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ENVIRONMENT**

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Nutrient Management in Cashew

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Majority of the cashew growing soils in India are lateritic, red and coastal sands which are acidic in nature with poor soil fertility. Limited nutrients or no use of fertilizers and organic manures is responsible for low productivity in cashew. Most deficient nutrients in cashew growing soils are nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), zinc (Zn), boron (B) and molybdenum (Mo). It has been estimated that for every one kg of cashew nut produced, the plant depletes the soil by 64.1 g N, 2.05 g P, 24.7 g K, 4.19 g calcium (Ca), 1.57 g sulphur (S), 525.7 mg iron (Fe), 63.6 mg manganese (Mn), 87.8 mg Zn and 26.5 mg copper (Cu) nutrients. Cashew requires regular fertilizer application to ensure early and high yields in new / young plantations, and regular high yields from mature plantations. Hence, nutrient management is useful venture in cashew.

The availability of soil nutrients to cashew plants depends on several factors. It may be due to low amounts in the parent material from which the soil is derived, fixation and immobilization of nutrients, or leaching losses of nutrients under high rainfall conditions, nutrient imbalances in the soil and continuous cultivation due to removal of nutrients by cashew plants without subsequent replenishment.

Nutrient dose and response

The major nutrients viz., nitrogen (N), potassium (K) and potassium (P) are required most for cashew growth and development. Nitrogen has more influence on tree growth, production and quality of cashew. Urea is the most commonly used nitrogenous fertilizer in India. Potassium is the second major nutrient next to N required by cashew. Among different sources of K fertilizers, Muriate of potash (potassium chloride) is most commonly used fertilizer in cashew. The recommended dose of K varies from 125 to 750 g/tree/annum as basal depends upon the nature of soil, spacing and age of the cashew plant. Phosphorus is the second most limiting nutrient after N and K in the nutrition of cashew. Phosphorus deficiency is common in cashew growing acid soils in which the mineral fraction is dominated by kaolinite and sesquioxides. Phosphate fixation of water soluble P is greater in cashew growing acidic soils dominated by kaolinitic type of clay mineral but allows the use of rock phosphate as a good source of P to cashew crop. Of phosphatic fertilizers for use on acid soils in India, the slow-release and more efficient ground Mussoorie (rock) phosphate is popular.

The recommended dose of fertilizers varies with the age of plants, plant density and fertility of the soil. About 10 to 15 kg farmyard manure (FYM)/plant/year is recommended in addition to primary nutrients (N, P and K). Recommended fertilizer dose by ICAR-Directorate of Cashew Research (DCR), Puttur are as follows: 500 g N and 125 g each of P and K and 10 kg poultry manure per tree per year under normal density planting system (10 m x 5 m; 200 plants/ha); 250 g N and 50 g each of P and K and 10 kg poultry manure per tree per year under high density planting system (4 m x 4 m; 625 plants/ha). After certain stage of the crop, reduction in recommended doses of fertilizers per plant may be necessary due to the nutrient build up in soil due to the deposit of cashew biomass fall out. It has been estimated that by systematically recycling all the waste biomass produced by cashew, it is possible to get back 20.7 kg N, 10.5 kg P₂O₅ and 30.8 kg K₂O /ha/year.

Time and method of fertilizer application

The key to enhance fertilizer use efficiency is to synchronize the time of fertilizer application with the growth need of the crop and period of high root activity. Flushing and early flowering phase (September to December) is the most appropriate time for fertilizer application in a cashew orchard. Fertilizers are applied in two split doses in Cashew, the first at the onset of the monsoon period and the second during the post-monsoon period.

Cashew trees are surface feeders with 72 per cent of root activity found within a 2 m radius from the tree trunk. Hence, fertilizer application within 2 m radius from the main stem results in efficient utilization of the applied nutrients. In Cashew the best suited methods of fertilizer application are viz., application of fertilizers in two circular trenches (1.5 and 3.0 m from the trunk) for sandy soils; a single trench method (25 cm wide and 15 cm deep circular trench at 3 m from the trunk) for sloping ground, and the band method (in a circular band 1.5-3.0 m from the trunk + soil incorporation) for flat ground. Flushing and early flowering phase (September to December) is the most appropriate time for fertilizer application in cashew orchard.

Foliar feeding

Deficiency or toxicity of essential micronutrients viz., Fe, Mn, Zn, Cu, B, Mo, chlorine (Cl) and nickel (Ni) in soil adversely affects the growth and development of cashew plants. Among micronutrients, deficiencies of Zn, B and Mo are more common in cashew growing acid soils. Iron and Al toxicity is a distinct problem. Micronutrient deficiencies in soil not only limit the cashew production but it also has negative effects on human health. Foliar feeding is often the most effective and economical way to correct micronutrient deficiencies in horticultural crops. Foliar application of nutrients normally reduces the loss through adsorption, leaching and other processes associated with soil application. Deficiencies of micronutrients can be corrected by foliar sprays of ferrous sulphate (0.5-1%), manganese sulphate (0.5-1%), zinc sulphate (0.5%), copper sulphate (0.1%), solubor (0.1%) and Mo (0.1%) salts to cashew at the emergence of the flush, panicle initiation and fruit set stages.

Integrated Nutrient Management

Application of chemical fertilizers, organic manures / green manuring and biofertilizers constitute an efficient nutrient management strategy in cashew to enhance the soil quality and also for sustainable production. Green leaf manuring with *glyricidia* and *sesbania* in cashew resulted in higher nut yield and improvement in soil nutrient content. The *glyricidia* contributed 186 kg N, 23.6 kg P₂O₅ and 126.2 kg K₂O/ha and *sesbania* contributed 141 kg N, 17.9 kg P₂O₅ and 162.3 kg K₂O/ha. Application of *Azospirillum*, *Azotobacter* and Vesicular Arbuscular Mycorrhizae increased the germination percentage of nuts and plant growth, and reduced the incidence of fungal diseases in the Cashew nursery.

About 15.5–37.7% of tree total requirements of macronutrients are recycled from canopy biomass fallout of leaves. Studies conducted at ICAR-DCR, Puttur on nutrient budgeting and nutrient balance in a six year old cashew plantation of 'Bhaskara' variety under high density planting system (625 trees/ha) showed a negative N, P and K balance of 113, 38 and 92 kg/ha in control plot where no fertilizer was applied. A strong positive N, P and K balance ranged from 128 to 253, 18 to 54 and 34 to 128 kg/ha were recorded in plots with 2/3rd and full dose of recommended fertilizers (750 g N and 150 g each of P₂O₅ and K₂O per tree/year).

Organic production of cashew offers immense potential. The availability of cashew leaf litter from different age group plantations (10 to 40 years) ranged from 1.38 to 5.20 t/ha. Studies have shown that about 5.5 tonnes of available cashew biomass waste per ha can be converted into 3.5 tonnes of compost which can meet nutrient requirement to cashew by 50 per cent.

The application of fertilizers through the irrigation water (fertigation) has the advantages of increasing the efficiency of the fertilizers and reducing the costs of labour and machinery for its application. In Cashew, water soluble fertilizers like urea, diammonium phosphate and muriate of potash are used for fertigation through drip lines from December to March and application of 2 kg castor cake to soil during August. With fertigation, quantity of nutrients (through fertilizers and organic manures) to be applied can be reduced to half of the quantity of recommended nutrients. An increase of 100 per cent and 226 per cent in yield was observed in the treatment received half of recommended dose of NPK in inorganic form (Recommended dose: 500 g N, 125 g each of P_2O_5 and K_2O /tree/year) of nutrients through fertigation indicating better nutrient use efficiency.

CONCLUSION:

Cashew requires regular fertilizer application to ensure early and high yields in new or young plantations and regular high yields from mature plantations. Application of chemical fertilizers, organic manures / green manuring and biofertilizers constitute an efficient nutrient management strategy in cashew to enhance the soil quality and also for sustainable production.