Farming Practices

Integrated nutrient management in coffee

Farmer Group Educator (FGE) training sessions

FGE training sessions

Farming practices

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Gender & ESS

Financial literacy

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Characteristics of coffee soils

- Should be deep (≥70 cm) with good porosity (> 100 mm per meter) to allow good drainage and root penetration)
- Water table 2 m below surface
- pH – slightly acidic (6.2 to 6.5)
- Rich in soil organic matter (~2%)

Soil testing

Soil testing – why it is needed

- To know the pH of soil and to correct the pH to suitable level using soil amendments
- To know the soil fertility status (organic matter, major nutrients), which help in arriving at correct doses of fertlisers
- To identify sufficiency / deficiency of nutrients
- Typically soil testing should be done once every 2-3 years

How to collect soil samples

Sample collection

Quartering method

Compound sample

Packing & labelling

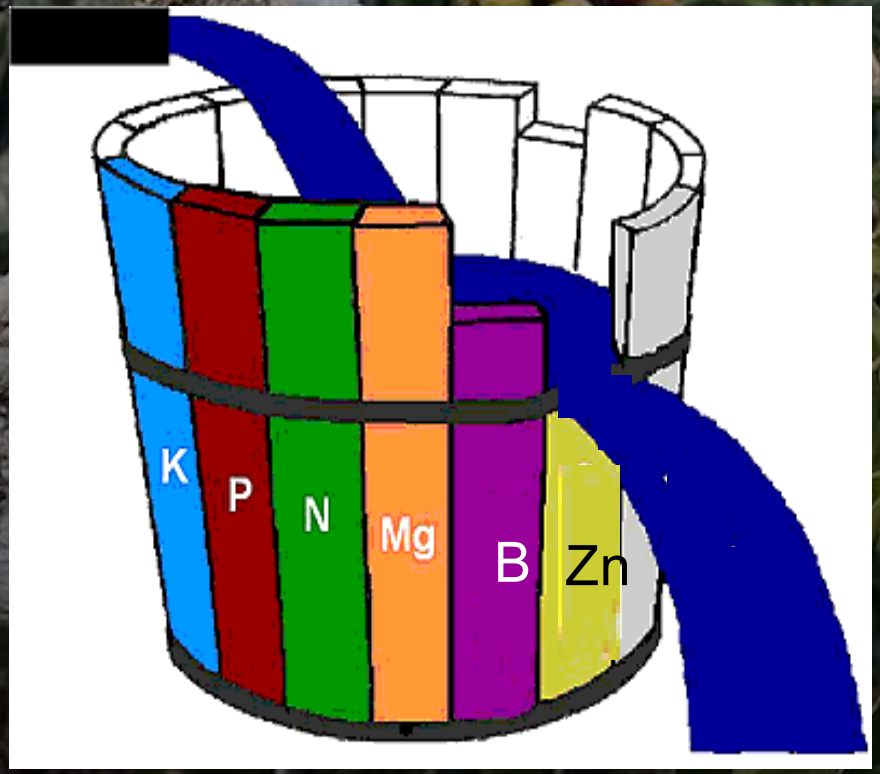
Soil amendments for correcting soil pH

- Optimum pH for normal growth of coffee and efficient use of applied nutrients is in the range of 6.2 to 6.5 (slightly acidic)
- Coffee soils tend to become highly acidic (pH falling below 5) due to high rainfall, which leads to leaching of cations like K, Ca, Mg etc.
- Under strongly acidic condition, most of the essential nutrients become unavailable to the plants
- Under low pH condition the growth of beneficial microorganisms is curtailed
- Hence it is important to correct the pH of coffee soils to maintain it around 6.2-6.5
- Soil amendments like Ag. lime (calcium carbonate) and Dolomite (calcium, magnesium carbonate) are commonly used for correcting soil pH

Essential nutrients

Essential nutrients for plant growth

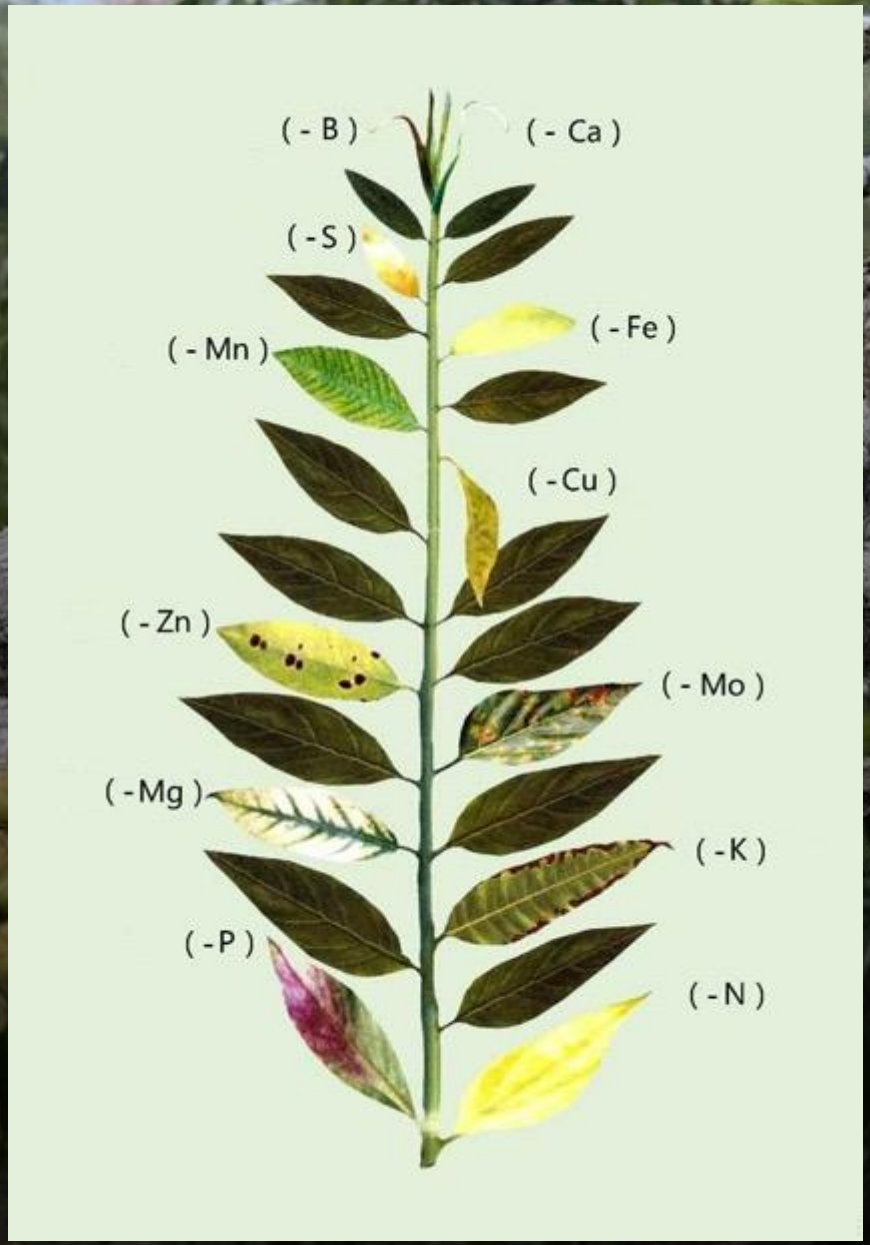
- Major nutrients: Nitrogen (N), Phosphorus (P), Potassium (K)
- Secondary nutrients: Calcium (Ca), Magnesium (Mg), Sulphur (S)
- Micronutrients: Zinc (Zn), Boron (B), Iron (Fe), Copper (Cu), Molybdenum (Mo), Manganese (Mn), Chlorine (C)
- Carbon (C), Hydrogen (H), Oxygen(O) available in the atmosphere



Function of nutrients

Nutrient	Functions	Peak Demand
Nitrogen	Vegetative growth	Throughout the year
Phosphorus	Root growth, flowering, fruiting, quality	Establishment stage, Flowering & fruit setting stages
Potassium	Fruit development, bean size, resistance to Pests & diseases	Berry maturation
Calcium	Resistance to drought, pests & diseases	Throughout the year
Magnesium	Yield, resistance to pests & diseases	Berry maturation stage
Sulphur	Resistance to pests & diseases, quality	Berry maturation stage
Micronutrients	Enhance FUE; assist in plant metabolic activity; Pest, disease & drought resistance; improve quality	Throughout the year

Nutrient deficiency symptoms



Source: acefertilizer.com

Sources of nutrients

Sources of plant nutrients

- Fertilisers
  - Straight fertilisers, complex fertilisers, mixed fertilisers, micronutrient formulations
- Organic manures
  - FYM, compost, vermicompost
- Biofertilsers
  - N-fixers, P-solubilizers, VAM

Common commercial fertilisers used in coffee

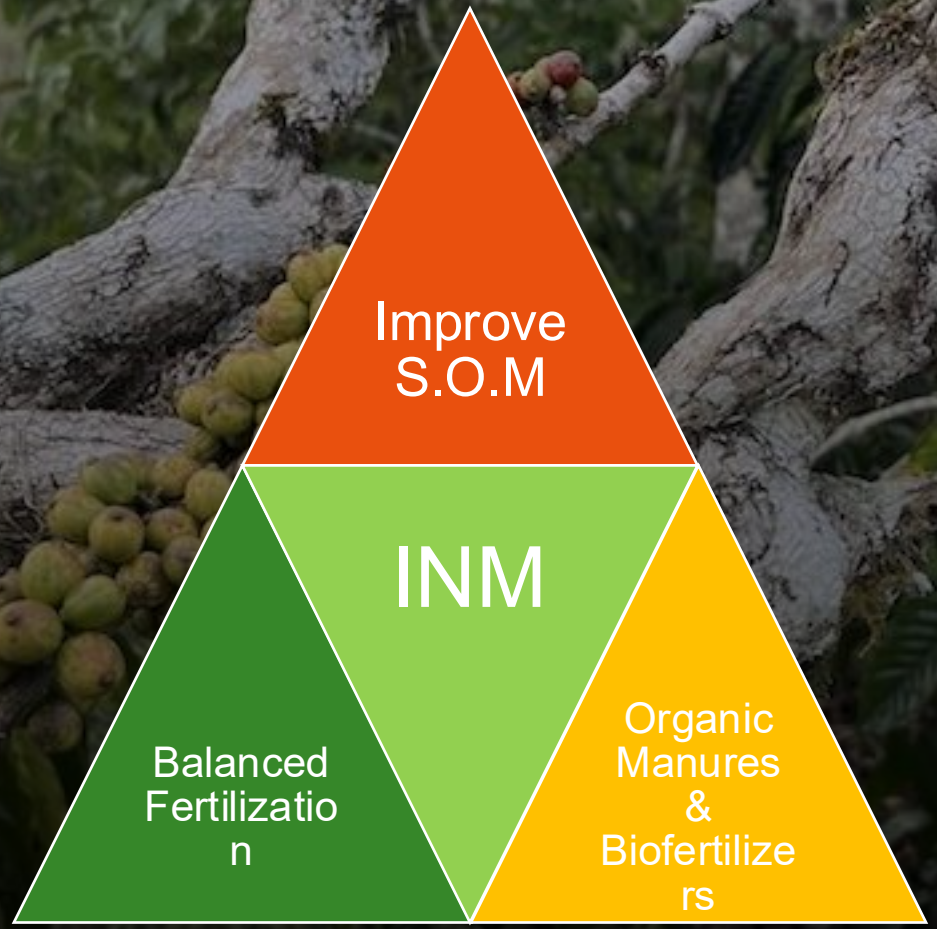
Fertilizer	N (%)	P_2O_5 (%)	K_20 (%)	CaO (%)	MgO (%)	S (%)
Urea	46	-	-	-	-	-
Rock Phosphate	-	16-18	-	-	-	-
Muriate of Potash (KCl)	-	-	60	-	-	-
Sulphate of Ammonium (SA)	21	-	-	-	-	23
Di-ammonium Phosphate (DAP)	18	46				
Single Super Phosphate (SSP)	-	16-20	-	-	-	11-12
Fused Ca-Mg Phosphate	-	14-16	-	28-30	18	-
NPK (16:16:8)	16	16	8	-	-	-
NPK (16:8:16)	16	8	16	-	-	-
NPK (15:15:15)	15	15	15	-	-	-
NPKS (16:8:14:13)	16	8	14	-	-	13
NPK (14:7:14)	14	7	14	-	-	-

Integrated nutrient management

Why integrated nutrient management (INM)

- Total dependence on chemical fertilizers to meet the nutrient requirement of plants is not advisable for the following reason
  - Fossil fuels used in their production – contribute to climate change
  - Ground water contamination - NO_3
  - Volatilization of certain elements like No_2 - contributes to GHGs
  - Excess use affects soil health and makes the soil unproductive
- Integrated Nutrient Management
  - Meeting the plant nutrient requirement with organic manures, biofertilizers and fertilizers
  - reduces chemical fertilizers and maintains soil health
  - sustainable coffee production

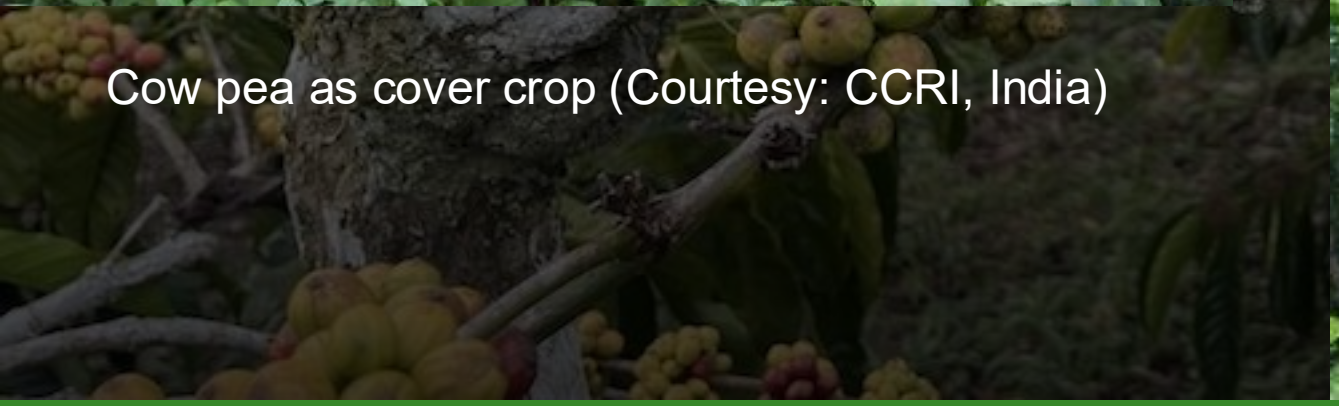
Essentials of INM



In situ enrichment of organic matter

- Shade trees contribute substantial qualities of biomass in the form of leaf litter which improves soil organic matter
- During early stages of coffee establishment - growing of green manure crops with *Crotolaria striata, C. anagyroides, Tephrosia vogelii* and cover crops like cowpea, horse gram etc., improves soil organic matter (6-10 tons of dry matter/ ha)
- Cover crops also help in suppression of weed growth
- Organic matter helps retain moisture & nutrients and release them slowly to the plants. It also facilitates growth of beneficial microorganisms in the soil

Wild groundnut as cover crop (Courtesy: WASI, Vietnam)



Cow pea as cover crop (Courtesy: CCRI, India)

Organic manures

- All available biomass on the farm like cherry pulp/ husk can be composted along with weed and leaf biomass
- The composts can be enriched by mixing biofertilizers like P-solubilizers and VAM one week before field application
- Application of enriched composts @ 8-10 tons per ha once in 2 years improves soil organic matter content
- Composts should be applied in furrows/ trenches (30cm width, 15-20 cm depth) 2-3 ft away from the tree trunk along the drip circle and covered with a layer of soil
- Always decompose organic matter before application to avoid ants and harmful microorganisms
- When organic manures/ composts are integrated into the nutrition management, the dosage of fertilizers can be reduced by one-third

On-farm composting

Source: CCRI, India

Balanced fertilisation

- Apply recommended fertilizers at least in 2 rounds per year, once at the beginning of rainy season and again towards the end of rainy season
- In case of irrigated fields, an additional split round of fertilization at the time of flowering is advantageous
- The recommended phosphorus can be applied in one single dose towards the end of rainy season
- Along with NPK, it is essential to apply secondary nutrients like Mg and S in the form of Mg SO_4 @ 25 kg/ ha by mixing with fertilizers before application
- Micronutrient sprays are suggested during post monsoon period especially after a bumper crop

Things to remember while applying fertilizers

- Testing of soil once in 2-3 years
- Correction of soil pH (Ag.lime/ Dolomite) – essential to avoid over use of fertilizers
- Straight (single source) fertilizers are cost effective over complex fertilizers
- Apply fertilizers when there is sufficient moisture in the soil
- Apply the fertilizers in a circular band the around the trunk by leaving a gap of 1-2 ft
- For intercrops – adopt separate nutrition management as per recommendations

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