NRCOP HIGHLIGHTS 2003 - 05

National Research Centre for Oil Palm
(Indian Council of Agricultural Research)
Pedavegi-534 450, West Godavari Dt., A.P.

NRCOP HIGHLIGHTS 2003-2005

ISBN : 81-87561-12-2

Published by

Dr. M. Kochu Babu
Director, National Research Centre for Oil Palm
Pedavegi - 534 450, West Godavari (Dt.)
Andhra Pradesh
Ph : 08812 - 259532
Fax : 08812 - 259531
Grams : PALMSEARCH
E-mail : nrcop@rediffmail.com
website : http://nrcop.ap.nic.in

Editors

Dr. R.S.N. Pillai
Dr. R.K. Mathur
Dr. P.K. Mandal
Dr. K. Suresh

Cover Page

1 Cocoa as a mixed crop
2 Control of Crows using Nylon nets
3 Mobile Oil Palm waste shredding unit
4 Training Programme

Printed at

New Image Graphics, Vijayawada-2, Phone : 0866 2435553, 939 3435553

Foreword

It is a pleasure for me to introduce this special publication depicting the progress made by the National Research Centre for Oil Palm during 2003-05. Efforts have been made to make this booklet informative and attractive. It contains an overview of the research achievements in the areas of Crop Improvement, Crop Production, Crop Protection, Post Harvest Technology and Transfer of Technology. Mention is also made on the new projects sanctioned and infrastructure developed during the period. National Seminar on Oil Palm Research and Development was organised to commemorate a decade of Oil Palm Research under irrigated tract. By successfully cultivating Oil Palm under the non-traditional environments of the country, the apprehension on this effort could be removed. It is heartening that there has been tremendous momentum in expanding area under Oil Palm in the states of Andhra Pradesh, Karnataka and Tamil Nadu, which culminated in the shortage of indigenous planting material in the country. However, efforts are on to achieve self-sufficiency in indigenous production of Oil Palm hybrid seeds through the existing Seed Gardens in the states of Kerala, Andhra Pradesh and Karnataka. Acquiring equipments like HPLC, GCMS, CHNS Analyzer and Sapflow Analyzer is expected to hasten the research activities of the Centre. Imparting training at various levels of personnel concerned in the sphere of oil palm development, which is customary was continued during this period also. The future strategy of research lies in acquiring new genetic materials and also the fullest exploitation of the existing genetic resources by taking classical breeding and biotechnology hand in hand. Programmes are also in progress for developing cost effective, efficient and environmentally sustainable agronomic and production technologies to achieve the potential yields. I am confident that the efforts made on all aspects of Oil Palm will pave the way for self-sufficiency in vegetable oil production in a short span of time.

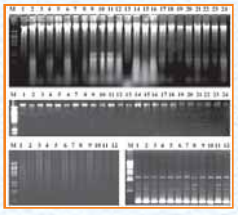
I thank all my colleagues of NRCOP for bringing out this publication in the targeted time.

(M. Kochu Babu)
DIRECTOR

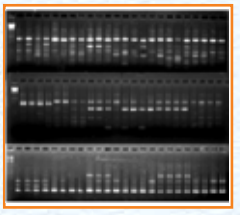
Station : Pedavegi
Date : 30-04-05

Crop Improvement

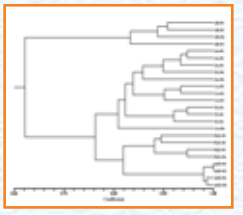
- A novel method of DNA extraction without the use of detergent was developed. The quality and quantity of DNA was on par or better than that of the methods using common detergent (CTAB). Restriction enzymes and *Taq* Polymerases could normally act on DNA, extracted by new method.



Crude & Purified DNA with & without detergent and their Restriction & RAPD Pattern

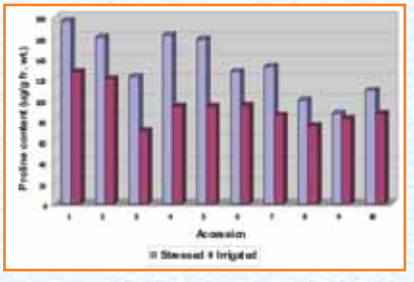


RAPD pattern of Palode and African germplasm



Dendrogram of different oilpalm germplasm

- Genetic diversity study by RAPD analysis for five accessions (Palode: GD3, 240D x 281D and 80D X 281D and two Costa Rican: 98C -254D and 98C-208D) with the help of 33 primers indicated that no two palms within the accessions were found genetically similar.
- Genetic diversity study by RAPD analysis for two sets of 24 palms from six accessions from Guinea Bissau (GB-22/311), Zambia (ZS-8), Tanzania (TZ-9) and Cameroon (CA13) and one each from ASD Costa Rica (98CX254D) and India (240DX281D) are in progress.
- Fatty acids composition of oil from *oleifera* palms indicated that palm no *Eo*- 02, *Eo*-04, *Eo*-05, *Eo*-11, *Eo*-17, *Eo*-18, *Eo*-19, *Eo*-20, *Eo*-22 and *Eo*-23 could be recommended for inter-specific hybridization.
- Proline and phenol contents in the exotic *duras* were found higher in stressed condition. All the genotypes showed significantly higher amount of soluble protein content under stress except ZS-I and ZS-2.



Proline content in the irrigated and water stressed Oil Palm germplasm

- Higher photosynthetic rates were recorded in the Guinea Bissau germplasm, which coincided with their high stomatal conductance to the diffusion of CO_2. The leaves of Guinea Bissau duras maintained less temperature, indicating their better tolerance to water stress. Zambian duras - ZS-8 and ZS-5 recorded maximum photosynthetic water use efficiencies among the different duras evaluated due to their lesser transpiration rates.
- Quantitative differences in the Epidermal and Stomatal features in different African duras revealed significant variations among them. ZS-1, ZS-5 and GB-21/310 had lower stomatal frequency indicating their better adaptation to

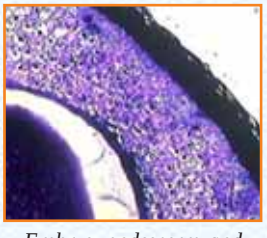
dry conditions. Conversely, GB-22/311, ZS-3 and ZS-2 may show poor drought tolerance ability under field conditions because of its high stomatal frequency.

GB-21 ZS-21 ZS-5 ZS-3 ZS-2

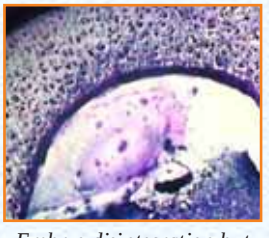
- Attempts were made to germinate *Oleifera* seeds by wet heat treatment for 60 days. The first germination was observed after 17 days of incubation and a total of 33% germination was recorded after 30 days.
- Two types of fruits were observed in single bunch of *E.g x E.o*. One type was round in shape and *dura* type and the other was longer and seedless. In another palm also some fruits were seedless but round in shape.

Fruit types in interspecific hybrids

- Accelerated aged seeds with initial water soaking recorded 40, 72 and 80 percent germination after 50, 60 and 80 days respectively after ageing whereas non-aged seeds did not germinate.



Embryo, endosperm and operculum of fresh seed



Embryo disintegration but operculam still intact

Dwarf Palm from African Collection

- Soaking in 1.5 & 2.0% Ethephon stimulated germination after 20 days of treatment. Soaking in 12% Sulphuric acid for 20 minutes stimulated germination but resulted in abnormal sprouts.
- Identified a dwarf Oil Palm from the African collection.
- Palode and Ivory Coast crosses recorded maximum photosynthetic rates and its associated parameters followed by ASD Deli X Avros. The Bunch Index was highest in Ivory Coast followed by Palode.
- A total of 6.6 Lakh sprouts were supplied to various agencies in the country and earned revenue to the tune of Rs. 60.6 Lakhs.

Crop Production

- Qualitative and quantitative changes in palm oil during fruit maturation indicated that moisture content in the mesocarp gradually decreased from 16th week till maturity. There was a very strong negative correlation (r = -0.991) between moisture content and oil content. Total saturated fatty acids (TSFA) content decreased, where as total unsaturated fatty acids (TUFA) increased from immature to mature fruit development.
- A fertilizer dose of 1200-600-1200g N, P_2O_5 and K_2O per palm per year was found to put in better growth characters, maximum flowering and early yield in the third year of field planting under rainfed conditions.
- About 2/3rd of the inorganic nutrient requirement of palm could be substituted through organic compost made from oil palm wastes.
- Inter cropping in Oil Palm involving multispecies crop combinations with Cocoa, Black Pepper, Cinnamon and Anthurium have been established to intensify the productivity and improve soil and water conservation in the undulating terrain of high rainfall areas.

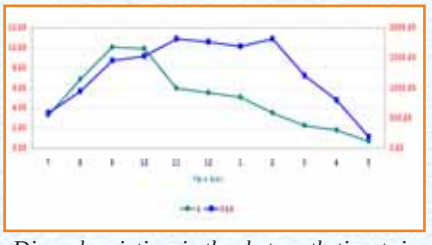
Banana as an intercrop in Oil Palm

Cocoa as a mixed crop in Oil Palm

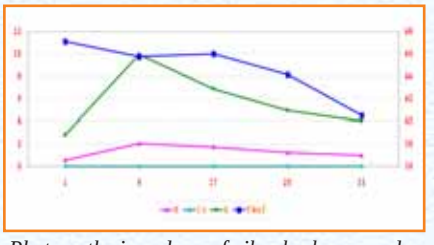
- Maize, Banana and Tobacco were found to be the most profitable and compatible inter crops in oil palm based cropping system during juvenile phase.
- Palms irrigated through drip system recorded maximum yield followed by jet and basin. Maximum yield was recorded in irrigation level IW/CPE = 1 followed by IW/CPE = 0.8 & IW/CPE = 0.6.
- The root distribution pattern studies in an adult plantation irrigated with basin irrigation system indicated that the root biomass was maximum at 10-20 cms depth followed by 20-30 and 30-40 cms depth. The density of roots was maximum at 1 m distance from palm base and decreased with the distance from palm base.
- A thorough understanding of the level of soil and leaf nutrients on the leaf breaking palms indicated that the N, P and K were highest in the healthy

leaves and decreased with the severity of damage. Conversely, the level of Ca was significantly higher in broken leaf than that of about to break and healthy leaves. The leaf K contents were in the deficient range, even though soil K was high. Secondary nutrients - Ca and Mg and Micronutrients – Cu, Zn, Mn and Fe were found to be optimum in all the leaves.

- The diurnal variations in the photosynthetic rate and its associated parameters indicated that maximum photosynthetic rate was observed between 9-10 AM and decreased thereafter. The decrease in the photosynthetic activity can be attributed to higher leaf temperature and low relative humidity.



Diurnal variations in the photosynthetic rate in relation to PAR in Oil Palm



Photosynthesis and age of oil palm leaves under irrigated conditions

- Photosynthetic activity measured in the different leaves of Oil Palm canopy revealed that the maximum rate was observed in the 9th leaf followed by 17th, 25th and 33rd leaf. The leaf temperature was maximum in the 1st leaf and it decreased with leaf age.
- 1294 leaf and 1103 soil samples were analyzed for different nutrients in the leaf analysis laboratory.

Crop Protection

- Basal stem rot was recorded from the plantations of Palode (Kerala), Bapirajugudem and Rajahmundry (A.P.) and Mohitnagar (W. Bengal). The isolates of *Ganoderma* are being identified.
- Virus particles were detected in the tender rachis tissues of Oil Palm showing symptoms of orange spotting.
- *In vitro* biomass degradation and DNA fingerprinting studies were conducted in the two sets of *Ganoderma* isolates. *Ganoderma* isolates of Oil Palm degraded higher coconut root biomass and less stem biomass.
- Twelve *Ganoderma* isolates from coconut and Oil Palm were characterised and nine could be grouped into virulent category and remaining three under non-virulent for coconut palms.

- Application of 0.005% λ-Cyhalothirin in two sprays at monthly interval was found effective in reducing the Rhinoceros beetle infestation.
- Application of Quinalphos and Lambda cyhalothrin was found effective in controlling the slug caterpillar. *Beuveria basiana* (10^{-1}) was also effective but time consuming compared to insecticides.
- House crow and Jungle crow in Krishna district, Parakeets in West Godavari district, Mynah in Vizianagaram district were the predominant avian pests causing moderate to heavy damage. Nylon nets of mesh size of 10 cm^2 was found effective in controlling house and jungle crows.

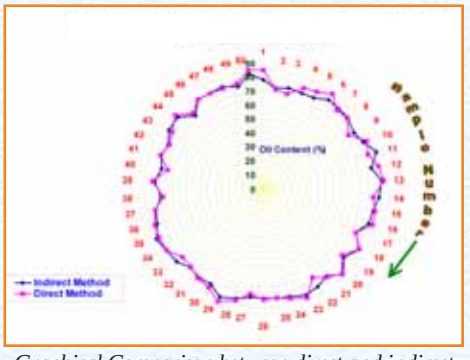
Nylon nets for control of Crows

Control of Slug caterpillar using Beaveria basina

Post Harvest Technology

- Among the different storage conditions of "pure form" caroteniods, storage in the deep fridge showed minimum degradation followed by 'in dark at room temperature".
- Reuse potentiality of better performing adsorbents were studied and no significant difference in recovery was observed between the fresh and reused Fullers earth, though average recovery from the fresh adsorbent was higher.
- Palm olein was found to be the balanced oil with respect to saturated and unsaturated fatty content (46.27: 53.73). Oil from *oleifera* palms was found better among the different categories of palm oil in terms of oleic (C18:1) and linoleic (C18:2) acids content. Palm kernel oil was more similar to coconut oil than that of other oils.
- The effect of high temperature on FFA content, Iodine Value and Peroxide Value showed that the lipase activity was consistent and steady up to 50°C even after 7 days of incubation of the fruits. When the harvested fruits were stored at high temperature, unsaturation of oil increased and there was no significant change in Peroxide value.

- A cost and time saving indirect method of oil estimation has been developed.



Graphical Comparison between direct and indirect methods of Oil Extraction

Oil extraction units for direct & indirect methods of oil extraction

- The pulping characteristics of Oil Palm fronds and EFB were studied for the preparation of paper boards and paper board files.
- The studies on gasification of oil palm waste indicated that the fronds cut into a size of 2" are suitable for gasification, while shredded EFB requires densification for proper gasification.
- Cooling pads and geo-textiles were prepared from EFB fibres. Performance evaluation of EFB fiber mats as cooling pads in concrete terraces indicated considerable reduction of room temperature during summer months.
- Modified mini palm oil mill is being evaluated for efficiency and capacity.
- Designed a mobile Oil Palm waste shredding unit.
- A suitable alternative has been found out to make window curtains from leaf rachis of Oil Palm which is cheap and eco friendly.

Mobile Oil Palm waste Shredder

Oil Palm Frond Curtain

Transfer of Technology and Computer Applications

- A total of 88 officers belonging to Andhra Pradesh, Goa, Gujarat, Karnataka, Kerala and Mizoram participated in training programmes on Oil Palm Production Technology, Oil Palm Hybrid Seed Production, Plant Protection in Oil Palm, Leaf Nutrient Analysis in Oil Palm and Oil Palm Cultivation.
- Sixteen one day training programmes on "Oil Palm Cultivation", eleven on "Integrated nutrient and water management in Oil Palm" and ten on "Harvesting of Fresh Fruit Bunches from tall palms" were organized for 1529 farmers belonging to Andhra Pradesh, Goa, Gujarat and Karnataka.

Training programme on Leaf Nutrient Analysis

Software on Oil Palm Seed Garden Information System

- Feed back data collected from trained officers and farmers regarding training programmes revealed that training was beneficial and felt need to have refresher trainings on specific subject matter areas like harvesting of Oil Palm FFB in tall plantations, intercropping, irrigation and nutrient management, leaf analysis, pest and disease management etc. They also indicated that irrigation, power supply and harvesting are the major problems in Oil Palm cultivation.
- Compiled information on area, production and other aspects related to Oil Palm in the different oil palm growing states of India.
- Software for computerization of Oil Palm seed garden and processing units has been developed and available for sale.
- The software for Oil Palm clinic was developed to store database of Oil Palm plantations.
- Re-designed the web site of National Research Centre for Oil Palm.

New Projects Sanctioned

AP Cess Fund Projects:

Utilization and recycling of Palm Oil Mill Effluent (M.Kochu Babu)

Acceleration of germination in Oil palm (P Murugesan)

Network Project:

Wilt of crops with special reference to cultural, morphological, molecular characterization and pathogenic variability of isolates in India (M. Kochu babu)

TMOP&M funded Project:

Strengthening of seed gardens for indigenous seed production (P. Murugesan)

Publications

- Folder on Oil Palm facts and figures
- Invited papers and abstracts of National Seminar on Research and Development of Oil Palm in India
- Technical folder - Vermicomposting of Oil Palm Wastes
- Technical folder No.6 - Oil Palm Empty Fruit Bunch Fibre Extractor
- Proceedings of interface meet on "Indigenous Production and Supply of Oil Palm Sprouts".
- Oil Palm Hybrid Seed Production in a Nutshell
- *Annual Reports (2002-03 & 2003-04)*
- Oil Palm Sagu (Telugu)

Software Developed

- Oil Palm clinic
- Oil Palm seed garden information system
- Oil Palm processing mill information system
- Information system on harvesting and processing of Oil Palm
- Oil Palm Pest Information System

Infrastructure Development

Major Equipments

- GC-MS
- CHNS analyzer
- Microwave Digestion system
- HPLC
- Inverted microscope
- Sap flow analyzer

Works

- Auditorium
- Partitioning in all the labs
- Mini Palm oil mill
- Compound wall
- Black topping of roads
- Dedicated power supply line

Meetings Held

Interactive Workshop on Palm Oil Mill Effluent

Organized Interactive workshop on Palm Oil Mill Effluent management strategies on December 29, 2004

Seed Meets

Meetings on Oil Palm hybrid seed production were organised on 19th March 2004 and 28th December, 2004 to assess the demand from the entrepreneurs and prepare the schedule of supply of Oil Palm sprouts. Seed garden officials, Entrepreneurs, Scientists and other Officials attended the meetings.

Demand, production potential and supply of sprouts (in Lakhs)

Year	Demand	Potential	Supply
2004-05	18.33	15.10	10.35
2005-06	21.82	19.04	-
2006-07	25.90*	22.05	-

* TMOP&M target

International Oil Palm breeders Meet 2005

A breeder's meet was organized on 22nd February ' 2005 at NRCOP Pedavegi to discuss strategies on Oil Palm breeding and Improvement under Indian Context. Dr. N. Rajanaidu, Oil Palm Breeder from Malaysia, Dr. M.K. Nair, Former Director, CPCRI, Dr. R.D. Iyer, Retd. Head, Division of Crop Improvement, CPCRI and Scientists of the Centre participated.

OER Studies

Expert committee headed by the Director, NRCOP, Scientists from IICT and NRCOP and officials from AP Oil Fed has studied OER (Oil Extraction Rate) in different Oil Palm processing Mills during December '2004. The study revealed that oil recoveries from Fresh Fruit Bunches in mills of AP Oil Fed and Palm Tech India Ltd. were about 18% and 20%, respectively. It was decided to continue the studies for the benefit of farmers and policy makers.

National Seminar on Oil Palm Research and Development

To commemorate a decade of Oil Palm research under irrigated conditions, the National Research Centre for Oil Palm has conducted a National Seminar on "Research and Development of Oil Palm in India" at Pedavegi during 19-20th February 2005, which coincided with its eleventh foundation day. The seminar was inaugurated by Sri. Srinivas, Hon. Minister of Horticulture, Government of Karnataka and presided over by Sri. Kanna Laxminarayana, Hon. Minister for Cooperation, Government of Andhra Pradesh. Dr. Gautam Kalloo, Deputy Director General, (Hort. & C.S) ICAR, Sri. K. Sambasiva Rao, Member of Parliament, Eluru and Sri. M. Venkateswara Rao, Member of Legislative Assembly, Denduluru, Mr. Ch. Venkata Rao, M.L.A., Mylavaram also graced the occasion. The seminar had two sessions namely Research and Development. A series of 23 invited lectures were delivered by experts belonging to ICAR and State Agriculture Universities and other Research Organisations for the research session. A total of about 90 delegates consisting of scientists, development officials, entrepreneurs, and farmers attended the two-day meet. The plenary session, chaired by Dr. G. Kalloo DDG (Hort & C.S) and co chaired by Dr. M Kochu Babu, Director, NRCOP, gave valuable recommendations, which would give a new fillip to Oil Palm research under irrigated conditions.

Oil Palm at a Glance

Oil palm	:	Highest vegetable oil yielder per unit area (3-6 t/ha)
Family	:	Palmae
Species	:	*Elaeis guineensis* (African Oil Palm) *Elaeis oleifera* (American Oil Palm)
Source of oil	:	Palm oil: Mesocarp, Kernel oil: Kernel
Fruit forms (Variety)	:	*Dura* (Thick shell) *Pisifera* (Shell less) *Tenera* (Thin Shell)
Economic cropping period	:	25-30 years
Climatic requirements	:	Above 2000 mm distributed rain/ irrigation Max. temp. 29-36°C Min. temp. 18-24°C Sunshine hours - 5 & above
No. of palms/ha	:	143 (9 x 9 x 9 m triangular)
Nursery period	:	12 - 18 months
Pollination	:	Insect *(Elaeidobius kamerunicus)*
Tree height	:	20 - 30 m
Leaf production/year	:	24-30
Leaf length	:	6 - 8 m
First harvest	:	36 months after planting
Yield of FFB/ha	:	15 - 30 t
No. of bunches/palm/year	:	5 - 12
No. of fruits/bunch	:	Above 2000
Av. bunch weight	:	25 kg.
Weight of fruit	:	30 g.
Fruit to bunch	:	42 - 65%
Mesocarp to fruit	:	60 - 83%
Oil to mesocarp	:	77 - 81%
Kernel to fruit	:	7 - 12%
Oil to kernel	:	49 - 52%
Shell to fruit	:	3 - 11%
Palm oil yield/palm	:	Bunch weight/palm x fruit/bunch x mesocarp/fruit x oil/mesocarp

NRCOP HIGHLIGHTS 2003-2005

ISBN : 81-87561-12-2

Visit us at : http://nrcop.ap.nic.in