

REVIEW ARTICLE

Oil Palm in India with difference – in various agro-climatic conditions in the tropical and Sub-tropical conditions with inter/mixed cropping systems under irrigated conditions

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ABSTRACT

Oil Palm (*E. guineensis*) in India is more than 142 years old with the introduction of oil palm as ornamental plant in the botanical gardens of Kolkata. But the commercial oil palm was started during 1961 in the forest lands of Kerala, at the same time when Malaysia and Indonesia also took up commercial planting. The two corporate plantations of Kerala and Little Andaman did not make much progress as a forest crop due to poor management. The Government of India (GoI) also did not want to grow the crop at the cost of forest lands. However the concept of irrigated oil palm as small and marginal holders' crop put forth by the author took a different turn in the Indian oil palm which made India as the largest irrigated oil palm growing country in the different agro-climatic zones. The country has got a potential of about 2 million ha in 18 states under irrigated oil palm. The Government of India through state governments implementing the oil palm development project since 1990 with planting material, plantation maintenance. Later under ISOPOM (Integrated Scheme of Oilseeds, Pulses, Maize and Oil palm) the GoI provided subsidy for seedlings cultivation expenditure, pump sets, drip irrigation, Inter cropping, harvesting tools, etc. So for 20.3 lakh ha in 9 states has been brought under irrigated oil palm as small holders crop starting from less than 1.0 ha to 15 ha. Andhra Pradesh alone has got more than 16.1 lakh ha. The yield levels have gone up to maximum of 50 t fresh fruit bunch (FFB) / ha / year (10 t CPO / ha). Many farmers under average management conditions are getting 20-30 t FFB / ha. A few farmers who are not managing the gardens are getting lesser yield.

Many intercrops like cereals (Maize, Finger millet, even rice), pulses, Oil seeds, vegetables, flowers,

banana, sugarcane etc.), were grown economically during the juvenile period for their livelihood security. Inter crops like Cocoa, Heliconia etc. are grown in adult plantation for getting additional income. Cattle and sheep Rearing is also an attractive mixed farming in adult plantations. Micro irrigation (Drip irrigation) with one drip at seedling stage to 4 drippers at adult stage have been installed to get 40, 80, 120 and 180- 250 l water/palm per day respectively during 1st, 2nd, 3rd and 4th year onwards. Fertilizer application in two splits is the common recommendation, but the farmers have gone for 3, 6 and 12 splits of fertilizer application. Eighteen processing units spread all over the country processing the FFB with the capacity ranging from 5 t – 40 t /hour. The thousands of Oil Palm growers and the processors working in Hand in Hand are able to elevate their economic situations through Oil Palm. Indian Oil palm deviating the norms of environment conditions from rain forest to tropical plains; climatic condition of temperatures beyond 45 – 48 °C as maximum in summer, 7- 10 °C minimum for at least 2 months in winter. The rainfall ranging from 800 – 3500 mm, low humidity in drier region but a plenty of sunlight, proved to be successful. The pH of the soil ranges from 4.5 to 8.5. Thus the Indian Oil Palm is with difference and can through light of confidence to other countries.

Key words: oil palm, inter crops, potential areas, fresh fruit bunches

INTRODUCTION

Oil Palm (*E. guineensis*) in India is also more than 142 years old with the introduction of oil palm as ornamental plant in the botanical gardens of Kolkata. But the commercial oil palm was started during 1961

in the forest lands of Kerala, the same time when Malaysia and Indonesia also took up commercial planting. The two corporate plantations of Kerala and Little Andaman raised under rain forest conditions did not make much progress as a forest crop due to inadequate care and management. The government of India also did not want to grow the crop at the cost of forest lands. However the concept of irrigated oil palm as small and marginal holders' crop put forth by the author took a positive turn in the Indian Oil palm which made India as the largest irrigated Oil palm growing country in the different agro climatic zones.

Potential for growing irrigated oil palm in India

Irrigated oil palm in India is basically small holders' crop grown in the earlier identified nine states in the country as garden land replacing some low value crops. Presently it is being developed in all the 18 states (Fig 1) identified recently by the Government of India team. During the juvenile phase of the first 2 to 3 years, to overcome income loss, farmers have taken up large number of crops as inter mixed, multiple crops as well as mixed farming in the different agro climatic regions. The soil pH ranged from 5.5 in the West Coast to 8.5 in the East Coast, the temperature in the North Eastern India ranges from 7.0 °C to 20 °C minimum and maximum 15 to 30 °C to 18 to 22° C minimum and 35 to 45° C and in some days going up to 48° C (Prasad et al. 2000). The soil type ranges from river alluvium, peat, red loam, and red sandy to black soils. The performances

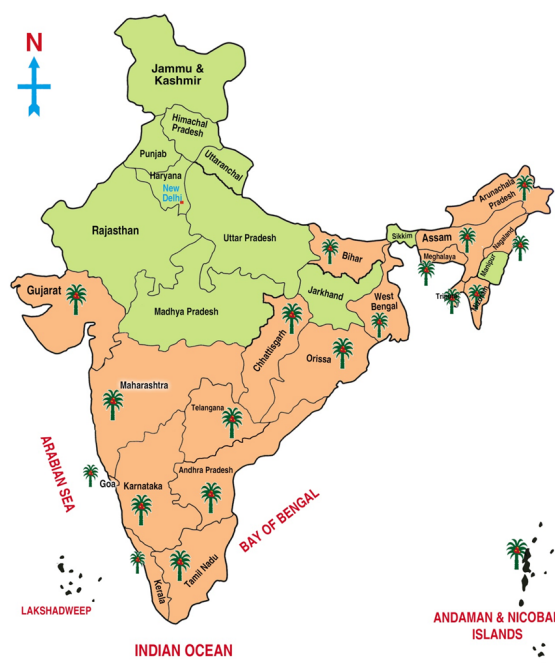


Fig. 1: Potential states for growing oil palm in India

were studied in the different agro climatic and environmental zones (Murugesan and Rethinam 2000).

For resource development, the country has been broadly divided into fifteen agricultural regions based on agro climatic features, particularly soil type, climate including temperature and rainfall and its variation and water resources availability as above. Oil Palm is grown in almost 11 agro climatic regions (Fig. 2) except five regions viz. Western Himalayan Region, Upper Gangetic Plains Region, Trans Gangetic Plains Region, Eastern Plateau and Hills Region, and Southern Plateau and Hills Region.

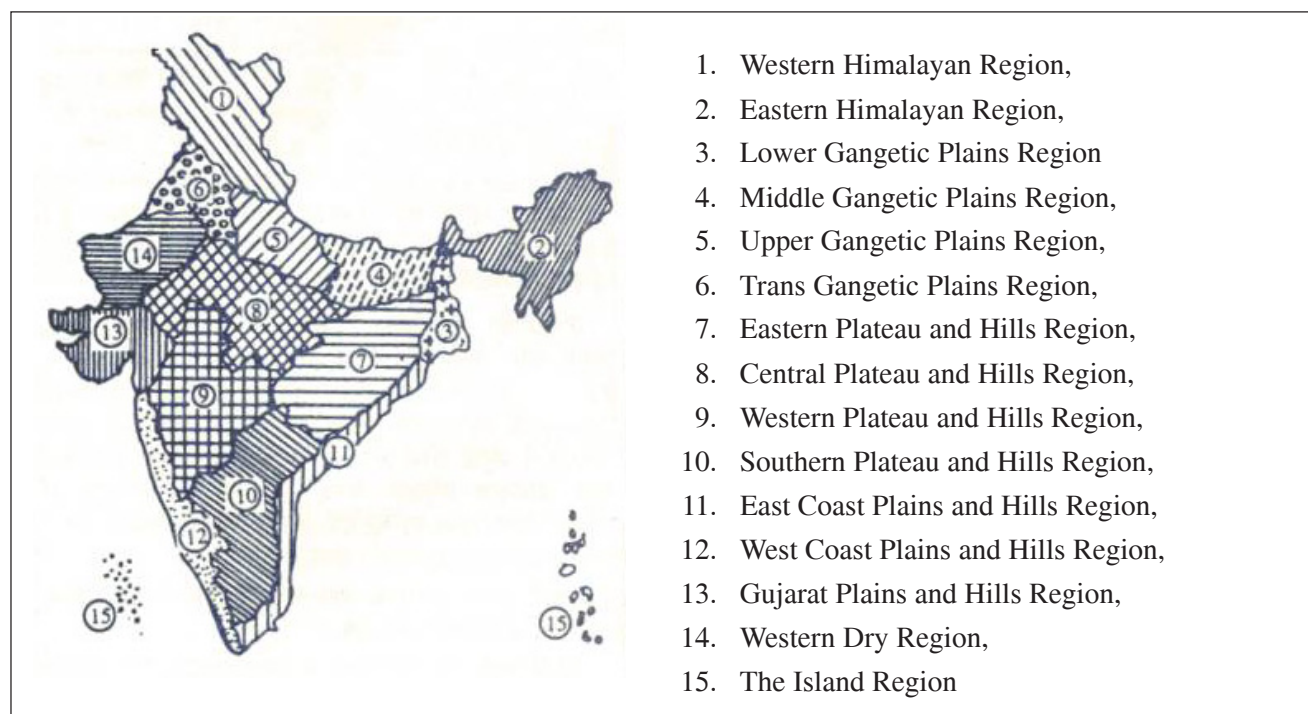


Fig. 2: Agro climatic zones of India

Western Dry Region and Central Plateau and Hills Region.

Attempts by Government of India to increase vegetable oil production

In order to increase the vegetable oil production, GOI formed Technology Mission on Oil Seeds in the year 1986 along with four other Missions. Besides nine annual oil seeds, Coconut and Oil Palm were also included. Oil Palm is the highest yielding perennial crop which can yield 4 to 8 MT of Crude palm oil and 0.4 to 0.8 MTs of Palm Kernel Oil per hectare per year for more than 25 to 30 years. So this crop was included in the Mission. As part of TMOP a separate project by name Oil Palm Development Project (OPDP) was launched in the year 1990-91. The entire TMOP was implemented by a Special Secretary Agriculture supported by four Joint Secretaries. Over a period of time the scope of TMOP was widened by adding pulses and maize.

Presently only Additional Secretary with a Joint Secretary are managing the programme under the Secretary Agriculture. A new name was coined for the Project ISOPOM and RKVY came in with some additional financial facilities. This set up was fairly giving financial support for various aspects of oil palm

cultivation including intercrops, fencing, creating irrigation facilities etc. During the current Five Year Plan, it is again called as NMOOP where financial assistance has been reduced in many areas.

Progress made so far in the Oil palm cultivation in India

Oil Palm being a new crop under irrigation, it had some initial starting problem and could reach 35000 ha during VIII FYP. In subsequent plan periods there were ups and downs due to price fall, change in subsidy pattern, power supply position etc., had delayed the area expansion. So far an area of 2.637 lakh ha (Table 1) has been brought under Oil Palm. However, today, it has been proved that Oil palm can be successfully grown as irrigated crop in all the identified states, it can be grown up to 8.0 soil pH, maximum temperatures up to 45°C and minimum up to 10-12°C.

Oil Palm growers of Andhra Pradesh are the fore runners and enjoying the benefit of growing Oil palm. Yield levels under average management is 20 MT FFB /ha / year, with better management farmers are getting 25 to 30 MT FFB/Ha/year and highest yield of 50 MT FFB/Ha (10 MT oil) also was obtained by a lady farmer). This shows the potentiality of this crop in our country. Molecular marker technologies also help in

Table 1: Oil Palm Planted Area up to March' 2018

S. No	States	Area planted till 2013-14 (Ha.)	2014-15	2015-16	2016-17	2017-18	Total
1	Andaman & Nicobar Islands	1593				0	1593
2	Andhra Pradesh	146373	8194	5289	7019	5554	172429
3	Arunachal Pradesh				504	767	1271
4	Assam	10					10
5	Bihar						0
6	Chhattisgarh	345	490	641	914	888	3278
7	Goa	854					854
8	Gujarat	4916	370	460	431	487	6664
9	Karnataka	45045	1952	1100	940	1119	50156
10	Kerala	6000					6000
11	Maharashtra	325					325
12	Meghalaya						0
13	Mizoram	32977	2790	2973	1607	979	41326
14	Nagaland	21685					21685
15	Orissa	3361	1686	886	1450	813	8196
16	Tamil Nadu	260	762	664	758	930	3374
17	Tripura						0
18	West Bengal						0
	Total	263744	16244	12013	13623	11537	317161

improving the oil palm yield and germplasm (Babu and Mathur 2016; Kumar et al. 2018; Babu et al. 2017). This is the time that we have to encourage for larger area expansion with high target. The area covered under each state as on today and the potential area identified by experts in 18 states are given below:

Processing facilities available

There are 16 Processing units to process around 420 MT of FFB / hour. Many units have been upgraded

to bigger units (Table 2). Palm kernel oil Processing units also have come. So far 5.733million tons of FFB have been processed and 1.001million tons of Crude Palm oil have been obtained. The cultivation is gaining momentum and will go fast if special mission mode approach by providing all infrastructure facilities for cultivation of Oilpalm like irrigation source, drip irrigation, electricity for lifting the irrigation, price fixing policies, minimum support price, price stabilization fund, crop insurance etc (Rethinam 2018).

Table 2: Oil Palm FFB Processing units in India

S. No	Name of the Unit	Location	Capacity(tonnes/hr)
ANDHRA PRADESH			
1	A.P Cooperative Oil Seeds Growers Federation Ltd.,	Pedavegi, West Godavari	24
2	Laxmibalaji Oils	Takarakandi village Kurupum, Vizianagarm	10
3	3F Oil Palm Agro Tech.	Yernagudem, West Godavari	30
4	3F Oil Palm Agro Tech.	Kottapet village Kaligiri Mandal, Nellore	10
5	Godrej Agrovet	Pothepalli, West Godavari	40
6	Godrej Agrovet Ltd.,	Chinthampalli	60
7	Navabharath Agro Products Ltd.,	Jangareddygudem, West Godavari	120
8	Ruchi Soya Industries Ltd.,	Peddapuram, East Godavari	75
9	Ruchi Soya Industries Ltd.,	Ampapuram, Krishna	50
10	Radhika Vegetable Oils (PVT.) Ltd.,	Garividi, Vizianagaram	15
11	Sri Srinivasa Palm Oil Mills	Rajam, Srikakulam	5
12	Agro Cooperative Ltd.,	Asilmetta, Visakhapatnam	5
13	Subrahmanyeswara Agro Products Pvt Ltd.,	Ambajipeta, East Godavari	10
		Sub Total	424
GUJARAT			
14	KalyanAgrl. Crop Sales and Processing Co-op. Society Ltd.	Maroli Bazaar, Navsari	2.5
		Sub Total	2.5
KARNATAKA			
15	BhadravathyBalaji Oil Palms Ltd.	Bhadravathy, Shimoga	10
16	Directorate of Horticulture, Government of Karnataka	Kabini, Mysore	2.5
17	Simhapuri Agro Tech.	Devangere	5
18	3F Oil Palm Agro Tech.	Koppal	5
		Sub Total	22.5
KERALA			
19	Oil Palm India Ltd.,	Anchal, Kollam	20
20	United Oil Palm Planters & Extractors	Kuravilangad, Kottayam	0.3
		Sub Total	20.3

TAMILNADU			
21	Cauvery Oil Palm Ltd., ' Godrej	Varanavasi, Perambalur	5
Sub Total			5
GOA			
22	Godrej Agro vet Ltd.,	Valpoi, Sattari	5
Sub Total			5
ANDAMAN & NICOBAR ISLANDS			
23	Andaman & Nicobar Islands Forest & Plantation Development Corporation	Little Andaman	5
Sub Total			5
ODISHA			
24	Lakshmi Balaji Oils Pvt. Ltd.,	Attada Village, Kerada Panchayat	5
Sub Total			5
MIZORAM			
25	Godrej Agrovet	Bukvannei village Kolasib District	5
Sub Total			5
TELANGANA			
26	T S Oil Fed	Ashwarapet, Apparaopeta	3030
Sub Total			60
Grand Total			584.3

Oil palm based cropping/farming systems

The review of available scientific information is quite encouraging. Many inter/mixed crops could profitably risen in both juvenile and adult phase.

Juvenile phase

A field experiment conducted at NRCOP to find out the most compatible and profitable crops in oil palm during 2001 and 2003. The yield of all inter crops (maize, tobacco, chillies, ridge gourd, bhendi, colocasia, banana, drum stick and guinea grass) except banana, drumstick and ridge gourd was comparable to yield obtained in a pure crop situation. And the benefit-cost ratio of different inter crops was varied from 1.02 for ridge gourd to 2.87 for maize (Reddy et al 2004). In another experiment at NRCOP, Pedavegi during 2003 and 2006, crops i.e, banana, papaya, drumstick, heliconia, bhendi, brinjal, radish, carrot, ridge gourd, bottle gourd, maize, curry leaf, sweet potato, maize, pumpkin and beans were evaluated (Table 3). Out of them, banana, maize, radish, carrot and heliconia were emerged as good yielders. All the crops have found profitable except drumstick, which gave only one good harvest during summer months. Therefore, drumstick may not be a good choice since it needs some amount of stress for fruiting but irrigation is must for oil palm (Rethinam. 2011).

Mature phase

A trial conducted at NRCOP RS, Palode, Kerala revealed that combination of cocoa and cinnamon in alternate inter rows, pepper trailed on palms and anthurium planted in the intra row spaces was found ideal for getting maximum net returns. Crops tried were cocoa, cinnamon, pepper, guinea grass, anthurium and kacholam. The amount of run off, soil and nutrient loss from a plantation under different cropping systems and management practices were also quantified from this experiment. In general, the soil and nutrient loss from the plantation was negligible under suitable cover crop mixtures and management practices such as mulching with EFB, organic matter application etc., (Varghese and Sunitha, 2005). Similarly, a study on mixed cropping has been initiated in 2007 at NRCOP, Pedavegi, A.P to observe the performance of various crops viz., cocoa, banana, heliconia, red ginger, betel vine, black pepper, bush pepper, anthurium and crossandra. Based on the results obtained so far, heliconia and red ginger have been found as most successful crops in oil palm.

Jessy Kuttyet al (2005) evaluated five types of medicinal plants viz., *Adhatodabeddomi*, *Alpinicalcarata*, *Kaempferiagalanga*, *Niliriantheshaenianus* and *Asparagus recemosus* in oil palm gardens of different age groups in Kerala. Among

Table 3: Profitable inter and mixed crops suitable for different regions

Name of the state	Juvenile phase	Mature phase
Andhra Pradesh	Tobacco, maize, banana, oil seedslike ground nut, sunflower, sesamum vegetables-bhendi, chillies, brinjal, tomato, yam, tapioca, cucurbits, turmeric, pulses-black gram, green gram, horse gram, fodder crops, cotton, drumstick, flowers like Heliconia, Mango ginger	Cocoa, banana, black pepper, long pepper, elephant foot yam, pine apple betel leaf etc.
Karnataka	Cereals-ragi, maize and jowar, vegetables-onion, brinjal, cucurbits, chillies, tomato, cole crops, oil seeds-ground nut and sunflower, flowers-marigold and china aster, fruits-banana and fig, sugar cane, tobacco, cotton, red gram, turmeric, ginger, drumstick, fodder crops etc.	Banana, coffee, vanilla, medicinal and aromatic plants, arecanut, annato etc.
Tamil Nadu	Sugarcane, banana, maize, vegetables-bhendi, tomato, brinjal, chillies, cucurbits, ground nut and flowers-crossnadra, tuberose, marigold , jasmine	Banana , Papaya
Orissa	Maize, sunflower, ground nut, banana, cotton, chillies, tomato, brinjal	Banana, turmeric, arrow root and pine apple
Gujarath	Paddy, bajra, groundnut sugarcane, banana and brinjal, flowers like chrysanthemum, Lilies, rose etc.	Banana
Mizoram	Paddy, banana, pine apple, ginger, chillies, cucurbits, cowpea, beans, mustard, maize, soya bean etc.	—
Goa	Vegetables-bhendi, chillies, brinjal, vegetable cowpea, cluster beans, cucurbits, banana, ground nut, tapioca, cowpea, fruits-banana, papaya and pine apple, flowers like Heliconia	Arecanut ,pepper

them, *Kaempferiagalanga* emerged as the most profitable crop in view of the highest cost benefit ratio.

In addition to the crops, milch animals and sheep rearing are also being done by the farmers for having continuous income and employment.

Out come

The progress made so far in terms of area expansion, production of FFB and extraction of oil id quite impressive and the project has proved the following:

1. India can grow Oil Palm successfully to get 15-20 tons FFB/ ha/ year. All the 18 states included in the Oil Palm Development Project (OPDP) are suitable for growing oil palm successfully with the existing varied soil,climatic conditions of very high summer temperature and very low winter temperature, very low rainfall quantity and

distribution. However assured irrigation throughout crop period of 25 to 30 years is must. Drip irrigation is very much suitable.

2. The oil palm presently grown in a wide pH 5.0 to 8.5, maximum temperature of 40o to 45o C, minimum temperature of below 16o C even up to 8o to 10o C for some days, as in North Eastern part.
3. Many of the progressive farmers have got 30 to 40 tons of FFB /ha/year from 6 year onwards which means 5 to 8 tons of CPO/ha/year. Highest yield of 54 t FFB / ha /year was recorded in Mysore State of Karnataka recently. Those farmers who are not taking care of oil palm in terms of optimum management are getting low yields. The farmers who are getting higher yield expanded the area further.
4. The economic development due to oil palm

cultivation is very well seen in the Coastal Andhra Pradesh. Farmers are getting 20 to 30 tons FF B / ha .In Tamil Nadu also now it is picking up. .It was possible to get economic yields in different agro climatic conditions.

5. The farmers could also raise as many intercrops as possible during juvenile phase of oil palm to make good of income loss. The setbacks of price fall for FFB during 1999-2000 and 2008-09 due to global vegetable oil price fall has reflected in low area.
6. Bulk of the waste lands and cultivable waste lands available in this country with adequate underground water facilities to be identified and go for irrigated Oil palm.
7. Oil palm is the best option for increasing the vegetable oil production in the country which can greatly help in building up lively hood, food. Nutritional and bio fuel security.

CONCLUSION

Indian oil palm is grown in the East, West, North East and Maidan (plateau) regions of the country mostly in the plain arable land avoiding the rain forest, instead helps to build forest for about 30 years .Hence there is fear of deforestation and thereby causing damage to bio diversity. In the West Coast the soil is acidic and temperature ranges between 18 to 38° C, in the East coast the soils Ph ranging from 7.5 to 8.5 and temperature in summer goes beyond 40° C for some time .In the North East pH ranges from 5.5 to 7.0 and in some areas it is peat soil. So Indian Oil palm grown in tropical and sub tropical regions under irrigation is the largest example of growing Oil palm without touching forest lands but, creating forest for 25 to 30 years.Effective utilization of land committed to Oil palm for longer period with array of inter mixed multiple cropping/ farming systems have been demonstrated which are eco friendly and environmentally sustainable. It is always possible to grow the shade loving and shade tolerant crops like cocoa, banana, elephant foot yam, pepper, ginger, colocasia, some medicinal, aromatic and cut foliage plants and shade loving crops like anthurium, orchids, vanilla, betel vine, ginger, cut foliage, Heliconia, red ginger, some medicinal, aromatic and cut foliage plants in mature oil palm gardens. Integrating animals for milk and meat is also possible. All these definitely support that India, oil palm is with difference

and can provide lot of new information to oil palm industry as a whole.

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