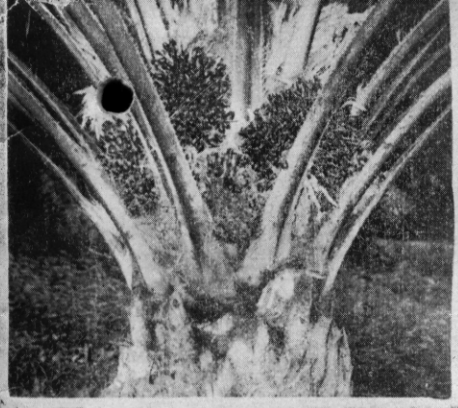


TECHNICAL BULLETIN No. 16

STRATEGY FOR OIL PALM RESEARCH AND DEVELOPMENT IN INDIA

CPCRI

Central Plantation Crops Research Institute
Kasaragod 670 124, Kerala, India

Published by:

K. V. Ahamed Bavappa
Director, Central Plantation Crops Research Institute
Kasaragod – 670 124, Kerala, India

Prepared by :

K. V. A. Bavappa
P. Rethinam
K. U. K. Nampoothiri

June, 1986

Printed at :
The Mathrubhumi M. M. Press, Calicut, Kerala

CONTENTS

STRATEGY FOR OIL PALM RESEARCH AND DEVELOPMENT IN INDIA

1. INTRODUCTION

The estimated annual deficit between the demand and production of vegetable oil in India is about 1.8 million tonnes, which may increase to about 7 million tonnes by 2000 AD. It will be difficult to bridge this gap with the present level of production from various oil seed crops. Of all the known oil yielding crops, oil palm ranks first with a production potential of 6–8 tonnes of oil per hectare per year. In Malaysia about 6 tonnes of oil per hectare per year has been realised under very favourable situations. Trials conducted in South India have shown that an yield of about 4 tonnes of oil per ha can be obtained under good management conditions. There is a potential to plant 2.4 lakh ha in states of Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra, out of which an area of about 1.5 lakh ha if planted will yield six lakh tonnes of oil at an estimated oil production level of 4 tonnes per hectare. The consumer acceptability of imported palm oil has been quite good. This crop can therefore, play a vital role in reducing the edible oil deficit in the country.

2. REQUIREMENTS OF OIL PALM

The climatic conditions favourable for the successful cultivation of oil palm are, an annual temperature variation between 20–35°C, a minimum of five hours sunshine per day, well distributed rainfall of about 2500 to 4000 mm per annum and absence of marked dry seasons. In low rainfall regions the crop can be successfully grown if supplemented with irrigation. An altitude below 450 m is considered to be the best. However, it has been reported that oil palm grows well upto 900 m. It can grow on a variety of soils; but moist, deep, loamy soils rich in humus with good water permeability is the best suited for its cultivation.

3. INTRODUCTION SO FAR MADE AND THEIR PERFORMANCE

3.1. Large scale planting

In Quilon District of Southern Kerala an area of about 4000 hectares has been planted with oil palm by Oil Palm India Limited of Kerala. An area of about 1300 ha has been planted in the Andaman and Nicobar group of Islands by the Forest Development Corporation. In addition, the two experimental farms at Palode (CPCRI) and Thodupuzha (Dept. of Agriculture, Kerala) have about 25 ha each under this crop.

The present yield of about 2.0 tonnes of oil per ha per year of the Oil Palm India Plantations does not indicate the potential of oil palm under South Indian conditions. With better management such as proper pruning of the leaves, bench terracing of the palm base and mulching, split application of fertilizers and cover cropping the inter-space, yield of about 4 tonnes per ha could be achieved. At Palode, a few palms with better environment have yielded over 4 tonnes of oil per ha.

3.2. Small scale trials in different states

Small scale planting of oil palm had been done in the country during last decade in the states of Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra.

3.2.1. Maharashtra

During the period of 1947–54 the African oil palm plants *(dura)* introduced in Pune and planted for ornamental purposes by the Maharashtra Association for Cultivation of Sciences (MACS) formed the source of seed for later supplies to the irrigation and Forest Depts and other institutions in the state. At Neeral about 100 palms planted along the irrigation canal are yielding about 40 kg fruits/bunch even under neglected conditions. A few palms available at Ganeshkind Fruit Gardens, Pune are in the early stages of flowering.

At the Agricultural School, Manjri, Pune over 100 oil palm plants supplied from CPCRI and planted during 1982 are coming up vigorously. The MACS, Pune also has about 0.5 ha young plantation of *dura* oil palm. At Konkan Krishi Vidyapeeth, Dapoli 48 *dura* oil palm plants are growing satisfactorily.

3.2.2. Karnataka

The Agricultural College Campus, Dharwad, Karnataka State has 15 five year old *dura* palms whose growth and vigour are satisfactory even under partial stress conditions. The palms planted at Sambaje Reserve Forest in Sullia hills (Dakshina Kannada Dist.) and at the Horticultural Research Station, Chettahalli (Kodagu Dist.) are coming up well.

3.2.3. Tamil Nadu

In Kanyakumari district there are about 24 palms planted in 1969 at Pechiparai and the palms are healthy even under neglected conditions. At Veppankulam of Tanjavur District about 12 palms planted during 1964 gave on an average 3 bunches weighing about 24 kg each. These palms after proper manuring and irrigation have improved considerably and some of the trees give as high as 10 bunches per year.

3.2.4. Andhra Pradesh

At Ambajipeta about 15 seven year old palms of *dura* grown under neglect has satisfactory growth. Two 20-year-old palms at Kovur Research Station are yielding well.

4. RESEARCH EFFORTS MADE SO FAR

The Dept. of Agriculture, Kerala established the Oil Palm Research Station in 1960 at Thodupuzha and conducted certain agronomic experiments and a comparative trial of planting materials. The Central Plantation Crops Research Institute Research Centre at Palode started research on oil palm in 1975. The salient achievements of research are listed below :

4.1. Germplasm

a) At the Oil Palm Research Station, Thodupuzha, the superiority of *tenera* hybrids over the others was established.

b) Of the 11 combinations of *dura* × *pisifera* planted at CPCRI Research Centre, Palode, three combinations *viz.*, 271-D × 30.4336-P, 120-D × 30.103-P and 108-D × 30.4336-P have performed well in terms of yield.

c) The total assemblage of oil palm germplasm consists of seven accessions of which six are from exotic sources.

4.2. Production of *tenera*

Till 1982 it was necessary to import the entire quantity of *tenera* seeds required by the country since *pisiferas* were not known to occur in India. Now a total of 40 promising high yielding *duras* (over 100 kg FFB/palm/year under rainfed conditions) and 25 *pisiferas* have been identified for producing *tenera* hybrids indigenously and it is possible to produce about 2 lakh *tenera* seeds annually. So far 10,000 seedlings and 80,000 seeds of *tenera* have been distributed to various agencies.

4.3. Management

i) The palms at Thodupuzha showed better response to higher dose of phosphorus and potash.

ii) Shallow planting helped in vigorous growth of palms.

iii) A fertilizer schedule of 1200g N, 600g P_2O_5 and 1200g K_2O/palm/year in two splits is recommended based on the results available from Palode.

4.4. Crop protection

i) Bunch failure which causes about 20% loss in yield can effectively be controlled by cleaning the crown, adopting assisted pollination and spraying with 0.2% Thiobendazole.

ii) Palms attacked by red palm weevil *(Rhynchophorus ferrugineus)* can be saved by treating the crown either with carbaryl (Sevin 50% WP) or with endosulfan (Thiodan 35 EC) at 1% strength. BHC (10%) dust with equal quantity of sand may be applied in leaf axils as prophylactic measure against the attack of the weevil.

iii) In the search for locating a pollinating agent it has been observed that *Eleidobius kamerunicus* Fst, an efficient insect pollinator of oil palm is present in the plantations. This will help in increasing the fruit set.

5. FUTURE NEEDS

5.1. Research

5.1.1. Germplasm

5.1.1.1. Germplasm availability and requirements

Since the crop is not indigenous to India, the first task will be to widen the spectrum of genetic variability of oil palm through collection. The germplasm at Palode includes *teneras* from Nigeria, Ivory-Coast, Republic of Zaire, Indonesia and India. *Tenera* material from Malaysia and *dura* from Malaysia and Nigeria are available at Oil Palm Research Station, Thodupuzha (Dept. of Agriculture, Kerala). Oil Palm India, Bharathipuram has introductions of *tenera* from Malaysia, Papua New Guinea, Nigeria, Ivory Coast and Republic of Zaire. It would be advantageous to get *tenera* materials of known parentage. Introductions from different countries proposed are given in Table 1.

5.1.1.2. Action plan for collection

Germplasm materials from Nigeria and Ivory Coast are proposed to be collected during 1986 and those from South America and Central America in 1987 by expedition programmes under support from IBPGR. Genetic material available with PORIM, Malaysia and the promising lines from Indonesia can be collected through correspondence/negotiations and personal visits.

5.1.2. Breeding strategy

The main objective in oil palm breeding is to evolve stress, pest and disease tolerant varieties with higher oil yield potential per unit area through increased production of bunches, higher bunch weight and high mesocarp and oil content. The following lines of approach are proposed to achieve the objective :

5.1.3. Identification and multiplication of best combinations

Tenera is the only commercially grown hybrid. Eleven *tenera* combinations along with one *dura* (self) is under evaluation at Palode since 1976. The dura parents used were from the Oil Palm Station, Thodupuzha and the [illegible] imported from NIFOR, Nigeria. Four out of the eleven combinations

Table 1. **Details of proposed oil palm introductions**

Name of the country and source	Materials required	Type of planting materials	Proposed year of introduction	Qualitative characters of materials
1. Nigeria (NIFOR)	1) *D*×*P* Crosses 34 lines	Seeds	1986	
	2) 30.103.P	1) Tissue culture plantlets 2) Pollen		Best *pisifera* source for production of *tenera*
	3) Avros	Seeds		For improving *dura* lines
	4) Dura z Avros			
	5) *Tenera* material of known percentage	Crossed hybrid seeds		High yielding and oil outturn
2. Ivory Coast	1) *Duras*–D.115.D, D.5.D, D.10.D, L.2.D	Seeds & tissue culture plantlets		Proven high yielding lines
	2) *Pisifera*	Tissue culture plantlets		
	3) *D*×*T* & *T*×*P* involving above *dura* lines	Seeds		
	4) *E. olifera*			Dwarfness oil quality
	5) *E. olifera* x *E. guineensis*	Seeds		
3. Malaysia (PORIM)	1) Collections from PORIM germplasm	Seeds		Introduction from Nigeria, Zaire, Congo, Ivory Coast & Cameroon
	2) Malayan dumpy *duras*	Seeds		
	3) Malayan deli *duras*	Seeds		
4. Indonesia	*Tenera*	Seeds		High yielding & high oil outturn
5. South America, Brazil	*E. oleifera*	Seeds	1987	Dwarf with high percentage
	E. odora (*Baracelle odora*)	Seeds	1987	of unsaturated fatty acid in oil (80%)
6. Central America, Nicaragua, Costa Rica, Paraguay	*Duras*	Seeds	1987	Widening genetic base

D. *Dura* T. *Tenera* P. *Pisifera* L. Selections from LaMe'

are performing very well compared to others. The best combination gave, in the ninth year, 1.9 tonnes of oil/ha under rainfed conditions and 3.5 tonnes under satisfactory moisture conditions. A total of 77 more combinations using indigenous *duras* and *pisiferas* to test the combining ability have been planned and crossing work initiated. Some of the promising combinations will be tested under multilocation trials.

5.1.4. Regeneration of *pisiferas*

The male parent *pisifera* has a decisive role in the productivity of hybrids. The number of *pisifera* palms available in the country are very limited. Being female sterile their multiplication is only possible through tissue culture technique which is being standardised. In the meanwhile *(tenera × tenera)* crosses are being effected to isolate *pisifera* palms from among the segregating progenies. A progeny population of 200 palms (T × T) under this programme was planted in 1983 at Palode.

5.1.5. Upgrading the *duras*

The *dura* parents will be studied for both total yield and oil content and those palms having high values for both these characteristics will be tissue cultured and used as parents for crossing with proven *pisiferas*. This programme will be continued so that the seed production technology will be continuously improved as and when better materials are identified.

5.1.6. Evolving stress and pest and disease tolerant lines

Though it is proposed to cultivate oil palm under irrigated conditions in areas where the stress period is limited the possibilities of growing this crop under rainfed conditions can be undertaken if moisture stress tolerant varieties can be isolated. The germplasm will be screened keeping the above need in view. Bunch failure and leaf yellowing are the two maladies causing yield loss in oil palm at present. Studies have shown wide variation in the occurrence of bunch abortion indicating the possibility of identifying resistant/tolerant lines.

5.1.7. Tissue culture

At present the parent material for seed production is available only at Thodupuzha. Apart from the vegetative multiplication of high yielding lines, tissue culture can be used advantageously for the multiplication of the parent material lines available anywhere in the country. Tissue culture work is in progress at CPCRI and BARC, Trombay. The technique developed will be made use of for developing adequate number of plants of parental lines. Since high Gene and Environment (G × E) interaction has been recently reported in oil palm from Malaysia, it will be necessary to select *teneras* with low G × E interaction. For this, best *teneras* will be identified based on the mesocarp to

fruit, kernel to fruit and oil to bunch ratios in addition to FFB (Fresh fruit bunches) yield. The clonal progenies of such selected *teneras* will then be field tested.

5.1.8. Commercial seed production

Since there is high demand for oil palm planting materials especially from Oil Palm India; Forest Development Corporation, Andamans; Universities; Departments of different states and private agencies, the production of planting material will have to be stepped up. Under the mission oriented oil seed development programme a seed garden of 20 ha has been envisaged for producing *tenera* hybrid requirement of the country. For establishing this seed garden it is worthwhile to import tissue cultured plants of proven parental lines of *duras* and *pisiferas* available in other countries such as Ivory coast, Puerto Rico, etc. Research on seed preservation and germination will be necessary. In the meanwhile *tenera* seeds of superior performance from Ivory Coast, Puerto Rico and Nigeria can be imported for meeting the immediate planting needs of the country. It will be necessary to keep the combination-wise identity of these materials.

5.1.9. Further refinements

Further refinement in oil palm breeding is possible by lab testing of large number of lines for heterosis through mitochondrial complimentation, evolving methods for early identification (at nursery stage) of *duras*, *pisiferas* and *teneras* in a segregating population, inclusion of characters like fruit composition (thinner shell, high mesocarp percentage), sex ratio and oil quality in the selection of parents.

5.1.10. Crop management

Location specific fertilizer experiments will be conducted and nutrient levels in the soil and plant tissues will be determined. Based on these studies fertilizer recommendation for different locations will be worked out. Drip irrigation and slow release fertilizer experiments will also be taken up to arrive at recommendation so as to economise on the inputs. Experiments on oil palm based cropping systems with different annual and perennial crops will be undertaken for determining crop combinations which give increased production and returns per unit area of oil palm plantation. Studies will also be taken up on cultural aspects such as population density, pruning of leaves, cover cropping, *in situ* terracing, mulching, etc. to prevent soil erosion and conserve soil moisture.

5.1.11. Crop protection

In order to obtain a clear idea on the diseases of oil palm prevalent in India a detailed survey will be undertaken in the existing plantations. Spear-rot complex already reported will be exhaustively investigated and etiology and control measures for this disease worked out on a priority basis.

Meanwhile an effective eradication programme will be evolved to prevent the spread of the disease and reduce its area of incidence. Surveillance to monitor the recurrence will also have to be organised.

In view of the large scale seed production programme it is essential to work out seed treatment procedures which have no deleterious effect on seed germination.

The role of beneficial insects like *Eleidobius kamerunicus* Fst. an efficient pollinator require to be studied in detail to assess its efficiency in pollination as well as its host ranges.

Being a crop recently introduced into the country, a vigil on all diseases will be maintained.

5.1.12. Harvest and post harvest technology

The main problem in the cultivation and development of oil palm is its requirement of a large area for establishing an economically viable unit. A 200 hectare plantation is required to be established for a viable medium scale mill and 5,000 hectares for a large scale mill. The scope for small scale cultivation is thus very much restricted. However, a simple and cheap technology being developed at Regional Research Laboratory, CSIR, Trivandrum indicates the possibility of palm oil extraction on a smaller scale. The possibilities of using fresh palm oil for edible purpose also exists. When the small scale extraction method is perfected it should be possible to raise the crop by the small and marginal farmers. Standardisation of packaging and storage and marketing possibilities of unrefined palm oil need further study. By-product utilisation studies for effectively using bunch stocks, mesocarp, leaves, etc, are also called for.

5.2. Oil palm development

5.2.1. Earlier surveys and recommendations

The investigation into the prospects of growing cocoa and oil palm in India was undertaken by Mr. DH Urquhart, Former Director of Agriculture, Gold Coast in 1959 at the request of Government of India, New Delhi. The report indicates that there are regions in South India where the climate and soil are admirably suited to the growth of oil palm. The available oil palm trees at Trivandrum and Trichur, in Kerala as well as Kallar and Burliar in Tamil Nadu were seen by Mr. Urquhart and he indicated that these palms have made good growth. He has concluded that where the oil palm can be placed in a suitable environment of climate and soil in South India they would be productive as in Sumatra and Malaya. He also suggested trying oil palm in Tripura.

Mr. L Davidson made a study on the prospects of oil palm development in Kerala in 1965. He identified Kuthali Estate Reserve as the best area for growing oil palm in about 3000 hectares. Konni Reserve along Achancovil

River, Vazhachal Forest Reserve, Ranni area and Nilambur area were also identified for oil palm plantation. In all he envisaged 8000 hectares for this purpose.

The Directorate of Coconut Development, Ministry of Agri. & Irrigation, Cochin prepared a project in 1976 for raising 2400 ha of oil palm in India in which the potentiality of growing oil palm in about 1000 ha in Kanyakumari disrict was mentioned.

A mission led by Mr. HGR Reddy, Regional Industrial Advisor on agro-industries and light industries made survey for the development of oil palm industry in the world. The mission visited Sri Lanka, India, Thailand, Papua New Guinea, the Khmer Republic and Malaysia in 1972. The mission recommended that there is a very strong case for an extensive development of an oil palm industry in India and suggested that a detailed technical feasibility study should be carried out before the establishment of any oil palm cultivation in the Reserve Forest areas of Kuthali, Vazhachal and Konni/Ranni in Kerala State. He also suggested the planting technique to be followed at Yeroor Reserve Forests. Suggestions were also made by him to use the existing materials at Thodupuzha for future plantings. For Tamil Nadu the team suggested a detailed technological and economic feasibility study for the establishment of oil palm industry.

5.2.2. Future strategy

5.2.2.1. Potential areas

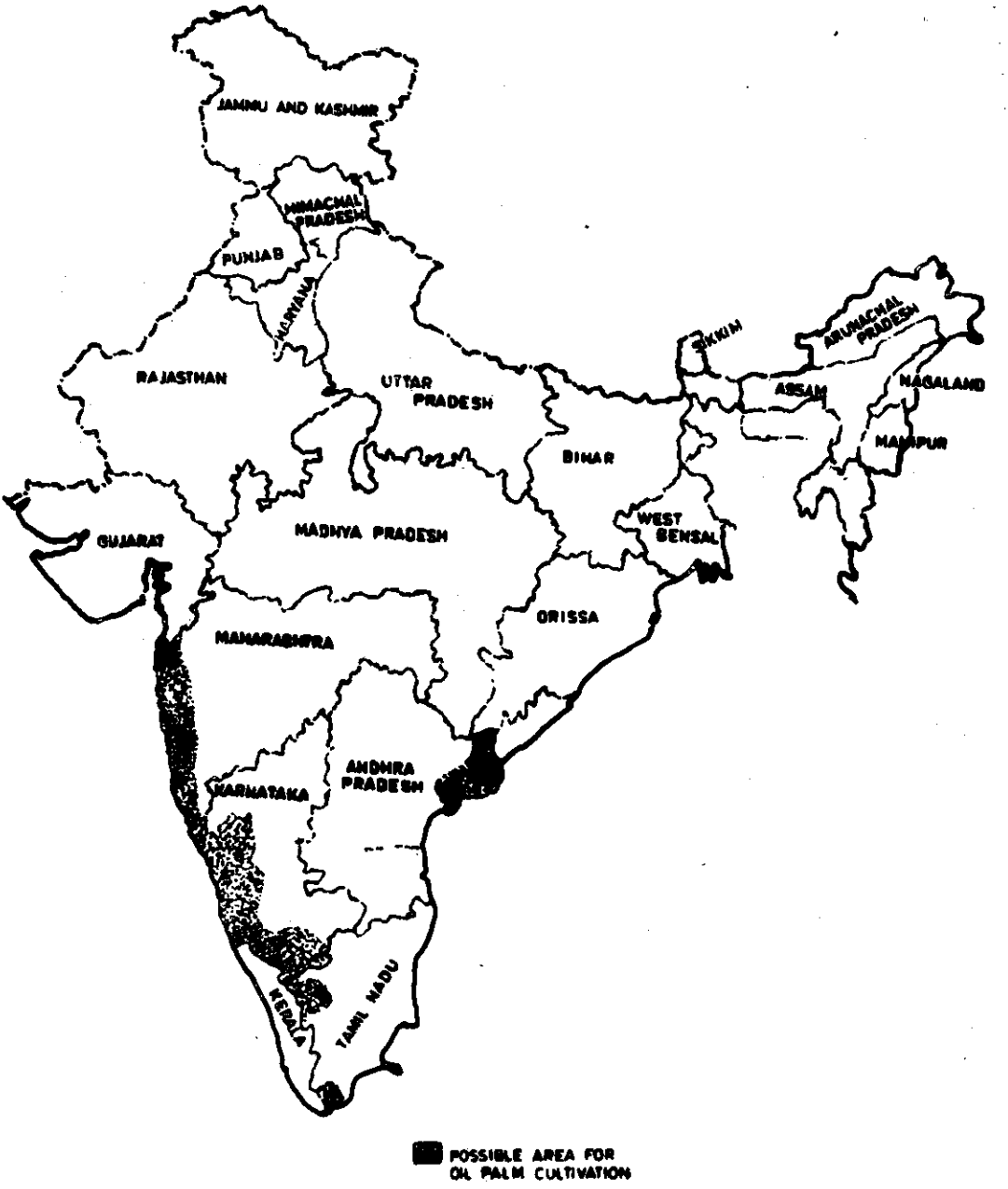
All the earlier missions by and large studied the performance of available oil palm plantings in the forest area under rainfed conditions and suggested some of the Reserve Forest areas for future expansion of the crop. A team consisting of Dr. P Rethinam, Project Coordinator (C & A) and Dr KUK Nampoothiri, Sr. Scientist in-charge, CPCRI Research Centre, Palode visited the four states *viz.*, Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra and studied the performance of oil palm growing in these states under varied agro climatic and environmental conditions. Their observations have been summarised in section 3.2 of this bulletin. They had discussions with the officials of the Development Departments, Agricultural Universities and other agencies involved in the oil palm cultivation and identified about 2.4 lakh ha where oil palm could be grown in these states under irrigated conditions (Table 2; Fig. 1), mostly in the major irrigation project areas.

In tracts where oil palm cultivation comes on a large scale with established factories for processing, the possibilities of small farmers' cultivation of this crop in the vicinity could be thought of so that processing will not come in the way of getting quality oil from the crop.

Table 2. **Possible areas for oil palm cultivation and other details**

State	Localities	Extent ('000) ha	Annual rain Range (mm)	Soil	Irrigation source
Karnataka	1) South Transition Zone Hassan, Chikmagalur, Shimoga, Mysore	200	611.7–1053.9	Red sandy loam	Thungabhadra Upper Krishna Malapradha Kattaprabha Kabini
	2) Northern Transition Zone Belgaum and Dharwad		619.4–1303.2	Shallow, medium black clay and red sandy loam	
	3) Hilly Zone Uttara Kannada, Belgaum, Shimoga, Chikmagalur, Dharwad and Kodagu		904.0–3695.1	Red clay loam	
	4) Coastal Zone Uttara Kannada, Dakshina Kannada		3010.9–4694.4	Red laterite and coastal alluvial	
Andhra Pradesh	East Godavari, Krishna, Nellore	20	1040.0–1139.0	Alluvial Red loam	Krishna and Godavari rivers
Tamil Nadu	Kanyakumari Coimbatore, Anna Dist., Madurai Dist.	10	2111.00	Red and Black	Pechiparai, Bhavani, Periyar, Aliyar Irrigation Projects
Maharashtra	Thane, Raigad, Ratnagiri, Sindudurg	10	2000.0–3300.0	Coastal sandy, Red laterite	
	Total	240			

FIG. 1. POSSIBLE AREAS FOR OIL PALM CULTIVATION



The possibilities of growing oil palm in Gujarat, Orissa, West Bengal and North Eastern hill complex comprising of Assam, Tripura etc. will have to be assessed.

5.2.3. Developmental activities required

Since oil palm, a new crop, is being introduced for large scale cultivation in the country it is essential to have on-farm trials and adaptive research plots laid out in the different states where its cultivation has been proposed. This is being done through the All India Coordinated Project on Palms. In the states of Maharashtra, Karnataka, Tamil Nadu and Kerala field trials to study the production potential of oil palms will be laid out during 1986.

The concerned state govt. may initiate action to demarcate the areas, for the cultivation of the crop. Entrepreneurs will have to be identified to establish plantations and factories in these areas. Public sector undertakings such as corporations can be thought of in each state. The Agricultural planning cell of each state may have to take the lead for follow up action.

For effective implementation of the project it is necessary to provide institutional finance wherever necessary. The state govts. concerned in collaboration with institutions like NABARD may formulate appropriate schemes.

Since it is envisaged to bring substantial area under this crop there will be need for large quantities of planting materials in the initial years. CPCRI is now in a position to produce about 2.5 lakh seeds of *tenera* annually. Seed gardens for added production of quality seeds are to be established. The estimated area of seed garden is about 20 ha. But import of seeds of proven parental combinations may also be resorted to as a short term measure.

A monitoring cell at the centre may be constituted with policy makers, administrators and scientists for periodical review and mid term corrections, if any, so that the project will be implemented expeditiously.