Proceedings of the XXXII Annual Review meeting of All India Coordinated Research Project on Biological Control of Crop Pests

Organized
by
ICAR - National Bureau of Agricultural Insect Resources, Bengaluru held at MPKV, Pune

(July 20 - 21, 2023)

AICRP on Biological Control of Crop Pests
NATIONAL BUREAU OF AGRICULTURAL INSECT RESOURCES
P. B. No. 2491, H. A. Farm Post, Bengaluru 560024
Karnataka

XXXII ANNUAL REVIEW MEETING OF ALL INDIA COORDINATED RESEARCH PROJECT ON BIOLOGICAL CONTROL OF CROP PESTS

PROCEEDINGS OF THE TECHNICIAL SESSIONS OF THE XXXII ANNUAL REVIEW MEETING OF AICRP-BC (July 20 – 21, 2023)

The ICAR-National Bureau of Agricultural Insect Resources, Bengaluru organized the XXXII Annual Review Meeting of All India Coordinated Research Project on Biological Control of Crop Pests at College of Agriculture, Mahatma Phule Krishi Vidyapeeth (MPKV), Pune on July 20 – 21, 2023.

Inaugural Session

Dr B A Bade, Entomologist, College of Agriculture, Pune welcomed the dignitaries and participants. Dr S N Sushil, Director, ICAR-NBAIR, Bengaluru & Project Coordinator, AICRP on Biological control of Crop Pests briefly presented the highlights of the project for the period 2022-23, which included the development and validation of promising biocontrol agents under the project and area covered through the adoption of biocontrol modules. He also urged the centres to publish the results of the experiments in the peer reviewed journals to meet the criteria for the approval of technologies by the ICAR.

Deputy Director General (Crop Science), Dr.Tilak Raj Sharma, ICAR, New Delhi appreciated the progress made in the project. He emphasised to explore more indigenous biocontrol agents which would play more role in natural farming. He highlighted the biocontrol research workers to enhance the adoption and conservation of natural enemies through natural farming to enable the farmers to double their income. Extensive search to be made to explore indigenous biocontrol agents for tackling invasive insect pests. He also urged the biocontrol workers to explore public private partnership mode to ensure the timely availability of quality bio-agents/bio-pesticides to attain sustainable pest and disease management. Industries should support institutes for developing products with more shelf life. He stressed to encourage the women entrepreneurs to establish start-ups. He advised to promote agroecological zone wise registration and production of biopesticides in fast track mode. He added to develop consortia of microbials with longer shelf life for combating complex crop pests and diseases. He also stressed to formulate modalities for sharing of biocontrol technologies with other countries.

Dr.Prashantkumar Patil, Hon'ble, Vice Chancellor, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra informed to explore the artificial intelligence (AI) and Internet of Things (IOT) in the management of insect pests. He also spoke about imparting training to the grass root level people on production and supply of quality biocontrol agents.

Dr. S. C. Dubey, Assistant Director General (Plant Protection & Biosafety), ICAR, New Delhi stressed the importance of registration requirements of biopesticides. He lauded the NBAIR team for the successful management of the invasive cassava mealybug through the imported parasitoid, *Anagyrus lopezi*. He insisted the house, for further refinement of technologies of fall armyworm management to get better results. He urged to involve the private industries and farmers to witness the results of large scale field demonstrations of biocontrol technologies. He emphasised to create the National Database on AICRP BC to enable to see the results of all Biological control experiments. He urged to initiate a collaborative research project under public private partnership mode to develop semiochemical based technologies. He also stressed the need of research on working out the SOPs for spraying of biopesticide formulations through drone technology.

Dr.Gorantiwar, Director of Research, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, spoke about opportunities in joining hands with private companies for promotion of biological control based technologies**.**

Programme Advisory and Monitoring Committee members, Dr. G.S. Dubey, Former Dean and Vice Chancellor, Birsa Agricultural University, Ranchi, Jharkhand, Dr. A.B. Rai, Former Head, Crop Protection, ICAR-IIVR, Varanasi participated in the meeting. Dr. C.S. Patil, Head, Department of Entomology, MPKV, Rahuri, Dr.A.G.Chandele, former Associate Dean, College of Agriculture, Pune, Dr. G.S.Pokharkar, Former Head, Dept. of Entomology, MPKV, Rahuriand other university officials participated in the review meeting. Around 100 scientists and ten company representatives from different parts of the country participated in the XXXII AICRP on Biological Control Annual Review Meeting. Dr.S.A. More, Assistant Entomologist, College of Agriculture, Pune, proposed the vote of thanks**.**

Salient findings, suggestions and recommendations:

SESSION I: Research on biological Control at ICAR –NBAIR, Biodiversity of naturalenemies and Crop Pest Outbreak report

Chairman : Dr.S.C. Dubey, ADG (PP & BS), ICAR, New Delhi, Bengaluru

Co-Chairman : Dr.K.Subaharan, HOD, DGCU, ICAR-NBAIR, Bengaluru

Rapporteurs : Dr. Deepa Bhagat, Principal Scientist, ICAR-NBAIR, Bengaluru.
Dr. C. Manjunatha, Scientist, ICAR-NBAIR, Bengaluru

Salient findings

- The incidence of pink bollworm, *Pectinophora gossypiella* was recorded to be 10-15 per cent in cotton growing districts of Punjab.
- The diverse natural enemies *viz.*, parasitoids (*Encarsia* sp., *Bracon* sp.), predators (*Novius tumidus, Aneglesis cardoni, Harmonia octomaculata* and *Prophyla dissecta*) and entomopathogens were recorded at Gujarat during the survey period. NPV infecting shoot and fruit borer, *Leucinodes orbonalis* was also recorded.
- Flower thrips/black thrips in chillies noticed at severe level in Srikakulam, Vizianagaram, Visakhapatnam and Guntur districts during November, 21 to January, 2023.
- New exotic whiteflies *Tetraleurodes acaciae*, *Aleurotrachelus atratus* and *Aleuroclava canangae* are reported in coconut system from Kerala, India.
- Two entomopathogenic fungi, *viz*., *Simplicillium formicae* and *Purpureocillium lilacinum* were isolated from the mummified mealybug cadavers of cassava mealybug complex.
- Two native isolates of entomopathogenic fungi infecting maize fall army worm from two locations of Andhra Pradesh identified as *Metarhizium rileyi* and accession numbers (OQ561247 and OQ547233) obtained from NCBI.
- Nine predatory syrphids species, *Episyrphus balteatus, Ischiodon scutellaris, Melanostoma scalare, Sphaerophoria chongjini, Eupeodes frequens, Eupeodes corolla, Metasyrphus confrater*, *Betasyrphusse rarius* and *Chrysotoxum baphyrum* were recorded from various crops in Punjab including wheat, barley, oilseeds, vegetables, fruits, ornamentals and weeds. Among these, *Episyrphus balteatus*was the predominant species (42.89 % abundance).
- Nine spider species belonging to three families Tetragnathidae, Salticidae and Araneidae were recorded from rice fields. Among these, *Neoscona theisi* was the predominant species (58.20 % abundance) followed by *Tetragnatha javana* (17.99 % abundance) and *T. maxillosa* (14.81 % abundance).
- In tomato cropping system natural enemies like *Nesidiocoris tenuis, Encarsia formosa, Neochrysocharis formosa, Diglyphus horticola, Coccinella septempunctata, Hippodamia variegata* and *Chrysoperla z. sillemi* were found associated with pests

like *Tuta absoluta, Trialeurodes vaporariorum, Helicoverpa armigera, Liriomyza trifolii, Tetranychus urticae* and *Macrosiphum euphorbiae.*

- In peach, apple and almonds coccinellid predators like *Coccinella septempunctata, Hippodamia variegata, Cheilomenes sexmaculata, Anthocoris*sp., *Orius*sp. and *Adaliatetra spilota* were recorded against peach leaf curl aphid and thrips.
- Survey for invasive alien insect pests in Kashmir valley revealed the invasion and infestation of apple blotch leaf miner, light brown apple moth, apple leaf roller and apple codling moth and the infestation of these insect pests ranged from 2.00 to 40.00% in different locations of the Kashmir Valley.

Suggestions / Recommendations

- Pest survey format has to be improvedby including map-based data and georeferencing data, encompassing the entire district, and format has to be distributed to all relevant centers.
- Comprehensive statistical analysis of the pest survey data has to be carried out to draw a meaningful conclusion.
- Reporting of pest survey data should be uniform.
- Pest incidence level above threshold level should be reported in pest outbreak report.
- While reporting local strain to be potent its molecular characterization must be done to know how it is different from other strains.

SESSION II: Biological suppression of pests of food and fibre

Chairman : Dr. S. N. Sushil, Director, ICAR-NBAIR, Bengaluru

Co-Chairman : Dr. C. S. Patil, Head (Entomology), MPKV, Rahuri

Rapporteurs : Dr. A. Kandan, Principal Scientist, ICAR-NBAIR, Bengaluru

Dr. B. L. Raghunandan, Assistant Professor, AAU, Anand

Salient findings

- Large scale demonstrations of biocontrol based IPM in organic *basmati* rice using 5-6 releases of *Trichogramma chilonis* and *Trichogramma japonicum* each @ 1,00,000 parasitoids/ha over an area of 336 acres in 7 districts of Punjab resulted in lowering the incidence of rice insect pests(leaf folder and yellow stem borer) and rendered higher grain yield with an additional benefit of Rs. 7231/- per hectare over untreated control with cost-benefit ratio of 1:2.89.

- Large scale demonstration of biocontrol based IPM package in Rice crop resulted in the reduction of the sheath blight disease upto 51.69% and Brown spot disease upto 44.04% at Uttarakhand state.
- Spraying of native isolates of entomopathogens *Metarhizium rileyi* (Anakapalle strain AKP- Nr-1) @ 5g/L and *Bacillus thuringiensis* (RARS TPT C33) @ 2 g/L three times at 20, 35 and 50 days after sowing gave effective control of fall armyworm in maize at Andhra Pradesh and Karnataka.
- Two releases of mutliple insecticide tolerant *Trichogramma chilonis* NBAIR MITS at weekly interval@ 1,00,000 eggs/ha from one week of sowing along with spraying of chlorantraniliprole 18.5 SC@ 0.4 ml/L at 35 days after sowing gave good reduction in maize fall armyworm compared to POP recommendation (Spraying of Azadirachtin 1500 ppm @ 2 ml/lt at 15 days after sowing + Spraying of chlorantraniliprole 18.5 SC@ 0.4 ml/L at 25 days after sowing +Spraying of Emamectin benzoate 5SG @ 0.4 g /L at 35 days after sowing) at Andhra Pradesh and Karnataka.
- BIPM module comprising, installation of pheromone trap @ 10 /acre + two weekly releases of *Trichogramma chilonis* @1,00,000 eggs /ha from one week after sowing + Spraying ICAR- NBAIR *Metarhizium anisopliae* NBAIR Ma35 @ 5 g/L as two sprays at 25, 35 days after sowing was effective against maize fall armyworm compared to POP Recommendation (Spraying of Azadirachtin 1500 ppm @ 2 ml/lt at 15 days after sowing + Spraying of chlorantraniliprole 18.5 SC@ 0.4 ml/L at 25 days after sowing + Spraying of Emamectin benzoate 5SG @ 0.4 g /L at 35 days after sowing) at Tamil Nadu, Telangana, Andhra Pradesh, Karnataka, Maharashtra, Rajasthan and Punjab.
- Three sprays of endophytic entomopathogenic fungus NBAIR-Ma35 @5g/L after germination at 14 days interval was found effective in the management of sugarcane early shoot borer with 7.8 and 9.4% dead heart compared to chlorantraniliprole sprays (5.7% dead heart) at Andhra Pradesh.
- Eight releases of *T.chilonis* @ 50,000 per ha at 10 days interval in sugarcane from mid - April to June, 2022 against early shoot borer, *C. infuscatellus* over an area 726 acres in 8 districts of Punjab in collaboration with Krishi Vigyan Kendras (KVKs) and Regional Station (Gurdaspur) at farmer's fields reduced its incidence by 57.32 per cent as compared to 80.27 per cent in chemical control (chlorantraniliprole 18.5 SC @

375 ml/ ha). The cost benefit ratio in biocontrol (1: 1.58) and chemical control (1: 1.75) was higher as compared to untreated control (1:1.48).

- Eight releases of *T. japonicum* @ 50,000 per ha at 1 0 days interval in sugarcane from mid - April to June, 2022 against top borer, *Scirpophaga excerptalis* over an area of 480 acres in 10 districts of Punjab in collaboration with KVKs at farmer's fields reduced its incidence by 53.97 per cent as compared to 79.01 per cent in chemical control (chlorantraniliprole 0.4 GR @ 25 kg/ha). The cost benefit ratio in biocontrol (1: 1.56) and chemical control (1: 1.73) was higher as compared to untreated control (1:1.48).
- Wettable powder formulation of entomopathogenic nematode *Heterorhabditis indica* NBAIR @ 10 kg/ha was found superior in controlling sugarcane white grubs and recorded 4.40 per cent mean clump mortality as compared to control (12.57%).
- Application of *Lecanicillium lecanii* NBAIR Vl 8 @ 5g/L in cotton recorded lesser leafhopper population (6.23/plant) as compared to control (15.23/plant).
- Demonstration of cotton pink bollworm BIPM module (Standard practice of plant protection till 55^{th} day + Erection of pheromone traps (Funnel type) @ 10/ plot + 6-8 releases of *Trichogrammatoidea bactrae* 100,000/ha/release starting from 55 days after germination + Application of azadirachtin 1500 ppm at ETL) revealed that BIPM practices recorded lesser rosette flowers (1.22-7.87%), lesser green boll damage (9.20 - 14.23%) and higher yield (18.90-26.60 q/ha) compared to the control plots (2.87 - 43.67%, 12.80 - 24.66% and 15.98-11,25 q/ha respectively,
- Spraying of entomopathogenic fungi, *Isaria fumosorosea* NBAIR Pfu5 @ 5 g/L two times with a release of parasitoid *Encarsia guadeloupae* reduced coconut rugose spiralling whitefly at AndhraPradesh, Tamil Nadu and Kerala.
- Augmentative release of the larval parasitoids, *Goniozus nephantidis* (20 /palm) and *Bracon brevicornis* (30/palm) reduced the incidence of black headed caterpillar from 42% to about 2% in a period of two years at Kasaragod, Kerala.
- Area-wide innundative release of the green muscardine fungus, *Metarhizium majus* @ 5 $x10^{11}$ spores/m^3 on to the breeding sites (wooden logs & cow dung pits) reduced the coconut rhinoceros beetle incidence and spear leaf damage of coconut at Azapuzha district of Kerala.

Suggestions / Recommendations

- Return on per rupee investment should be calculated at the end of the experiment.
- All the field experiment data should be analyzed using factorial method of statistical analysis.
- Biological control agents should be exchanged between the centres and analysis of the data to be done across the locations.
- Cell free extract of microbial agents may be used as an additional treatment after a prior lab testing.
- Use the susceptible variety in the experiments for the target pests to reach the ETL level for better results of the treatments.
- The percent reduction over control of pest and disease data should be avoided and non-significant data should be presented with proper justification.
- All the bioagents should be tested more than four locations to generate and utilize the bioefficacy data for CIBRC 9(3) registration.

SESSION III: Biological suppression of pests of pulses and oil seeds

Chairman : Dr. G. S. Dubey, Former Dean, Birsa Agrl. University, Ranchi

Co-Chairman : Dr.A.G.Chandele, Former Associate Dean, College of Agriculture, Pune

Rapporteurs : Dr. K. Selvaraj, Senior Scientist, ICAR-NBAIR, Bengaluru

Dr.Shyamal Sahoo, Professor, UBKV, Pundibari

Salient findings

- Three sprays of entomopathogen, *Bacillus thuringiensis* NBAIR Bt G4 2% @ 10 ml/L in Greengram effectively controlled spotted pod borer, *Maruca virtata* compared to POP recommendation (Sparying of Azadirachtin 1% 1500 ppm @ 2 ml/L+ Sparying of Chlorpyriphos @ 2.5 ml/L+ Spraying of Acephate @ 1.5 g/L).
- In chickpea, minimum pod damage of 3.49 % was recorded in insecticidal sprayed plots followed by the plots treated with *Bacillus thuringiensis* NBAIR Bt G4 2% @ 10 ml/L(4.32% damage) and both the treatments were significantly superior to untreated control (11.83% damage).
- Application of *Trichoderma harzianum* NBAIR strain as seed treatment @10g/Kg of seed and soil application twice @5kg/ha and spraying of *Bacillus thuringiensis* NIBSM Bt@10 ml/L during pod imitation and formation stage resulted 56%

reduction of chick pea pod borer *Helicoverpa armigera* and 46 % reduction of soil borne diseases of chick pea.

- In cowpea, the major pest black pea aphid *Aphis craccivora* and the pod bug *Riptortus pedestris* can effectively be managed using chitin enriched oil formulation of *Lecanicillium saksenae* @ 10^8 spores mL^{-1} when sprayed twice @1 mL/L.
- *Fusarium* wilt in cowpea can be effectively controlled by seed treatment with *Trichoderma asperullum* @ 20 g $kg^{-1}$of seed + basal application of *T.asperullum* enriched cowdung @ 250 g /plant + soil drenching of *T.asperullum*@ 2g/L at 20,40 and 60 days which was equally effective as chemical treatment with carbendazim.
- Entomopathogens, *Metarhizium rileyi* (AKP Nr1) @ 5 g/L and *Bacillus thuringiensis* RARS TPT C33 @ 2g/Lt as two sprays gave good control of leaf miner and *Spodoptera litura* in groundnut with higher pod yield and on par with emamectin benzoate 5SD@ 0.4 g/L.
- Among the bio-pesticides, Azadirachtin 3000 ppm @ 2.5 ml/lit treated plots showed the lowest number of mustard aphids per shoot (7.70 Nos.) followed by *Beauveria bassiana* (11.83 Nos.) as compared to control (17.25 Nos).

Suggestions / Recommendations

- A suitable microbial consortium may be developed and evaluated against insect pests and diseases of pulses and oilseeds.
- Standard operating procedures (SOP) for application of biopesticide formulations using drone may be developed.
- Evaluation of biocontrol agents against other emerging pests like semilooper, leafhopper, gall midge in sesame and painted bug in mustard may be initiated.
- Uniformity in statistical analysis should be followed for all the experiments .Common software may be developed for the uniform data entry and analysis.

SESSION IV: Biological suppression of pests of fruits, vegetables and polyhouse crops

Chairman	**:**	**Dr. A. B. Rai, Ex Head, Crop Protection, ICAR-IIVR Varanasi**
Co-Chairman	**:**	**Dr. D. S. Pokharkar, Ex Head,EntomologyDept, MPKV,Rahuri**
Rapporteurs	**:**	**Dr. P. S. Shera, professor, PAU Ludhiana**
		Dr.Richa Varshney, Scientist, ICAR-NBAIR Bengaluru

Salient findings

- Soil application of *Heterorhabditis indica* @ $2.5x10^9$IJs $ha^{-1}$was found effective against brinjal ash weevil and significantly superior over other treatments with 1.01 mean ash weevils adults per plant in EPN treated plots of brinjal as compared to control (10.23).
- *Metarhizium anisopliae* NBAIR Ma4 ($1x10^8$ spores/g)@5 g/L gave significantly effective control of leaf hoppers in okra with 2.59 mean leaf hoppers per plant followed by *Beauveria bassiana* NBAIR Bb5a ($1x10^8$spores/g) @5 g/ L (2.70 mean leaf hopper per plant) and *Metarhizium anisopliae* IIHR Strain @5ml /L (2.89 mean leaf hoppers per plant) as compared to control (7.12 mean mean leaf hoppers per plant).
- Four sprays of *Bacillus albus* NBAIR-BATP @ 20ml/L was significantly superior over other entomopathogens in managing *Thrips parvispinus* in chilli. The Mean number of thrips per plant observed was 8.66 in *B. albus,* compared to the untreated control (28.71 thrips per plant).
- The reduviid predator, *Sycanus collaris*, released at the rate of 20 nymphs/10 m^2 was as effective as the chemical chlorantraniliprole in managing *Spodoptera litura* in cucumber under polyhouse conditions.
- Release of predatory mite *Neoseiulus longispinosus* at 1:20 predator: prey ratio twice at 15 days interval effectively reduced the phytophagous mite, *T.urticae* on in cucumber under polyhouse condition. The mite population was 1.2/cm^2 in plants treated with *N. longispinosus* (50 nymphs/m row) as compared to chemical control plants where the mite population was 0.60 mites/ cm^2.
- Evaluated predatory mite @ 10 individuals per plant against spider mite, *Tetranychus urticae* infesting tomato under polyhouse which resulted lowest population of spider mite (1.33 mite per cm^2)and was statistically at par with 3 releases of an anthocorid predator *B. pallescens* @ 20 per plant at weekly interval and spray of Spiromesifen 240 SC @100 g.a.i.ha^{-1} at 15 days.
- Biointensive management of pests of cabbage, the treatment with BIPM components was significantly superior over rest of the treatments and recorded least aphids (24.32 /plant) with 77.65 per cent reduction over control and least larval population of diamond back moth (0.28 larva/plant) with 88.97 per cent reduction over control.
- *Metarhizium anisopliae* treated apple plots showed 65.57 per cent mortality of the

- apple root borer grubs in different orchards, while in chlorpyriphos (0.06%) treated plots the grub mortality was 89.30 per cent. Farmers saved about Rs 12000/- per hectare by avoiding/reducing pesticide applications.
- BIPM practices (ploughing in orchard during March-April, clean cultivation, regular collection and destruction of fallen infested fruits during May-June and six releases of *T. embryophagum* @ 4000 parasitized eggs per tree at 7-10 days interval starting from starting from fruit initiation to colour break stage) for litchi fruit borer resulted in 64.14 per cent reduction in fruit damage over untreated control as compared to 67.76 per cent in chemical control. The yield in BIPM (65.23 q/acre) was at par with farmer's practice (66.82 q/acre). However, lowest yield was recorded in untreated control (43.13 q/acre).

Suggestions / Recommendations

- GPS based survey of pests and natural enemies should be conducted and presented.
- AICRP centres (Solan, Jammu and Pantanagar) and NRC Muzaffarpur should be involved to conduct multilocation trial on BIPM in Litchi.
- Conservation/Habitat manipulation trials should be planned in fruits and vegetable crops.
- Field experiments with encouraging results should be validated by involving PC cell, nearby centres, company personnel and other officials.
- Plot size of common experiments should be uniform. Minimum number of trees per replication should be decided in fruit crop experiments.

SESSION V: Institute - industry interaction

Chairman : Dr. S. C. Dubey, ADG (PP&BS), ICAR, New Delhi

Co-Chairman : Dr. S. N. Sushil, Director, ICAR-NBAIR, Bengaluru

Rapporteurs : Dr. A. Joseph Rajkumar, Principal Scientist, ICAR-CPCRI, Kayankulum

Dr. Omprakash Navik, Scientist, ICAR-NBAIR, Bengaluru

Suggestions / Recommendations

- Emphasis need to be given to promote biopesticides available in ICAR institutes and SAU's with industrial partners.
- Research institutes and SAUs should agree to take up bioefficacy trials to fulfill the registration requirements.
- Emphasis should be given to simplify the regulatory requirements for the export of biopesticides.

- Biosafety analysis of potential biopesticides may be encouraged through industry on PPP mode for mutual benefits.
- Virulence and quality parameters against target pests should be of high standard for registration.

SESSION VI: Valedictory and Plenary

Chairman : Dr. S. C. Dubey, ADG (PP&BS), ICAR, New Delhi

Co-Chairmen : Dr.S.N.Sushil, Director, ICAR - NBAIR, Bengaluru

Rapporteurs : Dr. Jagadeesh Patil, Senior Scientist, ICAR-NBAIR, Bengaluru
Dr.Keerthi Patel, Scientist, ICAR-IIHR, Bengaluru

Suggestions / Recommendations

- Microbials used in the experiment should be of high virulence and good quality.
- Some more experiments may be included in technical programme for pulses.
- Concluded experimentshave to be presented with pooled data analysis and should be published.
- Software may be developed to enter the data of all AICRP centres and also maintain uniform statistical analysis.
- Private companies should be invited by NBAIR to showcase the technologies and to bridge the gap between Institute and Private companies.

Overall Recommendations

1. Pest survey format has to be improved by including map-based data and geo referencing data encompassing the entire district, and format has to be distributed to all relevant centres.
2. While reporting local strain to be potent, its molecular characterization must be done to know how it is different from other strains.
3. Cell free extract of microbial agents may be used as an additional treatment after a prior lab testing.
4. All the bioagents should be tested at more than four locations to generate and utilize the bioefficacy data for CIBRC 9(3) registration.
5. Suitable microbial consortia may be developed and evaluated against insect pests and diseases of major crops.
6. Conservation/Habitat manipulation trials should be planned in fruits and vegetable crops.

7. Emphasis need to be given to promote biopesticides available in ICAR institutes and SAU's with industry partners.
8. Concluded experiments have to be presented with pooled data analysis and should be published.
9. Software may be developed to enter the data of all AICRP centres and also to carryout uniform statistical analysis.
10. Private companies should be invited by NBAIR to showcase the technologies and to bridge the gap between Institute and Private companies.