

Annual Report 2015-16

Department of Seed Science and Technology



UTTAR BANGA KRISHI VISWAVIDYALAYA
Pundibari, Cooch Behar,
West Bengal-736165

1. BACKGROUND

Seed Science and Technology has been established as a full-fledged Department in 2013 bifurcating the Genetics and Plant Breeding department in order to active participation in academic activities to enrich students seed science and technology and provide better service as well as awareness among the farmers of the northern parts of West Bengal about use of quality seed and their production technology.

2. FUNCTIONS

Teaching, Research and Extension in the field of Seed Science and Technology

2.1. Teaching

Teaching of Undergraduate, Postgraduate and Doctor of Philosophy students. Different courses like Crop Physiology and Principles of Seed Technology for Bachelors' and all ICAR approved courses of seed science for Master and Doctoral degree programmes are being offered.

2.2. Research

2.2.1. Research

Thrust areas under research programme are

- Genetic purity and seed quality
- Seed enhancement for unfavourable conditions
- Improvement of seed storability
- Standardizing processing needs in major field crops
- Standardization of seed production technology of individual crop
- Use of biotechnological tools for enhancement of seed science in respect of synthetic seed and molecular characterization for genetic purity

2.2.2. Research projects

1. Improvement of traditional non-Basmati aromatic rice genotypes of northern part of West Bengal through induced mutation- BARC, Mumbai (Ongoing), PI: Dr. Bidhan Roy.
2. Tribal Sub Plant under MEGA-SEED Project (IISS-Main Scheme, Mau, UP), Co-PI: Dr. Bidhan Roy.
3. Collection, characterization, *in situ* and *ex situ* conservation of rice of North-Eastern India including the areas under jurisdiction of the University as a long term continuous crop improvement programme for higher yield and quality as well as resistant/tolerant breeding against biotic and abiotic stresses, University Project (UBKV), PI: Dr. Bidhan Roy.
4. 'All India Coordinated Rice Improvement Project', VOLUNTARY CENTRE, IIRR, Hyderabad, Cooperator: Dr. Bidhan Roy.

5. To evaluate the effect of Triaccontanol 0.1% EW on yield and its phytotoxic effect in relation to health on tea bushes” sponsored by M/s Godrej Agrovet Ltd., Mumbai, Dr. Puspendu Dutta, PI

2.2.3. Extension

The main objectives of the extension work of this Department are:

- Seed Production through Farmers’ Participatory mode
- Training on seed production technologies of major field crops of northern part of West Bengal
- Organizing trainings on Quality Seed Production of Field Crops under Tribal Sub Plant of MEGA-SEED Project, UBKV, Pundibari
- Formation of Self-help Group / Farmers’ Society very involved in Quality Seed Production to develop the village based seed enterprises

2.2.3.1. Establishment of Village Based Seed Enterprise

This University started Farmers’ Participatory Seed Production programme under the leadership of Dr. Bidhan Roy, Associate Professor, Department of Seed Science and Technology, UBKV, Pundibari, Cooch Behar, since 2007. Initially, leading farmers were selected for seed production in two villages, namely Khagrikabari (Unishbisha) and Petlanepra (Chotosalbari, Sitalkuchi) of Cooch Behar district. The farmers of Sitalkuchi and Unishbisha who involve in seed production under the guidance of UBKV were brought under one umbrella forming a Self Help Group – **Petlanepra Suphala Beej Swanirbhar Gosthi** (PSBSG) in June 2008, and registered under District Rural Development Cell, Cooch Behar. The SBSG has been again registered in 2012 under West Bengal Society Registration Act, 1961. The official address of the SBSG is Paglarhat, Dewankotjoyduar P.O., Sitalkuchi, Mathabhanga, Cooch Behar Dist., West Bengal. This SBSG is producing Certified and Foundation seeds of different varieties of rice, potato, pulses and mustard. The SBSG sell the seeds in the brand name of **Shyamali**. The brand name is in the process of registration under Indian Trade Mark Act (applied in August, 2012). The seed is being registered and certified by the West Bengal Seed Certification Agency on satisfaction of the quality of the produced seed. This programme has been recognized by DRR, Hyderabad and available at <http://rkmp.co.in/content/farmer-participatory-seed-production-of-rice>. In addition to seed production, the NGO also participate in rural social works and collection and conservation of local traditional rice cultivars.

Another Village Based Seed Enterprise has been established at Kayakhata, Salsalabari, Alipurduar-II, Alipurduar district, named as ‘Kayakhata Integrated Agri Service Co-Operative Society Ltd. (KIAS). The main objective of this organization is to produce and sale of quality seeds of agriculture and horticultural crops.

2.2.3.2. Training on Seed Production Technologies

The trainings were organized for tribal farmers under Tribal Sub Plant of MEGA-SEED Project (IISS-Main Scheme, Mau, ICAR), UBKV, Pundibari. During 2015-16, 10 training have been provided for the tribal farmers of Sighimari (Patlakhawa, Cooch Behar-II, Cooch Behar district),

Pashim Barachowki (Chaparerpar, Alipurduar-II, Alipurduar district) and Chakoakheti (Nathoyatari, Alipurduar district) (Table 1). The main objectives of those training were to train the farmers for production of quality seed for their own use, Variety Replacement by newly released varieties as well as to **Establishment Village Based** seed enterprise.



Fig. 1: Members of Petlanepra Suphala Beej Swanirbhar Gosthi

Outcome of Training

- The farmers of Singhimari village used their quality seeds produced by them for the cultivation of rice crop during *Kharif*-2016.
- The old variety- MTU 7029 has been replaced by newly released MTU 1075 in Singhimari village.
- Another Village Based Enterprise has been established at Kayakhata, Alipurduar-II, Alipurduar district.

Table 1: List of training organized during 2015-16 under MEGA-SEED Project (IISS Main Scheme)

Sl. No.	Date	Programme	Number of beneficiaries	Full address, name of village, district and state
1.	13.05.2015	Training on Nursery Management of Rice	50	Vill. Chakoakheti P.O. Nathoyatari Alipurduar district
2.	15.05.2015	Training on Nursery Management of Rice	50	Vill. Pashim Barachowki P.O. Barachowki Alipurduar district
3.	18.05.2015 to 19.05.2015	<ul style="list-style-type: none"> • Seed distribution among the tribal farmers • Training on Nursery Management of Rice 	50	Vill. Singhimarti P.O. Patlakhawa Cooch Behar district
4.	02.06.2015	<ul style="list-style-type: none"> • Pest control of rice • Roguing for seed production in rice 	59	UG Class Room Faculty of Agriculture UBKV, Pundibari, Cooch Behar
5.	30.09.2015	Roguing and harvesting of rice for seed production	50	Putimari Primari School Singhimari, Patlakhawa Cooch Behar
6.	16.12.2015	One Day training on “Farmers Participatory Seed Tuber Production of Potato, with Special Reference to Planting”	50	Singhimarti P.O. Patlakhawa Cooch Behar district
7.	23.12.2015	One Day training on “Farmers Participatory Seed Tuber Production of Potato, with Special Reference to Planting”	50	Pashim Barachowki P.O. Barachowki Alipurduar district
8.	29.12.2016	One Day training on “Farmers Participatory Seed Tuber Production of Potato, with Special Reference to Roguing and Plant Protection”	50	Pashim Barachowki P.O. Barachowki Alipurduar district
9.	29.12.2015	<ul style="list-style-type: none"> • Pest management of potato • Potato seed tuber production technology 	38	Putimari Primari School, Singhimari, PatlaKhawa Cooch Behar district
10.	11.02.2016	<ul style="list-style-type: none"> • Farmers Participatory Seed Tuber Production of Potato, with Special Reference to Roguing and Plant Protection 	80	Pashim Barachowki P.O. Barachowki Alipurduar district



Fig. 2. Training programmes. A) Training in progress on rice seed production at UBKV, Pundibari, Cooch Behar; B) Dr. S. Khalko, Agricultural Pathologist, delivering speech on management of disease in rice; C) Dr. Bidhan Roy, Plant Breeder, delivering speech on rice seed production; D) Prof. A.K. Singha Roy, Dean, Faculty of Agriculture, UBKV, delivering speech on agronomical management of rice crop; E) Mr. A. Barman, Board of Director, Tarai Research Society, Alipurduar, delivering speech on bio-control of Gandhbug in rice; F) Dr. S. Das, Plant Breeder, UBKV, delivering speech on scope of wheat cultivation in Cooch Behar district of West Bengal.

2.2.4. Teaching

2.2.4.1. Field of specialization for M.Sc. and Ph.D.: Seed Science and Technology

2.2.4.2. Undergraduate courses

i) Compulsory courses

Sl. No.	Course No.	Title	Credit Hours	Semester
1.	SST 101	Crop Physiology	1 + 1	First
2.	SST 351	Principles of Seed Technology	2 + 1	Sixth
3.	SST 101*	Introductory Crop Physiology	1 + 1	First

*Vth Dean Committee recommended syllabus

2.2.4.3. Post graduate courses

Course No.	Course-Title	Credit Hour	Remarks
Core-Courses			
SST 501	Floral Biology, Seed Development and Maturation	1 + 1	First semester
SST 502	Principles of Seed Production	2 + 0	First semester
SST 503	Seed Production in Field Crops	2 + 1	First semester
SST 506	Seed Legislation and Certification	2 + 1	First semester
SST 507	Seed Processing and Storage	2 + 1	Second semester
SST 591	Master Seminar	1 + 0	Fourth semester
Minor/Supporting Courses			
SST 504	Seed Production in Vegetable Crops	2 + 1	First semester
SST 505	Seed Production in Flower, Medicinal, Fruits and Plantation Crops	2 + 1	First semester
SST 508	Seed Quality Testing	2 + 1	Second semester
SST 509	Seed Physiology	2 + 1	Second semester
SST 510	Seed Pathology	2 + 1	Second semester
SST 511	Seed Entomology	2 + 1	Second semester
SST 512	Seed Production in Pasture, Forage and Green Manure Crops	2 + 1	Third semester
SST 513	Seed Storage and Deterioration	1 + 1	Third semester
SST 514	Seed Marketing and Management	1 + 1	Third semester
SST 515	Emerging Trend in Seed Quality Enhancement	1 + 1	Third semester
SST 516 [@]	Data Base Management, Evaluation and Utilization of PGR	2 + 1	Fourth semester
Doctoral Degree Courses			
SST 601**	Hybrid Seed Production	1 + 1	First
SST 602 ^{@@}	<i>In situ</i> and <i>ex situ</i> Conservation of Germplasm	2 + 1	First
SST 603	Testing for Genuineness and Purity of Cultivar	1 + 1	Second
SST 604**	DUS testing for Plant Variety Protection	2 + 1	Third
SST 605**	Advances in Seed Science Research	1 + 0	Fourth
SST 691**	Doctoral Seminar- I	1 + 0	Second
SST 692**	Doctoral Seminar- II	1 + 0	Sixth

** Compulsory Courses; @ Course enlisted with GP 516; @@ Course enlisted with GP 609

2.2.4.4. Post graduate requirement:

i) For M.Sc.(Ag) Degree: B. Sc. (Ag.)

ii) For Ph.D. Degree: M. Sc. (Ag.) in Seed Science and Technology or M. Sc. (Ag.) in Genetics and Plant Breeding/ Plant Breeding or M. Sc. (Ag.) Plant Physiology

iii) Students' Achievement:

JRF: 1 **SRF:** NA* **ARS-NET:** NA* **Others (Specify):** NA*

*Till now there is no pass out students of M.Sc. and Ph.D.

iv) Students' Placement:

Govt: 1* **Cooperate:** NA* **Bank:** NA[#] **NGO:** NA*

[#]Qualified for Bank Exam

*Till now there is no pass out students of M.Sc. and Ph.D.

3. RESEARCH ACTIVITY**3.1. Areas of research**

- Isolation distance requirements in view of GM varieties
- Review of seed certification standards
- GOT –seasonal requirements
- Genetic purity vis-a-vis trait purity
- Enhancement of pollen viability, stigma receptivity and seed setting
- Reduction of processing losses
- Alternate areas / protected cultivation methods for hybrid seed production
- Standardizing processing needs in high value crops and forage grasses
- Protein and oil content in GM cotton seed and its effect on longevity
- Optimization of hybrid seed production technology in field crops, vegetables and flowers
- Pollen collection methods and viability testing
- Management of seed borne diseases with biocontrol agents
- Seed enhancement for unfavorable conditions
- Identification of markers for hybrid confirmation and genetic purity testing
GM seed testing
- Seed testing protocols and seed standards for forage crops, medicinal species and spices
- Molecular control of seed viability, vigour and invigoration
- Standardisation of priming, coating and pelleting technologies
- Development of technologies for maintenance of parental lines of SI and MS based hybrids
- Any other location specific problems

3.2. Research achievements

3.2.1. Performance of Advance Lines of Rice in AICRIP Trials

UBKVR-15: The advanced Line of rice [IET 24173 (UBKVR-15)], a cross of MTU 7029 and Annada developed at RSS, Terai Zone, UBKV, Pundibari **ranked FIRST** in Initial Variety Trial – Boro (IVT- *Boro*) 2013-2014. Its salient features are- short bold grains and 138 days for 50% flowering, recorded a mean grain yield of 6159 kg/ha and out yielded all the 4 checks national, regional, local and hybrid with yield advantage of 26.78%, 37.97% 24.42% and 14.01% respectively. It was significantly superior to national, regional and local checks at Arundhutinagar (1st, 9428 kg/ha) & CRRRI (1st, 7382 kg/ha); It was significantly superior to regional and local checks at Varanasi (2nd, 8200kg/ha) Pundibari (2nd, 5150 kg/ha) and Karimganj (6th, 4804 kg/ha); while was superior to national and local checks at Chinsurah (5051 kg/ha) and over only national check at Pusa (5th, 4667 kg/ha). UBKVR-15 has been promoted to second year of testing (AVT-I-Boro).

IET 24173 (UBKVR-15) in its second year of testing it **ranked THIRD** in Advanced Varietal Trial-1 and registered mean grain yield of 5353 kg/ha with short bold grins 138 days to 50% flowering. It out yielded check national, regional and local with 60.56%, 19.99% and 6.73%, respectively. Statewise, IET 24173 ranked 3rd (4684 kg/ha) in Assam with 7.11% and 13.00% yield advantage over best varietal and hybrid checks, respectively. It ranked first in the state of Uttar Pradesh (8000 kg/ha) and West Bengal (9300 kg/ha) with 10.08% and 10.78% yield advantage over the best varietal checks respectively. Quality wise, this entry recorded moderate HRR (50.3%), intermediate AC (25.34%) and moderate GC (53 mm). UBKVR-15 has been promoted to second year of testing (AVT-2-Boro).

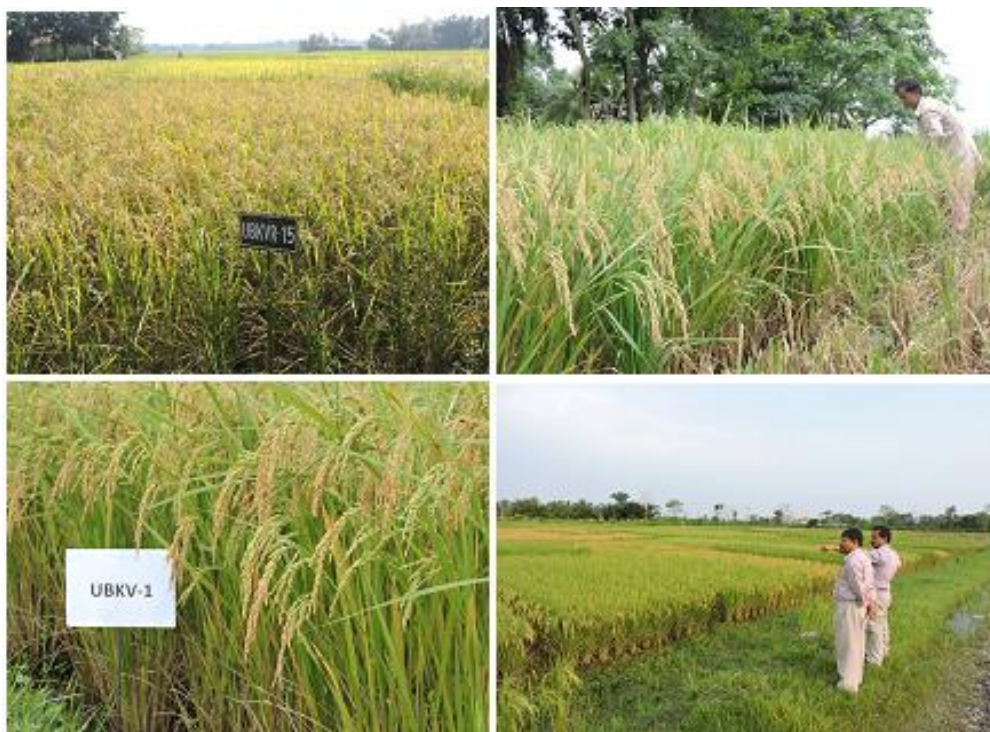


Fig. 3: Clockwise: Standing crop of UBKVR-15; Standing crop of UBKVR-1; Standing crop of UBKVR-1; Visit to University Rice Research programme by Prof. A.K. Singha Roy, Ex-Dean, Faculty of Agriculture.

UBKVR-1: Another Advanced Line [IET 24171 (UBKVR-1)], a cross between MTU 7029 and Gontra Bidhan **ranked THIRD** in Initial Variety Trial-Boro (IVT-Boro) 2013-2014. Its salient features are- medium slender grains, a grain yield of 5760 kg/ha. It recorded 133 days for 50% flowering and out yielded national, regional, local and hybrid checks with a yield advantage of 18.57%, 29.03%, 16.36% and 6.63% respectively. UBKVR-1 has been promoted to second year of testing (AVT-I-Boro). The UBKVR-1 also **ranked First** during *Kharif* 2013 under IVT-E-TP. Its average yield was 5364 kg/ha.

3.2.2. Registration of Farmers' Varieties under PPV&FRA, New Delhi

Collected 170 Farmers' Varieties (FVs) of rice from parts of West Bengal, Manipur, and Assam of which 46 are aromatic and 124 non-aromatic (Roy *et al.* 2013). All those FVs were characterized based on the "Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability on Rice (*Oryza sativa* L.)" published by Protection of Plant Varieties and Farmers' Rights Authority (2007), Government of India. High significant variability has been observed in respect of all quantitative and qualitative characters as listed in DUS guideline (Fig. 4).



Fig. 4. Pictorial depiction of special characters of Farmers' Varieties of rice. A) Undehusked grain of Thuri, B) Panicle of Thuri, C) Undehusked grain of Jugal, occurrence of single, double and triple kernels per spikelet in the FV *Jugal* was 53.9, 42.2 and 3.9%, respectively, D) Dehusked grain of Jugal (one kernalled grain and two kernalled grain, respectively), E) Unhusked grain of Rami Galee F). White coloured lemmas of Rami Gelee, which is generally longer than the fertile lemma and palea, G) Unhusked grain of Sadabhat Kalo, H) Dehusked grain of Sadabhat Kalo, I) Dark purple leaf and leaf sheath of Khara dhan.

Out of those 170 FVs, **96 have been registered** by Protection of Plant Varieties and Farmers' Rights Authority, New Delhi (Ref. No. PPV&FR/Reg/2015/1621-1747/2015/1429). Another two FVs of mustard (Ref. No. PPV&FR/Reg/2015/1621-1747/2015/1429) and two FVs of potato (Ref. No. PPV&FR/Reg/2015/1621-1747/2015/1428) also have been registered under PPV&FRA and obtained provisional registration number.

Another two farmers' varieties of mustard and two farmers' varieties of potato have been registered under PPV&FRA, New Delhi and obtained provisional registration number.

3.2.3. Registration of Kalo Nunia, a local rice cultivar under GI

Application has been submitted in collaboration with Department of Agriculture, Government of West Bengal for Registration of *Kalo Nunia*, a local rice cultivar under '**The Geographical Indications of Goods (Registration and Protection) Act, 1999**, Govt. of India.

4. AWARDS AND GOLD MEDALS

1. Dr. Bidhan Roy has been awarded **BHARAT GAURAV AWARD 2016**, by **Indian International Friendship Society**, Ranjit Studio, 7-Tansen marg. 1st Floor, Bengali Market, New Delhi 100 001.
2. Dr. Bidhan Roy has been awarded **SCIENCE EXCELLENCE AWARD 2015**, by **Foundation for Science and Environment**, Kolkata- 700118, West Bengal, INDIA on the occasion of **National Conference on Natural Resources, Diversity and Sustainable Development** held on 11th December, 2015 at University of North Bengal, West Bengal, India.
3. Dr. Bidhan Roy has been awarded **BEST ORAL PRESENTATION AWARD**, by **Cooch Behar Association for Cultivation of Agricultural Sciences**, in the poster presentation session of National Conference on "**Bioresources Management for Sustenance of Ecosystem and Livelihood**" from 26-29th November, 2015, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar 736 165, West Bengal, India.
4. Dr. Bidhan Roy has been awarded **SCIENTIST OF THE YEAR-2014**, Awarded by **Scientific and Environmental Research Institute**, 42-Station Road, Rahara, Kolkata-700118, West Bengal, INDIA on the eve of World Environment Day 2015 Celebration to be held at Meghnath Saha Auditorium, Rajabazar Science College, Kolkata on 5th June 2015.



Fig. 5: Bharat Gaurav Award presentation ceremony. From left to right: Dr. Viswma Narayana Singh, Ex-Governor of Tamil Nadu and Arunachal Pradesh; Dr. Jogindar Singh, Ex-Chief of Army; Dr. Bidhan Roy receiving the **Bharat Gaurav Award**.

5. SCHOLARSHIPS, STIPENDS AND FELLOWSHIPS: Nil**6. INFRASTRUCTURAL AND SUPPORT FACILITIES AVAILABLE**

1. Seed Testing Laboratory funded by MEGA-SEED Project, ICAR - Indian Institute of Seed Science, Mau, UP.
2. PG class room

6. FACULTY AND STAFFS**7.1. Head of the Department : Dr. Bidhan Roy****7.2. Faculty**

Sl. No.	Name	Designation	Specialization	Contact address
1.	Dr. Bidhan Roy	Associate Professor	<ul style="list-style-type: none"> • Seed Science and Technology • Plant Breeding 	Department of Seed Science and Technology
2.	Dr. Puspendu Dutta	Assistant Professor	<ul style="list-style-type: none"> • Plant Physiology 	Do
3.	Dr. Utpal Maity	Assistant Professor	<ul style="list-style-type: none"> • Plant Physiology 	Do

c) Non teaching staffs

Sl. No.	Name	Designation	Contact address
1.	Ms. Nandita Chakdar	Technical Assistant	Department of Seed Science and Technology
2.	Mr. Narayan Anjay	Laboratory Attendant	Department of Seed Science and Technology

8. PAPER & BOOKS PUBLISHED**8.1. Books/Manuals/Reports**

1. **Bidhan Roy.** 2015. **KHETRIYA PHSALER BEEJ UTPADANER ADHUNIC PADDHATI** (Quality Seed Production Technology of Field Crops). Published by Director of Farm, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar 736165, West Bengal. pp. 1-141.
2. **Bidhan Roy, P. Dutta, U. Maity.** 2015. **PRACTICAL MANUAL ON PRINCIPLES OF SEED TECHNOLOGY.** Department of Seed Science and Technology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar 736165, West Bengal, INDIA. pp. 1-79.
3. **Bidhan Roy.** 2015. **TRAINING REPORT.** TSP-MEGA-SEED Project, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar 736165, West Bengal, INDIA. pp. 1-32.

8.2. Research Papers

Sl. No.	Title	Author	Journal	Year	Page
Paper (Research and Extension)					
1.	Genetic Variability of Local Cultivars of West Bengal and Adjoining States with Special Orientation to Northern Part of West Bengal	Bidhan Roy , Surje Dinesh Tulsiram, Swarnajit Debbarma	Proceeding of National Seminar on “Biodiversity”- Prospectus: Threats and Current Scenario, from 26-27 th February, 2016. Tufanganj Mahavidyalaya, Tufangan, Cooch Behar, West Bengal	2016	11-16
2.	Studies on inbreeding depression from F ₁ to F ₃ generation in some intervarietal crosses of rice (<i>Oryza sativa</i> L.) in Terai region of West Bengal	Challa Venkateshwar lu, Allam CR, Bidhan Roy , Saha B	Journal of Progressive Agriculture	2015	6(1): 114-116
3.	Maintenance of Seed Viability and Seedling Vigour of Vigna spp. During Storage	Debati Devi M., Bidhan Roy , Asit Kumar Basu	Journal of Agriculture and Technology	2015	2(1&2): 28-31
4.	Genetics of grain yield and component characters through diallel analysis in rice under the humid tropics of bay islands	Mandal AB, Bidhan Roy , Pranit Mukhejee, Raju Mondal	Journal of the Andaman Science Association	2015	20(1): 19-25
5.	Fruit growth and development of Burmese grape (<i>Baccaurea sapida</i> Müell. Arg.)	Pradhan S, Bhowmick N, Deb P, Ghosh A, Pal PK, Roy B , Paul PK, Ghosh SK	Indian Journal of Plant Physiology	2015	20(1): 86-91

9. SEMINAR, SYMPOSIUM, CONFERENCE, TRAINING AND WINTER/ SUMMER/ REFRESHER COURSE/SHORT COURSE ATTENDED/ ORGANIZED

Sl. No.	Seminar, Symposium, Conference, Training and Winter/Summer/Refresher course/short course	Faculty associated	Date	Venue	Attended/Organised
Seminar, Symposium, Conference attended					
1.	National Conference on “Recent Advances in Statistical Tools for Agriculture and Allied Sciences”	Dr. P. Dutta	3-5 March, 2016	BCKV, Kalyani, Nadia, WB	Society for Application of Statistics in Agriculture and Allied Sciences (SASAA)
2.	National Conference on “Bioresources Management for Sustenance of Ecosystem and Livelihood”	Dr. P. Dutta	26-29 th Nov, 2015	UBKV Pundibari, Cooch Behar, WB	Cooch Behar Association for Cultivation of Agricultural Sciences (COBACAS)
3.	Training programme on	Dr. P. Dutta	3-4 th March,	IARI- Regional	ICAR-Directorate of

	“Maintenance Breeding: Training-cum-Exposure Visit”		2015	Station, Karnal	Seed Research in collaboration with ICAR-Indian Agricultural Research Institute-Regional Station, Karnal
4.	National Conference on “Bioresources Management for Sustenance of Ecosystem and Livelihood”	Dr. U. Maity	26-29 th Nov, 2015	UBKV Pundibari, Cooch Behar, WB	Cooch Behar Association for Cultivation of Agricultural Sciences (COBACAS)
5.	1 st International Conference on Environment and Ecology (ICEE 2015)	Bidhan Roy	2 nd -4 th March, 2015	Science City, Kolkata	Foundation for Science And Environment, Kolkata
6.	2 nd International Conference on Bio-resource and Stress Management	Bidhan Roy	7-10 th January, 2015	Prof. Jaysankar State Agricultural University, Hyderabad	
7.	National Seminar on Biodiversity-Prospects and threats: Present Scenario,	Bidhan Roy	26-27 th February, 2016	New Town, Tufanganj, Cooch Behar 736 160, West Bengal	Tufanganj Mahavidyalaya
8.	National Conference on Natural Resources, Diversity and Sustainable Development, Organized	Bidhan Roy	11-12 th December, 2015	University of North Bengal, West Bengal	Foundation for Science and Environment
9.	National Conference on “Bioresources Management for Sustenance of Ecosystem and Livelihood	Bidhan Roy	26-29 th November, 2015	Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar 736 165, West Bengal	Cooch Behar Association for Cultivation of Agricultural Sciences, UBKV
10.	Establishment of Village Based Seed Enterprises. India rice conclave, ,	Bidhan Roy	24 th & 25 th June 2015	The Lalit Hotel, Kolkata	Indian Chamber of Commerce, Kolkata
11.	Celebration and Workshop on World Environment Day 2015	Bidhan Roy	5 th June, 2015	Rajabazar Science College, Kolkata	Foundation for Science And Environment
12.	Inter-Disciplinary Workshop on "Positive and Negative Externality Measurement Module in Agriculture	Bidhan Roy	22-23 May, 2015	Down Town, Kolkata	
13.	Annual Rice Workers Group Meeting	Bidhan Roy	11-15 th April, 2015	ICAR – Indian Institute of Rice Research, Rajendranagar, Hyderabad, Telengana	Indian Institute of Rice Research

10. ANY OTHER (Achievement)

10.1. Technology Development

10.1.1. Mustard as RELAY CROP in the rice field

Mustard is an important oil seed crop in West Bengal. There is lack of irrigation in tribal dominating areas in northern parts of West Bengal. Thus the crop faces many constraints such as irrigation during critical stages of the crop, sowing of the crop at right time etc.

In northern part of West Bengal, the mustard crop is sown during first fortnight of November. The late sown crops subjected to infestation by the sucking pest, particularly the aphids. Late sown crops also get less time for vegetative growth leading to yield reduction. In North Bengal condition two irrigations are recommended. First irrigation must be given 20-25 days after sowing and second may be 15 days after the first irrigation. First irrigation is very important, which will delay flowering providing opportunity for vegetative growth. In absence of irrigation induce early flowering and the productivity of mustard reduce drastically. To avoid the dry condition of the crop field, mustard as RELAY CROP in the rice field was practiced in Pashim Barachowki (Alipurduar-II, Alipurduar district). A total of 30 demonstrations were undertaken.

A local variety of mustard- JHATI SARSON was chosen for relay crop in the rice field. The seeds were sown in the ripened standing crop of rice, just 10 days before harvesting of rice. Using the residual moisture of rice field, the mustard seeds germinated before harvesting of the rice (Fig. 5). The entire activities of **Mustard as RELAY CROP in the rice field** was supervised in collaboration with Tarai Research Society, Kayakhata, Salsalabari, Alipurduar district.

Under the water stress situation where there was no rainfall during the crop period of *Rabi*, 2014-15, JHATI SARSON gave a yield of 7.30 q/ha during 2014-15 and an average yield of 8.20 t/ha during 2015-16. The present success story in the farmers' field indicated that mustard is a climate resilient crop which can be grown without water in the residual soil moisture. By adopting the relay cropping system, the farmers could increase the productivity, reduced cost of cultivation as well as the cropping intensity may be increased.



Fig. 6. Mustard as relay crop in the rice field at Pashim Barachowki (Alipurduar-II, Alipurduar district).

10.1.2. Lentil as RELAY CROP in the rice field

Lentil is an important pulse crop in the northern part of West Bengal. We tried lentil as relay crop in paddy field (Fig. 6). The entire activities of **Mustard as RELAY CROP in the rice field** was supervised in collaboration with Tarai Research Society, Kayakhata, Salsalabari, Alipurduar district. In this area, tribal farmers generally keep fallow during *Rabi* season. Thus, lentil seeds were distributed among the selected tribal farmers of Pashim Barachowki. The seeds were sown 10 days before the harvest of rice crop. No supplementary irrigation was given. The yield of the crop was 10.25 t/ha. This programme was introduced during 2015-16. There is scope to increase the yield of lentil by supplying the seeds of improved varieties.



Fig. 7. Lentil as relay crop in the rice field at Pashim Barachowki (Alipurduar-II, Alipurduar district)

10.2. TWO TIERED RELAY CROPS

10.2.1. Mustard and Lentil as TWO TIERED RELAY CROP in the rice field in Cropping System

Lentil is also an important pulse crop in West Bengal. It is generally grown as sole crop (Fig. 7). After success in relay crop of mustard (variety- Jhati Sarson) in the rice field, we have tried a DOUBLE TIERED MIXED RELAY CROP in the rice field. Lentil seeds were soaked overnight and sown in the ripen standing crop of rice field. In the same field Jhati sarson (mustard) was sown on the same day. Sowing was done 10 days before the harvest of the rice crop.

The crops, mustard and lentil used the residual moisture of the paddy field for germination and establishment of seedling. Mustard crop is much taller than lentil and it form the upper tire of this cropping pattern and lentil formed the lower tire. The nitrogen fixed by the pulse crop (lentil) was used by both crops.

There was no rain during the crop period and no irrigation was also provided by the farmers. Here, the yield of Jhati Sarson was 1.30 q/ha and 6.5 q/ha of lentil. Therefore, without significant reduction the yield of mustard as Relay Crop in the paddy field, the farmers could get additional yield of lentil in Mustard and Lentil as RELAY CROP in the rice field in Two Tiered Cropping System. The entire activities of **Mustard and lentil as TWO TIERED RELAY CROP in the rice field** was supervised in collaboration with Tarai Research Society, Kayakhata, Salsalabari, Alipurduar district.



Fig. 8. Lentil and mustard as double tiered relay crop at Pashim Barachowki (Alipurduar-II, Alipurduar district)

10.2.2. Mustard and Niger as RELAY CROP in the rice field in Cropping System

Niger also is another important oil seed crop of northern part of West Bengal. This programme has been started from 2015-16 (Fig. 8). This programme again will be repeated in the next year as experimental basis to improve the yield. The entire activities of **Mustard and Niger as TWO TIERED RELAY CROP in the rice field** was supervised in collaboration with Tarai Research Society, Kayakhata, Salsalabari, Alipurduar district.

10.2.3. Mustard and Coriander as RELAY CROP in the rice field in Cropping System

Coriander is an important seed spice of northern part of West Bengal. It leaves also used in salad as well as in culinary purpose (Fig. 9). This programme has also been started from 2015-16. This programme again will be repeated in the next year as experimental basis to improve the yield and to expand the area of cultivation. The entire activities of **Mustard and Coriander as TWO TIERED RELAY CROP in the rice field** was supervised in collaboration with Tarai Research Society, Kayakhata, Salsalabari, Alipurduar district.



Fig. 9. Niger and mustard as double tired relay crop at Pashim Barachowki (Alipurduar-II, Alipurduar district)



Fig. 10. Lentil and mustard as double tired relay crop at Pashim Barachowki (Alipurduar-II, Alipurduar district)

Pictorial Depiction of Field Visit by ICAR Team



Fig. 11: Pictorial depiction of Scientists-Farmers' Interact and field visit by ICAR Team. A & B) Briefing TSP activities by Dr. Bidhan Roy at Singhimari village; C) Interaction by the Farm-woman; D) Harvest of potato crop; Field visit by ICAR Team; E) Field of Badami Alu (a local cultivar of potato of Cooch Behar district))