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# 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) | • Vegetative growth<br>• Crop bearing capacity<br>• Bean size |
| Phosphorus (P) | • Roots and bearing wood development<br>• Early berry maturity<br>• Bean density |
| Potassium (K) | • Berry development and ripening<br>• Mucilage formation<br>• Water utilization efficiency |
| Magnesium (Mg) | • Enhances bean colour (Blue/Green grey colour)<br>• Food formation |
| Calcium (ca) | • Growth of Terminal buds/flower formation |

**Table 2: Micro-nutrients and their importance**

| ELEMENT | ROLE IN COFFEE |
|---|---|
| Zinc (Zn) | • Plant Hormone<br>• Influences leaf size<br>• Intensifies flower initiation and formation |
| Boron (B) | • Promotes shoot growth<br>• Facilitates optimal flowering/fruit set<br>• Enhances fruit set |
| Iron (Fe) | • Chlorophyll synthesis for food formation<br>• Promotes bean colour (lack of iron leads to amber beans) |
| Sulphur (S) | • 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 its 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<br>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 NUTRTION SCHEDULES

| MONTH | TYPE AND AMOUNT OF FERTILIZER | | |
|---|---|---|---|
| | **Central Province and Embu** | **Meru , Machakos, Makueni and Taita** | **Western, Rift valley and Nyanza** |
| Jan | -Zinc Oxide or Zinc Sulphate and Solubor application @ 40-60 g/20 l of water<br>-Soil and leaf analysis (after every 2 years)<br>-Liming based on soil analysis or 250 g/tree//yr if analysis has not been done | -Urea Foliar application: 1st round @ 200 g/20 l of water (enough for 25–30 trees)<br>- Soil and leaf analysis (after every 2 years)<br>-Epson Salt:1st round @ 100 g/20 l of water (enough for 25–30 trees) | -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 | -Urea foliar application: 2nd round @ 200 g/20l of water (enough for 25 –30 trees)<br>-Epsom salt: 2nd round 100 g/20 l of water | -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 | -Zinc Oxide or Zinc Sulphate and Solubor application @40-60 g/20 l of water<br>-Urea Foliar application: 1st round @ 200g /20 l (5k g/ha)<br>-Epsom Salt: 1st round @ 100 g/20 l of water (enough for 25-30 trees) i.e 2.5 kg/ha | Zinc Sulphate and Solubor application @ 60g per 20 litres of water (enough for 20 – 25 trees)<br>- Liming based on soil analysis by broadcasting or 250 grams/tree/year if analysis has not been done | -Urea foliar application 1st round @ 200g/20litres of water (enough for 25 – 30 trees)<br>-Epson Salt:1st round @ 100g/20 litres of water (enough for 25 – 30 trees) |

| | | | |
|---|---|---|---|
| Aug | -Urea foliar application: 2nd round @ 200 g/20 l of water (enough for 25–30 trees)<br>-Epsom salt: 2nd round 100 g/20 lof water<br>-soil and leaf analysis every 2 yr if not done in January | Manure application @ 1-2 debes/tree | -Urea foliar application: 2nd round @ 200 g/20 l of water (enough for 25–30 trees) Use two 100 ml Kiwi tin<br>- Epsom Salt: 2nd 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.