52. *Afforestation with Coconut and Oil Palm*

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Introduction

World demand for vegetable oils will continue to increase as population increases. At present, increase in the world demand for edible oils is about 3 per cent per year. An increase of 25-30 per cent may be expected within another 10 years. In India, though self-sufficiency in food grains has been achieved to a larger extent, the increase in oilseed production is not commensurate with the demand resulting in import of edible oils to the extent of over 800 crores of rupees every year. The growth rate of oilseed production has, however, been only 1.6 per cent per annum for quite sometime, creating an ever increasing gap between demand and supply. Hence, there is an urgent need to produce more of oilseeds.

In India there is only 143 m ha of net area under the plough which has to feed not only 700 m people but also their domestic animals besides meeting the other basic requirements such as fuel etc. To meet the ever increasing demand for food, fodder, fuel and timber, deforestation is going on, which poses considerable strain on our forest area. Forest area in the country is only 23 per cent of the total geographical area against the projected need for about 33 per cent, the possibility for increasing the area under forest has to compete against land needs for food, oilseed and commercial crops. The industrial development in the country and housing needs are all slowly encroaching on the cultivable land. All these necessitate a system through which a land management and farming system must be evolved that is not only capable of producing food from marginal agricultural land but is also capable of maintaining and improving the quality of the producing environment through developing a viable system integrating agricultural/horticultural crops and forest trees. By this, a proper ecological balance can be maintained. For afforestation, the perennial oilseed crops like coconut (*Cocos nucifera*) and oil palm (*Elaeis guineensis* Jacq.) are most suitable crops that can increase

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the vegetable oil production in the country and also help to maintain a suitable ecosystem.

Why afforestation with coconut and oil palm?

Perennial Nature of Crops

Unlike annual oilseed crops, coconut and oil palm when planted once in the field remain in productive phase for more than 50 years. With normal management practices one can go on getting the yield for many years. Besides the oil yield, these two crops, because of their perennial vegetation, contribute to a greater extent in maintaining the agro-forestry system.

Higher Oil Yield

Both coconut and oil palm are capable of giving four to seven times more oil compared to groundnut, the most popular oilseed crop in the country. Harry (1984) has compared the average yield of oilseed crops and indicated that oil palm in Malaysia is able to produce 3,895 kg oil/ha while the peanut, rapeseed, safflower and sunflower in U.S.A. produce only 790, 409, 762 and 589 kg oil/ha, respectively.

Adaptability to a Very Wide Climatic and Soil Conditions

Though coconut is a crop of humid tropics it can be grown under varying soil and climatic conditions from saline sea coast to an elevation of 1,000 metre. It is widely grown in both East and West Coasts and also in central parts of the States of Kerala, Karnataka, Tamil Nadu, Orissa, West Bengal, Maharashtra, Assam, Goa, Andamans and Lakshadweep Islands. Coconut can also be grown under situations such as back water areas along the coast, paddy field bunds, river banks subjected to inundation, and canal bunds in the major irrigation project areas. In these areas, coconut can be grown either in a row planting or block planting according to the conditions available. Coconut growing is having a good potential in areas like Bihar and Uttar Pradesh.

For successful oil palm cultivation, a mean maximum temperature of 28-30 °C, mean minimum temperature of 22-24 °C, a minimum of 5 hours sunshine per day and a well distributed rainfall of about 2,000 mm per annum and absence of marked dry seasons are essential. Though these conditions are not prevailing in many parts of India, Kerala, Andaman and Nicobar Islands have conditions favourable for oilpalm cultivation. Since the recent efforts in Malaysia to cultivate oil palm under irrigated condition have been reported to be highly successful and the yield under such situation has reached 8.55 tonnes of oil/ha per year with *tenera* hybrid, there is every possibility of growing oil palm under irrigated system in the new irrigation project areas in the southern States of India (Bavappa, 1982).

Availability of High Yielding Cultivars/Hybrids in these Two Crops

Though the all-India average is only 29.1 nuts/palm/year there are cultivars/hybrids available which can produce higher oil yield. The Tall× Dwarf and Dwarf×Tall hybrids under good management are able to give up to 2-3 tonnes of oil/ha/year. Super palms yielding 400-600 nuts/palm/year are also available in both East and West Coast which strengthened the possibility of increasing the oil yield exploiting potentialities.

Similarly in oil palm also, *tenera* hybrids are the high yielders. Under irrigated conditions in Malaysia, *tenera* hybrid could produce 8.55 tonnes of oil per hectare per year (Bavappa, 1982). It is now possible to produce sufficient good quality *tenera* seeds indigenously with the identification of *pisifera* palms in India.

Availability of Production Technology for Higher Yields

Both coconut and oil palm respond well to the management conditions. Simple cultural practices, manuring and irrigation have considerable impact in increasing the yield. Production technologies for better yields are readily available in different coconut growing States.

Even in the black and red soils of maidan tract of Karnataka, and coastal sandy soils of Konkan Coast, manuring has increased the yield considerably. However, hybrids are able to give more yield under normal manurial and good management conditions (Table 1).

Table 1: Four-year mean yield of nuts by the genotypes planted in 1965 at Kasaragod (nut/palm/year) 1978-82 (CPCRI, Kasaragod)

Management	CDO×T	HY Tall*	T×CDO
No fertiliser	24	16	10
500 gm N+500 gm P_2O_5+1,000 gm K_2O/palm/year	71	47	52
1,000 gm N+1,000 gm P_2O_5+2,000 gm K_2O/palm/year	71	61	55

*High Yielding WCT progenies.

Likewise, though the oil palm yield of 1.4 tonnes of oil/ha/year obtained in Kerala is not a potential yield, better management such as pruning of trees, bench terracing of palm base and mulching the same, split application of fertiliser, and cover cropping the inter spaces, an oil yield of 2 tonnes per ha could be easily achieved (Bavappa, 1982).

Possibility of Raising Innumerable Inter/Mixed Crops

Coconut is a widely spaced perennial crop grown with a spacing of 7.5×7.5 metre (56.25 m^2), the area of maximum spread of roots is only 12.57 $metre^2$ which is only 22.24 per cent of the total area (Nelliat *et al.*, 1974) and this provides 77.76 per cent of its area to other crops. The

canopy pattern and solar energy utilisation also indicated the possibility of growing compatible inter-crops (Nelliat *et al.*, 1974).

Coconut based inter-crops

There are ample opportunities for raising innumerable annual and biannual inter-crops in coconut like cereals, pulses, oilseeds, ginger, turmeric, tuber crops, banana, pinepple, etc. The suitability of growing groundnut as an inter-crop was established even as early as 1931-32 (Anonymous, 1932). The profitability of growing groundnut and its effect on suppressing the weed growth and maintaining soil tilth was brought out by Sahasranaman (1964). Groundnut as an inter-crop increased the yield of coconut, increased income and created additional employment opportunities (Kannan and Nambiar, 1976; and Leela and Baskaran, 1978). Thus there is a possibility of raising a perennial and an annual oilseed crops from the same land and thus increase the oil yield from unit area.

In the maidan tract of Karnataka, where coconuts are grown at 9.0 metre×9.0 metre spacing, growing double cropping sequence of potato-wheat, French bean-wheat, chillies-wheat, *ragi*-wheat gave a net income ranging from Rs. 9,100 to Rs. 12,800 per ha/year. This clearly indicates the possibility of growing food and oilseed crops profitably from the same unit of land which not only increase the income but also increase the employment potential.

COCONUT-BASED MIXED CROPS

Growing perennial crops as mixed crops is also possible with coconuts. Growing mulberry as mixed crop in 0.4 ha of coconut garden and rearing silk worm had given a net income of Rs. 6,670/ha on an average for three years when compared to Rs. 1,924 from coconut alone. Growing coconut-cocoa mixed cropping also was proved to be profitable (Nair *et al.*, 1976; Anonymous; 1979, 1982).

Under the West Coast conditions, coconut, pepper and coconut, cocoa and pineapple in between the coconut rows was the most remunerative combination (Nelliat *et al.*, 1983). These crops develop a canopy at varying heights simulating the features of a multi-storeyed building and a miniature farm-forestry or agro-forestry. Similarly, other crops like clove, nutmeg, cinnamon, coffee, also have been identified as successful mixed crops. Since coconut can accommodate as many crops as possible, coconut-based high density multispecies cropping programme may be a viable one to generate more employment opportunities and provide food, fodder for cattle, fuel needs and a steady income to the farmers. The cultivation practices also will be the bare minimum.

POSSIBILITY FOR COCONUT-BASED MIXED FARMING

Mixed farming in coconut is another profitable system. The profitability of growing guinea grass and Napier grass which could yield 50-60 tonnes green fodder/ha and legumes like Brazilian lucerne and cowpea, 30

tonnes/ha with a cutting interval of 30-40 days to feed four milch cows at a feeding rate of 30-40 kg green fodder in the ratio of 3 : 1 grasses: legume/ animal/day, was reported by Sahasranaman and Pillai (1976). Mathew and Shaffee (1979) had indicated the incremental benefit of coconut+ dairy over coconut alone as Rs. 22,762.87/annum/ha. This mixed farming includes biogas plant also using the cowdung to provide light to house and cattle-shed, as well as fuel. This facilitates organic recycling and thereby increases the yield of palm to a considerable extent. Pepper on coconut, grass and lucaena (subabul) in between the rows and dairy is a multipurpose farm-forestry or agro-forestry which create a lot of employment potential, besides higher income.

Pest and Disease Management

Fairly good technology for the control of known pests and diseases have been developed for coconut. Unlike annual crops the risks involved are comparatively less.

High Biomass Production

These two unique palm species not only contribute much to the world trade of edible oils, but also produce about 170.8 m tonnes of biomass annually. The adult 30-40 year old tall variety of coconut palm growing in the west coast of India has an annual crop growth rate (CGR) of 11.9 to 18.4 tonnes at a planting density of 175 palm/ha (Ramadasan, 1984). Similarly, an annual CGR of 29.8 tonnes/ha for oil palm in Malaysia at a planting density of 122 palm/ha was reported by Corley *et al.*, (1971). The annual dry matter production through vegetative tissues excluding the nuts in the WCT palms is about 30-40 kg/palm (Ramadasan, 1984) which may come to 5.2 to 7.0 tonnes and may be used for fuel and thatching.

Coconut Support Many Byproduct Industries

Coconut as a perennial oilseed crop provides ample opportunities for livelihood in the field of agriculture and allied industries like coir industry, rubberised coir foam industries, charcoal and oxalic acid manufacturing unit from shell coir dust, desiccated coconut industries, etc.

Suitability of the Crops for Agro-forestry

King, the then Director of ICRAF has defined agro-forestry as a suitable land management system which increases the yield of land, combined the production of crops (including tree crops) and forest plants/or animals simultaneously or sequentially, on the same unit of land, and applies management practices that are compatible with cultural practices of the local population. Foregoing evidences clearly indicate the suitability of coconut crop for the farm-forestry or agro-forestry which can provide all the requirements either directly or indirectly, and also sustain large number of people by way of byproduct industries.

Possible areas for afforestation with coconut and oil palm

WESTERN GHAT REGION

In the Western Ghat Region comprising of Kerala, Karnataka, Goa, Maharashtra and Tamil Nadu up to an elevation of about 900 metre coconut-based cropping system with cocoa and pepper can be a suitable system.

HUMID BENGAL AND ASSAM REGION

There is a vast scope for increasing the area under coconut in this region. The task force appointed by ICAR on agro-forestry to prepare a list of species useful in agro-forestry for different agro-climatic regions in India has also recommended coconut (*Cocos nucifera*) for the coastal areas of West Bengal and Assam.

NON-TRADITIONAL AREAS

Due to its wider adaptability, coconut is now grown in the non-traditional areas like North Bihar and Madhya Pradesh. It is estimated that it will be possible to grow coconut in about 25,000 ha in North Bihar. It was also indicated that though the rainfall is low, water table is high and maximum temperature rarely goes beyond 34°C and successful crop could be planted with coconut provided adequate management is given (Thampan, 1983). Similarly, growing coconut in the Central Zone of Bastar district of Madhya Pradesh is possible where annual rainfall is up to 2,158 mm and the average maximum and minimum temperatures are 30°C and 12.1°C respectively. It is estimated that coconut cultivation to a tune of 1 lakh ha is possible in Madhya Pradesh by 2000 A.D. (Markose, 1984). In the years to come coconut growing in the non-traditional areas will become a possible venture and can contribute to a considerable extent in the oil production.

CANAL-BUND PLANTING

As is being done in Orissa, canal-bund planting can be extended to all the major irrigation project areas where the climatic conditions are suitable. By this there is vast scope for increasing the coconut area in Tamil Nadu, Andhra Pradesh, Maharashtra and Orissa.

AFFORESTATION IN SHIFTING CULTIVATION AREAS

In India, according to FAO, the area directly affected by shifting is estimated to be 8-10 m ha. Shifting cultivation is widely prevalent in Orissa, Andhra Pradesh and in the North Eastern Hill region of India comprising Assam, Manipur, Meghalaya, Nagaland, Tripura, Arunachal Pradesh and Mizoram. Since afforestation in these places are being stressed by all for maintaining the ecological balance and providing sustained living for tribals, coconut and oilpalm can be thought of to a limited extent in Andhra Pradesh, Orissa, Assam and Tripura wherever the clima-

tic and environmental conditions are available. Inter-crops like hill paddy, tapioca, ginger may be cultivated in between the coconut trees.

PLANTING COCONUT UNDER SOCIAL FORESTRY SCHEMES

Planting coconut in the villages under social forestry like Panchayat plantations, road-side plantations, etc., can be done wherever it is possible.

PLANTING COCONUT IN THE GARDEN LANDS

Increased awareness in planting coconut has come in many States. In Gujarat, coconut is planted all around the field bunds where there are irrigation facilities. In Tamil Nadu garden lands are being slowly converted into coconut plantations particularly in Pollachi, Udumalpet and Coimbatore taluks. Even in the coastal sandy soils coconut is being planted in Chengleput district with adequate irrigation facilities. These coconut lands afford excellent scope to develop coconut based multi-species cropping which would simulate forest conditions.

EXTENSION OF OIL PALM CULTIVATION AND ITS CONSTRAINTS

The fruits of oil palm have to be processed within 24 hrs of harvest for which a factory is required. Hence small-scale plantations will have the problem of oil extraction, unless it is done on a co-operative basis. By and large, either public sector undertaking or large-scale private enterprise with adequate factory and related facilities are required. In the new forest clearings and irrigation project areas this large-scale undertakings should be possible. In the southern States it is possible to grow oil palm to a considerable extent. If a low cost technology is available for oil extraction by the small and medium farmers, there will be ample scope for this crop. Oil palm also is amenable to multi-species cropping.

Projected oil production

Taking into account the area available in different States where favourable soil and climatic conditions (including those where irrigation can supplement drought conditions) exist, it has been estimated that about 4 lakh ha can be brought under coconut (Bavappa, 1982). At the present trend of new plantings of coconut in the traditional and non-traditional areas, there is possibility for extending the cultivation to another 2 lakh ha in the country. Out of the possible 6 lakh ha, even if 4 lakh ha are to be brought under coconut in the next five years under good management system, there is a possibility of increasing the coconut oil production by three folds of that of the present 2.17 lakh tonnes.

Similarly, the area under oilpalm can be brought to 25,000 ha in Andamans (Bavappa, 1982) which can be under rainfed conditions and another one lakh hectares having irrigation facilities in the southern States could be brought under cultivation with good management. By this, it will be possible to produce 2.5 lakh tonnes of palm-oil annually. With

good management practices, it is still possible to increase the oil production by another 1 lakh tonnes from the above area. Thus coconut and oil palm can produce annually an additional quantity of 1.0 m tonnes of oil by 2000 A.D.

In addition to this, the income generated from other crops, additional employment opportunities created, etc., are added bonus.

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