



# ICAR - NRCB NEWSLETTER

## ICAR - National Research Centre of Banana

An ISO 9001 : 2008 Certified Institute



### Hearty welcome to New Director General, ICAR

Dr. Trilochan Mohapatra, took over charge as Secretary, DARE and Director General, ICAR on February 22, 2016. He is an eminent scientist in the field of molecular biology and biotechnology who has made significant research contributions which includes development of high yielding bacterial leaf blight resistant basmati rice; mapping and sequencing of rice and tomato genomes. He started his career as Scientist at ICAR – National Research Centre for Plant Biotechnology, New Delhi and very popular among students as one of the best teachers. Later he assumed charge as the Director for ICAR – National Rice Research Institute, Cuttack and ICAR – Indian Agricultural Research Institute, New Delhi. He has received many prestigious awards including INSA Young Scientist award; NAAS-Tata award; IARI B.P. Pal award; DBT bioscience award and life time achievement award of the Indian Genetics Congress. The Director and Staff of ICAR – NRCB greet Dr. Trilochan Mohapatra the very best in his present assignment and look forward to receive his support, valuable guidance and leadership in all activities of the Institute.



### New Director for ICAR – NRCB

Dr. Mrs. S. Uma, Principal Scientist, has taken over the charge of Director, ICAR – NRCB on 19 July, 2016. She started her career as Scientist at ICAR – IIHR, Bengaluru and later transferred to ICAR - NRCB, Tiruchirapalli. She is an eminent Scientist in banana genetic resource management who explored extensively, took stock of *Musa* genetic diversity in the country and established the largest field gene bank in Asia with 1680 accessions including four new species. She has developed a low cost farmer friendly macro-propagation technology called *Khela Vruddhi*. She was also involved in developing accreditation system for tissue culture plants and certification standards for the tissue culture companies along with DBT, New Delhi and for the quality certification of tissue culture bananas, which is currently in vogue. She has developed and released banana variety 'Udhayam' and NRCB selections 07, 08, 09 and 10 which are in pipeline for release. She also served as FAO consultant for two projects during 2003 and 2006. She is the recipient of many prestigious national and international awards which include 'ICAR's Best Woman Researcher Award' and 'Pisang Radjah' Award from Bioversity International. She has more than 150 research publications to her credit.



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## FROM THE DIRECTOR'S DESK

I am privileged to take this new responsibility as seventh Director of this institute inherited through my great predecessors. It is going to be challenging but with my dedicated ICAR - NRCB team, I hope to steer ahead towards betterment of the farming community.

India takes the pride with 33.4 % enhanced production of banana and plantain and twice the global productivity. In spite of innovative technologies contributing to this development, pests and diseases have been causing extensive crop damage. Of late, Fusarium Wilt has emerged as a major disease wherein a resistant cultivar like Grand Naine has succumbed to its virulent strains. Race-1 affecting Grand Naine is rampant in Tamil Nadu while, another virulent race has been reported from Bihar. ICAR - NRCB is developing strategies to contain the wilt disease through multi disciplinary approaches. Banana scarring beetle is another pest spreading to Eastern India from its original confinement to North East India. Research initiatives in collaboration with North Eastern institutes is expected to give dividends. ICAR - NRCB has made headway in high throughput *in-vitro* production technologies, nutrient dynamics, virus diagnostic etc. Our ITMU unit has licensed seven products to empower interested entrepreneurs. Soil health card was issued to more than 200 farmers with an advisory to maintain better soil and plant health.

We celebrated many events during the last six months viz., Brainstorming discussion meeting on 'Emerging Pest and Disease Problems in Banana'; 'Swachh Bharath Pakwara'; 'International Yoga Day'; 'Cleanliness Awareness Programme' for School children; 'Hindi Pakwara' and 'Awareness on First Aid Management' during April to September, 2016 including ICAR - NRCB Foundation Day. We pledge to work with all stakeholders for betterment of the farming community.



S. Uma

## IN FOCUS

### AGRO TECHNIQUES

ICAR-National Research Centre for Banana, Tiruchirappalli has developed various agro techniques and effectively disseminated them for enhancing production and productivity of banana.

## High density planting and fertigation

In recent years, there has been considerable emphasis on high density planting as the yield of an individual plant under conventional planting system cannot be increased beyond certain limit. However, adoption of high density planting (HDP) technologies such as planting of two or three suckers per pit and paired row planting, increases the total yield and net returns per unit area, reduces weed growth and protects against wind damage.

The HDP technologies are being widely adopted by banana growers across the country. Commercial banana cultivars viz., Grand Naine (AAA), Nendran (AAB), Ney Poovan (AB) and Rasthali (AAB) are grown under HDP with good success and additional income to the farmers. The major advantages of modified high density planting are,

- Enhanced yield and income with about 40-50% increase in productivity.
- Reduced cost of cultivation through maintaining less number of clumps and saving of irrigation water (30-40%), fertilizers (25%) and plant protection chemicals. In addition, there is significant reduction in staking cost due to tying 3 plants by rope.
- Reduced initial investment on drip system because of wider spacing and easy fertigation.
- Gives ample scope for inter cropping.

In three suckers per hill system, the suckers are planted at 1.8 X 3.6m distance accommodating 4630 plants per hectare whereas only 3086 plants are accommodated by planting two plants per pit. In case of two suckers per pit / 3960 plants/ha (2.1 X 2.4m) or 3525 plants/ha (2.1 X 2.7m) could be accommodated. In 'paired row planting system', 3850 plants/ha (1.5 X 1.5 X 2.0m) or 5200 plants/ha (1.2 X 1.2 X 2.0m) could be accommodated.

In banana cultivation, maintaining optimum moisture at all stages especially during active vegetative growth and finger filling stages are very critical for better growth and enhanced productivity. Drip irrigation by surface or sub-surface method by applying water directly into the root zone of banana plants not only saves water by 40-50% but also reduces weed growth and improves fruit yield.

Drip irrigation has the advantage of large area coverage with less water, minimum labour and provides uniform distribution of water, fertigation and salinity friendly and also activates the uptake of nutrients. Based on the trials conducted, ICAR-NRCB has standardized stage wise water requirement and developed irrigation schedule for enhancing productivity.

### Plant population under different planting systems

S.No	Method of planting	Spacing (m)	Population/ ha
A	CONVENTIONAL PLANTING		
i	Dwarf Cavendish	1.5 X 1.5	4440
ii	Robusta and Nendran	1.8 X 1.8	3080
iii	Rasthali, Poovan, Karpuravalli and Monthan.	2.1 X 2.1	2260
B	HIGH DENSITY PLANTING		
i	Paired row planting system Dwarf Cavendish	1.2 X 1.2 X 2.0	5200
	Robusta, Grand Naine, Poovan, Rasthali and Ney Poovan	1.5 X 1.5 X 2.0	3800
ii	3 suckers/hill (45 cm apart in the pit)	1.8 X 3.6	4500
	Robusta and Nendran	1.8 X 3.0	5550

### Water requirement of banana through drip irrigation at different growth stages

S.No	Crop growth stage	Duration (weeks)	Quantity of water (lit./plant)
1	After planting / Ratoon	1 - 4	4 - 6
2	Juvenile phase	5-9	8 - 10
3	Critical growth stage	10 - 19	12
4	Flower bud differentiation stage	20 - 32	16
5	Shooting stage	33 - 37	20 and above*
6	Bunch development stage	38 - 50	24 and above*

\* Depending on the season

### Weekly fertigation schedule for banana (g /plant /week)

Weeks after planting	Urea	Total (g/plant)	MOP	Total (g/plant)
9 to 18 week (10 weeks)	15	150	8.0	80
19 to 30 week (12 weeks)	10	120	10	120
31 to 40 week (10 weeks)	7.0	70	12	120
41 to 46 week (5 weeks)	Nil	Nil	10	50
Total	----	340	----	375

### Enhancing the fruit yield through bunch spraying with Potassium Sulphate (K<sub>2</sub>SO<sub>4</sub>)

Spraying the bunches with 2% potassium sulphate twice i.e., first at 15 days after the bunch emergence and again 30 days later and covering with transparent polythene sleeves helps in uniform finger filling which improves the bunch grade and fetches premium price. In addition, it also advances the fruit maturity by 7-10 days. With about 10 per cent increase in bunch weight there is an additional yield of 6-8 t/ha and bunches get at least 15-20% additional premium price in the wholesale market and even better price in retail market owing to its superior bunch grade in terms of blemishless fruits and attractive green colored fruits.

### Optimum spacing and nutrition for enhancing the yield and quality of tissue culture banana

Use of tissue culture bananas has become popular among banana growers. The tissue cultured banana owing to its well developed root system exhibits rapid growth that demands early and higher dosage of fertilization. In tissue cultured banana cv. Robusta grown under wetland system of cultivation, application of 300g N and 400g K in five split doses at 45 days interval registered the highest bunch weight (23.3 Kg). The highest fruit weight, finger length and girth were recorded at higher levels of potassium application.

### Performance of certain banana cultivars under drip and fertigation system

The fertilizer use efficiency under conventional flood irrigation is very low (40 – 50 %) whereas, application of two inputs with drip irrigation i.e., fertigation improves efficiency by >90%. Fertigation gives flexibility in application of fertilizers, which enables to meet the specific crop requirements at various stages of growth. The performance of Rasthali, Robusta and Saba bananas grown under conventional planting system (CPS) and paired row planting (PRPS) with drip and fertigation was studied and results are presented in the table below.

### Performance of banana cultivars under drip and fertigation system

Cultivar	Robusta (AAA)	Rasthali (AAB)	Saba (ABB)
Fertigation schedule	150g N+ 250g K/plant (75% RDF)	100g N+ 150g K/plant (50% RDF)	100g N+ 150g K/plant (50% RDF)
Bunch weight (kg)	34.5 (CPS)	10.6 (PRPS) 16.4 (CPS)	27.7 (PRPS) 31.0 (CPS)
Yield (t/ha)	103.5 (CPS) 3086 plants/ha	55.0 (PRPS) 5200 plants/ha 41.9 (CPS) 2500 plants/ha	123.3 (PRPS) 93.0 (CPS)

## Effect of modified crop geometry and levels of fertigation on the growth and yield performance of banana cultivars

Adoption of paired row planting system (1.2 X 1.2 X 2.0m) in cv. Grand Naine recorded an yield of 52.68 t/ha, which was 38.3% higher than conventional planting system and both the bunch weight as well as total yield were on par in plants applied with 100% and 75% recommended doses of N&K fertilizers. In Robusta, paired row planting recorded 39.5% higher yield (65.9 t/ha) than the conventional planting (47.2t/ha) and enhanced fruit quality in terms of total sugars (23.3 %) and ascorbic acid (10.39%). In both these varieties, weekly fertigation with 75% recommended dose of fertilizers recorded significantly more number of hands (8.35) and fingers (145.0) per bunch as well as bunch weight (18.49 kg) and estimated yield (57.68 t/ha), which was on par with 100% recommended dose of 200g N<sub>2</sub> and 300g K<sub>2</sub>O / plant. Paired row planting with 75% RDF fertigation is suitable for enhancing the productivity in Cavendish bananas.

## Optimum spacing and nutritional requirements for NRCB variety, Udhayam

In banana cv. Udhayam, plant spacing of 2.1 X 2.4m was found optimum for advanced flowering (413.7 days) and recorded the highest bunch weight (35.7 kg) with more number of hands (16.4) and fingers (289.5) per bunch. Application of 300g N & 400g K/ plant recorded the highest total yield of 74.2 t/ha with a B:C ratio of 2.97 as compared to the lowest yield (56.5 t/ha) with a least B: C ratio of 2.41 in plants applied with lowest fertilizer dose of 200:300g N & K / plant.

## Standardization of stagewise nutrient requirement for NRCB variety Udhayam

Application of 300g N and 400g K fertilizers in the ratio of 7:2:1 N and 4:3:3 K<sub>2</sub>O during the vegetative, flowering and bunch development stages respectively recorded the highest bunch weight (34.2 kg) and total yield (72.7 t/ha) with the highest B:C ratio of 3.43. Whereas, application of RDF in the ratio of 7:3:0 N and 6:2.5:1.5 of K<sub>2</sub>O recorded the lowest yield (53.9 t/ha) and B :C ratio of 3.04.

## Standardization of nutritional requirements of banana using soluble fertilizers

In Robusta and Ney Poovan, application of 50% recommended dose of NPK as soil application at 3<sup>rd</sup>, 5<sup>th</sup> and 7<sup>th</sup> months after planting (MAP) along with five sprays of 3% Polyfeed (19:19:19) followed by another 5 sprays of 3% Multi K (13:0:45) at 15

days interval retained more number of healthy leaves at flowering and also recorded early flowering and early maturity of bunches as well as highest number of hands and fingers/bunch in Robusta and Ney Poovan bananas. The treatment recorded significantly highest bunch weight both in plant crop as well as ratoon crops of both the varieties. In cv. Robusta, the treatment recorded the highest cumulative fruit yield of 96.1 t/ha with a B:C ratio of 1.80. In case of Ney Poovan, it recorded the highest yield of 58.0 t/ha with the highest benefit cost ratio of 1.62.

## Management of the BSV and BBrMV infected Poovan banana with organics

In cv. Poovan, banana streak virus (BSV) and banana bract mosaic virus (BBrMV) are the most serious diseases in almost all banana growing areas. These diseases spread through infested suckers and cause yield reduction and also affects fruit quality that ultimately fetches very low price for the farmers. Management of infested plants with application of 25% additional fertilizers resulted in obtaining normal yield and hence, a trial was laid out to study the effect of different combinations of organics on BSV and BBrMV infested Poovan banana.

Pooled data of plant crop and two ratoons revealed that, application of 20 kg FYM + 0.9 kg Neem cake + 2.0 kg Vermicompost + 0.9 kg groundnut cake recorded the highest bunch weight (18.8 kg) with more number of hands (11.7) and fingers (180.9) per bunch. All these parameters were on par with application of 125% RDF through inorganic fertilizers. With regard to the fruit quality parameters, application of organic manures at different levels and combinations outperformed inorganic fertilization and recorded the highest fruit TSS (25.46°B) with low acidity (0.35%) and the highest pulp: peel ratio (5.68). Besides, organics recorded the lowest bulk density of 1.13 and improved the porosity (45.5 %) as well as particle density (44.3%) when compared to inorganic fertilization. Further, the treatment also recorded the least BSV index of 19.8 percent.

## Performance of polypropylene based non woven bunch sleeves on banana yield and quality

ICAR - NRCB has developed 'banana bunch sleeving technique' by covering the bunches with polypropylene based non woven fabric in banana cvs. Grand Naine, Ney Poovan and Rasthali. Use of blue polypropylene sleeves advanced the fruit maturity by 7.1 days. Bunches covered with blue

polypropylene sleeves recorded the highest bunch weight (35.7 kg) followed by white polypropylene bunch sleeves (34.5 kg) as against the uncovered bunch (32.9 kg). Similarly, in Ney Poovan and Rasthali bananas, polypropylene sleeves advanced the fruit maturity and enhanced the bunch weight than uncovered bunches. In addition, both the blue and white polypropylene bunch sleeves recorded significantly highest fruit length, fruit girth, pulp: peel ratio, TSS and total sugars as compared to control.

### Bunch cover with polypropylene bunch sleeves

Overall, the bunches of cv. Grand Naine grown by covering with blue or white polypropylene non-woven bunch sleeves produced blemish free high grade bunches that fetched about 10-15 per cent higher price as compared to control bunches.



*Three suckers / hill planting*



*Bunch sleeving with polypropylene material*

## RESEARCH HIGHLIGHTS

### Crop Improvement

#### Use of temporary immersion bioreactor in the mass multiplication of banana

Mass multiplication of banana through shoot tip culture is labour intensive and expensive in terms of glassware and gelling agents. Hence, an alternate (Temporary immersion bioreactor) technique was attempted for the mass production of quality planting material in cvs. Namwa Khom and Udhayam. This temporary immersion bioreactor produced approx. 56 and 14 numbers of shoots / explant in cvs. Namwa Khom and Udhayam respectively, within a short time span of 21 days which is 3-4 fold enhanced shoot proliferation as against normal tissue culture protocol. This will reduce the number of sub-culturing and thereby reduce the per cent occurrence of somaclonal variations. This technique will also cater to the large requirement of planting materials in a short span of time with less cost.

### Germination efficiency of embryogenic cell suspension (ECS) on different media

During the reporting period, the germination efficiency of somatic embryos of cv. Rasthali was tested by transferring 60 days matured somatic embryos in two different media namely MA<sub>4</sub> medium (INIBAP technical guidelines) and M<sub>4</sub> medium (QUT-CTCB protocol) in both solid and liquid states. MA<sub>4</sub> medium was supplemented with Myo-inositol and M<sub>4</sub> medium was supplemented with Gibberellic acid and Folic acid. In solid M<sub>4</sub> medium, germination of somatic embryos was around 65% as against 50% in MA<sub>4</sub> medium. Similarly, in liquid M<sub>4</sub> medium, germination of somatic embryos was around 85% as against 80% in MA<sub>4</sub> medium. The enhanced germination in M<sub>4</sub> medium than MA<sub>4</sub> might be due to the presence of GA<sub>3</sub>. In the liquid media of both M<sub>4</sub> and MA<sub>4</sub>, the germination of somatic embryos was higher by 15-30% as against solid medium.

### Evaluation of Nendran based progenies

First generation progenies of conventionally bred plants using cv. Nendran as common female and Pisang Lilin and cv. Rose as male parents were tested with 70 SSR primers and results showed that all the progenies are hybrid in nature. Out of 70 primers, three primers namely NRSIP40, NRSIP45 and NRSIP66 confirmed the hybridity of all progenies irrespective of male parents. Among the hybrids, NPL30 showed unique banding patterns with most of the SSR primers.

### Identification of putative mutants of cv. Rasthali showing resistance to wilt disease

Pot screening of ethyl methane sulphonate (EMS) treated embryogenic cell suspension (ECS) derived plants of cv. Rasthali has led to the identification of 15 putative mutants with Fusarium wilt resistance which are being multiplied for further screening in sick plots and hotspot areas.

### Crop Production

#### Studies on nutrient dynamics in banana

Second ratoon 'Ney Poovan' banana at ten leaves stage produced total dry matter (TDM) of 744.7 g with fragmentation of root-2.6%, corm-39.4%, pseudostem-33.6%, petiole-4.5% and leaf-19.9%, while Rasthali plant produced TDM of 1260.5g with fragmentation of 2%, 26.2%, 48.4%, 4.7% and 18.7%, respectively.

## Banana varieties suitable for leaf purpose

A survey was conducted in major banana growing belts of Tamil Nadu in order to understand the varieties that are mainly grown for leaf purpose. The variety 'Nattu Vazhai'(Monthan)is preferred for cultivation in Melur, Madurai and Tirunelveli districts, while 'Poovan' and 'Ney Poovan' in Tuticorin and Theni districts of Tamil Nadu.

## Assessment of post-harvest losses in banana

In Tamil Nadu, surveys were conducted in Theni and Erode districts for Grand Naine' banana to estimate and observe the post-harvest losses in banana at various levels. In 'Grand Naine' variety, overall 10.52% and 10.48% post-harvest losses were estimated in Theni and Erode Districts, respectively. In 'Poovan' variety, overall 16.50% and 9.10% post-harvest losses were recorded in Trichy and Tuticorin Districts of Tamil Nadu.

## Development of banana central core powder based instant soup mix

Banana central core powder based instant soup mix was developed by blending banana central core powder with onion powder, garlic powder, corn flour, clove powder, banana flour and cumin seed powder. Nutrient analysis revealed ascorbic acid (12.26 mg), total sugar (2.37%), starch -16.43 % and total carbohydrate (30.08%), crude fibre -81% with the moisture content of 6.13%.

## Post-harvest management of 'Ney Poovan' banana under modified atmospheric packaging

Post-harvest handling techniques along with modified atmosphere packaging recorded 29 days shelf-life in cv. Ney Poovan with 90% maturity at room temperature when compared to absolute control [7 days]. However, 49 days shelf-life in cv. 'Ney Poovan' was observed by adopting post-harvest handling techniques along with modified atmosphere packaging and maintaining at cold storage (13.5°C).

## Functions of resistant starch and designer food development from banana flour

Banana flour of four varieties viz., Grand Naine, Nendran, Monthan and Saba were characterized according to their drying kinetics with varying temperature and pre-treatments. Blanching for two-three minutes resulted in better flour for three starchy varieties other than Grand Naine. The texture and colour of the Grand Naine flour changed due to blanching prior to drying. Among the

temperatures, 55°C was found to be superior in various physico-chemical characteristics. Starch, nutritional composition and sensory characteristics were studied.

## Drought and salt stress tolerance in banana

Banana plants imposed with soil moisture deficit (-0.7 to -0.8 MPa) and salt stress (100 mM NaCl) under shaded condition (50% of light) recorded significant decrease (14.3 – 17.15 %) in photosynthesis compared to stressed plants under natural light. However, in terms of total dry matter production, there was a decrease by 37 - 43% in plants grown under full natural light with drought and salt stressed treatments. The senescence of leaves significantly increased (45%) in drought stressed plants under natural light than under shade stressed plants. The survival rate of shade stressed plants was found higher (94%) than natural light stressed plants (48%). The shade reduced the intensity of drought and salt stresses, as evidenced by survival percentage.

## Green ripening of Cavendish banana (cv. Grand Naine)

Postharvest treatment of pre-climacteric full three quarter (90%) mature green Grand Naine bananas with lysophosphatidyl ethanolamine (LPE) at 500 ppm concentration by dipping for 30 minutes enhanced the green life of bananas for 11 days at 13.5°C and four days at room temperature (26-30°C) over the controls. Analysis of physiological (CO<sub>2</sub> and O<sub>2</sub> evolutions), biochemical (ripening enzymes activities) and qualitative parameters [Total soluble sugars (TSS) and acidity] of LPE treated bananas during storage and induced ripening was similar to untreated control bananas. The TSS of both LPE treated and control [Grand Naine] bananas was 25.8-26.5°B and acidity was 0.278-0.31%.

## Crop Protection

### Isolation of endophytic fungi from *Musa* germplasm

The *Musa* germplasm available in the core collection of ICAR-NRCB was screened for the isolation of entomopathogenic endophytic fungi. A total of 314 fungi were isolated from germplasm accessions and they are as follows: *Beauveria bassiana* (150), *Metarhizium anisopliae* (134) and *Lecanicillium lecanii* (30) and these are being tested for their effectiveness against weevils.

### Transmission of Banana Bract Mosaic Virus

Banana bract mosaic virus, a potyvirus known to be transmitted by aphids and through infected

planting material was tested for its transmission through seeds by growing out test. The seeds of BBrMV infected variety H201 was collected and sown in a sand media in pots under insect proof glass house. After two to three months of sowing, 20 seedlings germinated and the leaves did not show any symptoms of the virus infection. The total RNA was isolated and RT-PCR was performed using virus specific primers. All the 20 leaf samples were positive in RT-PCR has confirmed that the virus is seed borne. Further study is required to quantify the virus in different parts of the seeds. In an experiment, the total transcripts and RNA was sequenced using Nextseq Illumina platform and the sequence data revealed the full length genome of BBrMV in the transcript.

### Assessment of Poovan bananas for virus diseases

Three thousand TC plants were produced through outsourcing from a hundred virus free plants identified from a long term field trial of cv. Poovan for assessing their performance in the field and to study the spontaneous virus infection, if any.

### Host plant gene – virus gene interactions

Protocol was standardized for carrying out Y2H assay. BBrMV genes were amplified and cloned in both bait and prey construct for studying the interaction among the viral genes in causing infection. Plant genes were amplified and cloned in prey construct for studying the interaction among the viral and plant genes. A total of 18 co-transformations of bait and prey construct harboring the viral and plant genes were carried out. Yeast prototrophic reporter gene assay was performed to know the interactions between the virus and plant genes. Primers were designed for differentially expressed proteins in BSMYV infected Poovan plants. Over-expressed CP protein were eluted and purified. Bioinformatic analysis was carried out for virus-encoded protein (VPg) of BBrMV.

### Survey on plant parasitic nematodes associated with banana in North Eastern Hill states

Soil and root samples collected from Assam and Meghalaya states indicated the presence of root-lesion (*Pratylenchus* sp.) and root-knot nematodes (*Meloidogyne* sp.) with an absolute frequency of 57% and 85% respectively. Other nematode pests include *Hoplolaimus* sp., *Rotylenchus* sp. and *Tylenchorhynchus* sp.

## CONSULTANCY SERVICES AND COMMERCIALIZATION OF TECHNOLOGIES

Five value added products/technology namely, banana fig, banana flour based baby food, banana chips, banana flower pickle (thokku) and Post-harvest handling, packing, storage and ripening in banana for domestic and export markets were transferred and commercialized.

- Under 'Lab accreditation facility for virus indexing and genetic fidelity testing of tissue culture plants', 606 batches of tissue culture plants at various stages of production (Grand Naine, Williams, Robusta, Ney Poovan, Red banana, Quintal Nendran etc.) have been tested for their genetic fidelity using SSR and ISSR markers and reports issued.

- A total of 10,733 samples were tested and issued certificate of labels for 13.85 million plants under contract services.

- As PI, Dr. M. S. Saraswathi visited M/s. Madappally service co-operative Bank Ltd., Kottayam, Kerala (under the Technical advisory consultancy project for setting up of a tissue culture unit and training to initiate the production of tissue cultured banana) to review the progress of work.

## IRC / RAC / IMC MEETINGS

### IRC Meeting

The 20<sup>th</sup> Institute Research Council (IRC) meeting was held on 13 and 14 June, 2016 under the chairmanship of Dr. B. Padmanaban, Acting Director, ICAR – NRCB. Dr. R. Selvarajan, Member secretary, IRC welcomed the chairman and other members of the IRC. After introductory remarks by the chairman, research achievements for the year 2015 - 16 and technical program for the year 2016 - 17 presented by the scientists were reviewed.

## OTHER INFORMATION

### Banana Kisan Mela cum ICAR - NRCB foundation day

ICAR – NRCB has celebrated its 23<sup>rd</sup> foundation day as Kisan Mela on 21 August, 2016. The mela was presided over by Dr. K. Ramasamy, Vice Chancellor, Tamil Nadu Agricultural University, Dr. Prakash Patil, Project Co-ordinator, AICRP – Fruits and Dr. S. Uma, Director, ICAR – NRCB.



### Brainstorming discussion meeting at ICAR – NRCB

ICAR – NRCB has organized one day brainstorming discussion meeting on “Emerging pest and disease problems in banana” on 23 April, 2016. The meeting was graced by Dr. N. K. Krishna Kumar, DDG (Hort. Sci.), ICAR, New Delhi. Dr. B. Padmanaban, Acting Director, ICAR- NRCB, Tiruchirapalli, Dr. Prakash Patil, Project Co-Ordinator, AICRP (Fruits), ICAR - IIHR, Bengaluru; Dr. Sadasakthi, Rep. of Commissioner of Hort. and Plantation Crops, Govt. of Tamil Nadu, Mr. R. Krishnamurthy, DDH, Dept. of Agri., Govt. of Tamil Nadu are others who participated in the discussion meet.



### Brainstorming discussion meeting at AAU, Jorhat

Scientists of ICAR – NRCB attended brainstorming discussion meeting on ‘Problems and prospects of banana in North East India’ held at Assam Agricultural University, Jorhat on 3 - 4 June, 2016. Delegates at the meeting include Dr. B. Padmanaban, Acting Director, ICAR - NRCB, Tiruchirapalli; Dr. A. Bhattacharya, Organizing secretary, AAU, Jorhat and Dr. S. K. Mukherjee, Senior consultant, NER-BPMC, DBT, Govt. of India, New Delhi.

### Field visits under Tribal Sub Plan

A team of scientists from ICAR - NRCB have visited B. R. Hills, Chamraja Nagar, Karnataka on 23 June and 26 - 27 July, 2016 and

conducted training and demonstrations on banana production and processing technologies to tribal farmers.

### Mera Gaon Mera Gaurav (MGMG)

Under MGMG program, frequent visits were made by the scientists of ICAR – NRCB to 20 adopted villages. A total of 140 villagers got benefited through this program. Apart from these visits, five demonstrations and two farmers’ meeting were also conducted, in which 247 farmers were participated and got benefited.

### Hindi fortnight

ICAR – NRCB has celebrated ‘Hindi fortnight’ from 14 to 28 September, 2016. Various competitions viz., ‘poem recitation’, ‘one minute talk’, ‘singing’, ‘identification’, ‘vocabulary’ and ‘hindi news reading’ were held and prizes were distributed.

### Yoga Day celebration

International Yoga Day was celebrated on 21 June, 2016. Members from Isha yoga trust, Coimbatore taught yoga to ICAR – NRCB staff.

### DDG (Hort. Sci.) became Bioversity International’s regional representative

Dr. N. K. Krishna Kumar, Deputy Director General (Hort. Sci.) was appointed as regional representative (South and Central Asia) of Bioversity International, New Delhi. He has worked for ICAR for 40 years at various capacities. He was Director, ICAR - National Bureau of Agricultural Insect Resources, Bengaluru; Acting Director and Principal Scientist, ICAR - Indian Institute of Horticultural Research; and Head, Entomology and Nematology. He has contributed significantly in horticulture pest management strategies and insect-vector studies, molecular biology and IPM. He has developed DNA barcode for 50 different species of insect-pests, designed species-specific markers for major insect-pests of horticultural crops. Staff of ICAR – NRCB wish him all the very best for his new assignment.



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