

4R Nutrient management practices

for higher oil palm yield

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Availability of affordable fertilizers in the local market and nutrient limitations in the soils help choose the right nutrient source in oil palm plantations. Spatial variability of nutrients confirmed through geo-statistical analysis warrants for practicing site-specific nutrient management to determine right rate of nutrient application. Understanding active root zone in the basin area of oil palm and nutrient requirement is critical for right method of nutrient application.

Key words: Application method, Fertilizer, Nutrient requirement, Oil palm

OIL palm is the highest edible oil yielding perennial crop producing two types of oil i.e., crude palm oil and palm kernel oil, which are used for domestic and industrial purposes. It produces about 4 to 6 tonnes of crude palm oil and 0.4 to 0.6 tonnes of palm kernel oil per hectare per year during its productive life span from 4 to 30 years. Visualizing its potential, Government of India has given emphasis to expand the area under oil palm cultivation to meet the ever increasing vegetable oil demand of the country and reduce the expenditure on import of vegetable oils. At present, about 0.331 million ha area is under oil palm cultivation in India, with a potential of increasing it to 1.93 million ha spread over 19 states. Predominantly, the crop is cultivated in Andhra Pradesh, Tamil Nadu, Kerala, Goa, Mizoram, Gujarat, Karnataka, Maharashtra, Odisha, Chhattisgarh, Assam and Arunachal Pradesh. The 4R Nutrient Stewardship approach of nutrient management considers the right fertilizer sources applied in combination with the right rate, timing and placement. This approach can improve nutrient use efficiency, profitability and promote sustainable fertilizer use.

Right source of nutrients

In oil palm plantations, fertilizers like urea, ammonium sulphate and diammonium phosphate (DAP) may

be used as a source of nitrogen (N) as per their availability in the market. However, cheaper price of urea over the other sources makes it the choice of N source to the farmers. There is a strong interaction between N and phosphorus (P) fertilizers as applied N fertilizer will not be efficiently utilized unless adequate P fertilizer is applied. Fertilizers like single super phosphate (SSP), rock phosphate (RP) and DAP can be applied as a source of P nutrition. Rock phosphate is generally profitable in oil palm as compared to super phosphate. However, application of RP is not recommended under high pH conditions. Potassium may be applied as muriate of potash (KCl) or sulphate of potash (K_2SO_4) according to availability and price. KCl is relatively cheaper and easily available in the market. Magnesium sulphate ($MgSO_4$) can be applied as a source of Mg to oil palm. In boron (B) deficient areas, borax, boric acid and sodium tetraborate etc. are applied as a source of B. Responses of oil palm to other nutrients like sulphur (S), zinc (Zn), copper (Cu), iron (Fe) and manganese (Mn) have

not yet been reported in India.

Right rate of nutrients

The nutrient requirement of oil palm is high and it requires a balanced and adequate supply of macro and micro nutrients for growth and yield. It varies widely, and depends on the soil type, ground cover conditions, target yield, type of planting material, palm spacing, palm age, as well as climate and other environmental factors. It also depends on the amount of nutrients removed in harvested fruit bunches, nutrients recycled to the soil through pruned fronds, male inflorescences and leaf wash, and nutrients immobilized in the palm biomass.

The details of nutrient recommendation in oil palm, based on the palm age is given in Table 1. The nutrient application requirement varied across locations representing different agro-climatic regions. The authors also suggested the need for modifying the existing rates based on soil and leaf analysis. Application of boron at 10 g/palm/year is recommended in B deficient soils or when the B deficiency symptoms are noticed.

Table 1. Recommended dose of nutrients for oil palm

Age of the palm (years)	Nutrients (g/palm/year)			
	N	P ₂ O ₅	K ₂ O	MgSO ₄
1 st	400	200	400	125
2 nd	800	400	800	250
3 rd and above	1,200	600	1,200	500

Table 2. Leaf nutrient concentrations of oil palm plantations

Leaf nutrients	Goa (n=64)		Mizoram (n=34)		Karnataka (n=42)		Gujarat (n=26)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
N (%)	2.21	0.43	2.22	0.50	2.26	0.63	2.49	0.51
P (%)	0.44	0.06	0.53	0.10	0.10	0.05	0.16	0.01
K (%)	0.56	0.14	0.78	0.29	0.68	0.15	0.61	0.15
Mg (%)	0.48	0.10	0.63	0.15	0.61	0.27	0.65	0.14
B (mg/kg)	8.48	4.04	17.0	7.23	18.3	9.46	20.7	12.1

With the availability of organic nutrient sources like FYM, green manure and neem cake, application of 50-100 kg FYM or 100 kg green manure per palm per year is recommended. Neem cake @ 5 kg/palm/year can also be applied. Whenever organic fertilizers are applied, nutrient applications through chemical fertilizers need to be reduced proportionately.

Oil palm plantations were either under-fertilized or over-fertilized due to application of different quantities of fertilizers. Also, low cost and easy availability of some fertilizers have encouraged farmers to make excessive applications with the belief that high yields would be ensured. However, this management adversely affects productivity, fruit quality and ground water quality. It is therefore pertinent for the farmers to economize on fertilizer adopting a strategy for site-specific and/or area-specific management based on spatial variability of the field to make oil palm production environmentally sustainable and economically viable. A study conducted on spatial variability of leaf nutrients in oil palm plantations located in Goa, Karnataka, Mizoram and Gujarat states of India (Table 2) confirmed differential distribution pattern of nutrients. The spatial variability study of soil properties in surface and sub-surface layers of oil palm plantations recorded a wider variability in spatial distribution pattern. It signifies the necessity of determining spatial variability of nutrient status of oil palm plantations while formulating a differential fertilization programme and suggested for practicing site-specific nutrient management for sustainable oil palm cultivation.

Right time of nutrient application

Oil palm, though produces FFB round the year, its production reaches

peak during June to September in Indian condition. The nutrient demand in oil palm is due to continued growth of the trunk throughout palm's life and the continued production and removal of FFB. It changes with change in size of the canopy which is rapidly up to 3 years and then more slowly up to 8-10 years. The nutrient demand is higher particularly when very high yield is obtained. Single and frequent applications of nutrients reported at par FFB yield. The storage capacity of the oil palm for nutrients is probably sufficient to control any short-term differences in availability. However, it is advised to apply N, P and K fertilizers in four equal splits at three months interval under irrigated conditions to minimize the loss of nutrients and to ensure higher nutrient use efficiency. Irrigation should be given immediately after fertilizer application. Under rain-fed conditions, fertilizer application should be made shortly before the onset of the rainy season and not before or during the dry season or in the middle of the rains, and are generally given in two splits.

Right place/method of nutrient application

Understanding root distribution of oil palm becomes important for deciding the method of nutrient application. The root density was maximum at 2 m distance from palm base and decreases inversely with the



Right placement of fertilizer in oil palm

distance from palm base. Absorbing roots in adult palms spread up to a maximum distance of 2 m from the trunk and to a depth of 40 cm from the surface. For achieving higher water and nutrient use efficiency, irrigation and fertilizers should be applied up to 2 m from the palm trunk.

All the fertilizers should be evenly broadcasted over the clean weeded circles about 1 m away from the palm base and incorporated into the soil with the help of forks. The area of application should be extended as the weeded palm circles become progressively enlarged as the palm gets older. Under normal circumstances, N and K fertilizers should be applied in close sequence followed by Mg, P and B fertilizers. Fertilizers can be mixed in water when drip irrigation method is followed for enhanced nutrient and water use efficiency. Preliminary studies on fertigation in oil palm at ICAR-Indian Institute of Oil Palm Research, Pedavegi, Andhra Pradesh indicated saving of up to 50% of the recommended fertilizer, as compared to the conventional method of fertilizer application, to achieve 20 t/ha FFB yield. However, the use of soluble and compatible fertilisers, good quality irrigation water, and application of required quantity of water are the prerequisite of the successful fertigation system in oil palm.

SUMMARY

Nutrient requirement of oil palm varies from place to place as it depends on the soil type, ground cover conditions, target yield, type of planting material, palm spacing, palm age, as well as climate and other environmental factors. Balanced and adequate amount of nutrients needs to be applied to oil palm through implementation of improved nutrient management practices based on the 4R Nutrient Stewardship approach for obtaining higher nutrient use efficiency, better FFB yield and reduction in negative environmental impact.

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