

DOPR News

DIRECTORATE OF OIL PALM RESEARCH

(Indian Council of Agricultural Research)

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From the Director's Desk

Dear Readers,

Haploids (Hs) are plants containing half the number of chromosomes in somatic cells. For instance, an oil palm haploid plant would contain one in each of the 16 pairs of chromosomes of its genome or it has half of the diploid number of a somatic cell. Haploids of higher plants are rare and they may originate spontaneously in nature. However, they are normally non-viable and sterile. Fertile doubled haploids (containing exactly identical two chromosome sets) could be achieved by spontaneous chromosome doubling of haploids which are extremely valuable in breeding as they are 100% homozygous.

The first haploid, arising spontaneously, in a flowering plant species was discovered in *Datura stramonium* followed by tobacco and wheat. Since then, spontaneous haploids have been detected in a wide range of plant species and have led to production of haploids/doubled haploids in more than 250 species with oil palm as a recent addition. The use of doubled haploids as parental lines for F1 variety production fully exploits hybrid vigour (heterosis) and has enabled substantial yield improvement in several crops like maize, rice, wheat, tobacco, sunflower, rapeseed, asparagus, egg plant, tomato, potato, *Capsicum*, cucumber, melon, onion, squash, watermelon, apple, kiwi, mandarin, pear, plum, sweet cherry, blackberry, carnation, petunia, rose and more than 290 varieties have already been released. In addition to breeding for higher yield, haploids and doubled haploids have been extensively used in genetic studies such as gene mapping, marker/trait association studies, location of QTLs, genomics and genetic transformations.

Oil palm is essentially an out breeding species. Therefore, an important use of haploids is achievement of homozygosity through production of doubled haploids in one generation and thereby, the breeder can eliminate the numerous cycles of inbreeding (also inbreeding depression) that is necessary to achieve practical level of homozygosity (at least eight generations of selfing) by conventional crossing methods .

Spontaneous haploids occur in oil palm like in many other plant species, albeit at low frequencies (about

one haploid in one lakh seedlings). Reliable diagnosis of Hs in oil palm includes conventional chromosome counting techniques and measurement of the DNA content using microdensitometry or more especially, flow cytometry.

I am happy to inform the readers that, for the first time in India, DOPR scientists have detected spontaneously formed haploids from our germplasm collections and atypical seedling collections raised from abnormal sprouts using Flow Cytometry Facility available at Centre for Cellular and Molecular Platforms (C-CAMP), National Centre for Biological Sciences, Bangalore. We are optimistic that, by pursuing with the success achieved with more rigorous effort, we would be able to use the haploids effectively in our crop improvement programmes.

S. ARULRAJ
DIRECTOR

Sectoral News

Techniques to be adopted in oil palm cultivation to overcome delayed monsoon conditions

Oil palm is cultivated under irrigated conditions in India. Due to high temperatures during summer and delayed monsoon conditions, crop is not being provided with sufficient water. Many of the farmers are reporting bunches with spiny tepals, aborted/dried and less weight bunches. This could be due to unfavorable weather conditions viz., heat waves during summer, low RH, non retention of moisture in light soils, etc. To overcome prevailing situation, it is advised to adopt following techniques in oil palm cultivation.

Plant the oil palm seedlings in the main field under assured irrigation/moist conditions only. Irrigation must be provided immediately after planting either through basin or micro irrigation.

Do not store the seedlings for days together in open place after lifting to the main field. Individual palms must be irrigated twice in a week in basin system of irrigation. Never run the irrigation channels along the palm rows. Avoid excessive irrigation through basin or micro irrigation, which may lead to loss of water and nutrients. It is advised to provide recommended water and fertilizers

through micro irrigation. Soon after onset of monsoon apply recommended dose of potash in 1st split. Due to which palm will be relieved from the stress created due to unfavorable weather conditions. Apply 50-100 kg of organic manure or 100 kg of green leaf manure in the palm base. Avoid ploughing in inter and intra row space. Weeds may be controlled by applying Glyphosate or Paraquat @ 750-1000 ml per hectare based on the nature of weeds and density. In juvenile Oil Palm plantations (up to 3 years) sow Sun hemp around the palm basin in 1 or 2 rows with a radius of 3 feet from the palm basin. Cut the Sun hemp during flowering stage and incorporate in the palm basin. While growing intercrops in Oil palm, care must be taken to provide recommended quantity of water and nutrients to Oil palm and intercrops separately. Mulching of Oil Palm basins is essential to conserve soil moisture as well as to control weeds. Practice ablation by removing male and female flowers produced in the early stages. Trenching can be adopted in order to utilize slight rain fall received through pre- monsoon showers, form trenches across the slope for every 3 or 4 rows with 1 feet width and 2 feet depth, to allow rain water to recharge the surrounding palms. These trenches will also be useful to drain the excess water due to heavy rains/ floods. Crop being sensitive to water stress, needs attention of irrigation and nutrient management during unfavorable weather conditions. Adoption of above techniques will overcome the unfavorable weather conditions, improve the plant growth, subsequently improve the production and productivity.

Research Achievements

Stability in bunch yield of second generation Dura mother palms

As part of advancement of breeding cycle to third generation, five year Fresh Fruit Bunch yield of ten DxD crosses in the second breeding cycle at oil palm seed garden Thodupuzha were collected. The data was then analysed for stability parameters in order to identify consistent performing crosses. The family mean of bunch yield was the highest in ThD1 followed by ThD2, ThD6, ThD7 and ThD3. Altogether, five families recorded mean yield above pooled mean. The lowest family mean yield was recorded by ThD10 followed by ThD9. Further, the genotypes were compared for regression coefficient (b), where those genotypes having b value close to unity is considered desirable. The Dura genotypes ThD6 and ThD5 showed b values close to unity where as ThD1 recorded the maximum deviation from unity. Subsequently the stability parameter (S^2_{di}) was considered where in the genotype with nearest to zero value is taken as the most stable one. As a result ThD 10 was found to be the most stable genotype over the entire environments followed by ThD2 and ThD6. However, the mean yield of ThD10 was the lowest.

Hence, by considering the stability parameter along with mean yield, ThD2 would be the best genotype followed by ThD6. Thus, the families were identified based on stability and mean yield. From among the best families, individual palms with highest mean yield were selected and used in developing crosses for advancement of the generation to third cycle.

Efficacy of organic solvents for storage of oil palm pollen

Oil palm pollen was stored in five different organic solvents (Diethyl ether, n-Hexane, Chloroform, Acetone and methyl alcohol) at -5°C, -20°C and -50°C for a duration of 12 months. Diethyl ether and n-Hexane were found to be effective for storing pollen up to 12 months. Pollen Storage at -20°C was not significantly different from storage at -50°C, hence, -20 °C may be preferred for medium term storage of oil palm pollen.

Evaluation of Dura progeny during 2013-14

The performance of dura progeny (D x D crosses from Palode and ASD Costa Rica planted in the year 2000 and 2002, respectively) at DOPR, Pedavegi was evaluated and based on the analysis of pooled data of last 5 years, in addition to the 85 mother palms selected earlier, 19 dura mother palms were selected for use in oil palm hybrid seed production. Out of these, 8 dura mother palms (recording on an average more than 200 kg FFB/palm/year) would be advanced to next breeding cycle.

Farmers Field Schools Organized



Farmer's field school on "Irrigation management in oil palm" was organised on 24.04.2014 at Challachintalapudi, West Godavari Dt., A. P. where in a group consisting of 19 oil palm growers participated in the field school. Group approach techniques were adopted to disseminate the technology.

Farmers field school on "Fertilizer management in oil palm" was organised on 23.05.2014 at Telikicherla, West Godavari Dt., A. P. in association with Krishi Vigyan



Kendra (KVK), Venkataramannagudem, Y.S.R.H.U. Group learning techniques were used to disseminate technologies viz., fertilizer application, soil and leaf sampling. A group of 24 oil palm growers attended the field school. Farmers collected 24 soil and leaf samples from their oil palm plantations for analysis. Documented innovative practices adopted by oil palm growers.

Extension activities

- Dr. B. N. Rao, delivered a TV show (ETV - Telugu) on 'Irrigation Management in Oil Palm' telecasted on 27th June, 2014.
- Dr. B. N. Rao participated in Farmer's Field Day school as resource person to talk about 'Irrigation Management in Oil Palm' at Challachintalapudi village on 24th April, 2014
- Dr. P. Naveen Kumar acted as Resource person in the Orientation training on improved production technologies (Water and nutrition management) in oil palm organized by Department of Horticulture, Govt. of A. P. on 21.05.2014 (at Borrampalem, T. Narasapuram Mandal, A. P.) and on 24.05.2014 (at Ramannapalem, Kamavarapukota Mandal, A. P.).

Meeting of Research Advisory Committee



RAC members visited the experimental fields

Fifteenth Meeting of Research Advisory Committee of the Directorate was held on 29.04.2014 under the chairmanship of Dr. S. Shikhamany, former Vice-Chancellor, Dr. Y S R Horticultural University, Tadepalligudem, Andhra Pradesh. Committee reviewed the progress of ongoing research programmes and offered suggestions to meet the requirements of oil palm sector.

Research Publications

- Behera, S. K. and Shukla, A. K. (2014). Spatial distribution of surface soil acidity, electrical conductivity, soil organic carbon content and exchangeable potassium, calcium and magnesium in some cropped acid soils of India. *Land Degradation and Development* DOI: 10.1002/ldr.2306
- Behera, S. K. and Shukla, A. K. (2014). Total and extractable manganese and iron in some cultivated acid soils of India - status, distribution and relationship with some soil properties. *Pedosphere* 24(2): 196-208.
- Murugesan, P. and Shareef, M. (2014). Yield, bunch quality and vegetative traits of American oil palm (*Elaeis oleifera*, HBK) population in India. *Indian Journal of Horticulture*, 71(1), 23-27.

Technical publications

- Behera, S. K., Rao, B. N., Suresh, K., Prasad, M.V., Ramachandrudu, K. and Manorama, K. (2014). Fertilizer management in oil palm for higher fresh fruit bunch production. *Plant Horti Tech.*, 13 (6): 12-15.
- Ravichandran, G., Naveen Kumar, P., Sunilkumar. K., Ramajayam, D., Mathur, R. K., Murugesan, P. and Arulraj, S. (2014). Proceedings of National Oil Palm Seed Meet – 2014, Technical bulletin published by Director, DOPR, Pedavegi, A. P., 26p
- Murugesan, P., Sunilkumar, K., Sujathakumari, N., Naveen Kumar, P., Ravichandran, G. and Mathur, R. K. (2014). DOPR Research Centre – Palode. In a nutshell. Technical folder published by Director, DOPR, Pedavegi, A. P.
- Manorama, K., Behera, S. K., Suresh, K., Ramachandrudu, K., Rao, B. N. and Prasad, M. V. (2014). Precise method to collect soil samples in oil palm plantations. Available at <http://www.krishisewa.com/cms/articles/soil-fertility/408-soil-sample-in-palm.html>.
- Behera, S. K., Rao, B. N., Suresh, K., Prasad, M. V., Manorama, K., Ramachandrudu, K. (2014). Best fertilizer management practices in oil palm for higher fresh fruit bunch production. Available at <http://www.krishisewa.com/cms/articles/soil-fertility/411-fertilizer-management-oil-palm.html>.

- Behera, S. K., Shukla, A. K. and Lakaria, B. L. (2014). Deficiency of boron and molybdenum in soils and crops in India and their amelioration through fertilizer application. Available at <http://www.krishisewa.com/cms/disease-management/428-boron-molybdenum-deficiency.html>.

Participation in Symposia/ Seminar/Workshop/ Conferences

Dr. S. K. Behera attended “Global Conference on Technological Challenges and Human Resources for Climate Smart Horticulture-Issues and Strategies” held at Navsari Agricultural University, Navsari, Gujarat during May 28 -31, 2014 and presented (oral) a paper entitled ‘Estimation of potassium concentration in oil palm (*Elaeis guineensis* Jacq.) leaf tissue by simple and inexpensive water extraction method’ authored by Behera, S. K., Suresh, K., Rao, B. N., Manoja, K., Ramachandrudu, K. and Manorama K.

Meetings attended and lectures delivered / papers presented

Dr. P. Murugesan participated in the meeting on ‘Plant Genetic Resources in Horticulture’ held at IIHR Bengaluru on 30.05.2014.

Dr. P. Naveen Kumar participated in the ‘Signing ceremony of License agreement for ‘DOPR developed oil palm tissue culture technology’ between Ms. Sristi Agro Biotech Private Limited, Howrah and Agrinnovate India Limited (ICAR) on 22.04.2014 at NASC complex, New Delhi.



Training courses attended

Dr. Ramajayam has undergone a ‘Basic course on Techniques in flow cytometry’ organized by the Centre for Cellular & Molecular Platforms (C-CAMP) during June 10 – 13, 2014 at C-CAMP, National Centre for Biological Sciences, Bangalore.

Recognition received

- Dr. B.N. Rao is recognized as examiner for evaluation of Ph.D thesis in Horticulture by Dr. YSR Horticultural University, Venkataramanna gudem, West Godavari District, Andhra Pradesh.
- Dr. P. Murugesan is recognized as external examiner for Ph. D and M. Sc (Ag) students of Tamil Nadu Agricultural University, Coimbatore.

Distinguished Visitors

- **Dr. B. Mazumdar**, Director, Bejo Sheetal Bio-Science Foundation, Jalna (licensee of DOPR Oil Palm Tissue Culture Technology) visited the DOPR, Pedavegi on 01.05.2014.
- **Dr. N.K. Krishnakumar**, Hon’ble Deputy Director General (Horticulture Science), ICAR visited DOPR-Research Centre, Palode on 02.05.2014. At the Centre, DDG visited experimental fields, Administrative Block, Laboratories and Oil Palm Training Centre. In the Lecture Hall of the Training Centre, he addressed the staff of the Research Centre. The new Seed Lab, constructed on the First Floor of the Administrative Building, was inaugurated by the honourable DDG (HS).

Based on the visit to the various experimental fields, DDG suggested a few priority areas of research that are to be addressed at the earliest. He offered to provide additional scientific manpower and resources to fully exploit the facilities available at the centre.



Visit to oil palm experimental fields at DOPR Research Centre, Palode.



Inauguration of new Seed Technology Lab.

Edited by :

**Dr. M. V. Prasad, Dr. K. Sunil Kumar,
Dr. P. Naveen Kumar and Mrs. A. Bhanusri**

Published by :

Dr. S. Arulraj

Director, Directorate of Oil Palm Research,
Pedavegi - 534 450, West Godavari District., A. P.
Phone: 08812 259532/259524; Fax: 08812 259531.
e-mail: dopr2009@gmail.com ; Web site: <http://dopr.gov.in>

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