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From the Director General's Desk

Mrs. V. Usha Rani, IAS
Director General

It is estimated that by 2050 the world population will increase by approximately 30 percent to 9.1 billion people, which will invariably increase the demand on global food supply. There are many feasible methods through which we can achieve sustainable Agriculture production while maintaining and encouraging the biodiversity of ecosystem. According to the UN's Food and Agriculture Organization, 90% of the world's food supply comes from about 100 crop species, and 71 of those crops (especially fruits and vegetables) rely on bees for pollination. The total annual economic value of crop pollination worldwide is estimated to be about € 153 billion. Most of the plants are pollinated in whole or partially by honey bees and by the other crop's natural pollinators, like bumble bees, orchard bees, squash bees, solitary bees etc. Without these pollinators, farmers and consumers would be at a greater risk and loss. The crops mostly dependent on bee pollination include fruits and vegetable crops, spices, plantation crops, pulses, vegetables etc.

In western countries, rental of honey bee colonies for pollination purpose is being widely practiced and is considered as the most viable component of commercial agriculture. Honey bees and other pollinators are now under threat worldwide for a number of reasons. The main reasons for global bees-decline are industrial agriculture, parasites/pathogens, loss of biodiversity, destruction of habitat and lack of forage due to monocultures and use of chemical insecticides. It is becoming increasingly evident that some insecticides, at concentrations applied routinely in the current chemical-intensive agriculture system, exert lethal effects on bee population. So it is important to make efforts to monitor the populations of various bee species visiting the plants and their role as pollinators in relation to increasing the agricultural production. The Government should also take initiative measures to save our nation from bee extinction and provide technical and financial assistance on bee keeping and bee conservation measures to increase the crop productivity.

(V. Usha Rani, IAS)
Director General

Theme Article: Boosting the crop yield through Bee pollinators

Dr. K. Vijaya lakshmi, Director & Dr. Jyothi Sara Jacob, SO

Intensification and diversification of agricultural crops are the present pressing needs for the sustenance of Indian agriculture for meeting the demands of the growing population. Many plants depend on insects for transfer of pollen between flowers. Pollination is therefore considered as an essential ecosystem service for maintaining the biodiversity and functioning of other vital ecosystem services.

Which insects pollinate crops?

Numerous studies revealed members of insects belonging to Hymenoptera (bees, wasps, and ants), Coleoptera (beetles), Lepidoptera (butterflies and moths) and Diptera (flies) as the important pollinators. Among them, the Hymenopterans, especially the bees, are the most effective pollinators of crops and various other flowering plants, accounting for pollination in about 70% of the world's cultivated crops.

Among the bees, most of the plants are pollinated in whole or part by honeybees and by the other crop's natural pollinators, like bumble bees, orchard bees, squash bees, sweat bees etc.

Different pollinators which play vital role in pollination (Abrol, 2009)

Pollinators	% contribution
Bees	73%
Flies	19%
Bats	6.5%
Wasps	5%
Beetles	5%
Birds	4%
Butterflies	4%

Why are bees important?

Bees are responsible for one out of every three bites of food we eat. Most crops grown for their fruits (including vegetables such as squash, cucumber, tomato and egg plant), nuts, seeds, fibre (such as cotton), and hay (alfalfa grown to feed livestock), require pollination by insects. Pollinating insects also play a critical role in maintaining natural plant communities and ensuring production of seeds in most flowering plants.

Bee pollination results in

- Increased yield in terms of fruit and seed and yield in many crops
- Improved quality of fruits and seeds
- Increased oil content in oilseed crops
- Bee pollination is a must for cross pollinated crops

The value of bees for crop pollination

The total economic value of crop pollination done by bees worldwide has been estimated at €156 billion annually (Gallai et al., 2009). The value of bee pollination in Western Europe is estimated to be 30-50 times the value of honey and wax. In Africa, bee pollination is sometimes estimated to be 100 times the value of the honey harvest, depending on the type of crop.

Bees are good pollinators

Many species of insects visit flowers to seek nectar or pollen; while doing so most will transfer a few pollen grains, thus contributing to pollination. Most of the pulses and oilseeds, fruits and orchard crops including vegetables heavily depend on bees for their pollination.

Honeybees are highly efficient pollinating insects, because:

- They have hairy bodies which easily pick up thousands of pollen grian as they move about inside flowers.
- They visit only one species during each foraging trip and thus ensuring maximum pollination to each species.
- Each foraging bee not only collects sufficient food for its own requirements, but continuously forages for nectar and pollen to supply the daily food needs of the colony.

During a single day, one bee may visit several thousand flowers of one plant species, collecting nectar and pollen and continuously transferring pollen grains from one flower to another.

Some Facts about bee pollination:

- More than 50% of the existing species of plants propagated by seeds are dependent upon insects for adequate pollination. .
- Value of additional yield obtained due to bee pollination alone is 15-20 times more than the value of all the hive products put together.
- The total value of pollination services rendered by all insects globally comes in excess of 100 billion US dollars annually (2003 valuation).
- In India 50 million hectares of land is bee dependent.
- It has been estimated that bees are gainfully tapping only about 1/4th of the available floral resources of the country (Orissa Review September – 2010).
- Of the 90% of flowers which are cross pollinated, 85% depend upon insects for pollination.
- Being a Mega diversity country there are about 1000 species of bee forage plants offering rich food to all the four important species of honey bees.
- The estimated losses in India due to complete absence of bee pollination has been measured to be somewhere between Rs.10,000 to Rs.55,000 per hectare in some crops. (Orissa review, 2010)

Crops mostly benefitted by bee pollination

- **Fruits and nuts:** Almond, apple, apricot, peach, strawberry, citrus and litchi
- **Vegetable and Vegetable seed crops:** Cabbage, cauliflower, carrot, coriander, cucumber, melon, onion, pumpkin, radish and turnip.
- **Oil seed crops:** Sunflower, niger, rape seed, mustard, safflower, sesame
- **Forage seed crops:** Lucerne, clover. (Source: TNAU, Agritech portal)

Plants which attract honey bees for nectar/pollen or both

- **Cultivated field crops:** Pigeon pea, lentils, clovers, Lucerne, mustard, rape, linseed, sesame, safflower, millets and sunflower
- **Vegetables:** All cucurbitaceous plants, okra, beans, turnip, radish, onion, brinjal, and sweet potato.
- **Trees:** Neem, *Cassia fistula, Acacia, Albizzia* spp, eucalyptus, Sandle-wood, wild cherry.
- **Fruit Trees:** All kinds of citrus, litchi, peach, apple, guava, jamun, date palm, apricot, pear, almond, plum, loquat, phalsa, and cashew

Natural and ornamental flowers

Cosmos, shoe flower, Golden rod, Cup & saucer zinnia, coral creeper (*Antigonon leptopus*), rose, rangoon creeper, aster, wild rose (kuja), hydrangea, portulaca, poinsettia, corn flower, dandelion etc. (TNAU Agritech Portal)

Species of honey bees involved in pollination

Honey bees have an edge over all other pollinators because their populations can be easily managed and precisely manipulated as per pollination requirement. In India, four species of true honey bees and nearly half a dozen species of stingless bees.

Rock bee - *Apis dorsata* is commonly referred to as the "Rock bee," or "Giant honey bee" owing to its large body size. It is considered as key e species in the forest ecosystem as it plays a crucial role in the pollination and sustenance of forest flora and fauna. Although the bees can't be domesticated for pollination, many crops throughout southern Asia depend upon *Apis dorsata*. Some of the major crops thought to be heavily dependent upon *Apis dorsata* pollination include: cotton, mango, coconut, coffee, pepper, star fruit etc.

Little bee or Dwarf bee - *A. florae* is called the dwarf honey bee due to its small size compared to other honey bees. They are excellent pollinators, which gives them an important ecological role in the places they inhabit.

Indian honey bee - *Apis cerana indica* among indigenous species of honey bees recognized from India, the Indian hive *bee Apis cerana* and rock bee *Apis dorsata* are the most abundant and predominant pollinators for cross pollinated crops including vegetables which constitute 46 and 42%, respectively of the total pollinators population (Sharmah, 2015). Several factors make *Apis cerana* efficient pollinators, the first being their smaller foraging range. A smaller range means that each worker spends more time with the same plants and has higher floral fidelity than does *Apis mellifera*. Apis cerana has a longer daily foraging period than does *Apis mellifera*.

European bee- *Apis mellifera*: They have been imported from European countries (Italy).It is an effective pollinator of plants such as cucurbits, sunflowers, apples, almonds and citrus trees. The honey bee, *Apis mellifera* L. (Hymenoptera: Apidae), is the most versatile, ubiquitous, and commonly used managed pollinator.

Stingless bees has two main genera viz. Melipona and Trigona. Stingless bees are effective pollinators of many of our economic crops of the families like compositae, cruciferae and leguminoceae etc.

Other bees involved in pollination:

Bumble bees (*Bombus spp.*): Bumble bees are highly social honey bees, They work harder, faster at cooler temperatures than honey bees (Light, 1994). Bumble bees reared under confined laboratory conditions can be utilized for the pollination of crops grown under protected conditions. Several companies are now using a patented process developed by European scientists for rearing bumble bees. Bumble bees pollinate tomatoes, eggplants, peppers, melons, raspberries, blackberries, strawberries, blueberries, and cranberries, just to name a few (Smith, 1998). Bumblebees are the only pollinators of potato flowers worldwide. The companies are charging users from $150 to $300 per colony. The high cost limits the bees' use to pollinating high-value crops in greenhouses. More than 300,000 colonies are reported to be in use in greenhouses in Europe and North America. (www.ebeehoney.com › Pollination)

HONEY BEES

Indian hive bee (*Apis cerana indica* (Apidae)) | Rock bee (*Apis dorsata* (Apidae)) | European bee (*Apis mellifera*) | Little bee (*Apis florea*) | Stingless bees (*Trigona spp.*)

OTHER BEES

Mining bees (*Andrena spp.*) | Bumble bees (*Bombus spp.*) | Sweat bees (*Halicitus spp.*) | Leafcutter Bees (*Megachile spp.*)

Solitary bees (Hymenoptera) | Carpenter Bees (*Xylocopa spp.*) | Squash Bees (*Peponapis pruinosa*) | Mason Bees (*Osmia spp.*)

Plant traits that may attract bees:

- Flower colour- bright white, yellow, blue or UV
- Flower shape- shallow, have a landing platform, tubular, single flower top
- Nectar - usually fresh, mild and a pleasant smell
- Pollen- often sticky and scented

Bees see all colours except the red

Bees need our Support!

Bee communities, both wild and managed, have been declining over the last half century.

Bees decline- A Global Pollination Crisis?

Attention has been drawn to pollinator health after the occurrence of unusually high mortality rates of managed honeybees in the USA during 2007, which they ascribed to a new syndrome, called Colony Collapse Disorder (CCD). CCD has not yet been observed in the EU countries. US research found CCD is linked to a combination of factors that place stress on honeybees, including varroa, poor nutrition and pesticides

During 2007 in USA, due to (CCD), some commercial hive owners have lost up to 90% of their bees.

The giant rock bee (*Apis dorsata*) is in sharp decline in one of its strongholds in the Nilgiris mountain range in southern India. The Nilgiri Biosphere Reserve, the first in India, has always been known for its giant bees, which form honeycombs on cliff tops and in tree canopies. The precise cause of colony collapse disorder (CCD) is not known, but researchers say that the loss of the bees will become disastrous for the whole ecosystem if it is not tackled. (www.Climatechangenews.com/.2016)

The study conducted in Idukki cardamom plantations and forest areas of Kerala recently revealed that there is a huge decrease in giant bee colonies and a drastic reduction in cardamom yield in the areas where the pesticide use was high," (Times of India, 2014).

Loss of pollinators and causes for decline:

Many modern agricultural practices are responsible for decline in insect pollinators. They include

- **Monoculture systems**- Reduces the floral diversity and, consequently, diversity of pollinating insects.
- **Agricultural intensification**—large-scale monoculture coupled with the loss of non-cultivated land—deprives wild pollinators of habitat.
- The intensive use of agro-chemicals including pesticides that may have a direct affect on insect pollinators, and herbicides that remove important floral resources.
- Pests and diseases affecting honey bees and their further spread to wild populations.

Are pesticides the main culprits for bee decline?

- European Food Safety Authority (EFSA) examined several factors responsible for bee decline and decided on 1st December, 2013 to restrict the use of three pesticides clothianidin, imidacloprid and thiamethoxam, belonging to the neonicotinoid group of insecticides as seed treatment, soil application and foliar sprays for a period of two years in all the 28 member states of the European Union.
- Since 1999, France enforced a ban on imidacloprid in sunflower seed treatment. Imidacloprid use on maize was banned in France from 2004.
- In Germany mass death of bees in May 2008 in oilseed rape fields which was attributed to the drift of the neonicotinoid insecticide clothianidin from the treated maize seeds. Thus Germany enforced a ban on clothianidin seed treatment from 2008.
- Italy has enforced a ban on Imidacloprid, thiamethoxam and clothianidin suspended for maize seed treatment since 2008 (CICR Report)
- Two new studies, both published by the journal Nature, (2015) are once again indicating the pesticide group, neonicotinoids, as having adverse affects on bee populations.
- In 2015, an 11-year British study showed a definitive relationship between increasing agricultural use of neonicotinoid and escalating honey bee colony losses at a landscape level. This is the first field study to establish a link between neonicotinoids and CCD (Coco McPherson, 2015).

How to enhance On-Farm Insect Pollinators (*Nicholls and Altieri, 2013*)

Choose the right plants to maximize pollinator diversity:

- Choose plants that flower at different times of the year to provide nectar and pollen sources throughout the growing season.
- Allow a minimum of three plant species that bloom at any given time during the growing season.
- Encourage combinations of annuals and perennials.
- Provide a variety of flower colours and shapes to attract different pollinators.
- Encourage plants to grow in clumps, rather than single plants, to better attract pollinators.

Sustain bee populations year-round: Lack of wild plants in fields or adjacent areas blooming before and after the main crop can result in a decline of healthy pollinator numbers. Encourage blooming weeds or establish diverse plantings within and adjacent to crop fields to provide the floral diversity that will support resident pollinators year-round.

Include flowering crops in the field: Many favourite flowers for honey bees, like sunflower, sweet clover, thistle, alfalfa, dandelion, mints, cosmos, aster etc., attract large population of honey bees which in turn help in pollination.

The field studies conducted at NIPHM to study the effect of flowering plants on beneficial insects during *kharif* 2016 indicated that sunflower crop grown as border crop attracted large population of honey bees throughout the flowering period and there was substantial increase in the yield of tomato, okra and groundnut. The quality of the vegetables has also improved in the bee pollinated crop plants.

Intercropping systems attract a diversity of pollinator species: Intercropping systems that include a tall and a short crop, such as corn and bean poly cultures, provide an ideal microclimate for pollinating insects, and allow them to move between plants more effectively. Another strategy is to include strips of pollinator-attracting plants within fields.

Sunflower as a Border Crop Attracting the Bees at NIPHM Field

Protect the bees –Save the crops: Global initiatives

The worldwide decline of pollinators resulted in the formation of specific initiatives related to pollinator management and conservation at national and global level. When Colony Collapse Disorder swept through American and European bee populations in 2007, the western world was alerted. These countries started several action plans to save bees, the initiatives include North American Pollinator Protection Campaign (NAPPC), Brazilian Pollinator Initiative (BPI), Canadian Pollinator Conservation, 2013 and European Pollinator Initiative (EPI, 2000). Even developing countries like Africa (African Pollinator Initiative) and Sri Lanka (Pollinator Conservation Action Plan for Sri Lanka) have pollination conservation strategies.

FINANCIAL AND TECHNICAL ASSISTANCE

Since 2008, the USDA Natural Resources Conservation Service (NRCS) has offered financial and technical assistance to eligible farmers for the creation of flowering hedgerows and wildflower meadows that support wild bees.

In India, after realizing the importance of role of bee pollinators in Agriculture, the first National Commission on Agriculture (1976) in India had recommended beekeeping purely as an agricultural input and put forth a plan for apiculture until 2000. Later the National Bee Board (NBB) was reconstituted in June, 2006. The main objective of the National Bee Board (NBB) is overall development of Beekeeping by promoting Scientific Beekeeping in India to increase the productivity of crops through pollination (http://www.agriculturesnetwork.org/magazines/india/insects).

In India Farmers have very limited knowledge about the pollination and pollinators. In western countries, pollination has been industrialized; bee keepers ship their hives from one place to other to meet the needs of the fruit and vegetable demands.

Rental of honey bees for pollination

In Western countries, Rental of honey bee colonies for pollination purposes is a highly demanded service and a viable component of commercial agriculture. Bee colonies are moved extensively across the country for use in multiple crops every year. There are also over 3,000 registered beekeepers in Florida, managing a total of more than 400,000 honey bee colonies and producing between 10–20 million pounds of honey annually. (nwdistrict.ifas.ufl.edu/.../pollination-of-vegetable-crops-maximize-your-crops-potenti... Jan 22, 2016).

Encouraging the beekeeping for pollination of crops will benefit both the farmer and the bee keeper. The system of hiring and renting honeybee colonies initiated and practiced in India on large scale to increase the production of various crops. Now the importance of bees in crop pollination is felt by many Government and Non-Government agricultural organizations and growers. The Government should take initiative measures to conserve the wild and natural bee pollinators to save our nation from bee extinction and provide technical and financial assistance to the bee growers to increase the crop productivity.

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Workshop on advances in urban pest management

A one day workshop on advances in Urban Pest Management was conducted at NIPHM in collaboration with Indian Pest Control Association (IPCA) on 29.07.16. Around 100 numbers of pest control operators / business owners / senior persons from the pest management industry participated in the workshop and benefited. Smt. V. Usha Rani, IAS, Director General of NIPHM inaugurated the workshop.

In view of the present scenario in changing environment of pest management industry, recent trends on Pest Control operations were discussed. Eminent faculties from NIPHM and other Research Institutes were delivered speeches on recent trends in pest management. The participants were exposed to pesticide application technology for effective spraying, bio-control laboratory and visited vertebrate and urban pest management laboratory.

Participation in Farmers Fare & Exhibition at Mathura (UP)

NIPHM always participating actively in farmer centric activities around the country. Recently, the institute has participated in the Farmers Fare cum Exhibition organized by MOA & FW at Deen Dayal Upadhyay Dham, Mathura (UP) from 25th to 29th Sept, 2016 (5 days). Under the leadership of Dr. O. P. Sharma, Joint Director, NIPHM a stall showcasing low cast technologies for sustainable agriculture was displayed. Hon'ble Union Agriculture and Farmers' Welfare Minister Shri Radha Mohan Singh, visited the NIPHM stall and appreciated the efforts to showcase various activities of NIPHM. The event of participation of NIPHM was appreciated by all sectors and created good awareness about various low cost technologies developed by NIPHM among the farmers. Farmers liked the low cost technologies developed at NIPHM and shown interest in getting detailed information and training on mass production of bio-pesticides, bio-control agents, bio-fertilizers at farm level and low cost equipment.

Setting up of Bio-fertilizers Training cum Production Unit at NIPHM

The utility of useful soil organisms as bio-fertilizer can be enhanced by selecting efficient microorganisms, culturing them and formulating them into ready to use products at low cost. A large number of officer trainees, farmers and visitors are requesting for hands-on training on production of bio-fertilizers and mother cultures from NIPHM. In view of scope of bio-fertilizers for sustainable farming systems, NIPHM has taken an initiative for setting up on pilot basis, bio-fertilizer training cum production laboratory at NIPHM. The lab has become functional with its inauguration by Shri S. K. Pattanayak, IAS, Secretary DAC & FW on 12.08.2016 in the presence of Smt. V Usha Rani IAS, Director General, NIPHM.

The facility is useful in selecting efficient strains of bio-inoculants and culturing them. The cultured bio-fertilizer strains are being multiplied and utilized in adaptive research trials, for hands on experience in practical session of PGDPHM programme as well as in other training programmes for officers and farmers. The mother cultures of bio-fertilizers (Rhizobium, Azotobactor, Azospirillum, PSB, KSB, ZSB, Pseudomonas, mycorrhiza etc.) are produced and

made available to trainees for further multiplication for use under various agro-climatic conditions. Efforts are being made to develop simple and low cost on-farm production techniques for these bio-fertilizers.

Inauguration of PGDPHM 6th Batch (2016-17)

The Post Graduate Diploma in Plant Health Management (PGDPHM) is a flagship programme of NIPHM. It is designed for capacity building in the areas of Plant Health Management, Plant Biosecurity and Pesticide Management. The one year programme is spread over two semesters and open to In-service personnel of Central/ State Departments of Agriculture/ Horticulture and fresh graduates in Agriculture/Horticulture and Post Graduates in life sciences.

The 6th Batch (2016-17) of the PGDPHM course was inaugurated by Mrs V Usha Rani, IAS Director General of NIPHM on 1st September, 2016. In the current batch, a total of 25 participants have been enrolled including eight in-service officials nominated by the Department of Agriculture/ Horticulture, Government of Andhra Pradesh and 17 fresh graduates from different States viz. AP, Telangana, Gujarat, Tamil Nadu, etc. during inauguration address, the Director General stressed upon to make the programme more practical and skill oriented so that participants can be become experts in dealing with Plant Health Management issues in a holistic manner. The inauguration session was followed by orientation by Directors of different divisions of NIPHM.

Research Project on Implementation of District Pest Management plan (DPMP) at Warangal

District Pest Management Plan is a holistic approach to prepare a pest management plan for a district and it includes various components like soil health management, varietal selection, nutrition management, agronomic practices, ecological engineering and influence of prevailing community on pests and diseases. The implementation of the DPMP is being taken up jointly by NIPHM and MANAGE in association with State Agriculture Department, State Horticulture department, Agriculture Research Stations, Warangal. It is taken as Pilot project district for implementation of DPMP in three crops viz., rice, cotton and chili.

As a part of Implementation of the project, project orientation workshops were organized with Agricultural Officers and Horticultural officers of Warangal. DPMP for all the three crops was prepared in the local language by including all Integrated Pest Management practices and distributed to farmers and Agricultural officers of Warangal district. Interactive sessions were conducted between farmers and scientists on insect pest problems, influence of weather on pest emergence and management practices.

Research Project on Study of "Impact of Indiscriminate Use of Chemical Fertilizers and Pesticides"

DAC has entrusted a project to NIPHM entitled "Impact of Indiscriminate Use of Chemical Fertilizers and Pesticides". The project was initiated with an approved budget of Rs. 617 Lakhs for three years to study the impact of indiscriminate use of insecticides and fertilizers on crops, soil, water and agricultural produce. To implement the project, NIPHM will be acting as the nodal agency and research studies will be taken up jointly by seven Agriculture Universities viz., Punjab Agricultural University, Ludhiana (Paddy and Tomato), Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (Paddy and Cabbage), Bidan Chandra Krishi Viswa Vidyalaya, West Bengal (Paddy and Brinjal), Vasanthrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Brinjal and Soyabean), Professor Jayashankar Telangana State Agricultural University, Hyderabad (Paddy and Soyabean), Tamil Nadu Agricultural University, Coimbatore (Cabbage and Paddy), Acharya N.G. Ranga Agricultural University, Guntur (Paddy) and Dr. YSR Horticultural University, Andhra Pradesh (Chilli).

Project implementation workshop was organized with Principal investigators of the projects on 29-07-2016 for the preparation of action plan to initiate the project.

Capacity Building

Fruit fly: Surveillance and Management

Tephritid fruit flies are responsible for losses in fresh produce as well as considered as major impediment in export of economically important fruits and vegetables. NIPHM organized a 5 days training programme on ''Fruit fly: Surveillance and Management'' from 25th to 29th, July, 2016 and 27 officials from the States of Maharashtra, Tamil Nadu, Uttarakhand, Gujarat, Himachal Pradesh, Odisha, Karnataka, Madhya Pradesh and Jammu & Kashmir. The participants were trained through various lectures & hands-on practices such as fruit fly biology, classification, fruit fly identification, exotic fruit flies and their pathways of entry, fruit fly surveillance.

Orientation for Phytosanitary Certificate Issuing Authority

An orientation training programme for Phytosanitary Certificate Issuing Authorities was organized from 25th to 29th August, 2016. Seventeen officials representing Punjab, Assam, Gujarat, Chhattisgarh and Maharashtra states were participated in the training programme and learnt international regulations and obligations under IPPC to promote safe agricultural trade, the role and responsibilities of NPPO and PSC issuing authorities. They were also introduced to on-line PQIS software for inspection & sampling, testing for regulated pests of concern to importing countries, importing country's regulations. The importance of PFA/ALPP in export promotion and role of phytosanitary treatments for mitigating the pest risks as per the Standard Operating Procedures for Phytosanitary Certification were explained.

Stored grain pest detection and identification

A 5 days duration training was organized from 1st to 5th, August, 2016 and 7 participants from the States of Tamil Nadu, Jammu and Kashmir and Haryana were trained.

The participants learnt the importance of stored grain pest management in the context of national food security and global grain trade. They also learnt methods of detection and identification of various stored grain insect pests by employing appropriate identification tools, use of pheromones and traps. The significance of Systems Approach in managing the food grains was explained.

Stored grain pest detection and identification & Phytosanitary treatments

A Twenty one day duration training programme on “Stored Grain Pests-Detection and Identification & Phytosanitary Treatment (MBr& ALP)” was organized from 1st to 22nd August, 2016 and four officials from DPPQ&S from the States of Tamil Nadu, Andhra Pradesh, Kerala, Haryana and one official from Gujarat State Agricultural University attended the training.

The participants learnt various inspection & sampling methods to detect insect pests & identification of different stored grain insect pests by using various identification keys and online tools. The participants were familiarized with physical and chemical properties of Phosphine and Methyl bromide, safety precautions to be followed while handling fumigants, mode of action of fumigants, principles of fumigation, monitoring the fumigant concentration, appropriate use and maintenance of fumigants and safety equipments.

Phytosanitary treatments (MBr & AlP)

A 15 day duration training programme was organized from 8th to 22nd August, 2016 and a total 28 participants from various pest control organizations and fumigation service providers were trained. The participants were able to understand the guidelines laid in NSPM-11, 12 (MBr

Capacity Building

fumigation) and NSPM-22 (Phosphine fumigation) to conduct appropriate fumigation procedures as well as the accreditation procedure of fumigation operators prescribed by the Directorate of PPQ&S. The participants had hands-on practical experience in creating gas-tight enclosure, laying gas supply and monitoring lines, use of vaporizer, leak detector and gas concentration monitor.

Pest Surveillance

NIPHM organized eight day duration programme on Pest Surveillance from 24th to 31st August, 2016 and trained 33 participants representing Tamil Nadu, Telengana, Karnataka, Himachal Pradesh, Bihar, West Bengal, Uttar Pradesh, Goa, Maharashtra, Jharkhand, Chhattisgarh and Maharashtra. The participants learnt various pest surveillance strategies such as detection, monitoring and delimiting surveys. The participants learnt tools required for surveillance of target pests and the procedures for establishment of Pest Free Areas to gain Market Access. The participants learnt about various lures and traps for carrying out fruit fly surveillance for monitoring as well as for area-wide control.

Stored grain pest management for FCI and CWC officials

The most commonly used fumigant, Aluminum phosphide (AlP) is a restricted pesticide under Insecticides Act, 1968 and it must be used only by the trained & skilled officials. With the objective to train the quality control officials of FCI, CWC & SWCs who are actively involved in storage of food grains, a 5-days training on Stored Grain Pest Management for FCI, CWC & SWCs officials was organized from 19.09.16 to 23.09.16. Total eighty two (82) participants from FCI, CWC & SWCs from different parts of the country were benefited and they were trained extensively on scientific storage and proper procedure for fumigation of food grains with Aluminium phosphide.

On-farm production of bio-control agents and bio-pesticides under CROPSAP, Maharashtra

NIPHM has organized two training programmes of five days duration from 04th to 08th July 2016 and 11th to 15th July, 2016 on 'On farm production of bio-control agents and bio-pesticides under CROPSAP, Maharashtra'. Trainees were given exposure to Mass production of bio-pesticides, predators and parasitoids, on-farm production techniques of bio-control Agents, Mycorrhiza etc. A total 52 Agriculture Extension Officers from Maharashtra were attended the training.

Refresher training programme on 'New Dimensions in agricultural Extension Management for middle level extension functionaries

NIPHM and MANAGE have jointly organized two refresher training programmes from 14th to 15th July, 2016 and 25th to 26th August 2016 for middle level extension functionaries on various aspects of plant health management. In this programme the participants were given training on various low cost on farm mass production techniques of bio-control agents and microbial biopesticides. A total of 39 participants attended this training programme.

Capacity Building

Induction training on Plant Health Management and Horticultural Extension

NIPHM and MANAGE, Hyderabad have jointly organized the induction training programme to newly recruited Horticulture extension officers. The programme is designed with various aspects of Plant Health Management with special focus on farm level mass production of biocontrol agents, biopesticides and biofertilizers, principles of biosecurity and extension management skills, marketing, work ethics, etc. The duration of the training programme is of two weeks (8 days at NIPHM and 5 days at MANAGE). Field trip for participants was also organized to Fruit Research Farm, Sanga Reddy and provided exposure on latest techniques in nursery management, propagation methods, high density plantation, rejuvenation of old orchards, irrigation management etc. During the quarter, two induction training programmes i.e. one from 16th-22nd July, 2016 and another from 13th to 19th Sept., 2016 were organized and attended by 79 newly recruited Horticultural Officers from different states of Tamil Nadu.

NIPHM and MANAGE have jointly organized two refresher training programmes from 14th to 15th July, 2016 and 25th to 26th August, 2016 for middle level extension functionaries on various aspects of plant health management. In this programme the participants were given training on various low cost on farm mass production techniques of bio-control agents and microbial biopesticides. A total of 39 participants attended this training programme.

On-farm production of bio-control agents and microbial pesticides to promote AESA based Plant Health management in conjunction with Ecological Engineering for pest Management – Meghalaya, RKVY Project

A ten days training programme on 'On-Farm Production of Bio control Agents & Microbial Bio pesticides to Promote AESA based Plant Health Management in conjunction with Ecological Engineering for Pest Management' was organized under Meghalaya RKVY project to the Agricultural officers of Meghalaya. The technologies covered under this programme are (i) mass production of parasitoids such as *Trichogramma, Chelonus, Bracon, Goniozus* etc. (ii) mass production of predators such as Chrysoperla, Reduviid, Spiders, Coccinellids etc. (iii) mass production of microbial biopesticides such as *Trichoderma, Metarhizium, Lecanicillium, Beauveria, Nomuraea, Paecilomyces, Pseudomonas, Bacillus* and (iv) Entomopathogenic nematodes. A total of five participants have attended the programme.

Production protocol for bio-control agents and quality analysis and quality management of microbial bio-pesticides

Training programme on 'production protocol for bio-control agents and quality analysis & quality management of microbial bio-pesticides' was conducted to create a pool of master trainers with enhanced skills in the area of production of superior BCAs and their quality management. Participants were trained in laboratory and on-farm production of bio-control agents and microbial biopesticides. Additionally they were imparted hands-on experiences in the techniques and methods required for registration and quality management of microbial biopesticides. A total of 5 participants from Punjab, West Bengal, Karnataka and Andhra Pradesh have attended this training programme.

Fundamentals of Plant Health Management for Plant Health Doctors

Training programme on 'Fundamentals of Plant Health Management for Plant Health Doctors' was organised at NIPHM, Hyderabad from 24th August to 13th September, 2016. The participants were trained on IPM, biological control, Mass production of hosts, parasitoids, predators, bio-pesticides, bio-fertilizers, Ecological engineering, AESA, EPNs and novel approaches in pest and disease management of important crops. Training was provided on safe use of pesticides, pesticide residue management, vertebrate pest management and rodent pest management. A total of 5 participants have attended the programme.

Capacity Building

Training programme on Integrated Pest Management on Cotton (3 days):

A training programme on Integrated Pest Management on Cotton was conducted from 29th to 31st August, 2016 under "SMAE- Support to State Extension Programmes for Extension Reforms Scheme (SSEPERS- ATMA-SAMETI, Kudumiyanmalai, Tamil Nadu). Total 27 participants attended the programme. The participants were learnt new concepts of pest management i.e. Agro-ecosystem Analysis (AESA) and Ecological Engineering (EE) for managing pests in crops especially in cotton agro-ecosystem. They were also exposed to the integrated weed, nutrient, disease and insect pest management in cotton ecosystems and trained in High density planting in cotton and its implications in pest management, seed treatment with microbial bio pesticides (bio-priming), rodent pest management, etc.

Crop specific Agro Ecosystem analysis (AESA) based Plant Health Management (PHM) in conjunction with Ecological Engineering for pest management (Rice/Vegetables):

A training programme of 21 days duration on "Agro Ecosystem Analysis (AESA) based Plant Health Management (PHM) in conjunction with Ecological Engineering for Pest Management (Rice/Vegetable)" was organized at NIPHM, Hyderabad. The participants were trained on recent concepts of plant health management and novel approaches in pest and disease management of Rice and vegetables. A total of 5 participants have attended the programme.

On farm production of Bio-control agents and microbial biopesticides to promote Plant Health Management in conjunction with Ecological Engineering for Pest Management

A ten days training programme on 'On-Farm Production of Bio control Agents & Microbial Bio pesticides to Promote AESA based Plant Health Management in conjunction with Ecological Engineering for Pest Management' was organized. A total of 4 trainees from Kerala and Himachal Pradesh attended this programme.

Pesticide Formulation Analysis (PFA)

The training program on PFA was conducted during 12th July to 15th Sept, 2016 and where in 12 participants were trained. The participants were imparted knowledge to the insecticide act, 1968 and insecticide rules 1971, procedures for implementation, enforcements. The basics of pesticide formulations, physic-chemical properties, and principles of volumetric, colorimetric, titrimetric and chromatographic analysis were taught.

Inspection Sampling and Prosecution Procedures under Insecticide Act, 1968 (ISPP)

The program aims capacity building of the Insecticide Inspectors appointed under section 20 of the Insecticide Act 1968, for enforcement of the Act which helps them understand the Act and Rules and procedures to be followed for successful enforcement of the act. This course is organized from 19th to 24th September, 2016. The participants are trained to equip themselves on the salient features of the Insecticide Act, 1968, Insecticide Rules 1971,

Capacity Building

their implementation giving emphasis on the role of Insecticide Inspectors, duties & Responsibilities, the procedures for sampling, an exposure to the Procedures and methods of analysis of synthetic pesticides, Bio products and the interpretation of the Analytical Reports besides Procedures for prosecution including the evidence act & Cr. PC.

Laboratory Quality System Management and Internal Audit as per ISO/IEC 17025-2005

The Analysts and the Managers of the Laboratories are imparted training on Quality system procedures so as to equip themselves with the procedures of internal audit and quality management of the Laboratories and to organize the labs to obtain the accreditation by the NABL and also to maintain the stipulated conditions in the Laboratory under ISO certification for continuous performance. The participants also are given training on internal audit of the Laboratory. The program was conducted with 13 participants (12 from PFA and 1 from Govt. of Tamil Nadu).

Quality Analysis and Quality Management of Microbial Bio pesticides:

The program was conducted as a part of production protocols for bio-control agents, conducted by PHM. The emphasis was given on Quality parameters and Quality control procedures for microbial bio-pesticides, with practical work.

Appropriate pesticide Application Techniques and Farm Level Storage Structures

The main purpose of pesticide application technique is to achieve maximum efficacy with minimum side effects on non-target organisms. The knowledge on farm level storage structures enhances the farmers to safely store the produce to get better market price. Total 15 participants from various states attended the training programme. The participants gained knowledge on use of spraying techniques and farm level storage practices.

Safe and Judicious Use of Chemical Pesticides

NIPHM organized a training programme on Safe and Judicious use of chemical pesticides from 22nd to 29th August, 2016. Total of 15 participants from 5 states attended the training programme. Participants were trained on various aspects like appropriate selection of spraying techniques, dosage requirements, pesticide formulation and their properties, quality control of pesticides, judicious use of rodenticides, safe use of pesticides and precautions to be taken while spraying and storage of pesticides. Practical sessions were organized on application techniques, selection of suitable nozzles, calibration of the sprayers, and their operation. An Institutional visit to CRIDA research farm was organized to get acquainted with different farm equipment.

One month training for B. Tech Agricultural Engineering students (01.07.2016 to 29.07.2016)

A tailor made training program was organized for one month duration for private agricultural Engineering College students covering an overview of the agricultural engineering aspects. A batch of 22 students has undergone the training programme. The programme gives an overall idea of agricultural engineering and also an exposure to job opportunities in various fields. Some project work was also assigned to evaluate the field efficiency of lever operated knapsack sprayer, battery operated sprayer, NIPHM trolley mounted sprayer, compression sprayer, mist blower and hand ULV sprayer.

In-plant training for B.Tech Agricultural Engineering students of 4 months (commenced from 06.06.2016 to 06.10.2016)

A four month training programme was conducted for B. Tech Agriculture Engineering students. During the training they have learnt various aspects on appropriate pesticide application techniques, safe and judicious application of chemicals, storage problems at farm and commercial level, storage structures. Total 20 B. Tech final year students from

Capacity Building

College of Agricultural Engineering, Bapatla (13) and Madakhasira (7) were attended the training programme.

Training on Vertebrate Pest Management

NIPHM organized a five days training on Vertebrate Pest Management, to the agriculture extension officials from 11th to 15th July, 2016. A total 13 agriculture officers from Tamil Nadu, Gujrat and Karnataka states were participated. The participants were given exposures to different aspects like Indian Wild Life Act., 1972, biology and management of rodents, ungulates, wild boar, birds and their managements. Dr. Vasudev Rao (Co-coordinator), All India Network Project on Vertebrate Pest Management & Dr. Srinivasa Rao, Sr. Scientist from Andhra Pradesh Rice Research Institute were invited and rendered their expertise to the participants. The participants were given field exposure on wild boar and rodents damages and their management.

Refresher training on Rodent pest Management

A Refresher training on Rodent Pest Management was conducted for middle level extension functionaries from 29th August to 2nd September, 2016. The objective is acquainting the participants in identification of rodent species, rodent damage/infestation measurement, ecology and ethology of the rodents which provides a basic knowledge on rodent pest management and facilitates them to plan and organize rodent control campaigns at village level. Total Thirteen (13) participants from Tamil Nadu, Bihar, Gujarat were trained on several basic aspects of rodent pest management, with more exposure to management in field conditions.

Certificate course on Urban Integrated Pest Management

Certificate course of 15 days duration on Urban Integrated Pest Management was conducted from 25th July to 08th August, 2016 with an objective to build technical manpower to undertake commercial urban pest control services in human habitations, institutions and industrial premises for structural pest management professionals. A total 17 participants (13 Private Industry & 4 officers from Department of Agriculture, Government of Kerala) from Maharashtra, Odisha, Telangana, Andhra Pradesh, and Tamil Nadu attended the training. The participants were given field based training on biology and management of mosquitoes, termites, flies, cockroaches, rodents, stored grain insect pests besides giving exposure on pesticide toxicity, zoonotic diseases, safe and judicious use of pesticides through scientific application techniques, food safety and principles of IPM with concomitant field practical. The participants took assignment works in groups on biology and management of major urban pests.

An inbuilt module training of five days on Urban Integrated Rodent Pest Management (UIRPM) was organized from 26th to 30th July, 2016. One participant from Telangana attended the programme.

Farmer training programme on Integrated Pest Management on Vegetables, Pulses and Paddy

Ten training programmes were conducted on IPM of vegetables, pulses and paddy for 268 farmers from different districts of Tamil Nadu. They were trained on mass production of bio-control agents at farm level and microbial biopesticides to promote AESA based PHM in conjunction with Ecological Engineering for Pest Management. As a part of programme, farmers were also provided hands on training in on-farm mass production techniques of host insect, Corcyra and parasitoids and predators, microbial biopesticides such as Trichoderma, Pseudomonas also on bio-fertilizers, fruit fly trap and lure preparation, rodent pest management, pesticide application techniques etc.

Transfer of NIPHM technologies from lab to the field

To transfer the NIPHM technologies from lab to field, NIPHM has initiated the farmer's field trials at Kampasagar district of Nalgonda and Garikapadu of Krishna district. The farmers were provided with all inputs and technologies developed by NIPHM for rice cultivation viz., bio-pesticides, Bio-fertilizers and ecological engineering flowering plants etc. The nursery crop was raised successfully without using any chemical fertilizers and pesticides and the main field crop after two months of transplantation is maintaining good crop health.

Rodent damage in cocoa plantations in West Godavari District

Mr. Mariadoss, A., Asst Director (RPM) and Dr. Ch. Sreenivasa Rao, Director (PM)

Cocoa is an important commercial plantation crop of the world. The country has exported 32,633.58 MT of Cocoa products to the world for the worth of Rs. 1,266.99 crores during the year of 2015-16 (APEDA, 2016). The major export destinations are United States, Singapore, United Arab Emirates, Korea Republic and China. In India, the current productions is about 12,000 Metric Tonnes and are primarily cultivated in Southern states like Andhra Pradesh, Karnataka, Kerala and Tamil Nadu as a popular inter crop in coconut plantations. In Andhra Pradesh, the five coastal districts of East and West Godavari, Krishna, Visakhapatnam and Srikakulam are the principal producers of cocoa in the state as the climatic conditions are suitable for the crop.

Pests and diseases are risk to productivity and quality of harvest which in turn affects the returns to the farmers. Since cocoa is an introduced crop the more important for the farmer is to be clear about the pests and diseases and be able to identify the symptoms correctly.

Rats (*Rattus rattus*) and squirrels (*Funambulus trisriatus* and *F. palmarum*) are the major rodent pests of cocoa. They cause serious damage to the pods. The rats usually gnaw the pods near the stalk portion whereas squirrels gnaw the pods in the centre. Squirrel damage can be distinguished by the coarser chips and the bigger size of the holes made, although there is wide overlap in individual cases. Rats damage the mature and immature cocoa pods whereas squirrel damages only mature pods.

In a recent visit to Kokkirapadu village in West Godavari District, damages due to both rats and squirrels were observed in cocoa plantations which are being grown as intercrop in coconut orchards. The damages observed were to the tune of more than 35%. The plantations are located where rice crop is predominantly grown throughout the year in the District and cultivated as an intercrop among coconut plantations. The availability of food and water sources throughout the year favours the regular breeding of *Rattus rattus* and consequent damages. The availability of rodent population are also ensured by other crops like sugarcane and oil palm which are predominantly grown in the district.

Management of rodents in Cocoa

- Keep the orchards weed free to avoid movement and breeding of rodents.
- The rats can be controlled by placing 10 g bromadiolone (0.005%) wax cakes or ripe banana stuffed with carbofuran on the branches of cocoa trees twice at an interval of 10-12 days.
- Squirrels are best controlled by trapping with wooden or wire mesh single catch 'live' trap with ripe coconut kernel as the bait.
- For squirrels set up poison baits or traps in the early morning hours, whereas for rats, do it in evening hours.
- Remove rodent nests from coconut crowns and do general cleaning of the crowns to reduce rodent infestation.
- Identify the live burrows and go for packeting and pocketing of bromodialone bait in the burrows.
- Go for burrow smoking to check the rodents.

On-farm production of biofertilizers using low cost medium

Dr. O P Sharma, JD-Agro and Dr. Neha Singh, SRF

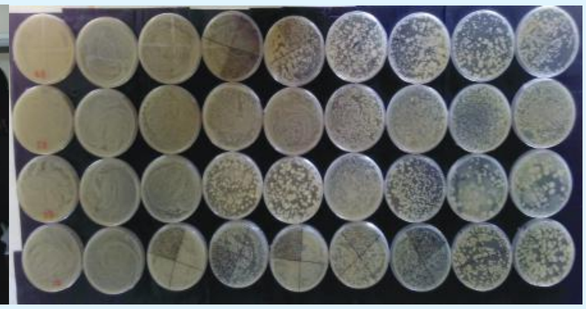
Biofertilizer contains living or latent cells of efficient microorganisms which, when applied to soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the availability of nutrients to the host plant. These are important eco-friendly agricultural inputs for sustainable agriculture system.

NIPHM has developed techniques for farm level mass production of biofertilizers using low cost production medium. The preliminary results show that these low cost production medium are suitable for multiplication of bacterial bio-fertilizers like Rhizobium, Azotobacter, Azospirillum, PSB, etc.

The study carried out at Biofertilizer lab at NIPHM using different medium namely Nutrient broth, Jaggary, NIPHM medium and combination of both i.e. Jaggary + NIPHM medium for growth of Rhizobium in terms of cfu/ml count.

The results of present study showed that, medium used for mass production of biofertilizer i.e. Jaggary, NIPHM medium and combination of both (Jaggary + NIPHM medium) was found effective and low cost at par with commercial nutrient broth as indicated below-

[illegible]	[illegible] factor	[illegible] broth	[illegible] broth	[illegible] broth	[illegible] Jaggery broth
[illegible]	10^1	1856	1897	1879	1931
2.	10^2	1234	1314	1220	1332
3.	10^3	1266	1267	1153	1272
4.	10^4	888	869	821	845
5.	10^5	678	768	670	770
6.	10^6	489	476	467	495
7.	10^7	324	322	280	333
8.	10^8	190	189	150	191
9.	10^9	53	62	47	79



The per liter cost of different medium is Rs. 0.6, 5, 5.6 and 49.27 for Jaggary, NIPHM, NIPHM + Jaggary and commercial nutrient broth, respectively. The low cost production medium like Jaggary and NIPHM medium can be used by the farmers for multiplication of bacterial biofertilizers like *Rhizobium, Azotobactor, Azospirilum, Bacillus*, etc. on their own farm.

Live Streaming of NIPHM Low Cost Technologies

National Institute of Plant Health Management (NIPHM) always used to adopt new and advanced technologies. As a new initiative, live Streaming of, NIPHM developed low cost technologies demonstration over internet is taken up. The services of third party solution provider www.livestream.com are being used for this purpose.

The live-streaming is done with mere mobile phone with 3G/4G internet connectivity and the live demo can be viewed in mobile devices / laptops/ desktops etc. The outcome of the initiative is a seamless video streaming, which can be viewed by any number of viewers across the globe with a bare Gmail id / Facebook ID.

The viewer's just need to register and login to the URL link provided by NIPHM, which is sent through SMS (almost 5000 agricultural professionals in Telangana & A. P. are accessible through Mobile Phone initially) prior to the event date and time. NIPHM is preparing a database of contact numbers of all Agriculture professionals across India for this purpose.

The live streaming demonstration initiative was inaugurated by Sh. S.K. Pattanayak, Hon'ble Secretary (AC&FW), Ministry of Agriculture and Farmers Welfare on 20th September, 2016 and more than 500 viewers were witnessed on the live streaming site and viewed the Live Streaming.

Independence Day was Celebrated by NIPHM officers with great enthusiasm, Mrs. V. Usha Rani, IAS, Director General NIPHM hoisted the National Flag on this occassion




Official Visit

Dr. Ch. Sreenivasa Rao, Director - Pesticide Management Division has visited Malaysia as Subject Matter Expert and Master Trainer for USDA sponsored "Training on Pesticide Residues in Food Crop and Dietary Risk Assessment" during 21st - 23rd September, 2016.


राजभाषा कार्यान्वयन समिति की द्वितीय बैठक एवं अन्य गतिविधियां संपन्न

दिनांक 30.08.2016 को श्रीमती वी.ऊषारानी, भा.प्र.से. महानिदेशक, रावस्वाप्रसं अध्यक्षता में वर्ष 2016-17 हेतु राजभाषा कार्यान्वयन समिति (राकास) की द्वितीय बैठक आयोजित हुई। उक्त बैठक में जुलाई–सितंबर, 2016 की तिमाही हिन्दी प्रगति रिपोर्ट की समीक्षा की गई। महानिदेशक ने पिछली बैठक के दौरान लिये गए निर्णयों पर की गई कार्रवाई पर संज्ञान लेते हुए संस्थान में राजभाषा कार्यान्वयन का सुनिश्चित करने एवं संस्थान में आगे भी राजभाषा अधिनियम की धारा 3(3) का अनुपालन शत प्रतिशत किये जाने के निदेश दिये। महानिदेशक ने किसानो के लिए सभी प्रौद्योगिकी वीडीयो, महत्वपूर्ण जानकारी और किसान उपयोगी तकनीकों का हिन्दी में अनुवाद करने के निदेश दिये। बैठक में निर्णय लिया गया कि संस्थान में चलाये जा रहे प्रशिक्षणों की पाठ्य सामाग्री (मैन्यूअलों) का शीघ्र हिन्दी में अनुवाद किया जाए, ताकि देश के विभिन्न क्षेत्रो से आने वाले प्रशिक्षार्थियों एवं कृषक समुदायों को हिन्दी में पाठ्य सामाग्री उपलब्ध हो सके।

दिनांक 31.08.2016 से 14.09.2016 तक संस्थान में 'हिन्दी पखवाड़ा-2016' का आयोजन किया गया एवं दिनांक 14.09.2016 को हिन्दी दिवस मनाया गया। हिन्दी पखवाड़ा के दौरान विभिन्न हिन्दी प्रतियोगिताएं अयोजित की गई और प्रतियोगिता में सफल प्रतिभागियो को नगद पुरस्कार और प्रमाणपत्र प्रदान किये गए। दिनांक 06.09.2016 को संस्थान के कर्मचारियों के लिए 'राजभाषा नीति, कार्यान्वयन एवं केन्द्रीय सरकारी कर्मचारियों की इसके प्रति जिम्मेदारी' संबंधी विषयों पर एक दिवसीय हिन्दी कार्यशाला का आयोजन किया गया। इस कार्यशाला के अतिथि वक्ता डॉ.संतराम यादव, क्रीडा, हैदराबाद ने इन विषयों पर व्याख्यान प्रस्तुत किया। कार्यशाशाला के समापन के बाद कर्मचारियों के लिए हिंदी वाक् प्रतियोगिता का आयोजन किया गया, जिसमें कर्मचारियों ने बढ़-चढ़कर भाग लिया।

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