



# IARI NEWS



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## RESEARCH

### Eco-friendly Waste Water Treatment and Reuse: An Innovative Initiative of IARI

The Indian Agricultural Research Institute (IARI) evolved an innovative and eco-friendly wastewater treatment facility in its Delhi campus. The newly created facility utilizes emergent wetland plants (e.g. *Typha latifolia*), local media, and native microorganisms present in natural wastewater for treating 2.2 million litres per day (MLD) of sewage waters, sourced from the Krishi Kunj colony. The eco-friendly sewage treatment plant (e-STP) is spread over 1.42 ha

and is capable of irrigating 132 ha of IARI farmlands. Long term monitoring of the treatment capacity of so developed wastewater treatment plant of IARI has revealed its exceptional performance especially with respect to lowering turbidity (99%), BOD (87%), nitrate (95%), phosphate (90%), lead (81%), iron (99%). A comparison of the so treated wastewaters with the local ground water samples showed that the treated water was associated with either better or same EC, pH, turbidity, nitrate, sulphate, phosphate and metal concentrations than those of the ground waters of

surrounding areas (viz., SPU, MB1A and New area). A comparison of the so created eco-friendly wastewater treatment system with the conventional wastewater treatment systems further showed that the proposed technology is associated with just 1% energy requirement; zero-chemical application; zero-sludge generation; 50-65% reduced treatment cost; and no skilled manpower requirement. The facility could create a good annual local surface water source of about 660 million litres bridging an annual gap (of 520 ML) between the irrigation water demands vs. supply in IARI farmlands. On longterm scale, a conjunctive use of the so created good quality surface water source, along with the existing ground water source, is expected to not only build water-levels in the receding ground water aquifers of the IARI and hence reduce total energy required for pumping ground waters but would also help improve soil quality and agricultural productivity of the IARI farmlands.

**ENVIRONMENT FRIENDLY SEWAGE WATER TREATMENT FACILITY**  
for augmenting IARI farm irrigation water supply



**Panoramic View of e-STP**



**E-STP Treatment Capacity:** 2.2 MLD  
(~660 ML over 300 days of total cropping season)  
**Design:** Horizontal Sub-surface Flow  
**Hydraulic Retention Time:** 2.2 days  
**Areal Spread:** 1.42 hectares  
**Irrigation Potential:** 132 ha

**Just 1% energy requirement**  
**Zero-chemical application**  
**50-65% reduced treatment cost**



**Sewage**      **Treated**

**Exceptional treatment efficiency w.r.t. Turbidity (99%), BOD (87%), Nitrate (95%), Phosphate (90%), Lead (81%), Iron (99%).**

### New Barley Variety Released

A new barley variety BHS 400 (Pusa Sheetal) was released by the Central Sub-Committee on Crop Standards, Notification and

Release of Varieties for Agricultural Crops for cultivation in the Northern Hills Zone comprising Himachal Pradesh, Uttarakhand, Jammu & Kashmir and North-Eastern States under timely sown rainfed conditions. It produced an average grain yield of 3.27 t/ha under rainfed situations and also shown resistance to stripe rust. The variety would help to improve barley productivity in North-West Himalaya.

### Spread of Pusa Basmati 1509

IARI has now come out with a new variety Pusa Basmati 1509, which combines semi-dwarf stature, early maturing (120 days), non-shattering habit, and grain, cooking and eating quality superior than Pusa Basmati 1121. Owing to earliness, it requires less water (33% water saving). It can be planted as late as 1st to 2<sup>nd</sup> week of August, with yield up to 4.5 t/ha. Under timely planting (3<sup>rd</sup> week of July), it can give yield up to 6.0 t/ha. In order to make quality seed of Pusa Basmati 1509 available to farmers, IARI has taken massive participatory seed production programme and signed MoU with 15 seed companies for seed production. According to rough estimates during *kharif* 2014, Pusa



Pusa Basmati1509 Pusa Basmati1121

Basmati 1509 has replaced Pusa Basmati 1121 in nearly 50 % its area, covering approximately 7 lakh ha in the states of Punjab, Haryana, western UP and Uttarakhand. The farmers, who had grown Pusa Basmati 1509 during *kharif* 2013, could get on average ₹ 100,000/acre gross return. This variety is likely to bring a new revolution Basmati rice production and export. IARI is further researching on incorporation resistance to major biotic stresses such as bacterial blight, blast and brown plant hopper.

### HD 2967 - Fast Spreading Wheat Variety among the Wheat Growing Farmers

HD 2967 – a popular wheat variety released for cultivation in North Western Plains Zone under timely sown irrigated conditions. Due to its superior performance in terms of yield, adaptability and resistance to yellow rust, it is spreading in an unprecedented manner among the wheat farmers of NWPZ. Based on the its growing demand for seed, it was estimated that it has reached to around three million ha during 2013-14 under wheat cultivation in the NWPZ in a short span of 2-3 years of its release. The analysis of pedigree HD 2967 showed that its parents and grandparents consist of old Indian wheat varieties HD 1962, Kalyansona, HD 1592, Bluebird and Gabbo and it has minor- gene based durable resistance against rusts including Ug99. It does not possess “Veery” or 1B/1R trans-location or any known major gene for resistance unlike other varieties such as PBW 343, PBW 550, PBW 621, HD 2851, HD 2733, etc.

### Tomato Production through Smart Horticulture Technique

Smart horticulture refers to an intensive production of crop inside protected structures using maximum available space. Decreasing land for crop production has led to an option of smart horticulture technology as a boon for the farmers of urban and peri-urban areas. Using this technology, the area can be enhanced many fold (3-4 times) in the greenhouse by effective utilization of both vertical and horizontal spaces inside the structure thereby increase in tomato production. It also gives attractive and aesthetic look while visiting the smart horticulture structure.

Production of tomato was undertaken using smart horticulture technology at CPCT, IARI, New Delhi during July 2013 to June 2014. An indeterminate tomato hybrid (GS 600) was transplanted in July at spacing of 50 cm × 50 cm. Plants were trained and pruned and trellising was done using plastic ropes 15-20 days after transplanting. A schedule of branch pruning and pinching of side shoots was continuously practiced at weekly interval until the crop lasted. Plant were trained as vine into single stem through out to utilize both horizontal and vertical spaces inside the structure. A need based requirements of crop i.e., drip irrigation, fertigation, application of macro and micro nutrients, sanitation, disease control measures, pests and nematode management were adopted throughout the production period. During winter season, an electronic pollinator was used for increasing fruit set in

flower clusters of tomato. The daily micro climate in terms of temperature, relative humidity, solar radiation and ventilation were monitored and maintained inside greenhouse structure through cooling pad, exhaust fan and rolling/unrolling of side curtains while heat escape was provided by spreading of UV stabilized anti-sun screen net.

Under smart horticulture technique, enhancement was observed for tomato flower cluster per plant (18-20), fruits per cluster (5-7) and plant vine length up to 6.5-7.5 m. The average yield was obtained 10-12 kg per plant as compared to 3-4 kg/plant in open field grown tomato. The fruit size was uniform with 90-95% fruits having 5-6 cm diameter and an average fruit weight of 100-120g whereas; it was only 3-4 cm diameter and 60-70g fruit weight in open field. It was estimated that 20-25 tons of tomato production could be obtained from 1000m<sup>2</sup> area with

a net income of ₹ 1-1.25 lakh per year.

### Vegetable Varieties Identified

Two varieties, namely, DC 31 of cauliflower and DAG 12 of ash gourd were identified by the Central Varietal Release Committee during XXXII workshop of AICRP (VC).

DC 31 is an early group cauliflower variety identified for release for zone IV. Its curd initiation and development takes place at an average temperature range of 22-27°C. It suits for transplanting during July and reaches marketable maturity during October. Its curds are compact with retentive white colour. The average curd weight is 500-600 g with a yield potential of 16-18 t/ha.

The ash gourd variety DAG 12 was identified for *kharif* cultivation in Zone VIII (Karnataka, Tamil Nadu and Kerala). Its vines are



DC 31: Early group cauliflower variety



DAG 12: *Kharif* grown ash gourd variety

medium long (average length 7.0 m) and fruits are cylindrical and easy for long distance transportation. It requires 100-110 days for first fruit maturity. Its fruit has greenish white rind and white flesh with an average flesh thickness of 6.40cm. The average yield in national level is 36.5 t/ha with an average fruit weight of 3.5 kg.



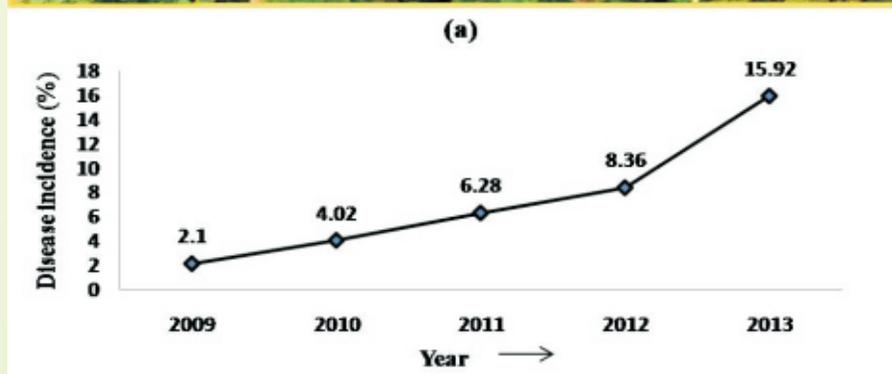
Tomato grown under polyhouse using vertical space

Dr. H.S. Gupta, Director, IARI visited the Smart Horticulture greenhouse with Dr. S. Ayyappan, Secretary, DARE and Director-General, ICAR, and Dr. R.S Paroda, Chairman, Haryana Farmer's Commission

## Cotton Leaf Curl Disease (CLCuD) Incidence in Delhi Conditions

For the last five years, cotton leaf curl disease (CLCuD) has been increasing year by year and was as high as 28.6 to 35.7% in current year of 2013 compared to 2.1- 5.5% in 2009. The efforts were been made to determine the cause of the increased incidence based on molecular based epidemiological study of causal factors. Complete genome (2753-2762nt) of five CLCuD-begomovirus isolates (IARI-30, -34, -42, -45 and -50) showing typical CLCuD symptoms were cloned and sequenced. Along with, two betasatellite (1371nt) and three alphasatellite molecules (1366-1371nt) associated with CLCuD-begomovirus were cloned and

sequenced. The sequence analysis clearly demonstrated that CLCuD in cotton is caused by *Cotton leaf curl Rajasthan virus* (CLCuRV) and *Cotton leaf curl Burewala virus* (CLCuBuV) and associated beta- and alphasatellite molecules. Recombination analysis showed both the viruses and satellite molecules are recombinants, derived from multiple recombination events, exchanging sequences from divergent begomovirus sequences. It is concluded that the high CLCuD incidence in Delhi condition is due to appearance of recombinant cotton leaf curl viruses (CLCuVs) and their associated recombinant satellite molecules with their complex interaction along with insect vector whiteflies (*Bemisia tabaci*) resulting in resistance breaking of cotton plant.



Different kinds of symptoms of CLCuD in cotton (a) and graph representing year wise incidence of CLCuD at the experimental field of IARI, New Delhi

## A Donor for High Temperature Tolerance in Rice

Some rice germplasm lines were phenotyped by early transplanting during the month of April in the field conditions. Among seventy one lines of germplasm, Nerica-L-44 thrived



Nerica-L-44: a new Nagina-22: check source of heat tolerance

well at high temperature (>40°C) and showed no burning of leaf tissues, while Nagina-22, a National check for drought and heat tolerance, showed burning of leaf tips and margins. The spikelet fertility of Nerica-L-44 was comparable to Nagina-22 at 38°C day temperature. It has erectophile leaf canopy, and produced higher biomass and grain yield under high temperature stress. Grains of Nerica-L-44 showed less grain chalkiness as compared to Nagina-22. Thus Nerica-L-44 can be used as new source of heat tolerance.

## Green Chickpea Flakes from Pusa Green 112

The Institute developed green chickpea flakes using the naturally produced grains of variety Pusa Green 112. The product has low glycemic index (30-35), hence suited for even diabetic people. The preparation of green chickpea flakes involves cleaning, soaking,

flaking, roasting, spicing and packaging. It is ready-to-eat crunchy product and can be used as snacks. Natural green colour of the variety has been retained in the flakes. Initial organoleptic trials have shown good product acceptability.

### Higher Yield of Rainfed Soybean Using Straw Mulch and Anti-transpirants

With an objective of improving soil moisture retention and soybean yield under rainfed conditions, a study was conducted for two years in light sandy loam soil of Northern Plains Zone of India. The results revealed that application of straw mulch @5 t/ha improved surface soil moisture by over 20% and reduced surface soil temperature by 1.38-2.34 °C and increased soybean seed yield by 17.2%. Increase in oil and protein yields of soybean due to mulching was 18.3%. Anti-transpirants, MgCO<sub>3</sub> (5%) and KNO<sub>3</sub> (1%) resulted in comparable soybean seed yields, which were significantly higher than in other anti-transpirants. These two anti-transpirants enhanced oil and protein yields by more than 20%.



Spraying anti-transpirant in soybean crop

## EDUCATION

### Dr. B.P. Pal Memorial Lecture Delivered

Dr. Shivaji Pandey, Special Advisor and former Director, Plant Production and Protection Division, FAO delivered the 21<sup>st</sup> Dr. B.P. Pal Memorial Lecture on May 26, 2014 on a very impressive and emerging topic “Sustainable Agriculture: An Imperative to Feeding People and Protecting Earth”. Dr. Mangala Rai, former Secretary, DARE and Director



Dr. Shivaji Pandey, Special Advisor and former Director, Plant Production and Protection Division, FAO delivering the 21<sup>st</sup> Dr. B.P. Pal Memorial Lecture

General, ICAR presided over the function. Dr. R.K. Jain, Dean and Joint Director (Edn.) welcomed the Chairman, Speaker and the audience present on this occasion. Dr. H.S. Gupta, Director, IARI presented the introduction of the lecture series and the Chairman, Dr. A.K. Singh, Professor of Genetics presented the vote of thanks.

### Meeting of Research Advisory Committee

The Research Advisory Committee (RAC) meeting of IARI

was held on May 20-21, 2014 under the chairmanship of Dr. R. S. Paroda, Chairman, Haryana Farmers' Commission and former Secretary, DARE & DG, ICAR. The other members who attended the meeting were: Dr. S. K. Dutta, DDG (CS), Prof. S.L. Mehta, Ex-VC, Maharana Pratap University of Agriculture & Technology, Prof. A. N. Mukhopadhyay, Ex-VC, AAU, Dr. G. L. Kaul, Ex-VC, AAU and

Dr. Mruthyunjaya, former National Director, NAIP. Dr. S. Ayyappan, Secretary, DARE & DG, ICAR also graced the occasion and participated in the meeting on both the days. Dr. H. S. Gupta, Director, IARI and Dr. K. V. Prabhu, Joint Director (Research) & Member Secretary, RAC, the Directors of sister institutes, all Joint Directors, Comptroller, Project Director (WTC), Heads of Divisions & Regional Stations and Unit In-charges also participated in the meeting.

Dr. H.S. Gupta, while welcoming the Chairman and members of RAC informed the house that efforts are being made to prioritize and streamline the research programmes of the institute to meet the research targets set for XII Plan. Dr. Gupta emphasized that major thrust would be given to undertake high quality research in frontier and challenging areas of national importance. A presentation on “Transformational Technologies: Development, Adoption & Impact” was made by the Director in the meeting. Dr. Prabhu presented the action taken report of

RAC 2013 meeting. The Chairman & RAC members expressed their satisfaction over good follow up of the previous RAC recommendations and appreciated profusely on the research achievements made in last one year.

Dr. Paroda desired that there should be more inter-disciplinary interactions and linkages within and across the schools and also inter-institutional collaborations in future, for implementation of new research programmes of the institute during the XII Plan period. He also urged that there should be one or two Flagship programmes within each school reflecting challenging areas of research and addressing the problems of topical importance.

Dr. S. Ayyappan, DG, ICAR stated that IARI should continue maintaining its leadership role while meeting the emerging challenges at the national level. While appreciating the state of art facilities created at IARI & its regional stations, DG emphasized that HRD and capacity building should be given high priority during the XII Plan. He also urged

that academic collaboration with other international universities and advanced Centers be strengthened.

In the concluding session, Dr. H.S. Gupta, Director, IARI thanked the DG, ICAR, Chairman, RAC and all the RAC members for their valuable remarks and suggestions and assured that the RACs recommendations would be implemented in every aspect for bringing in desired improvement in research, teaching and extension programmes of the Institute.

## EXTENSION

### Field Day

During the reported period, a field day on *Moong* was organized in the Khanpur village of Gurgaon district. In this field day 30 farmers and 7 farm women participated.

### Internship Programme for School Students

An internship programme for students of Salwan Public School, Gurgaon was organized by KVK from May 26 to 30, 2014 to make them aware about the avenues in agriculture and allied sciences. In this programme, 15 students participated.



Meeting of Research Advisory Committee



Students are being shown vermi-compost technology

## Participation in II Rajasthan Science Congress

The Institute put up an exhibition of IARI technologies and products during the II Rajasthan Science Congress held from May 1 to 3, 2014 at K.N.Modi University, Rajasthan.

## CAPACITYBUILDING

### Training Programmes Organized by KVK, Shikohpur

- ❖ Vocational training courses on: i) "Dairy Farming" from May 6 to 16, 2014 at KVK campus (41 rural youth from Gurgaon district participated); and ii) "Preservation of Seasonal Fruits & Vegetables" from June 23 to 28, 2014 (25 rural women were participated).
- ❖ Trainings for in-service personnel on: i) "Integrated Pest Management in *Kharif* Crops" on May 23, 2014 (25 ADOs participated); and ii) "Integrated Plant Nutrient Management in *Kharif* Crops" on June 20, 2014 (21 ADOs participated).

### Training Programmes Organized by CATAT

- ❖ An exposure-cum-training on "Improved Agriculture Technologies for Higher Productivity and Income" from April 2 to 11, 2014. Nineteen farmers from Darrang and Kamrup districts of Assam participated in the training programme.
- ❖ Two training courses on "Bio-fertilizers and bio-pesticides in

Agriculture" and "Bio-organic Fertilization" from June 6 to 20, 2014 for ICARDA scientists from Iraq.

### Workshops

- ❖ A workshop on "*Kharif* 2013" was organized on April 6, 2014 to review progress of partnership programme. The Workshop was attended by 20 VO's representatives and concerned IARI officials.
- ❖ A workshop to review the progress during *kharif* 2013 under the NEP programme was organized on April 17, 2014. The workshop was attended by 11 officials of various ICAR institutes/SAUs.
- ❖ An Indo-German workshop on "Microbial Ecology and Application of Inoculants in Bio-control" was organized from April 7 to 10 2014 at NASC complex. The workshop covered contributions of experienced scientists as well as young researchers on Microbial ecology, rhizosphere biology, bio-control of plant pathogens, development of formulations, their use and constraints. Eleven German and two Austrian delegates along with 21 Indian delegates participated in the workshop.

## MISCELLANY

### New Projects Sanctioned

- ❖ "Biomolecules and Industrially important enzymes from extremophilic bacteria" funded by ICAR – AMAAS. Principal

Investigator: Dr. A.K. Saxena, Division of Microbiology.

- ❖ "Draft Genome Sequencing of P-solubilizing *Pseudomonas striata* PS27 and functional validation of MSP Genes" funded by ICAR – AMAAS. Principal Investigator: Dr. A.K. Saxena, Division of Microbiology.
- ❖ "Metagenomics and cultural approaches for identification of novel microbial genes/alleles and microbes for bioconversion of lignocellulosic biomass at extreme physiological conditions of low temperature" funded by ICAR – AMAAS. Principal Investigator: Dr. Rajeev Kaushik, Division of Microbiology.
- ❖ "Prospecting of potential of cyanobacteria based formulations as plant growth promoting and biocontrol agents in cereal-legume cropping system and selected vegetables" funded by ICAR – AMAAS. Principal Investigator: Dr. Radha Prasanna, Division of Microbiology.
- ❖ "Synthetic biology and metabolic engineering opportunities for enhanced production of biofuels through microbes" funded by ICAR – AMAAS. Principal Investigator: Dr. (Ms.) Anju Arora, Division of Microbiology.

### Technologies Commercialized

- ❖ PB 1509 licensed to Eco Seeds, No. 8, Madhok Complex, Ferozepur Road, Ludhiana
- ❖ Five nanonutrient technologies developed by CAZRI licensed

to Allwin Industries, 11, 13-14, 4th Floor Dawa Bazar, Rnt Marg, RNT Marg, Chhoti Gwaltoli, Indore, Madhya Pradesh- 452001

### Patent Renewed

- ❖ A process for the preparation of Mosquito larvicidal formulations based on *Rabdosia melissoindes* ingredients

### Contract/Consultancy Services

- ❖ IARI will provide contract service to Novozymes South Asia Pvt. Ltd., Bangalore on agronomic studies of phosphate solubilizing fungi (PSF) based product jumpstart in paddy.
- ❖ M/s Bayer Crop Science, Mumbai to generate multi-location supervised field trial on residue and persistence study of Metribuzin 70% WPC (Sencor 70 WP) in sugarcane.
- ❖ M/s R.G. Industries, New Delhi to generate multilocation supervised field trial data of Orchol-13 on Apple crop and soil.

### Agribusiness Incubation Activities

- ❖ *Agribusiness Incubation Programme:* ZTM&BPD Unit launched “Agribusiness Incubation Program” on April 25, 2014 for providing a platform for identifying next generation of agribusiness

leaders from India’s emerging agribusiness innovation ecosystem, giving them capacity building opportunities to develop and set up viable business models based on innovative ideas in association of ZTM & BPD Unit, IVRI, Izatnagar and BPD units of NDRI, Karnal, BAU, Ranchi, CIPHET, Ludhiana and with support of CIIE, Ahmedabad.

- ❖ *Agribusiness Idol camp and Incubation workshop:* Agribusiness Idol camp and Incubation workshop was organized by ZTM&BPD Unit on May 9, 2014. Out of 32 business proposals, 10 business proposals were selected for two months mentorship programme. Two finalists Mr. Nitin Gupta and Mr. Abhay Kumar Verma were nominated for the Agribusiness

Conclave organized by NAIP on May 18-19, 2014. A compendium of thirty seven technologies from the North Zone and new website of ZTM&BPD Unit were also launched in the event.

- ❖ *Funding for entrepreneurs:* MSME Ministry, Govt. of India sanctioned an amount of ₹ 26.89 lakhs for funding of five incubation projects recommended by ZTM&BPD Unit.
- ❖ *Incubation Facility:* Aegis Agro Chemical India Pvt. Ltd. took the incubation facility at ZTM&BPD Unit, IARI, New Delhi.

### Corporate Membership

In this quarter 27 new members were registered and 3 members renewed their registration.

### Visitors from Abroad

During the period April-June 2014, two delegations – one each from Russia and Indonesia visited the Institute.



Indonesian delegation discussing with the scientists of rice group

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