

COFFEE NUTRITION





INTRODUCTION

For optimum performance of the coffee tree, sustainable soil fertility management is critical. A fertilization program is dependent on inherent soil characteristics and expected production level.

NUTRITIONAL REQUIREMENTS

The coffee tree requires certain elements in large quantities such as Nitrogen (N), Phosphorous (P), Potassium (K) among others. These elements are referred to as **Macro-nutrients**.

Other elements are required in very small quantities such as Zinc (Zn), Boron (B), Iron (Fe), Manganese, Molybdenum, chlorine among others . These are referred to as **Micro-nutrients**.

Table 1: Macro-nutrients and their importance

ELEMENT	IMPOTRANCE IN COFFEE
Nitrogen (N)	<ul style="list-style-type: none">• Vegetative growth• Crop bearing capacity• Bean size
Phosphorus (P)	<ul style="list-style-type: none">• Roots and bearing wood development• Early berry maturity• Bean density
Potassium (K)	<ul style="list-style-type: none">• Berry development and ripening• Mucilage formation• Water utilization efficiency
Magnesium (Mg)	<ul style="list-style-type: none">• Enhances bean colour (Blue/Green grey colour)• Food formation
Calcium (ca)	<ul style="list-style-type: none">• Growth of Terminal buds/flower formation

Table 2: Micro-nutrients and their importance

ELEMENT	ROLE IN COFFEE
Zinc (Zn)	<ul style="list-style-type: none">• Plant Hormone• Influences leaf size• Intensifies flower initiation and formation
Boron (B)	<ul style="list-style-type: none">• Promotes shoot growth• Facilitates optimal flowering/fruit set• Enhances fruit set
Iron (Fe)	<ul style="list-style-type: none">• Chlorophyll synthesis for food formation• Promotes bean colour (lack of iron leads to amber beans)
Sulphur (S)	<ul style="list-style-type: none">• Enhances aroma of the liquor

Fertilizers Recommended for Coffee

Straight fertilizers - Supplies one nutrient

Nitrogen Fertilizers

- Calcium Ammonium Nitrate (CAN) 26% N
- Ammonium sulphate nitrate (ASN) 26% N
- Ammonium Sulphate (AS)- 20 21% N
- Urea 46 % N

Phosphate Fertilizers

- Single super phosphate (SSP)18 -22% P2O5
- Di-ammonium phosphate (DAP) 46% P2O5
- Triple super phosphate (TSP) 46% P2O5
- Phosphoric acid

Potassium Fertilizers

- Sulphate of potash (Potassium sulphate)
- Potassium chloride (Muriate of potash)
- Magnesium Fertilizers
- Magnesium sulphate (Epsom Salts)

- Magnesium Nitrate
- Calcium Fertilizers
- Calcite - Agricultural Lime
- Dolomite - Magmax
- Gypsum - Calcium sulphate (plaster of Paris)

Zinc Fertilizers

- Zinc Oxide
- Zinc Sulphate
- Boron Fertilizers
- Borax
- Solubor

Compound Fertilizers -supply more than one nutrient

These are fertilizers consisting of a mechanical mixture screened to homogenous granules each having certain proportion of primary nutrient (NPK) such as 20:10:10 or 17:17:17

Use of Compound Fertilizers

- If two or more nutrients are limiting in the soil, it's economical to apply a compound fertilizer
- One of the annual N-fertilizer application should be replaced with a compound fertilizer at a rate sufficient to supply the same quantity of Nitrogen.
- To help maintain an optimum pH (soil reaction) a compound fertilizer should be followed by two applications of Nitrogen
- For maximum benefit and production of new bearing wood

Foliar Fertilizers

Used to Supplement soil applied fertilizers with the aim of;

- correcting nutrient deficiency
- supplementing nutrient availability/utilization where soil Nutrient uptake is impeded during dry weather.

Apply when transpiration is low i.e. when it's not hot (morning/evenings)

Manures/Mulches

Organic manures and mulch materials act as sources of plant nutrients after decomposition process. Amounts of nutrients released depends on:

- nature and origin of material
- rate of decomposition
- climatic conditions

Hence the material to be used should depend on soil nutrient requirement in order to avoid inducing nutrient imbalances.

Attributes of Manures/ Mulches;

- Improves soil texture and structure
- improves soil aeration
- Moderates top soil temperatures
- Minimizes top soil moisture loss
- Increases microbial activity
- Suppresses weed/insect pests
- Control soil erosion
- Poultry manure - rich in phosphorus and Nitrogen

Recommended General Fertilizer Application Regime

Liming

Apply lime at 250 g /tree per year during dry weather in order to maintain a suitable soil pH (acidity). Broadcast between rows

N.P.K application

Apply 6 months before main flowering (April for October /November flower

ing) and October for March/April flowering) at the rate of 250g/tree and 2 weeks after the onset of rains. Apply along the drip line and incorporate shallowly in the soil.

Boron/Zinc application

2 months before the main flowering, apply a foliar mixture of Zinc and Boron at the rate of 2 - 3 kg of each/ha (40 - 60 g of each/20 l of water)

Nitrogen application

- Apply nitrogen fertilizer (CAN/ASN) after the main flowering at the rate of 300 g/tree/year
- Apply in 2 equal splits east of Rift Valley at 3- 4 week interval (150 g/application)
- Apply in 3 equal splits west of Rift Valley at 3-4 week interval (100g/ application)
- Apply along the drip line 2 weeks after the onset of rains
- If trees are carrying a heavy crop, apply a foliar fertilizer rich in Nitrogen during the dry spell e.g. Urea (46% N) at the rate of 10 kg/ha (10kg in 1000 l of water or 200 g /20 l of water)

Manure application

Apply 1- 2 debes of well decomposed manure/coffee pulp once a year during dry weather (January or August)

Rates of Fertilizer Application

Table 3: Nitrogen Fertilizers

Soil Reaction (pH)	Acid soil (pH below 4.4)	Moderately acid soil (pH 4.4 - 5.4)	Mildly acid soil (pH over 5.4)
N Fertilizer	For every 3 application use CAN twice, ASN or Urea* once	Alternate between CAN/ ASN	AS/ASN

*if urea is used, it must be incorporated into the top soil to avoid loss of nitrogen through volatilsation if the fertilizer is left on the surface.

Table 4: Phosphorus Fertilizers

Soil reaction pH	Acid soil (below pH 4.4)	Moderate acid soil (pH 4.4 - 5.4)	Mildly acid soil (over pH 5.4)
Forms of Phosphate fertilizers	TSP	TSP SSP	DAP

Table 5: Application rates based on production

Amount of crop estimated in the current season	Kg N/ha/year	Grams of fertilizer/tree		Kg of fertilizer/ha	
		21% N	26% N	21% N	26% N
Less than 1000 kg clean coffee/ha (5 kg of cherry/tree)	80	330	260	390	310
1000-1500 kg clean coffee/ha (5-7 kg of cherry/tree)	100	358	290	476	385
1500–2000 kg clean coffee per hectare (7–10 kg of cherry/tree)	100–150	358 to 538	290 to 434	476-715	385-577
Over 2000 kg clean coffee per hectare (over 10 kg of cherry/tree)	Up to 200	716	578	952	769
N/B: Farm specific recommendations for fertilizers can only be given based on soil and leaf analysis					

MONTHLY COFFEE NUTRITION SCHEDULES

MONTH	TYPE AND AMOUNT OF FERTILIZER		
	Central Province and Embu	Meru , Machakos, Makueni and Taita	Western, Rift valley and Nyanza
Jan	<ul style="list-style-type: none"> -Zinc Oxide or Zinc Sulphate and Solubor application @ 40-60 g/20 l of water -Soil and leaf analysis (after every 2 years) -Liming based on soil analysis or 250 g/tree/yr if analysis has not been done 	<ul style="list-style-type: none"> -Urea Foliar application: 1st round @ 200 g/20 l of water (enough for 25–30 trees) - Soil and leaf analysis (after every 2 years) -Epsom Salt: 1st round @ 100 g/20 l of water (enough for 25–30 trees) 	<ul style="list-style-type: none"> -Zinc Oxide or Zinc Sulphate and Solubor application @ 60 g/20 l of water (enough for 20–30 trees)
Feb	Foliar application high in Nitrogen and Potassium	<ul style="list-style-type: none"> -Urea foliar application: 2nd round @ 200 g/20l of water (enough for 25 –30 trees) -Epsom salt: 2nd round 100 g/20 l of water 	<ul style="list-style-type: none"> -Liming based on soil analysis (can also be done in January)
Mar	Manure application 1 – 2 debes/tree every 2 yr (can be done from mid Feb to mid march)	Manure application @ 1–2 debes/tree	Manure application @ 1-2 debes/tree every 2 yr (can be done from mid Feb to mid march)
April	Nitrogen fertilizer: CAN or ASN @ 150 g/tree	Compound fertilizer: NPK Fertilizer @ 250 g/tree	Nitrogen fertilizer: CAN or ASN @ 100 g/tree
May	Nitrogen fertilizer: CAN or ASN @ 150 g/tree	No application	Nitrogen fertilizer: CAN or ASN @ 100 g/tree
June	Foliar spray high in Nitrogen and Potassium	No application	Nitrogen fertilizer: CAN or ASN @ 100 g/tree
July	<ul style="list-style-type: none"> -Zinc Oxide or Zinc Sulphate and Solubor application @40-60 g/20 l of water -Urea Foliar application: 1st round @ 200g /20 l (5k g/ha) -Epsom Salt: 1st round @ 100 g/20 l of water (enough for 25-30 trees) i.e 2.5 kg/ha 	<ul style="list-style-type: none"> Zinc Sulphate and Solubor application @ 60g per 20 litres of water (enough for 20 – 25 trees) - Liming based on soil analysis by broadcasting or 250 grams/tree/year if analysis has not been done 	<ul style="list-style-type: none"> -Urea foliar application 1st round @ 200g/20litres of water (enough for 25 – 30 trees) -Epsom Salt: 1st round @ 100g/20 litres of water (enough for 25 – 30 trees)

Aug	-Urea foliar application: 2 nd round @ 200 g/20 l of water (enough for 25–30 trees) -Epsom salt: 2 nd round 100 g/20 l of water -soil and leaf analysis every 2 yr if not done in January	Manure application @ 1-2 debes/tree	-Urea foliar application: 2 nd round @ 200 g/20 l of water (enough for 25–30 trees) Use two 100 ml Kiwi tin - Epsom Salt: 2 nd round @ 100 g/20 l of water (enough for 25– 30 trees)
Sept	Manure application @ 1-2 debes/tree	Manure application @ 1-2 debes/tree	Compound fertilizer: NPK Fertilizer @ 250 g/tree
Oct/Nov	Compound Fertilizer: NPK Fertilizer @ 250 g/tree	Nitrogen fertilizer: CAN or ASN @ 300 g/tree in two splits at an interval of 4 weeks	Nothing
Dec	No application	No application	Soil and Leaf analysis after every 2 years

N/B The schedule is based on the rainfall pattern for each region .

Highlights On Good Agricultural/hygienic Practices

- Good nutrition results in vigorous growing plants which reduces susceptibility of crop to pests and diseases.
- Good nutrition gives uniform sized beans which pulp, ferment, dry and roast uniformly.
- Adequate N supply is associated with larger, bold or beans which are of high quality.
- Adequate K supply promotes uniform ripening of berries that prevent prolonged harvest period.
- K also ensures adequate mucilage in the cherries that prevent nipping of beans during pulping. Nipping of beans could be a source of mould infection during primary processing which could lead to development of mycotoxins such as **ochratoxin-A (OTA)**.
- Phosphorus (P) deficiency leads to undersized beans, (ragged/low density beans) which leads to lack of body in the final cup.
- Iron deficiency leads to discoloration of beans (amber beans) which are of poor cup quality.





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Editorial and Publication Coordinated by:
Knowledge, Information and Outreach Unit

KALRO Advisory Bulletin Series No. 2017/001

Kshs. 50