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Monsoon Nutrient Management in Arecanut: Strategies for Higher Yield, Better Nutrient Use Efficiency and Soil Health

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Arecanut (*Areca catechu* L.) is one of the most important plantation crops cultivated extensively in Karnataka, Kerala, Assam, and other parts of India. Karnataka contributes more than 60% of the country's arecanut production. The crop is highly responsive to nutrient management due to its perennial nature, continuous growth habit, and substantial nutrient removal through harvest. Monsoon plays a crucial role in arecanut cultivation. While adequate rainfall promotes nutrient dissolution and root activity, excessive rainfall often causes nutrient leaching, soil erosion, poor aeration, and nutrient imbalances. Therefore, scientific nutrient management during the monsoon season is essential to sustain productivity, improve nutrient-use efficiency, and maintain soil health.

Importance of Nutrient Management During Monsoon

The southwest monsoon replenishes soil moisture and stimulates active root growth in arecanut. However, heavy rains can wash away mobile nutrients such as nitrogen and potassium, especially in lateritic and sandy soils. Improper fertilizer application during this period may result in:

- Nutrient losses through leaching
- Reduced fertilizer-use efficiency
- Nutrient deficiencies
- Poor nut development
- Increased susceptibility to diseases

Scientific nutrient management helps to:

- Maintain balanced nutrition
- Improve root activity
- Enhance bunch development and nut filling
- Increase nutrient-use efficiency
- Sustain long-term soil fertility

Nutrient Requirement of Arecanut

ICAR-CPCRI recommends the following annual fertilizer schedule for bearing arecanut palms:

Nutrient	Quantity per Palm per Year
Nitrogen (N)	100 g
Phosphorus (P_2O_5)	40 g
Potassium (K_2O)	140 g
FYM/Compost	12 kg
Green Leaf Manure	12 kg

These recommendations should preferably be modified based on soil-test results for achieving higher fertilizer efficiency.

Nutrient Uptake Pattern in Arecanut

Studies have shown that nutrient uptake by arecanut follows the order:

N > K > Ca > P > Mg

Among micronutrients:

Fe > Mn > Cu > B > Zn

This indicates the importance of adequate nitrogen and potassium supply for sustaining yield and palm vigor. Potassium is particularly important under high-rainfall conditions due to its high mobility in soil.

Monsoon Nutrient Management Strategies

1. Split Application of Fertilizers

Split application minimizes nutrient losses during periods of heavy rainfall.

For rainfed plantations:

- First dose (May–June): 35 g N, 15 g P_2O_5, and 50 g K_2O per palm after receiving sufficient rainfall.
- Second dose (September–October): 65 g N, 25 g P_2O_5, and 90 g K_2O per palm.

This practice improves nutrient availability throughout the growing season and reduces leaching losses.

2. Application of Organic Manures

Organic matter plays a significant role during monsoon by improving soil structure, moisture retention, and nutrient-holding capacity.

Recommended organic inputs include:

- Farmyard manure (FYM)
- Compost
- Vermicompost
- Green leaf manure
- Arecanut husk compost

Application of 12 kg organic manure per palm during monsoon enhances microbial activity and nutrient recycling. Organic amendments also reduce nutrient losses caused by heavy rainfall.

3. Recycling of Plantation Biomass

An arecanut garden generates approximately 5–8.5 tonnes of organic residues per hectare annually.

Materials that can be recycled include:

- Fallen leaves
- Leaf sheaths
- Husk
- Intercrop residues

Composting these materials and returning them to the soil helps maintain soil organic carbon and reduces dependence on external fertilizers.

4. Use of Green Manure Crops

Green manure crops can be established before monsoon onset. Suitable species like *Stylosanthes gracilis*, *Calopogonium mucunoides*, *Pueraria javanica*, *Mimosa invisa*, Sunhemp can be used which helps in biological nitrogen fixation, prevention of soil erosion, weed suppression and improves of soil organic matter. These crops may be incorporated into the soil during October after sufficient biomass production.

5. Micronutrient Management

Continuous rainfall often reduces the availability of micronutrients.

Zinc Deficiency

Common symptoms:

- Crown choking

- Crown bending
- Oblique nodes
- Reduced leaf size

Boron Deficiency

Common symptoms:

- Fused leaf tips
- Thick leaf sheath
- Distorted young leaves

In deficient soils, corrective application of zinc sulphate and borax can significantly improve growth and yield. Studies have reported increased productivity with supplementation of zinc and boron in arecanut plantations.

6. Soil Acidity Management

Most arecanut-growing areas experience heavy rainfall leading to soil acidification.

Where soil pH falls below 5.0:

- Apply lime @ 1 kg per palm.
- Apply 15–20 days before fertilizer application.
- Incorporate lightly into the soil.

Liming improves nutrient availability and root activity while reducing aluminum toxicity.

7. Drainage Management for Efficient Nutrient Utilization

Nutrient uptake is closely linked with root health.

During monsoon:

- Provide adequate drainage channels.
- Maintain drains 25–30 cm deeper than the palm basin.
- Prevent water stagnation around roots.

Poor drainage reduces oxygen availability, damages feeder roots, and decreases nutrient uptake efficiency.

Integrated Nutrient Management (INM)

Integrated Nutrient Management (INM**)** involves the combined use of chemical fertilizers, organic manures, crop residue recycling, biofertilizers, and soil test-based fertilizer application to achieve balanced crop nutrition. This integrated approach enhances nutrient-use efficiency, improves soil biological activity, increases nutrient availability, sustains long-term productivity, and reduces production costs. Studies have shown that integrating organic nutrient sources with recommended fertilizer doses significantly improves growth, flowering, yield, and overall soil health in arecanut-based cropping systems.

Role of Biofertilizers During Monsoon

Biofertilizers are highly effective during the monsoon due to favourable soil moisture conditions. The application of Azospirillum**,** Azotobacter**,** Phosphate Solubilizing Bacteria (PSB**)** and Arbuscular Mycorrhizal (AM) fungi improves biological nitrogen fixation, enhances phosphorus availability, promotes root growth, and increases nutrient uptake. Their combined use with organic manures and recommended fertilizers improves nutrient-use efficiency, soil health, and the sustainability of arecanut production.

Practical Nutrient Management Schedule for Monsoon

Month	Operation
May–June	First split fertilizer application
June–July	Application of FYM and organic residues
June–August	Green manure establishment
July–August	Drainage maintenance
August–September	Lime application (acid soils)
September–October	Second split fertilizer application
October	Incorporation of green manure crops

Conclusion

Monsoon is both a blessing and a challenge for arecanut cultivation. While rainfall promotes vigorous growth, it can also cause significant nutrient losses through leaching and runoff. Efficient nutrient management during this period should focus on split fertilizer application, adequate organic matter addition, biomass recycling, green manuring, micronutrient correction, and proper drainage management. Adoption of integrated nutrient management practices based on soil testing can substantially improve nutrient-use efficiency, maintain soil fertility, and enhance arecanut productivity in a sustainable manner. Scientific nutrient management not only increases yield but also improves resilience of plantations against climatic variability and disease incidence.

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