Time to take note of Oil Palm

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The increased demand for palm oil and also the technological developments for its extraction has greatly changed the entire structure of the oil palm industry.

Red oil palm is now being sought after both by the scientists and producers. Considered as the highest oil yielding crop per unit area, it can produce up to 8 tonnes of oil a hectare.

Deep orange to red in colour the palm oil finds a number of uses in industries, besides in the formulations for margarin and cooking fats like Vanaspati and shortening. For frying, purposes it stands out for its low foam and longer keeping qualities. It could be used as replacement in formulations of blends of Hydrogenated liquid oils, margarine oils and other oils and fats. It is also used in the manufacture of biscuits, ice-cream soaps, detergents and shampoos. Palm oil can also be used to yield vitamins, protein and anti-biotics.

Oil palm (Elaeis guineensis L. Arecaceae), is a native of West Africa. Today it is grown extensively in Malaysia, Nigeria, Indonesia, Republic of Zaire and Ivory Coast and to a limited extent in India. Ghana, as well as in South and Central America. Refined palm oil that is being marketed in India is imported from Malaysia.

The cultivation of oilpalm in India is at present restricted to the Government owned plantations and public sector undertakings located in Kerala and Andamans. Preliminary survey has revealed that there is potential for oilpalm cultivation in Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra, Orissa, West Bengal, Assam and Tripura.

Climate and Soil considerations

Oil palm grows well where the annual temperature varies between 20°C to 35°C. While well distributed rainfall of 2500 to 4000 mm per annum is ideal for the crop, it can also withstand higher rainfall as well as three to four months of drought without drastic reduction in yield.

Oil palm has been reported to be growing very well up to 900 m, but an altitude below 450 m is considered to be the best.

Oil palm can come up on a variety of soils. But a moist deep loamy soil rich in humus with good water permeability suits the palm best.

Oil palm has a highly branched root system. Oil palm bears bunches in the same palm (monoecious). In the axil of every leaf, there is a bud which may develop into a male, female or occasionally bisexual inflorescence. The inflorescence is branched and the flowers (spikelets) are arranged spirally around the branches. An inner and outer spathe tightly enclose the inflorescnece until about 6 weeks before flower.

The fruit is usually spherical to ovate or elongated and bulging at the top. It is about 2-5 cm long and weight may vary

3-30 g. It consists of an outer thin skin (exocarp), oil bearing pulp (mesocarp) and a shell (endocarp). The shell together with the kernel inside form the seed. The embryo is straight about 3 mm long and dull white in colour. Palm oil is extracted from the mesocarp. Kernel also yields oil known as kernel oil, though the quantity is only about 1/4 of that obtainable from mesocarp.

Oil palm bunch consists of outer and inner fruits. The inner fruits are less pigmented, somewhat flat and some undeveloped and non-oil bearing. Bunch weight varies from a few kilograms to 100 kg, the average being around 30 kg. Well set bunches carry 1000 to 3000 fruits. Ripening is usually from tip downwards. A bunch takes about 5-6 months for ripening. Oil formation in the kernel and mesocarp takes place towards the end of a period of maturation during which shell hardens and the embryo becomes visible.

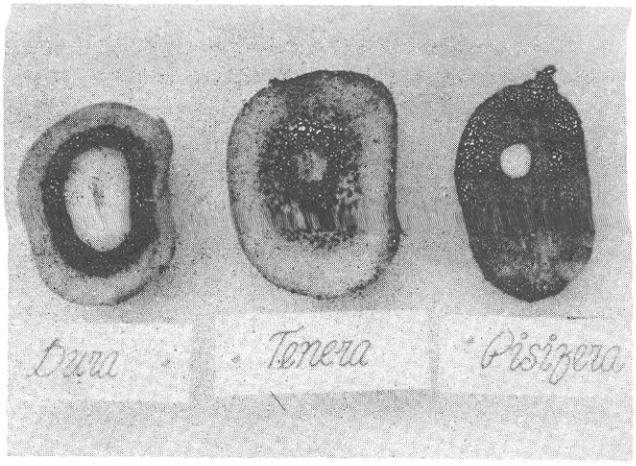
Assisted pollination

Since oil palm is a cross-pollinated crop, assisted pollination is found necessary. For collection of pollen, the male inflorescence is bagged before the flowers open. The inflorescence is separated from the palm along with bag at the time of opening of flowers and dried for 24 hr. in an oven at 35-40° C or in shade. Pollen which easily sheds into the bag is then sieved and stored in moisture free containers. It remains viable for 30 days or longer if stored in a refrigerator. Pollination is effected by applying the pollen into the receptive stigma with a puffer. The fruits ripen 5-6 months from the date of pollination.

Several species of weevils belonging to the genus Elaeidobius are known to act as pollinating agents. Elaeidobius kamerunicus is the most efficient pollinator. They congregate on male inflorescence during anthesis and breed on male inflorescence on which anthesis is over. The weevils visit the female inflorescences also effecting pollination.

Varieties

Based on the difference in fruit structure three oil palm varieties have been indentified. They are dura, pisifera and tenera.



Tenera is the most widely grown variety. This is a hybrid obtained by crossing dura (female) and pisifera (male). It has a thin shell usually measuring 0.5 mm to 4 mm and a medium to high mesocarp content of about 60-95 per cent.

The pisifera variety is characterised by shell-less fruit and pea like kernel inside. Often the kernel is also absent. Since many of the fruits do not have embryo; seed propagation is almost impossible.

Seed germination

The fruits are separated from the bunch and seeds are extracted by scraping off the exocarp and mesocarp with a knife, or by retting in water or by other mechanical means. In retting, the fruits are immersed in either running or still water for 10 days. The process is completed by pounding the fruits mixed in a wooden mortar to remove the adhering mesocarp. In dura fruit, a clean seed is obtained while in tenera a portion of fiberes remain attached to the seeds. The seeds are then dried by spreading them on concrete or wooden floors under shade for two days. Such seeds can be stored for three to nine months at about 27°C without much reduction in viability.

Under natural conditions, oil palm seed takes about two to two and a half years to germinate. For quicker germination the following technique is recommended:

Seeds are soaked in water for five days changing the water daily. Thereafter the seeds are spread out for drying for

24 hr. The dried seeds are put in polythene bags (of conventional size and guage) closed tightly using rubber bands, and placed in germinator maintaining a temperature of 40°C. After 80 days, the seeds are removed from polythene bags, soaked in water for 5 days changing the water daily and dried in the shade for two hours. After this, the seeds are put back into bags and kept in a cool place in order to maintain the moisture content. The germination commences in about 10-12 days. The per centage of germination obtainable by this method is 90-95 per cent.

It has been found possible to reduce the germination period of oil palm seeds by 'deoperculation method' in which the operculum of kernel is removed under sterile conditions and germinated in a moist chamber.

Raising nursery

Of the different systems of nursery techniques, the single stage polybags system is the best. In this system, the polybag (preferably black) of 400-500 guage, measuring 40 by 35 cm are used. The bags are filled with top soil and compost arranged at a spacing of 45 cm square and one seed/bag is dribbled. A good mulch during summer is desirable. Watering the seedlings weekly thrice is recommended. A fertiliser mixture containing 15 g N, 15 g P_2O_5 and 6 g K_2O at the rate of 8 g in five litres of water for 100 seedlings may be applied when the seedlings are two months and eight months old.

Planting

Oil palm is planted in the main field in triangular system at a spacing of 9 m accommodating about 150 palms/hectare. Planting is preferably done at the onset of the rains during May-June. The polythene bag is torn open and the entire ball of earth is buried in the pit (50 cm^3) and levelled. The young seedlings are to be protected from rodents wherever necessary, by a wire netting (45 cm by 120 cm) encircling it at a radius of 15 cm from base.

Field Management

Cover Crop: Establishing cover crops in an oil palm plantation is advantageous. A mixture of three species of legumes viz. Pueraria phaseoloides, Calapogonium mucunoides and Centrosema pubescens (2:2:1) is recommended. Seeds are mixed and sown in drills in between the rows of palms at a rate of 5 kg/hectare. Mucuna species (velvet bean) is another useful cover crop.

Weeding: The base of the palm is to be kept clean by hand weeding and pruning cover crops entering in. Alternatively, weedicides can be sprayed around the base. Fernoxone is injurious to oil palm and hence should not be used for weed control.

Manuring: The following fertiliser schedule is considered satisfactory for oil palm:

Age	Fertiliser (g) per palm per year			
	N	P_2O_5	K_2O	Mg
First year	400	200	400	Necessary only
Second year	800	400	800	if deficiency
Third year	1200	600	1200	symptoms are noticed.

Fertilisers are preferably applied in two equal split doses (in May and September), within 2 m diameter around the palm and forked in. Supply of sufficient quantities of green leaf or compost is advantageous especially where the soil is poor in organic matter content.

Leaf pruning: Dead and diseased leaves and all inflorescences should be cut off regularly upto three years after planting. When the palms are yielding, it is necessary to remove some of the leaves while harvesting. In such cases pruning should be done judiciously to avoid over-pruning. In addition all dead and excess leaves should be cut off and crown cleaned atleast once in an year, usually during the dry season.

Harvesting

First harvest can be taken 3½-4 yr after planting. Plantation is to be regularly inspected to harvest ripe bunches. When a few ripe fruits are loose/fall off, the bunch is ready for harvesting. Processing over-ripe fruits reduces quantity and quality of palm oil.

A chisel is used for harvesting bunches from young palms. The stalk of

the bunch is struck hard with the chisel to cut off and push the bunch out. When the palms become taller (from 10 year onwards) a harvesting hook has to be used. This is made by tying a sickle-shaped knife on to a pole with binding wire, the length of the pole depending on the height of the palms. When the palms are too tall, it is necessary to climb the palms for harvesting.

Yied

Under average management, an yield of 12 tonnes of fresh fruit bunches (FFB) per year can be expected from one hectare of mature plantation. Under very good maintenance, especially with irrigation the yield could be four to six tonnes of oil (20-25 tonnes of FFB) per hectare per year.

The average weight of a harvested fresh fruit bunch is 30 kg. However, bunches weighing upto 100 kg with 1000-3000 fruits are also obtainable. The tenera fruit has on an average 35 per cent palm oil, 35 per cent pulp residue, 7 per cent kernel and 23 per cent shell. The extraction ratio of palm oil to bunch is generally 20 per cent. The average oil yield is around 2.5 tonnes per hectare feasible under good management.

Processing and products:

For large oil palm plantations, efficient and economic oil mills capable of processing 6 tonnes of FFB per hour are required. But the small and medium scale plantations require cheap and reasonably efficient oil extraction plants. For plantations not exceeding 40 hectares, a hand operated hydraulic press will be sufficient. The stork hydraulic hand press can be operated with 12 men at a time and it processes about 3.5 tonnes of bunches per day.

The usual method of processing (dry process) involves the following stages:

Sterlisation: Carried out by heating with compressed steam for about 2 minutes in cylindrical vessel. This helps to soften the fruits for easy pounding as well as to inactivate the fat splitting enzymes which would otherwise raise the F.F.A. content of oil.

Stripping: The fruits are separated from the sterilised bunches by passing through a revolving, inclined slotted steel drum.

Fruit digestion: The digester comprises of a cylindrical vessel in which rotating knives pulverise the fleshy part of the fruit to a pulp and at the same time gets heated with injected steam. This releases the oil from the pulp and raises the temperature of the pulp to 95°C to increase fludity of the oil.

Pressing: The pulp passes through the press where the liquid component is separated from the solid. In small scale semi-commercial operations small hand-operated hydraulic presses are sufficient. The hydraulic press which can process upto 3 tonnes of FFB/hr has largely been superceded by the continuous screw press capable of handling 10-20 tonnes. This consists of one or more screws turning within a perforated cage through which the oil is expelled. The fibre and nuts pass to the depericarper.

Clarification: The crude oil from the press contains a mixture of oil, water, cell debris and particles of fibre and shell. It is first passed through a double vibrating screen to remove particles.

Hot water is then added and the oil is allowed to separate in clarification tanks from which it is continuously decanted. Finally the oil is passed through a high-speed centrifuge followed by an oil drier before storage.

Depericarping: The process involves the separation of the nut and fibre. The cake passes through a "matte breaker" where it is lacerated and dried by passing along a steam-jacketed conveyor fitted with peddle like agitators. In the depericarper, the nuts are separated by blowing off the lighter fibre in an air steam within a vertical cylinder. The nuts are cleaned and polished and the fibre is conveyed to the boiler station.

Nut cracking and drying: The nuts are shelled in a rotary cracker and the light fraction removed in an air stream to be used as fuel. Separation of shell from kernel is done and the kernel is passed through a drying silo and are ready for packing.

Palm Oil: Crude palm oil, gets semisolid at a temperature of 20°C. It is composed

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