



DOR Newsletter



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EVENTS

DOR received accolades for participation in Krishi Vasant, 2014

Krishi Vasant 2014 a mega agricultural exposition, jointly organized by the Ministry of Agriculture, Government of India and ICAR at the Central Institute for Cotton Research, Nagpur during 9-13 February, 2014 was inaugurated by the Honourable President of India Shri Pranab Mukherjee amidst higher officials of ICAR/DARE and large number of farmers from all over the country. DOR, Hyderabad actively participated in live-crop demonstrations, farmers' conference (Self-reliance in Oilseeds Production) and farmer-scientist interaction sessions. An exhibition stall was put up by DOR showcasing DOR/AICRP strengths through attractive displays, products and seed sale counter.

In live-crop demonstrations, three hybrids of sunflower *viz.*, LSFH-171, DRSH-1 and KBSH-44; five cultivars of castor comprising three hybrids DCH-177, DCH-519 and GCH-4 and two varieties DCS-107 and 48-1; four cultivars of safflower *viz.*, PBNS-12 (Parbhani Kusum), NARI-6, SSF-708 and NARI-H-15 (Hybrid) were taken up in the oilseed block at CICR, Nagpur well in advance so that the crop reached flowering stage during demonstration. The exhibition stall portrayed latest technologies of DOR including seed supply and received great appreciation from higher officials of ICAR/DARE as well as from the organizers and participating farmers from all over the country.



Demonstrations in oilseed block at Krishi Vasant

Visit of DG, ICAR and other dignitaries to DOR stall

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A large number of farmers and other stakeholders /dignitaries of ICAR/DARE visited the live-crop demonstrations of mandated crops and exhibition stall. They discussed and clarified issues pertaining to the production/protection/value addition/marketing. Publication material printed in Hindi, English and Telugu languages were distributed for the benefit of farmers and other stakeholders. Live-products/castor spikes were also displayed at the ICAR stall.

Sale of limited quantity of DOR hybrid seed has given an opportunity to popularize crops like castor in non-traditional areas of Maharashtra. The database /mobile phone numbers of large number of farmers who visited DOR stall could be utilized in research/future programmes. Further, the appreciation received from higher officials has elevated DOR's capability and contribution to the national cause. Dr(s). K.S. Varaprasad, I.Y.L.N. Murthy, M. Padmaiah, G. Suresh (Nodal Officer),

G.D. Satish Kumar, M.Y. Dudhe, Mr. M. Bhaskar Reddy, Mr. B. Kistaiah and Mr. E. Ravi Kumar participated in the event.

Farm Innovators' Day



DOR celebrated the 'Farm Innovators' Day on 28 February, 2014. Twenty innovative farmers from four states *viz.*, Andhra Pradesh, Karnataka, Maharashtra and West Bengal participated and shared their innovations.

Dr. K.S. Varaprasad, Project Director, DOR welcomed the farmer innovators and highlighted the importance of innovative farmers in acting as role models for other farmers and also recognize them as farmer-scientists for their innovations.

On this occasion, farmers shared their innovations such as water supply systems in employing a single motor to irrigate water from two bore wells, semi-automatic cultivator for weeding, intercultural operations and irrigation and plant based medicines for control of mosquitoes, pains and wounds.

A small innovation of 'skip row irrigation' adopted by a safflower farmer saved the cost of labour, water and increased the yield up to 10 quintals/acre. A sunflower farmer of West Bengal which is a non-traditional area for the crop, developed his own oil filtering technique using lemon juice. Tribal farmers of Andhra Pradesh, adopted sprinklers in castor crop and harvested a bumper crop. Safflower farmers of Karnataka adopted safflower + coriander intercropping system to reduce the incidence of pests and diseases.

Selected innovators were felicitated during the occasion. Shri Srikar, Vice President, Palle Shrujana

speaking on the occasion informed that their objective was to identify the innovators and facilitate popularization of their innovations. Chief Guest Dr. B.C. Viraktamath, Director, DRR highlighted the importance of innovativeness of small farmers in solving their specific field problems. He praised the innovators for evolving need based 'low-cost/no-cost' technologies. He advised the gathering that scientists and farmers could learn from each other.

A CD on "Success Story of Chenchu Farmer" and a bulletin on "Castor Seed Production" was released on the occasion. Dr. I.Y.L.N. Murthy, Head (Crop Production) and Principal Scientist, DOR proposed the vote of thanks.

Research News

Severe Infestation of Root-knot nematode, *Meloidogyne incognita* on castor in Rajasthan

Castor is considered a poor host to root-knot nematodes. However, the crop was found severely infected by root-knot nematodes at Sirohi district of Rajasthan. Survey of different villages in Revdar mandal *viz.* Danpura, Varman, Jiraval, Harniamarapura, Dontrai, Amirpura, Mohanpur and Rauva revealed rampant growth of galls on castor roots. Infested crop showed yellowing and stunting. Soil nematode population varied from 3 to 36/cc soil. Root population (egg mass) was



Galls on castor root

Galls - Close-up view

found ranging from 121 to 357 per root. There is an urgent need to address the nematode issue as these nematodes are highly polyphagous and destructive on many field and horticultural crops. The help and guidance of Dr. D.J. Patel, Principal Scientist & Dean (Retd.) in conducting the survey is greatly acknowledged.

P. Giribabu

Safflower germplasm [IC 13884 (NIC 7133 (SD5-1278)/GMU 4983)] registered with PGRC, ICAR for resistance to Fusarium wilt as INGR14002

A safflower landrace from Uttar Pradesh, IC 13884 [NIC 7133(SD5-1278)/GMU 4983] identified for resistance to *Fusarium* wilt caused by *Fusarium oxysporum* f.sp. *carthami* by Dr. N. Mukta, Dr. R.D. Prasad and Dr. P. Anil Kumar was approved for registration by PGRC at its XXVIII meeting held on 31 January, 2014 at NBPGR, New Delhi and allotted the registration number INGR14002.

Meetings

Institute Management Committee Meeting



The 33rd meeting of the Institute Management Committee was held on 2 February, 2014 at DOR under the Chairmanship of Dr. K.S. Varaprasad, Project Director, DOR. The meeting was attended by Dr. Y. Laxman Das, JDA (CS), Govt. of AP, Hyderabad; Dr. N. Mohan Reddy, Dy. Director of Research, ANGRAU; Dr. T. Radhakrishnan, Principal Scientist, DGR, Junagadh; Dr. S.N. Sudhakara Babu, Principal Scientist, DOR; Shri P. Gopal Reddy, Member (Non-Official) and Mr. Anil Behari, SAO, DOR and Member Secretary. Dr. I.Y.L.N. Murthy, Principal Scientist; Dr. D. Pati, Chief Technical Officer and Shri H. Ganesh, FAO, DOR also participated in the meeting as special invitees. The Chairman welcomed the Management Committee Members and presented the research achievements of the Directorate. The Committee reviewed different research and developmental activities and applauded the overall progress made by the Institute. Thereafter the Member

Secretary apprised the members about the Action Taken Report on the proceedings of the 32nd IMC meeting. The agenda means were discussed by the Committee.

Visit of Monitoring Team for Sunflower DUS Trial



The Monitoring Team visited the sunflower DUS trial funded by PPV&FRA comprising of 25 candidates with 12 reference entries on 22 January, 2014 under the Chairmanship of Dr. D.M. Hegde, Ex-Project Director, DOR, Hyderabad. The other members were representatives from four private seed companies and Dr. N. Mukta (Nodal Officer), Dr. C. Lavanya (Associate Nodal Officer) and Dr. Mangesh. Y. Dudhe (Associate) from DOR, Hyderabad. The team was satisfied with the crop expression and data recording.

Training

Hands-on Training

A hands-on training on “Microbial Agents of Major Insect Pests and Diseases of Crops” was organized during 4-13 March, 2014 at DOR. The training was attended by eight participants (six from private sector and two from SAUs). The participants were trained on isolation, identification, mass production, formulation, quality control and registration of microbial agents with specific reference to the plant disease antagonists - *Trichoderma* spp., and *Pseudomonas fluorescens*, entomocidal bacterium - *Bacillus thuringiensis*, entomopathogenic fungi like *Beauveria bassiana*, *Metarhizium anisopliae*, *Nomuraea rileyi*, *Paecilomyces fumosoroseus* and *Verticillium lecanii*, baculoviruses of *Helicoverpa armigera* and *Spodoptera litura* and entomopathogenic nematodes. Identification of fungi through molecular techniques as well as bacteria through PCR techniques including cry gene profiling for



Bt were taught to the participants. Drs. R.D. Prasad and P. S. Vimala Devi were the Course Directors while Drs. P.S. Srinivas, P. Duraimurugan and P. Giribabu were the Course Co-ordinators.

Workshop on “Leveraging mobile phone technology to reach the farmers”

It is a well known fact that the increasing penetration of mobile phone networks and handsets in India presents an opportunity to make useful information more widely available even to farming community. In order to explore the possibility of sending text/voice based agro - advisories in a holistic way to the farmers in Andhra Pradesh, a workshop on “Leveraging mobile phone technology to reach the farmers” was organized at DOR on 18 March, 2014. Major objective of the workshop was to come out with an execution plan on disseminating agro - advisories for the ensuing *kharif* for the benefit of farmers of Andhra Pradesh.

Accordingly, after a day-long deliberations with all the stakeholders *viz.*, farmers, representatives from NGOs, technology providers - National Informatics Centre, Hyderabad (NIC) and IFFCO Kisan Sanchar Limited (IKSL), Hyderabad and Acharya NG Ranga Agricultural University (ANGRAU), ICAR institutes *viz.*, CRIDA, DRR, DSR and NAARM, the following action plan was developed for implementation during the ensuing *kharif*.

For the ensuing *kharif* season, four districts *viz.*, Prakasam, Mahabubnagar, Anantapur and Krishna were selected for disseminating text and voice messages to around 8000 farmers growing oilseeds, sorghum and rice.



The strength of the NGOs *viz.*, REEDS, VBF and RMS will be utilized in selecting the mobile numbers of the farmers, which are not represented in the NIC database.

SMS Service to Oilseed Farmers

Information and communication technologies (ICTs) can play an important role in their endeavour of reaching the unreached farmers. The typical ICT tool *viz.*, mobile telephone with a subscriber base of more than 920 million and overall tele-density of 61.38 may play significant role in technology transfer. In order to utilize this mobile technology for technology transfer, SMS has been initiated in collaboration with National Informatics Centre. Farmers from Andhra Pradesh were enrolled into the system and SMSs on sunflower and castor production technologies are being disseminated in local language (telugu). Farmers interested to avail this service may enrol themselves at the following link: <http://www.apagrisnet.gov.in/agrisms/Farmer/farmerdetails.jsp?message=Inserted%20Successfully>.

Field days Safflower

A field day was organised at Veligonda village, Uravakonda mandal, Anantapur district on 4 January, 2014 to monitor the performance of safflower crop introduced during this *rabi* season and also to interact with the farmers on their experience with safflower *vis-a-vis* the competing crops.

Around 150 farmers participated in the field day. The representatives from the State Department of Agriculture and MARICO industries also actively



participated in the field day. The farmers expressed that the safflower crop is primarily a low external input crop and hence holds high promise in future considering the stagnancy of productivity levels and also the high cost of production of bengalgram. The representatives from the industry assured that they would buy the entire produce as per the market price that prevails on the date of purchase.

Sunflower

Sunflower germplasm field day was conducted by AICRP (Sunflower) Centre, ORS, MAU, Latur during 5-6 February, 2014 in collaboration with DOR, Hyderabad and Division of Germplasm Conservation, NBPGR, New Delhi. Sunflower breeders got an opportunity to look at the performance of germplasm accessions contributed by Latur centre (490), NBPGR New Delhi (1093), DOR, Hyderabad (369) and Ludhiana (45). All together 1997 accessions were raised for field day. A total of 15 Sunflower breeders from different AICRP centres participated in the field day and selected specific germplasm for future use in breeding.



Publications

Research Papers

- ✦ Anjani, K. and Raof, M.A. 2014. Analysis of mode of inheritance of *Fusarium* wilt resistance in castor (*Ricinus communis* L.). *Plant Breeding*, 133: 101–107. DOR/CI-67/13.
- ✦ Anjani, K., Raof, M.A. and Desai, A.G. 2014. Evaluation of world castor (*Ricinus communis* L.) germplasm for resistance to *Fusarium* wilt (*Fusarium oxysporum* f. sp. *ricini*). *European Journal of Plant Pathology*. DOI 10.1007/s10658-014-0413-x. available on-line from 22/3/14. DOR/CI-68/13.
- ✦ Kumar, G.D.S., Padmaiah, M., Aivelu, K. and Madhuri, P. 2013. Impact of mobile phone based agro-advisories on knowledge of sunflower (*Helianthus annuus* L.) farmers'. *Journal of Oilseeds Research*, 30 (2):154-157. DOR/SS-28/13.
- ✦ Murthy, I.Y.L.N., Sudhakara Babu, S.N., Haripriya, Ch. V. and Bhaskara Reddy, M. 2013. Effect of calcium and boron on sunflower (*Helianthus annuus* L.) seed yield in Alfisols. *Journal of Oilseeds Research*, 30 (2): 177-179. DOR/NRM-64/13.

Book Chapter

- ✦ Praduman Yadav, Sunil Kumar, Taruna Yadav, Prathap Reddy, K. and Murthy, I.Y.L.N. 2014. Oxidative stress and antioxidant defense system in plants. *In: Biotechnology Vol. 2: Plant Biotechnology*. 261-281. DOR/NRM-61/13

Papers Presented in Seminars/ Workshops/ Conferences

- ✦ Duraimurugan, P., Srinivas, P.S. and Sampath Kumar, M. 2014. Evaluation of pheromone trapping for monitoring of seasonal activity of *Spodoptera litura* in castor (*Ricinus communis*). *In: Proceedings of 2nd International Conference on Agricultural & Horticultural Sciences*, 03-05 February 2014, Hyderabad, India. Pp. 239.
- ✦ Suresh, G., Sudhakara Babu, S.N. and Aziz Qureshi, M.A. 2014. Performance of soybean-sunflower cropping system under varied nutrient management practices in Vertisols. *In: Mitigating productivity constraints in soybean for sustainable agriculture. Proceedings of SOYCON 2014: International Soybean Research Conference*. Society for Soybean

Research and Development, Directorate of Soybean Research, Indore held during 22-24 February, 2014. Pp.173.

- ✦ Vimala Devi, P.S. 2014. Microbial Pesticides: R & D to Commercialization. National Symposium on “Emerging Trends in Eco-friendly Insect Pest Management”, 22-24 January, 2014 held at TNAU, Coimbatore.

Folder

- ✦ Three pamphlets on Sunflower, Safflower and Castor were published in Hindi for distribution at Krishi Vasant held at CICR, Nagpur during 9-13 February, 2014.

Invited Lectures

- ✦ Dr. Sentilvel Senapathy, Sr. Scientist (Pl. Breeding) delivered a lecture on “QTL Mapping” during the

Winter School on “Molecular Breeding Approaches for Genetic Enhancement of Millet Crops” conducted by DSR, Hyderabad on January 1, 2014.

TV Presentations

- ✦ “Agronomic management practices for higher productivity of safflower” by Dr. P Padmavathi, Senior Scientist (Agronomy) telecasted by CVR News Channel, Hyderabad on January 6, 2014.

Personnel

Promotions

- ✦ Dr. (Mrs.) Chunduri Sarada, Senior Scientist (Agricultural Statistics) has been promoted to the next higher grade of Principal Scientist (Agricultural Statistics) with effect from 6 December, 2012.

HRD

Participation in Conferences/Workshops/Trainings/other Programmes

Dr. H.P. Meena Dr. Praduman Yadav	Training Programme on “Oilseeds Production Technologies”	ATMA, Nawada, Bihar	1-4 January, 2014
Mr. G. Raghunath Mr. V. Sambasiva Rao	National Seminar on "Emerging Technologies in Information Management"	S.V. Agricultural College, ANGRAU, Tirupati	4 January, 2014
Dr. K.S. Varaprasad	Sesame Exporters Meeting	IOPEPC, Mumbai	16 January, 2014
Dr. P.S. Vimala Devi	National Symposium on “Emerging Trends in Eco-friendly Insect Pest Management”	TNAU, Coimbatore	22-24 January, 2014
Dr. P. Duraimurugan	2nd International Conference on “Agricultural and Horticultural Sciences (Agri-2014)”	HITEX, Hyderabad	3-5 February, 2014
Dr. K.S. Varaprasad, Dr. I.Y.L.N. Murthy, Dr. M. Padmaiah, Dr. G. Suresh Dr. G.D. Satish Kumar Dr. M.Y. Dudhe Mr. M. Bhaskar Reddy Mr. B. Kistaiah Mr. E. Ravi Kumar	Agriculture Fair-cum-Exhibition “Krishi Vasant-2014”	CICR, Nagpur	9-13 February, 2014
Mr. P. Ashok	Training Programme on “Capacity Building for Technical Personnel”	IIPA, New Delhi	10-21 February, 2014
Dr. G. Suresh	International Soybean Research Conference (SOYCON 2014)	DSR, Indore	22-24 February, 2014
Dr. S.V. Ramana Rao Mr. G. Raghunath Mr. V. Sambasiva Rao	National Workshop on “KOHA Professional Training”	NAARM, Hyderabad	24-26 February, 2014
Dr. Sujatha, T.P.	Training Programme on “Computational Aspects for NGS Data Analysis: A Sojourn from Lab to Field”	AAU, Gujarat	4-13 March, 2014

राजभाषा कार्यशाला आयोजित

निदेशालय में एक दिवसीय कार्यशाला का आयोजन 22 मार्च, 2014 को किया गया। कार्यशाला की अध्यक्षता डॉ. के. एस. वरप्रसाद, परियोजना निदेशक ने की। कार्यक्रम का शुभारंभ डॉ. प्रद्युम्न यादव, वैज्ञानिक के स्वागत भाषण से हुआ।



इस कार्यशाला में श्रीमति निलिभा तिवारी, हिन्दी प्राध्यापक, हिन्दी शिक्षण योजना, हैदराबाद ने हिन्दी व्याकरण और अन्य आयाम पर प्रकाश डाला। आपने बहुत सरल तरीके से हिन्दी भाषा का व्याकरण, इसके उपयोग में आने वाली कठिनाइयाँ तथा इसे दूर करने के उपाए बताए। सरकार की राजभाषा नीति और इससे संबंधित नियमों की जानकारी दी। कार्यालय में हिन्दी का उपयोग बढ़ाने संबंधी बहुत सारी महत्वपूर्ण जानकारी प्रदान की।

डॉ. के. एस. वरप्रसाद, परियोजना निदेशक ने इस जानकारी को बहुत उपयोगी एवं कार्यालय में हिन्दी के उपयोग को बढ़ाने में एक महत्वपूर्ण कदम बताया। डॉ. हरिप्रकाश मीणा, वैज्ञानिक के धन्यवाद ज्ञापन से कार्यक्रम का समापन हुआ। कार्यशाला संचालन श्री प्रदीप सिंह, सहा. निदेशक (रा.भा.) ने किया। इस कार्यशाला में निदेशालय के वैज्ञानिक, अधिकारी एवं स्टॉफ सदस्यों ने भाग लिया।

बिहार के किसान हेतु प्रशिक्षण कार्यक्रम

तिलहन उत्पादन बढ़ाने की तकनीकी

(01 - 04 जनवरी 2014)

तिलहन अनुसंधान निदेशालय में चार दिन (01- 04 जानवरी, 2014) का प्रशिक्षण कार्यक्रम आयोजित किया गया। यह प्रशिक्षण कार्यक्रम कृषि तकनीकी प्रबंध संस्था, नवादा बिहार द्वारा प्रायोजित

किया गया था। इसमें बिहार के नवादा जिले के 17 किसानों ने भाग लिया। इस प्रशिक्षण कार्यक्रम का मुख्य उद्देश्य किसानों को तिलहनी फसलों की जानकारी देना था। इस कार्यक्रम का मुख्य उद्देश्य तिलहनी फसलों का उत्पादन बढ़ाने की तकनीकी जानकारी देना था। इस प्रशिक्षण कार्यक्रम में नौ तिलहनी फसलों (सूरजमुखी, अरण्डी, कुसुम या करडी तिल, रामतिल, राई और सरसों, जलसी सोयाबीन एवं मूँगफली) के बारे में प्रशिक्षण दिया गया। इसमें मुख्यतः फसल को उगाने के क्षेत्र, जलवायु, मृदा, खेत की तैयारी, बुआई कैसे करे एवं कब करें, बुआई का समय, मौसम, बीजदर प्रति हैक्टर, बीज शोधन या बीजोपचार, बीज की गहराई, प्रजातियों का चयन, उर्वरक तथा खाद की मात्रा एवं समय सिंचाई की क्रान्तिक अवस्थाएं, खरपतवारों का नियंत्रण कैसे करे, पकने की अवधि कौन-कौन से कीट लगते हैं एवं उनका नियंत्रण कैसे करें, फसल पर कौन-कौन से रोग लगते हैं एवं उनकी रोकथाम के उपाय (कृषि क्रियायें, रसायन विधि, जैविक विधि), फसल चक्र कैसे अपनाये एवं फसल चक्र के फायदे, फसल की कटाई कब एवं कैसे करें एवं मंडाई कैसे करें पर विस्तार चर्चा की गई। किसानों ने चर्चा में काफी रुचि दिखाई एवं कई प्रश्न भी पूछे। इनके अलावा इक्रिसेट (ICRISAT) पटानचेरू में आधे दिन के भ्रमण का कार्यक्रम भी रखा गया। जिसमें डॉ. मुरली मनोहर शर्मा जी ने इक्रिसेट के बारे में किसानों को विस्तार से जानकारी दी। उन्होंने यह बताया कि यहाँ पर कौन-कौन सी फसल पर काम होता है एवं उनकी नई प्रजातियों कौन-कौन सी हैं तथा इसके अलावा उन्होंने जल संरक्षण पर विशेष जोर दिया तथा किसानों को बताया कि किस तरह से आप कम पानी वाले क्षेत्रों में भी बारिश के पानी से सिंचाई देकर कैसे अपने उत्पादन को बढ़ा सकते हैं। उन्होंने किसानों को जल संरक्षण के फायदों भी बताये जिससे किसानों की जल संरक्षण में रुचि बढ़े। किसानों ने तिलहन अनुसंधान निदेशालय के राजेन्द्रनगर स्थित फार्म पर जाकर तिलहनी फसलों के बारे में विस्तार से जानकारी ली। किसानों को इस प्रशिक्षण कार्यक्रम से काफी सीखने को मिला जिसमें मधुमक्खी पालन भी मुख्य था। इस प्रशिक्षण कार्यक्रम के दौरान किसानों ने कुसुम, सूरजमुखी एवं अरंडी में ज्यादा लेपि दिखाई जिसके चलते सभी किसानों को कुसुम के बीज की जानकारी के लिए इस हिन्दी पुस्तिका दी गई ताकि वो भविष्य में किसी भी फसल के बारे में पूरी जानकारी पा सके। इस प्रशिक्षण कार्यक्रम को सफल बनाने में परियोजना निदेशक महोदय डॉ. के.एस. वरप्रसाद, डॉ. जी.डी. सतीश कुमार, डॉ. प्रद्युम्न, डॉ. हरिप्रकाश मीणा, डॉ. हरवीर सिंह, डॉ. अजिज कुरैशी, डॉ. एन. मुक्ता, डॉ. पद्मावति, डॉ. जवाहर लाल एवं कृषि प्रसार के सभी कर्मचारियों का मुख्य योगदान रहा।

एम. पद्मय्या

From Director's Desk



Insect pest management in agriculture is important to safeguard crop yields and productivity. In India, on an average 33% of crop loss occurs due to pests and diseases which is estimated to the tune of ₹ 200 billion. In addition, ₹ 1000 crore worth agricultural exports are rejected due to presence of high pesticide residues. This warrants reduced dependence on pesticides by using safer alternatives to manage insect pests.

Plant protection against pathogens, pests and weeds has been progressively reoriented from a remedial approach to a rational use of pesticides in which consumer health and environmental preservation prevail over other productive or economic considerations. Currently several beneficial microorganisms are the active ingredients of a new generation of microbial pesticides.

The National Farmer Policy 2007 has strongly recommended the promotion of bio-pesticides for increasing agricultural production, sustaining the health of farmers and environment. Bio-pesticides market was valued at \$1.6 billion in 2009 with 3.7% share of the \$43 billion pesticide market that is expected to reach 6.9% (\$3.3 billion) by 2014. Among the different microbial agents, bacteria, fungi and baculoviruses are considered promising for pest control. Altogether 14 primary microbial pesticide products and their various formulations have been registered in India.

DOR has been pioneering the research pertaining to development and promotion of microbial pesticides towards eco-friendly pest management for the past two decades. It is well equipped in terms of expertise and infrastructure for research, development and commercialization of potential microbial agents and is a notified referral laboratory of Central Insecticides Board (CIB), GOI, for testing of

microbial pesticides. Focused research efforts in this direction have led to identification of virulent strains of *Bacillus thuringiensis* (Bt) var. *kurstaki*, *Beauveria bassiana*, *Trichoderma viride*, *T. harzianum*, *Pseudomonas fluorescens*, etc., and development of efficient formulations with extended shelf life. Existing norms make registration of microbial pesticides mandatory for commercial exploitation in India. The Directorate has been licensing technologies pertaining to Bt W.P. formulation, *B. bassiana* SC formulation, *T. harzianum* SC formulations, along with the data packages for registration with the CIB to the firms involved in bio-pesticide production and sale in India.

For promoting research and development of microbial pesticides, DOR has been conducting hands-on-training programmes annually for more than a decade to train teachers, researchers and extension workers from ICAR institutes/SAUs/State Department of Agriculture/ KVKs/ other Universities and private organizations. Trained personnel are essential in the areas of production, processing and quality testing of the product. In addition, several customized training programmes have been organized for training staff working in bio-control labs under the Departments of Agriculture from states like Andhra Pradesh, Kerala, Gujarat, etc. DOR has also provided technical support in establishment of the Bio-pesticide testing laboratory at Hyderabad under the Department of Agriculture, A.P.

DOR has also taken the initiative to foster public-private partnership by organizing an interface meeting with bio-pesticide entrepreneurs on 27 July, 2013 that received a highly encouraging response. As a follow-up of the meeting, a consortium has been formed at DOR providing membership to the bio-pesticide firms with incentives like concession in license fee, additional support for the licensed technologies in the form of training staff and provision of cultures as well as visits to the field trials pertaining to technologies in pipeline. Thus DOR has emerged as a key player in promotion of eco-friendly pest management in India.

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