वार्षिक प्रतिवेदन
Annual Report
2018-19

SILVER JUBILEE CELEBRATIONS
ICAR-INDIAN INSTITUTE OF OIL PALM RESEARCH
1995-2020

भाकृअनुप - भारतीय तेल ताड़ अनुसंधान संस्थान
ICAR - Indian Institute of Oil Palm Research
(An ISO 9001:2008 Certified Institute)
पेदवेगी - 534 450, पश्चिम गोदावरी जिला, आन्ध्र प्रदेश
Pedavegi - 534 450, West Godavari Dt., Andhra Pradesh

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1. Preface

Oil palm has been introduced in India to bridge the gap between demand and supply of vegetable oils in the Country. Till date, an area of 19.33 lakh ha has been identified as feasible for oil palm cultivation in India and it is being grown in an area of about 3.31 lakh ha with highest productivity levels to the tune of 30-35 t FFB/ha/year. ICAR-Indian Institute of Oil Palm Research (IIOPR) is playing a significant role in ushering the growth of oil palm sector and in addressing emerging problems in the field. The institute has largely contributed in developing and popularizing several technologies that are widely adopted by farmers in oil palm growing states of the Country. I am proud and privileged to present the Annual Report for the year 2018-19 of our Institute.

During the reported year, there has been tremendous progress on various fields. Eight genotypes have been identified with high yielding coupled with slow vertical growth. Registration and publication of oil palm genetic stocks with unique traits was completed. The Standardization of tissue culture protocol for oil palm is under progress. Seventeen QTLs were identified for seven vegetative traits and 30 QTLs were identified for bunch analysis parameters. Medicinal and aromatic were introduced as inter crops into mature oil palm plantations and their performance is being studied. A quantitative assessment of the biomass waste generated annually in a typical oil palm plantation has been made. Seasonal variations in oil content in oil palm fresh fruit bunches were initiated in the experimental fields. Oil palm suitability maps using GIS and Remote sensing technologies were developed for Indian sub-continent both under irrigated and rainfed conditions. A total of 1354 farmers were trained on oil palm cultivation during the report period. ICT tools were developed for aiding the oil palm stakeholders of the Country. The technologies developed were spread to the stakeholders through Mera gauv mera gaurav and Farmers First programme.

The valuable feedback received from oil palm stakeholders during various interface meeting were duly incorporated while revising the technical programme of the nine ongoing research projects of the Institute. I thank all the staff members including scientific, technical, administrative and supporting categories for their willing support and cooperation in achieving the targeted goals. The contribution of Prioritization, Monitoring and Evaluation Cell is acknowledged for its role in shaping the content and quality of the research output of the Institute. The patent applied for DNA marker associated with slow vertical growth need to be appreciated.

I am grateful to Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR and Dr. Anand Kumar Singh, Deputy Director General (Hort. Sci.), ICAR who have extended guidance and cooperation without which this progress would not have been possible. I also thank Dr. W.S.Dhillon, and Dr. T.Janakiram Assistant Director Generals (Hort.) for all their support extended during the report period.

03-07-2019
Pedavegi

(R. K. Mathur)
Director

2. Executive Summary

Oil palm is likely to play a major role in the future in augmenting the supply of vegetable oil in the country as it is the highest oil yielding perennial crop. Looking at its potentiality, Government of India has been expanding area under oil palm in order to bridge the gap between consumption and domestic production of edible oil. As against the potential area of 19.30 lakh hectares spread over 18 states in the country, an area of 3.31 lakh ha was planted (Till March 2018). With good planting material, irrigation and proper management, there is a potential of yielding 30-35 MT fresh fruit bunches (FFB) per hectare after attaining the age of 5 years. This in turn is capable of yielding 6-7 tonnes of palm oil and 0.6-0.7 tonnes of palm kernel oil. The role of ICAR-Indian Institute of Oil Palm Research is of crucial importance in conducting research on a systematic basis along with continuous monitoring of progress. The Institute is conducting research mainly on Genetic Resources Management, Biotechnology, Production System Management, Physiological and Biochemical basis for oil palm yield, Post Harvest Technology, Plant Health management and Transfer of Technology & Information and Communication Technology.

The technologies developed at the Institute were showcased by implementing flagship programmes like Mera gauv mera gaurav (MGMG), farmers First programme (FFP). The Govt. of India promoted programmes like Swachh Bharat, International yoga day, World soil day, Vigilance awareness week were celebrated at the Institute as per the directives received from ICAR. HRD programmes were implemented as per the Annual Training Plan 2018-19 and 100 % of the trainings planned for different categories of staff could be realized. The ISO 9001-2008 certificate for IIOPR has been renewed upto 31-03-2019. During the year, Dr. B. Kalyana Babu, Senior Scientist (Biotechnology) received the prestigious ICAR- Lal Bahadur Shastri Outstanding Young Scientist Award for the year 2017 (Crop and Horticultural Sciences).

The Institute has sanctioned staff strength of 82, including Director, 22 scientists, 18 technical, 15 administrative and 26 skilled support staff, of which 50 are in position. Total financial outlay of the Institute for 2018-19 was Rs. 1214 lakhs with a revenue generation of Rs. 0.63 cores. During the period, nine in-house research projects, 1 DST funded project, one project under farmers FIRST programme and 4 ICAR Inter-Institutional collaborative research projects were implemented. Major highlights of achievements during 2018-19 are presented here:

IC numbers were received from ICAR-NBPGR, New Delhi for 7 new germplasm accessions. Registration and publication of oil palm genetic stocks with unique traits was completed. Standardised the technique for cryopreservation of oil palm embryos. In dura improvement trial, 29 D x D crosses (evaluated to identify high yielding and dwarf palms) were grouped into five distinct clusters based on cluster analysis. Eight genotypes were identiûed to be high yielding and slow vertical growth in habit. Among the cluster IV D x D crosses, DD7 and DD8 have a common parent 257 CD; DD17 and DD18 also have a common parent 232 CD. Five sterile dura palms with wild traits like broad leaf sheath and bulky stature were identified in D x D crosses.

Oil palm cross 40CD x 282CD recorded minimum height (100.01 cm) with maximum yield (187.60 kg/year) among the 11 D x D crosses evaluated for high yield and dwarfness. In Dura Improvement Trial V, promising dura palm no. 151(206CD x 4D) with highest yield (220 kg/palm/year) was identified. Eight D X P crosses were evaluated in the field. Maximum number of bunches (21.19) and yield (64.68 kg) were

recorded in cross 94D X 76P followed by cross 45CD X 110P.

Standardized the technique for de-operculated kernel germination in oil palm. Six different packaging materials were evaluated for heat treated oil palm seed storage and found that Tri-laminated aluminium foil bag has provided better storability and loss of germination was less than 50 % of initial level up to 60 days. The viability of zygotic embryo through TZ staining test during different seasons did not show any significant variations due to seasons. It is observed that endosperm development started at 60 and 90 days after pollination when it is pollinated during May to June and July to December respectively, which indicated there is some influence of season for the development of endosperm during the fruits formation. 65890 and 26000 D×P germinated seeds were supplied to different companies from Pedavegi and Palode seed production centres respectively.

Standardization of tissue culture protocol for oil plam is under progress. Callusing and somatic embryoids were achieved using the explants like spear leaf, male inflorescence and seedling spear leaves. A total of 17 QTLs were identified for seven vegetative traits and 30 QTLs were identified for bunch analysis parameters. Molecular characterization of selected dura and pisifera germplasm was done using polymorphic SSR markers. Highly similar and divergent dura and pisifera germplasm was identified for further crossing programmes. A total of 30 pisifera identified from various germplasm blocks. Dwarf SSR marker was validated and confirmed through association mapping.

Empty fruit bunch fibre can be used as mulch along with one litre of water per seedling per day during the secondary stage of nursery. Medicinal and aromatic crops *i.e.*, Red ginger, Black ginger, White turmeric, Wild turmeric, Galanga, Bitter ginger, Lal chitrak, Chitrak, Coleus, Artemsia, Arrow root, Snap ginger and Brahmi were introduced as inter crops into mature oil palm plantations and their performance is being studied. Study conducted with different methods (microjet and drip) and dose of irrigation water in oil palm using crop factor (0.6, 0.7 and 0.8) and Potential Evapotranspiration (PET) indicated that though, highest annual yield of fresh fruit bunches (19.83 T/ha) was recorded by drip method of irrigation at crop factor 0.8, it was on par with crop factor 0.7 (19.61 T/ha). An alternate mechanism has been identified to apply mulching sheet in oil palm basins, so that the sheet does not get damaged while harvesting bunches and leaf pruning.

DRIS indices were developed for oil palm plantations of East Godavari Dt., Andhra Pradesh; N>B>K>P>Mg is the order of importance of nutrients. Nitrogen and boron are the more critical nutrients in East Godavari Dt. Most of the oil palm plantations are in normal range for leaf Mg content. Application of 45 g B (300 g Borax - Di-Sodium tetraborate pentahydrate) per palm is efficient in controlling B deficiency at shorter span of time. Boron deficient palms need to be applied with 30 g of B per palm per year for about two years and normal palms are to be maintained with 15 g B per palm per year.

A quantitative assessment of the biomass waste generated annually in a typical oil palm plantation has been made. Biochar was produced from three different wastes of oil palm *viz.,* trunk, fronds and empty fruit bunches in collaboration with ICAR-CTRI and characterized. Out of different types of biochar tested, tobacco stalk biomass was found to be superior as potting mixture for growing oil palm seedlings.

Seasonal variations in oil content in oil palm fresh fruit bunches indicated that the hybrids showed increasing trend in oil content from 14th week onwards and reached highest oil content during 18-19th week after anthesis (August and September harvests) and 20-21st week after anthesis (October-January) harvest. The highest oil content in oil palm fruitlets was obtained during the October harvest followed by December and November harvests. The lowest oil content was during the September harvest.

Salt tolerance studies in oil palm indicated that oil palm seedlings could tolerate up to 0.4 per cent NaCl solution and all the biochemical parameters like membrane stability index, proline content, super oxide dismutase were severely affected at higher salt concentrations (0.6-1.0 %)

Oil palm suitability maps were developed for Indian sub-continent under both irrigated and rainfed conditions. The parameters were identified separately for irrigated and rainfed conditions and collected data at district level. Thematic maps were developed in ArcGIS10.6 and by integrating them, suitability maps were developed. Estimated the potential areas for oil palm cultivation in India under rainfed and irrigated conditions. A decision tool was developed to evaluate the suitability of site at individual farm level for growing oil palm both under irrigated and rainfed conditions.

Experiments conducted in oil palm plantations of Mysore Dt., Karnataka where fruit setting was a problem indicated that, application of 1% gibberlic acid and heavy pruning of leaves were effective for initiation of male flowers in problematic areas. Application of *Isaria fumosorosea* fungus (strain of NBAIR, Bengaluru) proved effective in managing Rugose Spiralling Whitefly (RSW) *Aleurodicus rugioperculatus* when applied at a spore concentration of 130 x 10^4. Mass multiplication and mother culture multiplication procedures were standardized using locally available material like starch and jaggery. Liquid culture preparation of *Isaria* fungus was standardized using PDB and starch.

Four national level training programmes were organised to 70 officers and seven one / two days training programmes were organised to 307 officers belonging to the states of Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Karnataka, Chhattisgarh, Mizoram and Arunachal Pradesh. Fifteen on campus training programmes on Oil palm cultivation practices were conducted at ICAR-IIOPR, Pedavegi to 428 farmers and 11 on farm training programmes were organised by ICAR-IIOPR, Pedavegi to 926 farmers belonging to Andhra Pradesh, Chhattisgarh, Karnataka, Kerala and Arunachal Pradesh.

Designed and developed 'Fertilizer calculator' for application of recommended dose of fertilizer for oil palm. A mobile app on ''Oil palm crop doctor' was developed, tested and Beta version of the app is placed on the Google Play Store. Eight short video films *viz.*, Irrigation management, Fertilizer management, Mulching, Intercrops, Management of nutrient deficiencies, Pest and disease management, Green manure and cover crops were brought out in Hindi language. Mobile apps on oil palm (English, Hindi and Telugu) developed by ICAR-IIOPR are being downloaded by stakeholders; no. of downloads till March 2019 is 3842. Under the Oil palm kisan mobile message services, 60 text SMS were sent to 4.43 lakh mobile numbers of oil palm stakeholders belonging to 13 states in English, Hindi, Telugu, Kannada and Tamil.