertilizer usage is in making the preparations available at the farmers' door-step or nearest seed and fertilizer outlets and there is thus a great scope to innovate market chains including on-line delivery of quality inoculants to create brand equity. ❖ Composting is a microbiological, non-polluting and safe method to recycle agricultural wastes to manure and its application enhance the soil health, biodiversity and improve carbon storage in a long-run. ❖ In-situ decomposition of crop residue by employing ligno-cellulolytic microbial consortia are eco-friendly options for alternative to crop residue/stubble burning. ❖ The in-situ decomposition of rice and wheat residue could be achieved within 30 days and for sugarcane trash within a period of 45 days. ❖ A novel formulation comprising two promising lignocellulolytic fungi namely *Coprinopsis cinerea* and *Cyathusster coreus* has also been developed for accelerated in situ degradation of paddy straw with additional promise in improving soil health. ❖ Novel bioformulations of phosphorus and potassium using low-grade P and K-

			bearing mineral along with phosphate and potassium solubilizing microorganisms could be used as alternate fertilizers for sustainable crop production and soil health when India is relying wholly on imports to meet the P and K demand of the crops. ❖ Phytoremediation approach is a gentle and green cure technology and is a slow process. Therefore, development of new hyper accumulating plant genotypes by biotechnological approaches along with efficient agronomic management practices can make the process faster and efficient.
23.	Women in Science & their role in Sculpting modern Agriculture	26th August 2020	❖ Role of women in modern society will be excel when expand investment in Women's Education with goal to achieve parity with men ❖ Reward women's achievements outside of marriage and children and encourage married women to work by developing high quality child care programs ❖ Recognizing and addressing to social inequalities is necessary to design technologies and interventions that are both socially and technically robust ❖ Gender responsive budgeting, process of entailing a gender-based assessment of budgets, incorporating a gender perspective at all levels of budgetary process and through partnering in value chain will promote gender equity in agriculture. ❖ Exclusive components of the student READY programme such as experitial learning (business mode), hands on training (skill development), rawe, internships, student projects etc are interactive and conceptualized for building skills in project development, decision making, problem solving etc. ❖ Agriculture has an exceptionally high impact in terms of its potential to reduce poverty in low income developing countries but this growth in agriculture could only come from effective reduction in gender disparities. ❖ Therefore, making public administration more gender-responsive, increasing the participation of women in local councils and promoting women in community-based organization will be the reasons behind modernization of society with gender equality
24.	Mushroom Production: An Emerging Avenue for Rural Youth & Self Employment	26th August 2020	❖ Lack of availability of quality spawn among the mushroom growers, thus, there is an urgent need to develop extensive and effective technology to ensure the production of high quality mushroom spawn. ❖ Development of better packaging material for fresh mushroom fruit for long term storage and distant marketing of mushroom. ❖ Mushroom market is not very well developed as not many Indians consume mushroom. The available market is limited to big supermarkets and hotels who demand high standards of hygiene and strict on delivery of ordered volumes on time. A Marketing Intelligence System (MIS) needs to be developed. The MIS should be preceded by a study linked with their feasibility and possibilities for implementation. ❖ Scientists may be advised to organize a scientists-farmer's interaction meeting at farmer's mushroom growing sites to explore the difficulties faced by them subsequently scientists would provide the possible feasible and cheap scientific remedial measures to the farmers to overcome on their problems.

			❖ Extensive governmental support in the mushroom sector is little attention; therefore, the government may be informed to take necessary steps to strengthen the scientific cultivation of mushroom and marketing channel. ❖ Effective and cheap techniques of mushroom processing and value addition are not much more available. Thus, there is an urgent need to design and develop a low cost mechanical processor which could be easily operated. ❖ Formulation of policies and extension services are not up to the mark, therefore, i must be strengthened. ❖ Improvement of tools available to the breeder, decoding mushroom fungus genome and commercial pressure facing the industry can propel efforts for new strain development in the future. ❖ Strengthening and establishment of storage facilities and promotional activities of mushroom in new areas should be explored. ❖ Need to be develop mushroom based industry, creates a scope to export mushroom products, thus it can generate employment opportunity for unemployed.
25.	Sustainable pest management of organic Banana: Need of climate Smart Agriculture	31st August 2020	❖ **For management of Banana corm weevil, *Cosmopolites sordidus*** ✚ Monitor the weevil activity in a garden by keeping longitudinal split banana pseudostem traps @ 10-15/acre. Once weevil is attracted to the laid traps, keep the longitudinal split banana traps @100/ha with biocontrol agents like, *Beauveria bassiana* (10g per trap) the biocontrol agent can be smeared on the stem traps and keep the cut surfaces facing the ground. ✚ Install pheromone trap, Cosmolure @ 5 traps/ha. the trapped weevils remain there they will die. Change the position of traps once in a month. ❖ **For management of Banana stem weevil, *Odoiporus longicollis*** ✚ After the harvest of banana bunch cut the tree at base and treat it with 100 ml of *Beauveria bassiana* (3ml/litre) ✚ Monitor banana weevil activity in a garden by banana stem traps i). Longitudinal split trap (30 cm) ii). Disc-on –stump trap at the rate of 100 traps/ha. The attracted weevils to be collected daily and killed. ❖ **For management of Banana fruit scarring beetle**, *Nodostoma viridepenne* Jac ✚ Tie bunch sleeve at the time of shooting. The bunch sleeve made out of 100 gauge thickness polythene having 6 % ventilation. ❖ **For management of Banana aphid (*Pentalonia nigronervos*a Coq.)** ✚ The virus-affected plant should be rouged out. Ratoon and inter crops should not be taken up Collect planting material from healthy plants. ✚ To control aphids spray Neemazal (2.5ml per litre) or or entomopathogenic fungus, *Verticillium lecanii* (2 ml/litre).
26.	Biodiversity in vegetable crops for healthier life	27-28 August 2020	❖ Vegetable biodiversity helps ensure not only a stable and sustainable supply of sufficient quantities of food, energy and protein but also plays a major role in ensuring its quality. ❖ Underutilized horticultural crops could come up as potential crops for improving

	& livelihood		nutrition and food security having high medicinal values as well as playing significant role in diversification leading to farm income as well as of aesthetic value. ❖ Accentuating urban and peri-urban horticulture through home gardening, roof top gardening, organic production, protected and hydroponic production. ❖ Following good agricultural practices (GAPs) to improve vegetable produce quality and safety. ❖ Opening the avenue of horticultural tourism which could create opportunities for the farmers in India and provide revenues for horticultural products and environmental preservation. ❖ Developing a habit of eating organic vegetables through grow your own vegetables to have vegetables free from pesticides and fertilizers residue as well as conserve local indigenous vegetable biodiversity. ❖ Characterization and documentation of Indian chillies were utmost important for breeding point of view. Besides, utilization of wild relatives (embryo rescue or development of bridge crosses) and marker assisted breeding approach for evolving of high yielding, location/ region specific, consumers preference based, insects and disease resistant varieties/ genotypes for Indian as well as global markets was also necessary. ❖ Vegetable research in public-private partnership was necessary to cope up with the different challenges faced by the farming community. ❖ Conservation of farmers' variety was necessary which could serve as a vital resource for global food security. Besides, wild relatives should be used as donor source for quality and biotic stress resistance. Utilization of mutant genes particularly for quality of vegetables is also an important strategy. ❖ Multiple disease resistant varieties and hybrids would be the key players for tomato. ❖ Emphasis on bio-fortification of vegetable crops was the need of the day. Moreover, diverse vegetables in proper quantities included in diet could serve as functional food and help improve human immunity.
27.	Cultivation of Medicinal and Aromatic Plants (MAPs): An Innovative Effort towards Sustainable Development	01st September 2020	❖ Policy documentation should be promoted in wide range areas for MAPs production. ❖ Extension functionaries must play an active role. ❖ Exploring the role of different MAPs such as Cinnamon, clove, lemongrass, oregano, thyme, nutmeg, basil, etc. and plants-derived commercially available bioactive compounds used in agri-food industries, pharmacy etc., among the growers in wide range. ❖ Encouraging the MAP growers to adopt a holistic approach to manage the rich heritage of medicinal and aromatic plant wealth. ❖ Promoting the agri-business opportunities through cultivation and processing of medicinal and aromatic plants in the country for boosting the farmer's income. ❖ Strengthening and development of storage facility of MAPs and their products. ❖ Lastly, looking in to different acts of biopiracy exploiting indigenous knowledge on

			herbal products without recognition of the owner country, there is need for bioprospection of Indian flora for novel formulations to be used in agriculture as well as pharma sector.
28.	Augmenting vegetable productivity through recent techniques	9th-10th September 2020	❖ F1 hybrids should be adopted in vegetables since they can improve productivity and for production of cheap F1 hybrids seeds male sterility systems should be utilized. ❖ Good agricultural practices (GAP) comprising of raising healthy seedlings through portray/protected structures, raised bed cultivation of vegetable crops, mulching, proper training-pruning, foliar nutrient application for correction of deficiency is extremely important for increasing vegetable production and productivity. ❖ Cultivation of high value vegetables like tomatoes and cherry tomatoes, capsicum, seedless cucumber can enhance the economic returns and thus provide livelihood security to farmers. Protected cultivation of vegetables can also enable offseason cultivation of these crops and enable fetching premium price. ❖ Adoption of micro irrigation in vegetable not only saves water but also improves productivity and quality of vegetables. ❖ Grafting in vegetables, specially solanaceous and cucurbits for overcoming biotic stress and enhancing quality. In cucurbits particularly, grafting can be effectively used for control of Fusarium wilt and root knot nematode. In brinjal for grafted crop, two ratoon crops could be allowed and the ratoon could be taken when the first crop was 6-7 months old (after transplanting). ❖ Organic farming could act as a mitigation strategy towards climate change as well as for assuring food security. ❖ Land races of vegetable crops are sources of important traits and should be utilized in breeding programmes particularly for biotic and abiotic stress resistance and quality enhancement. ❖ The aim of modern breeders is breeding for functional foods, i.e., vegetables rich in phytoceuticals and bioactive compounds. ❖ Underexploited and minor vegetables should be explored since they are highly nutritious. The future nutrition strategy consist of utilising the landraces and underexploited vegetables. ❖ The need of the hour for enhancing vegetable productivity consist of collaborative approach of horticulturists, breeders, physiologists, biochemists, geneticists, biotechnologists.
29.	Plant Physiological Paradigms towards Agricultural Sustainability Under Climate Change	15th September 2020	❖ Climate change has become a reality established beyond doubts, and is now considered as the single gravest threat to global food security, with India being recognized among the worst-hit countries of the world. ❖ Water, the most important component of life, is rapidly becoming a critically short commodity for humans and crop production. Limited water supply is one of the major abiotic factors that adversely affect agricultural crop production worldwide.. ❖ The management of plant nutrients is very helpful in reducing the detrimental effects of drought. Better plant nutrition can be helpful to utilize the available water more efficiently by a number of mechanisms

			❖ The micronutrients like Fe, B, Mn and Mo alleviate the adverse effects of drought indirectly by activating the physiological, biochemical and metabolic processes in the plants. ❖ Some of the most important guiding principles include equal emphasis on t management of natural resources, appropriate institutional and financial mechanisr and improving preparedness of stakeholders to engage in well-informed actions. ❖ Warming directly affects rate of plant respiration, photosynthesis, and other biogeochemical processes. In the future it is thought that the increase in CO_2 and other greenhouse gases will cause an increase in global mean temperature, with larger increases at high latitudes than elsewhere and larger increases during winter than summer. ❖ The Earth's climate has always changed and evolved. Some of these changes have been due to natural causes but others can be attributed to human activities such as *viz;* greenhouse gases, deforestation ❖ Currently, vulnerable to hunger and under malnutrition supports the need for considerable investment in adaptation and mitigation actions toward a "climate-smart food system" that is more resilient to climate change influences on food security. ❖ This Webinar takes a broader view and explorers the multiple effects that global warming and climate change could have on food production and food security and what actions can be taken to increase agriculture productivity, build resilience, and reduce Green House Gas (GHG) emissions and increases global CO2 concentrations through enhancing climate-smart agriculture (CSA), both in policies and practices. Recently there has been a growing concern about the effects of climate change due to global warming.
30.	Trash to Treasure: Managing crop residues into winning investment	05th November, 2020	❖ Authentic data required on amount of Crop residue generated including horticultural crops. ❖ Promotion of in-situ management of crop residues. ❖ Diversified use of crop residues like charcoal, gasification, power generation, bio ethanol production and packaging materials. ❖ Capacity building and awareness generation regarding adverse effects of crop residue burning. ❖ Formulation of policy measures on crop residue management. ❖ Database generation on the potential use of paddy straw in different sectors for its efficient and planned utilization of crop residues and its consumption. ❖ Increasing the non fossil fuel based capacity for energy generation through utilization of crop residues in ethanol production. ❖ Promotion of sugarcane cultivation for production of ethanol and closed sugar mills maybe reopened and converted into ethanol production units. ❖ Establishment of village level ex-situ crop residue cold storage facilities from where crop residues can be supplied for different sectors like ethanol production plants, briquetting units for conversion to commercial products. ❖ Develop schemes in line with the central govt. for implementation of CRM

			strategies in the state. ❖ The extent of adoption of Zero tillage in Bihar is less than 2%. This can be increased through establishment of custom hiring service providers. ❖ Establishment of community rice nurseries could be done through rice entrepreneurs. ❖ Evaluation and validation of Pusa Decomposer for rapid decomposition of rice residues in-situ under Bihar conditions where farmers have no alternate uses of rice straw residues.
31.	Recommendations emerging from the National Web Conference on Sustainable Fodder Production for Improving the Livelihood of Small and Marginal Farmers	26th November 2020	❖ Research and Development programmes for fodder and feed resources should involve stakeholder participation as well as target youth for creating employment opportunities and rural livelihoods. ❖ The identified viable fodder based cropping systems and technologies should be popularised and provided institutional support for providing cheap and quality fodder for development of dairy industry. ❖ The problem of fodder scarcity during the lean season could be targeted through hydroponics, appropriate silage and hay making technologies and utilization and development of non-conventional feeds and fodders such as aquatic weeds, tree fodders and Azolla.

PUBLICATIONS

13. PUBLICATIONS

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UNIVERSITY BUDGET

14. UNIVERSITY BUDGET

Financial Year 2020-21		Rs. in Lakh		
Plan Scheme				
	Particulars	**BE 2020-21**		**RE 2020-21**
A	Pay & Allowances	9266.70		5457.80
B	Contingency	9652.57		9870.60
C	Construction of Infrastructure	80048.61		42339.49
	Total (A to C)	**98967.87**		**57667.89**

Committed Expenditure (Non-Plan) Scheme				
	Particulars	**BE 2020-21**		**RE 2020-21**
A	Pay & Allowances/Pension	10645.73		8953.72
	Pay arrears for CAS Scheme			634.46
	Pay for 25% state share for AICRP			337.01
	Promotion arrears to Non Teaching Staffs(JRA)			25.00
	Pay arrears for MACP			300.00
	Pay for Proposed to appointment of Teacher/Scientists	1185.91		296.18
	Pay for Proposed to appointment of Non-teaching Staffs	1136.28		283.19
B	Contingency	1975.11		2730.73
C	Construction of Infrastructure	2511.58		2613.65
	Total (A to C)	**17454.61**		**16173.95**

ANNEXURE

Annexure I

Member of Senate during the year 2020-21

Sl. No.	Name	Responsibility
1.	The Chancellor Bihar Agricultural University, Sabour	Chairman
2.	Vice Chancellor, Bihar Agricultural University, Sabour	Member
3.	Agriculture Production Commissioner or Agricultural Secretary, Department, Government of Bihar	Member
4.	Principal Secretary, Food & Consumer Protection Department, Government of Bihar	Member
5.	Special or Additional or Joint Secretary of the Department of Agriculture, Government of Bihar	Member
6.	Special or Additional or Joint Secretary of the Department of Animal & Fisherues Resources Deptt., Government of Bihar	Member
7.	Chief Conservator of Forest, Bihar	Member
8.	Director Agriculture, Bihar, Patna	Member
9.	Director Animal Husbandry, Bihar	Member
10.	Director of Fisheries, Bihar	Member
11.	Joint Director of Agriculture, Education, Bihar, Patna	Member
12.	Director, Research, Bihar Agricultural University, Sabour	Member
13.	Director, Extension Education, Bihar Agricultural University, Sabour	Member
14.	Dean (Agriculture), Bihar Agricultural University, Sabour	Member
15.	DRI-cum-Dean PGS, Bihar Agricultural University, Sabour	Member
16.	Assoc. Dean-cum-Principal, Bihar Agricultural College, Sabour	Member
17.	Assoc. Dean-cum-Principal, Mandan Bharti Agricultural College, Agwanpur, Saharsa	Member
18.	Assoc. Dean-cum-Principal, Bhola Paswan Shastri Agricultural College, Purnea	Member
19.	Assoc. Dean-cum-Principal, Dr Kalam Agricultural College, Kishanganj	Member
20.	Assoc. Dean-cum-Principal, Veer Kunwar Singh College of Agriculture, Dumraon, Buxar	Member
21.	Assoc. Dean-cum-Principal, Nalanda College of Horticulture, Noorsarai	Member
22.	Regional Director, Agricultural Research Institute, Patna	Member
23.	Assoc. Director of Research, RRSS, Agwanpur, Saharsa	Member
24.	Dr. Janardan Prasad, Associate Professor (SSAC), BPSAC, Purnea	Nominated Member

25.	Dr. D.K.Singh, Associate Professor (Hort.), VKSCOA, Dumraon	Nominated Member
26.	Dr. D.K.Mahto, Assoc. Prof (Agron.), NCOH, Noorsarai	Nominated Member
27.	Dr. Feza Ahmad, Univ. Prof. (Hort. Fruits), BAC, Sabour	Nominated Member
28.	Dr. Sanjay Kumar, Asstt. Professor (PBG), MBAC, Agwanpur, Saharsa	Nominated Member
29.	Dr. D.P. Saha, Asstt. Prof. (Pomo), DKAC, Kishanganj,	Nominated Member
30.	Dr. Sangita Kumari, Asstt. Prof. (Hort. Flor. & Veg.), ARI, Patna	Nominated Member
31.	Bihar Phal and Sabji Vikas Nigam	Nominated Member
32.	COMFED, Patna	Nominated Member
33.	Sri Sanjay Mishra, JRA, BAC, Sabour	Nominated Member
34.	Mr. Mayank Kumar Sinha, Student,BPSAC/34/2016-17	Nominated Member

Annexure II

Member Board of Management during 2020-21

Sl. No.	Name	Role
1	Vice-Chancellor	Chairman
2	Registrar	Member Secretary
3	Agricultural Production Commissioner/ Principal Secretary/ Secretary, Agriculture Department, Govt of Bihar, Patna	Member
4	Principal Secretary/ Secretary, Finance Department, Government of Bihar, Patna	Member
5	Principal Secretary/ Secretary, Animal & Fish Resources Department, Government of Bihar, Patna	Member
6	Director Agricultural, Government of Bihar, Patna	Member
7	Director, Horticulture, Government of Bihar, Patna	Member
8	ICAR (Nominee), Dr. P. S. Pandey, Assistant Director General (EP&HS)	Member
9	DRI-cum-Dean, PGS, Bihar Agricultural University, Sabour	Nominated Member
10	Director Research, Bihar Agricultural University, Sabour	Nominated Member
11	Chairman, Entomology, Bihar Agricultural College, Sabour	Nominated Member

Annexure III

Members of Academic Council during 2020-21:

Sl. No.	Name	Role
1.	Vice-Chancellor, Bihar Agricultural University, Sabour	Chairman
2.	Registrar, Bihar Agricultural University, Sabour	Member Secretary
3.	Director Administration, Bihar Agricultural University, Sabour	Member
4.	Director Extension Education, Bihar Agricultural University, Sabour	Member
5.	Director Research, Bihar Agricultural University, Sabour	Member
6.	Director Seed & Farms, Bihar Agricultural University, Sabour	Member
7.	Director Planning, Bihar Agricultural University, Sabour	Member
8.	Director Student Welfare, Bihar Agricultural University, Sabour	Member
9.	Director Works & Plan, Bihar Agricultural University, Sabour	Member
10.	Dean (Agriculture), Bihar Agricultural University, Sabour	Member
11.	Director Resident Instruction-cum-Dean, PGS, Bihar Agricultural University, Sabour	
12.	Assoc. Dean-cum-Principal, Bihar Agricultural College, Sabour	Member
13.	Assoc. Dean-cum-Principal, Mandan Bharti Agricultural College, Agwanpur, Saharsa	Member
14.	Assoc. Dean-cum-Principal, Bhola Paswan Shastri Agricultural College, Purnea	Member
15.	Assoc. Dean-cum-Principal, Nalanda College of Horticulture, Noorsarai	Member
16.	Assoc. Dean-cum-Principal, Dr Kalam Agricultural College, Kishanganj	Member
17.	Assoc. Dean-cum-Principal, Veer Kunwar Singh College of Agriculture, Dumraon, Buxar	Member
18.	Chairman, Agril. Economics, Bihar Agricultural College, Sabour	Member
19.	Chairman, Agronomy,	Member

	Bihar Agricultural College, Sabour	
20.	Chairman, Extension Education, Bihar Agricultural College, Sabour	Member
21.	Chairman, Entomology, Bihar Agricultural College, Sabour	Member
22.	Chairman, Horticulture (Fruit Science), Bihar Agricultural College, Sabour	Member
23.	Chairman, Horticulture (Vegetable Science), Bihar Agricultural College, Sabour	Member
24.	Chairman, Food Science Post Harvest Technology, Bihar Agricultural College, Sabour	Member
25.	Chairman, Plant Pathology, Bihar Agricultural College, Sabour	Member
26.	Chairman, Soil Science & Agricultural Chemistry, Bihar Agricultural College, Sabour	Member
27.	Chairman, Biotechnology and Crop Physiology, Bihar Agricultural College, Sabour	Member
28.	Chairman, Molecular Biology and Genetic Engineering, Bihar Agricultural College, Sabour	Member
29.	Chairman, Plant Breeding and Genetics, Bihar Agricultural College, Sabour	Member
30.	Chairman, Seed Science and Technology, Bihar Agricultural College, Sabour	Member
31.	Dr. Sanjay Kumar, Chairman (Agron.), BAC, Sabour	Nominated Member
32.	Dr. S.N. Roy, Chairman (Ento.), BAC, Sabour	Nominated Member
33.	Dr. Feza Ahmad, University Prof. (Hort. Fruits), BAC, Sbour	
34.	Dr. Pankaj, Principal Scientist, ICAR-IARI, New Delhi	Nominated Member
35.	Comptroller, Bihar Agricultural University, Sabour	Member
36.	Assoc. Librarian, Bihar Agricultural University, Sabour	Member

Annexure IV

Members of UG Board of Studies during 2020-21

Sl. No.	Name	
1	Dr. R R Singh, (Agriculture)	Chairman
2	All Assoc. Dean-cum-Principal, BAU, Sabour	Members
3	All Chairman/HODs, BAC, Sabour	Members
4	Dr. Feza Ahmad, University Professor, Hort.(Fruits), BAC, Sabour	Member Secretary
Nominated Faculty Members		
i	Dr. Sanjay Kumar, Asst. Prof. (PBG)	
ii	Dr. S.K Pathak, University Professor-cum-Chief Scientist (Agronomy)	
iii	Dr. Kiran Kumari, Asstt. Prof. (Entomology)	
iv	Dr. Ravindra Kumar, Asstt. Prof.-cum-Jr. Scientist, Hort. (Fruit)	
v	Dr. Meera Kumari, Asstt. Prof. (Agril. Economics)	
vi	Dr. R. K. Sharma, Asstt. Prof. Hort. (Veg. & Flori.)	
vii	Dr. Anshuman Kohli, Asstt. Prof. (SSAC)	
viii	Dr. J.P Singh, University Professor-cum-Chief Scientist (FST)	
ix	Dr. Sanoj Kumar, Asstt. Prof. (Agril. Engineering)	
x	Dr. Anil Paswan, Asstt. Prof. (Extn. Edn.)	
xi	Dr. A.P. Bhagat, University Professor-cum-Chief Scientist (Plant Pathology)	
xii	Dr. M.D. Ojha, Assoc. Professor-cum- Sr. Scientist, ARI, Patna	
xiii	Dr. Arun Kumar, Asstt. Prof. Hort. (SST)	
xiv	Dr. Shashi Kant, Asstt. Prof., Deptt. of Biochemistry and PP, BAC, Sabour	
xv	Dr. B. Kole, Asstt. Prof. Hort., DKAC, Kishanganj	
xvi	Mr. Tribhuvan Kumar, Asstt. Prof., Dept. of MB&GE, MBAC, Saharsa	

Annexure V

Members of PG Board of Studies during 2020-21

Sl. No.	Name	
1	Dr. S N Singh, DRI-cum-Dean PGS	Chairman
2	Dr. R R Dean (Agriculture)	Member
3	All Assoc. Dean-cum-Principals, BAU, Sabour	Members
4	All Chairman/HODs of PG Departments	Member
5	Dr. Feza Ahmad, University Professor, Hort. (Fruit)	Member Secretary
Nominated Faculty Members		
i.	Dr. S.K Pathak, University Professor, Deptt. of Agronomy., BAC, Sabour	
ii.	Dr. J.P. Singh, University Professor, Deptt. of FST, BAC, Sabour	
iii.	Dr. A.P Bhagat, University Professor, Deptt. of Plant Pathology, BAC, Sabour	
iv.	Dr. R.B. Verma, Assoc. Prof., Hort.(Veg. Sci.), BAC, Sabour	
v.	Dr. Anshuman Kohli, Assoc. Prof., SSAC., BAC, Sabour	
vi.	Dr. Kiran Kumari, Asstt. Prof., Entomology, BAC, Sabour	
vii.	Dr. Meera Kumari, Asstt. Prof., Agril. Economics, BAC, Sabour	
viii.	Dr. Ravindra Kumar, Asstt. Prof., Hort.(Fruits), BAC, Sabour	
ix.	Dr. Shashi Kant, Asstt. Prof., Deptt. of PBG, BAC, Sabour	
x.	Dr. Anil Paswan, Asstt. Prof., Asstt. Prof., Deptt. of Extn. Education, BAC, Sabour	
xi.	Dr. Sanjay Kumar, Assoc. Prof., Agronomy., BAC, Sabour	
xii.	Dr. Fozia Homa, Asstt. Prof., SMCA, BAC, Sabour	
xiii.	Dr. Bishun Deo Prasad, Deptt. of Biotechnology, BAC, Sabour	
xiv.	Dr. Arun Kumar, Deptt of SST, BAC, Sabour	
xv.	Dr. Mankesh Kumar, Deptt. of PBG, BAC, Sabour	
xvi.	Dr. Feza Ahmad, University Professor, Hort.(Fruits), BAC, Sabour	

वार्षिक प्रतिवेदन

ANNUAL REPORT

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