



PRODUCT CATALOGUE





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ACRON NPK FERTILIZERS

ACRON NPK FERTILIZERS ARE:

- true chemically produced compound fertilisers, not simply a mixture of different fertilisers pressed into a granular form (a granulated blend) or different fertilisers physically mixed (a blended fertiliser). The consistent granule size range allows uniform application with no separation of nutrients.
- high-performance complex prilled fertilisers containing, in various percentages, all the basic nutrients required for plants growth.
- water soluble and dissolve quickly for a fast-acting response. All nutrients required for plant growth are all in one granule. Granules size is homogenous for even distribution of nutrients
- suitable for blended products (mixtures of fertilisers), and they are often utilized in high-quality blends.
- treated with anti-clodding agents to preserve their properties and avoid caking during transportation and storage
- suitable for use in cereals, technical crops, oil crops, vegetables, fruit, vines, pasture and fodder crops. Compared to urea, these formulas provide more readily available nitrogen over a range of climatic conditions with no volatilisation. Nitrogen is present both as nitrate and ammonium. The readily available nitrate-nitrogen gives an immediate growth response, while the more slowly available ammonium-nitrogen ensures a long-lasting effect.
- ideal for plants during their establishment and early growth stages because of their specific formulation. They contribute to the development of new shoots and leaves. Also they perfectly fit for crops that require additional nitrogen and phosphorus beneficial for additional vigour or development of new shoots, canopies or foliage.
- composed of fast and slow acting nutrients at a specific ratio to meet the complete nutritional needs of a vast range of crops and provide a balanced nutrition, making it an ideal fertiliser during the different phases of crops growth and development.
- compatible with sustained, long-term farm production. They have a low salt index and hence minimizes the potential for fertiliser scorch. They are near neutral in their effect on soil pH, which helps maintain a productive soil environment.
- ideal as a base or top dressing. They are non-dusting, a free-flowing product that can

be applied as a band or broadcast or can be incorporated into the soil before planting.

- both nitrate and ammonium forms of **nitrogen** in Acron's NPK facilitate the absorption of **phosphorus**. In the case of NH_4^+ , the reason appears to be the excretion of H^+ ions by the plant when nitrogen is administered in this form in significant quantities. These H^+ ions cause slight acidification of the root area, which can favour the solubility of some phosphorus salts which would otherwise be trapped or remain in an insoluble form.
- **Phosphorus** is in a soluble form, allowing ready uptake by plant roots.
- **Potassium** in our fertilisers may be presented as potassium sulphate (which makes the product chloride free for Cl^- sensitive crops) or as potassium chloride.
- Acron's NPK with S supplies **sulphur** as readily available sulphate. The presence of sulphur ensures efficient nitrogen utilisation within the plant.
- plants absorb the **magnesium** from our NPK's more readily, due to the interaction between the magnesium and the nitrate anion.



ROLES OF NUTRIENTS

ROLES OF NUTRIENTS IN CROP YIELD AND QUALITY OF AGRICULTURAL PRODUCTS

PRIMARY NUTRIENT ELEMENTS

N Function of Nitrogen

- Involving in photosynthesis, promoting root growth, budding, new leaf formation, fruit development, biomass increase.
- Nitrogen is the decisive factor for crop yields, especially for leafy crops.
- Nitrogen boosts the process of accumulating starch, sugar and vitamin supplements to increase the quality of agricultural products.

P Function of Phosphorous

- Promoting early roots formation and development, helps healthy roots development to absorb nutrients from the soil.
- Involved in photosynthesis, respiration, storage and transport of plant nutrients during growth
- Limits the toxic of mobile aluminum and iron elements to plants, especially on acid sulphate soils, salty-acid soil, and low pH soils in the upland
- Enhances the formation ability of flower buds- flowering and rate of fruiting to fruit trees, and seeds on seeded crops.
- Together with other nutrient elements, phosphorus improves the quality of agricultural products.

K Function of Potassium

- Promotes photosynthesis, helps plants healthy growth at all stages
- Promoting full of grain and seed formation, improving fruit set, and limiting the rate of fruit falling off.
- Improving the quality of agricultural products resulting from the accumulation of starch and sugars through the activation of enzymes.
- Increasing crop tolerance of drought conditions, and improving plant disease resistance.

SECONDARY NUTRIENT ELEMENTS

Ca Functions of Calcium

- Joining to cell division and formation, Involved in nitrogen metabolism and reduces plant respiration
- Aids translocation of photosynthesis from leaves to fruiting organs
- Increases fruit set and for nut development in peanuts

Mg Functions of Magnesium

- Key element of chlorophyll production, Improves utilization and mobility of phosphorus, an activator and a component of many plant enzymes.
- Increases iron utilization in plants

S Functions of Sulfur

- An integral part of amino acids helps develop enzymes and vitamins
- Promotes nodule formation on legumes, and seed production
- A key element of chlorophyll production



ROLES OF

MICRONUTRIENTS ELEMENTS

Cu Function of Copper

- The catalysts for several reactions in the plant, major function in photosynthesis, key function on flowering and fruit formation stages, Indirect role in chlorophyll production, Increases sugar content, intensifies colour, improves the flavour of fruits and vegetables

B Function of Boron

- Germination of pollen grains and growth of pollen tubes.
- Essential for seed and cell wall formation, promotes maturity
- Necessary for sugar translocation affects nitrogen and carbohydrate absorption

Zn Function of Zinc

- Support, stimulate plant growth and enzyme systems.
- Necessary for chlorophyll production
- Necessary for carbohydrate formation
- Necessary for starch production. Necessary for seed formation

Fe Function of Iron

- Promotes the formation of chlorophyll. Play role as an oxygen carrier
- Reactions involving division and growth of plant cell

Mn Function of Manganese

- Function as a part of certain enzyme systems
- Aids in chlorophyll synthesis, increasing the absorption capacity of P and Ca

Mo Function of Molybdenum

- Joining to form the enzyme "nitrate reductase" which reduce nitrates forming ammonium in plants. Aids in the formation of legume nodules. Converting inorganic phosphates to organic forms in the plant.



SYMPTOMS OF NUTRIENT DEFICIENCY

SYMPTOMS OF NUTRIENTS DEFICIENCY IN PLANTS

Improper fertilizer application will cause symptoms of nutrients deficiency in crops. The symptoms of nutrient deficiency usually occur on the leaves. Lack of one of these nutrient factors, leading to reduce productivity and quality of agricultural products

N Symptoms of Nitrogen deficiency

- Lack of N, young leaves turn pale green, leaf blade small. The older leaves are yellow and wilted. Plants exhibit stunted and delayed growth and cause the plant quick to wilt/death.



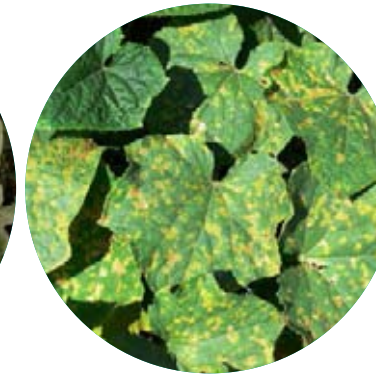
P Symptoms of Phosphorous deficiency

- Leaves become dark green than usual, in some cases green leaves turn purple on top and rim of leaves. Roots stunted and slowed development.



K Symptoms of Potassium deficiency

- Yellowish along the edges of leaves, the tip of the old leaves turn brown and spread into the leaf blade, the margin of leaves is burned, turn brown and fall off.



Ca Symptoms of Calcium deficiency

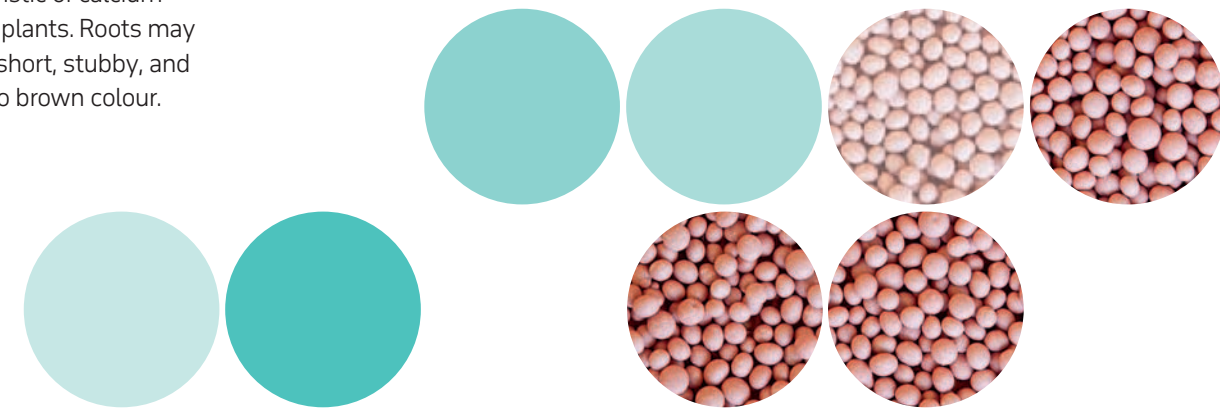
- Usually occurs in young leaves. Distortion or disfiguration of the buds and young leaves, while old leaves still normal development is a clear characteristic of calcium-deficient plants. Roots may become short, stubby, and change to brown colour.

Mg Deficiency Symptoms of Magnesium

- Leaf flesh becomes Yellow, usually found in the beloved leaves (old leaves), the blade of mature leaves are curled upward.

S Deficiency Symptoms of Sulfur

- Usually occurs in young leaves with light green, leaves small and short, leaf tips still green, but yellow in the bases
- Leaf tip and margins are rolled inwards.





Zn Deficiency Symptoms of Zinc

- Expressed on young leaves, leaves are deformed: small, pointed tip leaf, narrowed leaf blades, green veins and yellow leaves flesh.

B Deficiency Symptoms of Boron

- Usually occurs in young leaves, young leaves at the shoots are discoloured, leaves weakened from the petiole and died.

Mn Deficiency Symptoms of Manganese

- Leaves are mottled in green colour, dark green in the main and sub veins of leaves, and they are often arranged perpendicularly each other.



Fe Deficiency Symptoms of Iron

- Leaves are lost in green, white colour is mainly found on young leaves, while leaf veins still green. Stunted growth.

Cu Deficiency Symptoms of Copper

- Leaves are lost green colour between the leaf veins; leaves are often wilting and easy to fall off.

Mo Deficiency Symptoms of Molybdenum

- Light Green coloured leaves, light yellow to orange, and appear brown spots on all leaf surfaces [excluding leaf veins].



NUTRIENTS MANAGEMENT GUIDE FOR PLANTS

ANNUAL CROPS

CABBAGE

Environmental condition requirements:



Temperature

Best growth in the temperature from 15–20 °C, over 25 °C inhibits cabbage head formation.



Soil requirements

Cabbage is suitable on light soil texture, sandy soil, alluvial, soft, good drainage, soil pH from 6.0–6.5, soil moisture from 75–80%.



Planting time

Early crop: from June to July; main crop from the September to October, and late crop from the November to December.



Nutrition requirements

To achieve a yield of 20–25 t/ha, cabbage requires a fertilizer for 1 ha as follows: Manure 10–12 t/ha combined with mineral fertilizer at dosage of 160–190 kg N + 80–90 kg P₂O₅ + 100–120 kg K₂O.



Methods of fertilization

- Fertilizer application for cabbage splits in to 4 times, the used amount for each application [look at table 1].
- Organic and inorganic fertilizers are applied directly into the soil. However for nitrogen, the best for cabbage is dissolve in water and irrigate [single N fertilizer-urea].



Table 1. AMOUNT OF NPK FERTILIZER APPLICATION FOR CABBAGE (per ha)

TYPE OF FERTILIZERS	BEFORE PLANTING	AFTER 7–12 DAYS	AFTER 30–45 DAYS	AFTER 75–80 DAYS
Organic fertilizers	10–12 t	–	–	–
NPK 16–16–16-TE	300 kg	–	–	–
NPK 25–9–9-TE	–	150 kg	–	–
Urea 46%	–	60 kg	–	–
NPK 19–9–19-TE	–	–	200 kg	–
NPK 18–6–18-TE	–	–	–	110 kg

NUTRIENT ANNUAL CROPS



KOHLRABI

Environmental condition requirements:



Temperature

Kohlrabi grows best in temperature range from 15–20°C, temperature over 25°C inhibit fruit formation.



Soil requirements

Kohlrabi is suitable on light soils texture, sandy soils, alluvial, soft, and good drainage, pH 6.0–7.5, soil moisture 75–80%.



Planting time

Early crop: from July to August; main crop from September to October, late crop in the mid–November.



Nutrition requirements

To achieve the yield of 25–30 tons/ha, required fertilizer application per one hectare as follows: Manure 10–12 t/ha, combined with mineral fertilizer at dosage of 100–120 kg N + 50–60 kg P₂O₅ + 60–80 kg K₂O.



Methods of fertilization

- Fertilizer application for kohlrabi splits in to 4 times, the used amount for each application [look at table 2].
- Organic and inorganic fertilizers are applied directly into the soil. However for nitrogen, the best for kohlrabi is dissolve in water and irrigate [if use single N fertilizer as urea].

Table 2. AMOUNT OF NPK FERTILIZER APPLICATION FOR KOHLRABI (per ha)

TYPE OF FERTILIZERS	BEFORE PLANTING	AFTER 7–12 DAYS	AFTER 30–45 DAYS	AFTER 75–80 DAYS
Organic fertilizers	15–20 t			
NPK 16–16–16-TE	200 kg	–	–	–
NPK 25–9–9-TE		120 kg	–	–
Urea 46%	–	10 kg	–	–
NPK 19–9–19-TE			130 kg	–
Urea 46%	–	–	30 kg	–
NPK 18–6–18-TE	–	–	–	100 kg

NUTRIENT ANNUAL CROPS

TOMATO

Environmental condition requirements:



Temperature

Tomatoes are best grown in the temperature range of 21–24 °C, temperature above 34 °C the ability to flower and fruit formations are poor.



Soil requirements

Tomatoes are suitable for sandy soils, alluvial soil, good drainage, pH 6.0–7.5, soil humidity of 75–80%.



Planting time

- Winter–spring crop from October to November,
- summer–spring crops from December–January,
- summer–autumn crop: from June to July.



Nutrition requirements

To achieve a yield of 20–25 t/ ha, tomatoes require a fertilizer in 1 ha as follows: Manure 15–20 t/ha, combined with mineral fertilizer at dosage of 150–180 kg N + 70–80 kg P₂O₅ + 80–100 kg K₂O.



Methods of fertilization

- Fertilizer application for tomatoes is divided into 5 times, and the amount of fertilizer for each application [see table 3].
- Base application: All organic fertilizer, and 1/5 of NPK fertilizer are applied into the soil before planting.
- Top dressing: NPK and nitrogen fertilizers can be applied into the soil or dissolved in water and irrigate.



Table 3. FERTILIZER APPLICATION FOR TOMATO [per ha]

TYPE OF FERTILIZERS	BASAL APPLTION	AFTER 7–10 DAYS	AFTER 30–40 DAYS	AFTER 60–70 DAYS	HARVESTING DAYS
Organic fertilizers	15–20 t	–	–	–	–
NPK 16–16–16–TE	200 kg	–	–	–	–
NPK 25–9–9–TE	–	100 kg	–	–	–
Urea 46%	–	10 kg	–	–	–
NPK 19–9–19–TE	–	–	130 kg	–	–
Urea 46%	–	–	20 kg	–	–
NPK 18–6–18–TE	–	–	–	90 kg	–
Urea 46%	–	–	–	50 kg	–
NPK 18–6–18–TE	–	–	–	–	100 kg
Urea 46%	–	–	–	–	45 kg

NUTRIENT ANNUAL CROPS

CARROT

Environmental condition requirements:



Temperature

Carrots suit temperature from 20–22°C, at temperatures above 25°C the yield decreases, due to tubers poor development.



Soil requirements

Carrots are suitable for sandy, soft, well drained soils, pH 6.0–7.5, soil moisture 75–80%.



Planting time

The growth time is 130 days.

In cold climates (Da Lat, Moc Chau), carrots can be grown all year round. In the Red River Delta carrot is planted mainly in winter and winter–spring seasons.

- Early crop: from early October (from 8–15th of October), harvested from November,
- Main crop: from 16th of October to December 15th, harvest around the Lunar New Year,
- Late crop: from December 16th to January 30 next year, harvested until May.



Nutrition requirements

To achieve a yield of 30–50 t/ ha, carrots require the amount of fertilizer per ha as follows: Manure 5–7 t/ha, combined with mineral fertilizer 100–130 kg N + 120–130 kg P₂O₅ + 120–140 kg K₂O.



Methods of fertilizer application

- Fertilizers application for carrot is divided into 5 times, the amount of fertilizer for each application see in table 4.
- Basal application: All organic fertilizer, and part of fertilizer NPK fertilizer directly into the soil.
- Top dressing: Can apply NPK directly into the soil or mix NPK and potassium fertilizer evenly and apply on the soil bed for carrot.



CARROT

Table 4. FERTILIZER APPLICATION FOR CARROT (per ha)

TYPE OF FERTILIZERS	BASAL APPLICATION	AFTER 12-15 DAYS	AFTER 45-50 DAYS	AFTER 70-80 DAYS
Organic fertilizers	5 t	–	–	–
NPK 16-16-16-TE	300 kg	–	–	–
NPK 25-9-9-TE	–	200 kg	–	–
NPK 19-9-19-TE	–	–	150 kg	–
KCl 60%	–	–	30 kg	–
NPK 18-6-18-TE	–	–	–	120 kg
KCl 60%	–	–	–	30 kg

NUTRIENT ANNUAL CROPS

CUCUMBER

Environmental condition requirements:



Temperature

Cucumber grows well at temperatures between 20–30°C and high soil moisture 80–85%, at those mentioned conditions, cucumber gets high productivity.



Soil requirements

Cucumber is suitable on many different soil types such as sandy soils, soil with medium clay content, porous, good drainage, pH of 6.0–7.5. Soil moisture content of 75–80%.



Planting time

From January to February every year, in the Mekong Delta provinces from September to October every year.



Nutrition requirements

To achieve a yield of 20–25 t/ha, cucumber requires a fertilizer of 1 ha as follows: Manure 5–7 t/ha, combined with mineral fertilizers 100–125 kg N + 70–80 kg P₂O₅ + 120–150 kg K₂O.



Methods of fertilizer application

- Fertilizer for cucumber is divided into 4–5 times, the amount of fertilizer for each application [see table 5].
- Basal application: apply all manure and a part of NPK before planting.
- Top dressing: NPK fertilizers directly into the soil, some extra nitrogen, potassium fertilizers application with irrigation.



CUCUMBER

Table 5. FERTILIZER APPLICATION FOR CUCUMBER (per ha)

TYPE OF FERTILIZERS	BASAL APPLICATION	AFTER 15–20 DAYS	AFTER 40–60 DAYS	AFTER THE FIRST HARVESTING DAYS
Organic fertilizers	15–20 t	–	–	–
NPK 16–16–16-TE	200 kg	–	–	–
Urea 46%	–	25 kg	–	–
NPK 19–16–8-TE KCl 60%	–	–	220 kg 25 kg	–
NPK 18–6–18-TE	–	–	–	200 kg

NUTRIENT ANNUAL CROPS



ONION

ONION

Environmental condition requirements:



Temperature

Suit low temperature, best growth in temperature ranges from 16–20°C.



Soil requirements

The best soil for growing onion is light soils texture, sandy soils. In the northern provinces onion is well grown on rice field (after harvesting rice) in winter and winter–spring crop rotation. In addition, it can be grown in winter–autumn crop rotation.



Planting time

- winter crop: from September to October,
- winter–spring crop from February to March,
- autumn crop: from July to August.



Nutrition requirements

To achieve a yield of 10–15 t/ha, the demand for fertilizer is 1 ha as follows: Manure 5–7 t/ha, combined with mineral fertilizer at dose of 100–120 kg N + 40–50 kg P₂O₅ + 100–120 kg K₂O.



Methods of fertilizer application

- Fertilizer for onion is divided into 3–4 times, the amount of fertilizer for each application see table 6.
- Basal application: Apply all manure and a part of NPK before planting.
- Top dressing: NPK fertilizers directly into the soil, nitrogen and potassium fertilizers with irrigation water, farmers can also dissolve NPK fertilizer in water and then irrigate at the 4th application.

Table 6. FERTILIZERS APPLICATION FOR ONION (per ha)

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 15–20 DAYS	AFTER 40–50 DAYS	AFTER 80–90 DAYS
Organic fertilizers	15–20 t	–	–	–
NPK 16–16–16-TE	100 kg	–	–	–
Urea 46%		30 kg		
NPK 19–9–19-TE	–	–	250 kg	–
NPK 18–6–18-TE	–	–	–	250 kg
KCl 60%	–	–	–	20 kg

NUTRIENT ANNUAL CROPS

WATERMELON

Environmental condition requirements:



Temperature

Watermelon suitable for temperatures from 23–30°C, nonresistant to cold, the temperature fluctuation in large range of day and night will improve the quality of fruit.



Soil requirements

Suitable watermelon on sandy soil, good drainage, watermelon can be grown on light acidic soils, suitable soil pH from 5–7. Soil moisture of 60–70%.



Planting time

- Northern provinces: watermelon is grown in the summer–spring crop: from April to May.
- Southern provinces: watermelon is grown from November to December every year.



Nutrition requirements

To reach the productivity of 30–40 t/ha, watermelon requires the amount of fertilizer for 1 ha as follows: Manure 20–30 t/ha, combined with mineral fertilizer at dosage of 130–150 kg N + 60–80 kg P₂O₅ + 100–130 kg K₂O.



Methods of fertilizer application

- Fertilizer for watermelon is divided into 4 times, the amount of fertilizer for each application see table 7.
- basal application: all manure and a part of NPK are applied before planting.
- top dressing: NPK fertilizers are applied directly into the soil when the stems are not yet covered all bed surface of soil; nitrogen and potassium fertilizers can be applied with irrigation water when watermelon fully covers on the soil bed.



Table 7. FERTILIZER APPLICATION FOR WATERMELON (per ha)

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 7-10 DAYS	AFTER 20-25 DAYS	AFTER 40-45 DAYS
Organic fertilizers	15–20 T	–	–	–
NPK 19-16-8-TE	250 kg	–	–	–
Urea 46%	–	50 kg	–	–
NPK 18-6-18-TE	–	–	180 kg	–
Urea 46%	–	–	50 kg	–
KCl 60%	–	–	30 kg	–
NPK 19-9-19-TE	–	–	–	120 kg
KCl 60%	–	–	–	50 kg

YARD LONG BEAN (snake bean)

Environmental condition requirements:



Temperature

Yard long bean grows well at temperatures between 25–35°C, if temperature above 35°C plants still grow but the yield is significantly reduced, demonstrate intolerance of waterlogging.



Soil requirements

Yard long bean can be grown on a various soils type, most suitable on loam soils with light texture, rich in organic, suitable pH 6–7, suitable soil moisture from 70–80%.



Planting time

- spring crop: from March to April,
- summer crop: from May to June,
- autumn crop: from July to August/



Nutrition requirements

To reach the productivity of 15–20 t/ha, crop requires the amount of fertilizer for 1 ha as follows: Manure 15–20 t/ha, combined with mineral fertilizer 90–100 kg N + 60–80 kg P₂O₅ + 100–125 kg K₂O.



Methods of fertilizer application

- Fertilize application for Yard long bean is divided into 4–5 times, the amount of fertilizer used per fertilizer see table 8.
- Basal application: apply all manure and a part of NPK before planting.
- Top-dressing applications: NPK fertilizers directly into the soil, nitrogen and potassium fertilizers mix with water and irrigate, can also mix with NPK fertilizer and apply at the third top dressing application.



Table 8. FERTILIZER APPLICATION FOR YARD LONG BEAN (per ha)

TYPE OF FERTILIZERS	BASAL APPLICATION	AFTER 10-15 DAYS	AFTER 30-35 DAYS	AFTER 50 DAYS
Organic fertilizers	15–20 t	–	–	–
NPK 16–16–16-TE	150 kg	–	–	–
Urea 46%	–	50 kg	–	–
NPK 25–9–9-TE	–	–	100 kg	–
KCl 60%	–	–	40 kg	–
NPK 16–16–16-TE	–	–	–	200 kg
KCl 60%	–	–	–	20 kg

NUTRIENT ANNUAL CROPS



PUMPKIN

Environmental condition requirements:



Temperature

Pumpkin suits high temperature, and can be grown all year round, but it is the best to grow pumpkin in spring and summer in the northern provinces, and grow all year round in the Mekong delta provinces.



Soil requirements

Pumpkin can be grown on many different types of soil, most suitable on sandy-loam soils, alluvial soils, with pH of 6.5–8. Pumpkin does not favor on lowland or flooding areas.



Planting time

- spring and summer crop: from January to February,
- autumn crop: from August to September, in the Southern provinces throughout the year, but need to arrange crop planting to avoid harvest in the rainy season.



Nutrition requirements

To achieve a yield of 10–13 t/ha, pumpkins require a fertilizer of 1 ha as follows: Manure 15–20 t/ha, combined with mineral fertilizer 200–250 kg N + 120–150 kg P₂O₅ 150–200 kg K₂O.



Methods of fertilizer application

- Fertilizer for pumpkin is divided into 3 times, the amount of fertilizer used at each application see table 9.
- Basal application: All manure and a part of NPK fertilizer apply before planting.
- Top dressing: NPK fertilizer is applied into the soil following each stem root.

Table 9. FERTILIZERS APPLICATION FOR PUMPKIN (per ha)

TYPE OF FERTILIZER	BEFORE PLANTING	5-6 LEAVES	BLOOMING FLOWERS	FRUIT SET
Organic fertilizers	6-11 t	-	-	-
NPK 19-16-8-TE	570 kg			
NPK 16-16-16-TE		200 kg		
NPK 18-6-18-TE			300 kg	
NPK 18-6-18-TE				150 kg

BITTER MELON

Environmental condition requirements:



Temperature

Bitter melon can be grown all year round, suitable temperature from 25–35°C, air humidity 60–70%.



Soil requirements

Bitter melon is grown on different soil types, most suitable on sandy-loam soils with a pH of 5.5–6.5.



Planting time

Bitter melon can be planted year-round, however the most suitable is winter-spring crop season from September to October, and summer-autumn season from August to September.



Nutrition requirements

In order to reach the productivity of 30–40 t/ha, bitter melon requires the amount of fertilizer per hectare as follows: Manure 8–10 t/ha, combined with mineral fertilizer at dosage of 120–150 kg N + 90–100 kg P₂O₅ + 100–130 kg K₂O.



Methods of fertilizer application

- Fertilizer for bitter melon is divided into 5 times, the amount of fertilizer for each application see table 10.
- basal application: all manure, phosphate fertilizer and a part of NPK fertilizers are applied before planting.
- Top dressing: NPK fertilizers are applied directly into the soil, potassium fertilizers are applied with water (dissolved in water and then irrigated); at the fifth time application, fertilizer NPK can be dissolved in water and irrigate.



Table 10. FERTILIZER APPLICATION FOR BITTER MELON [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 15–20 DAYS	AFTER 35–40 DAYS	AFTER 55–60 DAYS	AFTER 70–80 DAYS
Organic fertilizers	8–10 t	–	–	–	–
NPK 19–16–8–TE	250 kg	–	–	–	–
Super phosphate	120 kg	–	–	–	–
NPK 18–6–18–TE	–	120 kg	–	–	–
NPK 18–6–18–TE	–	–	150 kg	–	–
NPK 19–9–19–TE	–	–	–	120 kg	–
KCl 60%	–	–	–	10 kg	–
NPK 19–9–19–TE	–	–	–	–	120 kg
KCl 60%	–	–	–	–	10 kg

CHINESE BROCCOLI

Environmental condition requirements:



Temperature

Chinese broccoli likes mild and cool climate. Most brassica group grow well at 18–22°C.



Soil requirements

Chinese broccoli can be grown on many different soil types, the needs are only keep good irrigation and drainage systems. However the best for Chinese broccoli is cultivated on sandy-loam, porous soils and soil pH ranges from 5.5 to 7.



Planting time

Under conditions of water resources available and regular irrigation, broccoli can be grown all year round, most suitable from July to January next year.



Nutrition requirements

To reach the productivity of 15–20 t/ha, required amount of fertilizer for 1 ha as follows: Manure 15–20 t/ha, combined with mineral fertilizer 60–80 kg N + 30–40 kg P₂O₅ + 40–50 kg K₂O.



Methods of fertilizer application

- Fertilizer application for Chinese broccoli is divided into 3–4 times, the amount of fertilizer for each fertilizer see table 11.
- Basal application: all manure and a part of NPK fertilizer is applied before planting.
- Top dressing: nitrogen, potassium and NPK are mixed with water and irrigate, or sprayed around the roots and then watered.



Table 11. FERTILIZER APPLICATION FOR CHINESE BROCCOLI (per ha)

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 10-15 DAYS	AFTER 25-30 DAYS
Organic fertilizers	15–20 t	–	–
NPK 16-16-16-TE	80 kg	–	–
NPK 19-16-8-TE		120 kg	
Urea 46%	–	40 kg	–
KCl 60%		20 kg	
NPK 25-9-9-TE			100 kg
Urea 46%	–	–	25 kg
KCl 60%			10 kg

NUTRIENT ANNUAL CROPS

CHILLY

Environmental condition requirements:



Temperature

Chilly is a tropical plant suitable on high temperature from 18–30 °C. Temperatures above 32 °C and below 15 °C stunted growth, and have a negative effect on productivity.



Soil requirements

Chilly plants are suitable on various types of soil, suitable on sandy-loam soils and chilly can grow on wet rice land.



Planting time

Chilly can be grown all year round, but usually focus on 3 main crop seasons:

- winter–autumn crop from September to October,
- spring–winter crop from November to December,
- spring–summer crop from February to March.



Nutrition requirements

To reach the yield of 25–30 t/ha, chilly plant needs amount of fertilizer in 1 ha as follows: Manure 8–10 t/ha, combined with mineral fertilizer at dosage of 150–180 kg N + 100–150 kg P₂O₅ + 150–180 kg K₂O.



Methods of fertilizer application

- Fertilizer application for chilly is divided into 5 times, the amount of fertilizer for each application see table 12.
- Basal application: all manure and a part of NPK fertilizer are applied before planting
- At the fourth top dressing Application time: fertilize NPK is applied directly into the soil, K fertilizer is applied with water.
- At the fifth time, NPK fertilizer can be dissolved in water and irrigated.



CHILLY

Table 12. FERTILIZERS APPLICATION FOR CHILLY [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 7-10 DAYS	AFTER 20-25 DAYS	AFTER 50-60 DAYS	AFTER 1 ST HARVESTING
Organic fertilizers	8–10 t	–	–	–	–
NPK 16–16–16-TE	500 kg	–	–	–	–
NPK 25–9–9-TE	–	200 kg	–	–	–
NPK 18–6–18-TE KCl 60%	–	–	100 kg 25 kg	–	–
NPK 18–6–18-TE KCl 60%	–	–	–	80 kg 25 kg	–
NPK 18–6–18-TE	–	–	–	–	100 kg

NUTRIENT ANNUAL CROPS

GARLIC

Environmental condition requirements:



Temperature

Garlic is a cold tolerant plant that can grow at temperatures of 18–20°C. But to form bulb, it needs temperatures in between 20–22°C.



Soil requirements

Garlic grows well on sandy-loam soils, spongy, alluvial, rich on organic matter, and good drained. In the central provinces it can be grown on sandy soils.



Planting time

Growing season for garlic is from September to October and with growing period of 130–140 days harvesting season is from January to February [next year].



Nutrition requirements

To achieve a yield of 7–8 t/ha, garlic requires a fertilizer of 1 ha as follows: Manure 8–10 t/ha, combined with mineral fertilizer 120–140 kg N + 90–100 kg P₂O₅ + 120–140 kg K₂O.



Methods of fertilizer application

- Fertilizer application for garlic is divided into 4 times, the amount of fertilizer used at each application see table 13.
- Basal application: All manure and a part of NPK fertilizer are applied before planting.
- Top dressing applications: NPK fertilizer and potassium can be applied on the bed, and then irrigated water into the field, or can be dissolved in water and irrigated.



Table 13. FERTILIZER APPLICATION FOR GARLIC (per ha)

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 25–30 DAYS	AFTER 50–60 DAYS	AFTER 80–90 DAYS
Organic fertilizers	8–10 t	–	–	–
NPK 16–16–16-TE	250 kg	–	–	–
NPK 25–9–9-TE	–	180 kg	–	–
NPK 16–16–16-TE KCl 60%	–	–	180 kg 20 kg	–
NPK 18–6–18-TE KCl 60%	–	–	–	150 kg 25 kg

NUTRIENT ANNUAL CROPS

SHALLOT

Environmental condition requirements:



Temperature

Shallot suits low average temperature, best growing in the range of temperature between 20–25°C and soil moisture from 75–80%.



Soil requirements

The best option for shallot is light texture soils, sandy soils, in the northern provinces shallot is also grown on wet soil after rice in winter crop rotation, and winter–spring crop season is most suitable. In southern provinces, the shallot is grown all year round.



Planting time

Shallot is grown all year round, however, it is usually planted in October–November or in the spring. During the sunshine season, shallot's yield is higher than during the rainy season.



Nutrition requirements

In order to reach the productivity of 20–25 t/ha/one harvesting time, the shallot requires the amount of fertilizer per ha as follows: Manure 20–25 t/ha, combined with mineral fertilizer 120–150 kg N + 70–80 kg P₂O₅ + 40–50 kg K₂O.



Methods of fertilizer application

- Fertilizer for shallot is divided into 4–5 times for one harvesting time (shallot can be harvested 3–4 times), the amount of fertilizer for each application see table 14.
- basal application: all manure, phosphate fertilizer and a part of NPK fertilizers are applied before planting.
- Top-dressing application: NPK fertilizer and nitrogen fertilizer can apply on the bed and irrigate, or can be dissolved in water and then irrigated.



SHALLOT

Table 14. FERTILIZER APPLICATION FOR SHALLOT [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 7–10 DAYS	AFTER 17–20 DAYS	AFTER 27–30 DAYS	AFTER 37–40 DAYS
Organic fertilizers	20–25 t	–	–	–	–
NPK 19–16–8–TE SSP	180 kg 50 kg	–	–	–	–
NPK 25–9–9–TE	–	120 kg	–	–	–
NPK 25–9–9–TE	–	–	100 kg	–	–
NPK 25–9–9–TE	–	–	–	60 kg	–
Urea 46%	–	–	–	–	30 kg

NUTRIENT ANNUAL CROPS

TURNIP

Environmental condition requirements:



Temperature

Turnip requires cool climate, suitable temperatures vary from 17–20 °C. This crop is not suitable for areas with heavy rainfall or shallow groundwater table.



Soil requirements

Turnip prefers to grow on sandy and light texture soils, alluvial soil, with good drainage and with soil pH from 6.0–7.0.



Planting time

Turnip can be grown from August –September, or later cropping season from October – November. Spring–summer crop can be sown from April to May. However, spring–summer season often gives lower yield. The harvesting season for summer–autumn crop is in 70–80 days after sowing. For the spring summer crop, turnip can be harvested in 35–40 days after sowing,



Nutrition requirements

To achieve a yield of 17–25 t/ha, turnip requires the amount of fertilizer per hectare as follows: Manure 20–25 t/ha, combined with mineral fertilizers at dosage of 30–50 kg N + 30–40 kg P₂O₅ + 50–60 kg K₂O.



Methods of fertilizer application

- Fertilizer application for turnip is divided into 4–5 times, the amount of fertilizer for each application see table 15.
- Basal application: all manure, phosphate fertilizer and a part of NPK fertilizers are applied before planting.
- Top-dressing application: NPK fertilizer and potassium can be applied on the bed and irrigate, or dissolved in water and then irrigated.



TURNIP

Table 15. FERTILIZER APPLICATION FOR TURNIP [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 12–15 DAYS	AFTER 30–35 DAYS	AFTER 50–60 DAYS
Organic fertilizers	20–25 t	–	–	–
NPK 19–16–8–TE SSP	80 kg 50 kg	–	–	–
NPK 18–6–18–TE	–	100 kg	–	–
NPK 18–6–18–TE KCl 60%	–	–	70 kg 15 kg	–
NPK 18–6–18–TE KCl 60%	–	–	–	50 kg 15 kg



PEA

Environmental condition requirements:






- 
Temperature
 Peas suitable for growth at temperature from 18–20°C in humid climate. Temperatures above 25°C and below 12°C make growth slower and at 35°C growth is stunted, and the productivity decreases dramatically.
- 
Soil requirements
 Pea can grow on various soil types, from light texture sandy soils to heavy clay soil texture, but it is the best to grow on loam or clay-loam soils rich on organic matter. Suitable soil pH for pea planting is 5.5–7.
- 
Planting time
 Planting from October to November, harvested from December to early March next year. If to sow later, severe white powdery mildew disease can significantly reduce the yield.
- 
Nutrition requirements
 To reach the productivity of 20–25 t/ha, need fertilizer for 1 ha as follows: Manure 20–25 t/ha, combined with mineral fertilizer 100–130 kg N + 50–60 kg P₂O₅ + 150–180 kg K₂O.
- 
Methods of fertilizer application
 - Fertilizer application for peas is divided into 4 times, the amount of fertilizer used at each application see table 16.
 - Basal application: all manure and a part of NPK fertilizer are applied before planting.
 - Top-dressing: NPK and potassium fertilizer can be applied in each stem root area then be covered by soil, or dissolved in water and then irrigated.

Table 16. FERTILIZER APPLICATION FOR PEA [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 10–15 DAYS	AFTER 25–30 DAYS	AFTER 45–60 DAYS
Organic fertilizers	15–20 t	–	–	–
NPK 19–16–8–TE	150 kg	–	–	–
NPK 25–9–9–TE	–	200 kg	–	–
KCl 60%	–	50 kg	–	–
NPK 18–6–18–TE	–	–	150 kg	–
KCl 60%	–	–	50 kg	–
NPK 18–6–18–TE	–	–	–	150 kg
KCl 60%	–	–	–	40 kg

PEPPER

Environmental condition requirements:



Temperature

Pepper can grow well in the temperature range 25–27°C. Temperatures above 40°C, or below 10°C will adversely affect on growth.



Soil requirements

Pepper is grown on various different soil types (red basaltic soil, alluvial soil, gray soil), with good drainage, with groundwater table deeper than 2m and soil pH of 5–6.



Planting time

Seasonal planting varies from region to region:

- Southeast region of Vietnam from June to August,
- Central Coastal areas from September to October,
- Central Highlands from May to August.



Nutrition requirements

In order to reach the productivity of 5–6 t/ha [fresh], pepper demand for fertilizer per 1 ha as follows: Manure 20–25 t/ha, combined with mineral fertilizer 300–350 kg N + 100–150 kg P₂O₅ + 240–300 kg K₂O.



Methods of fertilizer application

- Fertilizer application for pepper is divided into three times, the amount of fertilizer used at each application see table 17.
- Application before flowering: All manure and a part of NPK fertilizer applied at the beginning of the rainy season in May and June.
- Top dressing 1: application in the middle of the rainy season (in August–September), apply around the root and fill up the soil.
- Top dressing 2: application at the end of rainy season (in November–December), applying around roots and filling up by soil.



Table 17. FERTILIZER APPLICATION FOR PEPPER [per ha]

TYPE OF FERTILIZER	BEGINNING OF RAINY SEASON	MIDDLE OF RAINY SEASON	THE END OF RAINY SEASON
Organic fertilizers	20–25 t	–	–
NPK 19–16–8–TE	550 kg		
NPK 25–9–9–TE		500 kg	
KCl 60%		83 kg	
NPK 18–6–18–TE			300 kg
KCl 60%			167 kg

NUTRIENT ANNUAL CROPS

SQUASH

Environmental condition requirements:



Temperature

Squash is a warm-suiting plant and grows well in the temperature range of 24–28°C, and has very limited resistance against waterlogged condition. High humidity due to rain or irrational irrigation at the generative stage (flowering, and /or fruit set period) will be resulting in yellowing of leaves, flowers and fruit fall off, seriously impacting on productivity.



Soil requirements

Squash suits on the light texture soil, sandy soil, alluvial soils rich in organic matter and with soil pH ranges from 5.5–6.0, preferably with availability of irrigative water and good drainage system. Don't plant squash on the land where watermelon or cucumber were planted in the previous seasons.



Planting time

- spring–summer crop season: from January to February.
- autumn–winter crop season: from August to October.



Nutrition requirements

In order to reach the productivity of 30–40 t/ha, squash needs fertilizer for 1 ha as follows: Manure 8–10 t/ha, combined with mineral fertilizer 125–150 kg N + 60–70 kg P₂O₅ 160–180 kg K₂O.



Methods of fertilizer application

- Fertilizer application for squash is divided into 4 times, the amount of fertilizer for each application see table 18.
- Basal application: all manure and a part of NPK fertilizer are applied before planting,
- Top-dressing: NPK fertilizers, nitrogen and potassium fertilizer can be applied in the stem root area, or can be dissolved in water and then irrigated to each root stem.



SQUASH

Table 18. FERTILIZER APPLICATION FOR SQUASH [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 15–20 DAYS	AFTER 35–45 DAYS	AFTER 60–90 DAYS
Organic fertilizers	8–10 t	–	–	–
NPK 19–16–8 –TE	200 kg	–	–	–
NPK 18–6–18–TE		120 kg		
Urea 46%	–	10 kg		–
KCl 60%		10 kg		
NPK 19–9–19 –TE	–	–	150 kg	
KCl 60%			30 kg	
NPK 18–6–18 –TE				150 kg
KCl 60%				10 kg

LETTUCE

Environmental condition requirements:



Temperature

Lettuce grows well at wide range of 10–27°C. The most suitable temperature is 15–20°C. Daily light for 10–12 hours is very good for the growth and development of lettuce to achieve high productivity.



Soil requirements

Lettuce can be grown on various soil types, but it requires soil with high topography location, easy drainage, sandy soil or sandy-loam soil, soils pH must be in range 5.5–6.7.



Planting Time

Seasonal planting of lettuce from August to April next year.



Nutrition requirements

To achieve productivity from 30–40 t/ha, lettuce needs fertilizer for 1 ha as follows: Manure 15–18 t/ha, combined with mineral fertilizer 50–80 kg N + 30–35 kg P₂O₅ + 40–60 kg K₂O.



Methods of fertilizing

- Fertilizers application for lettuce is divided into 3 times, the amount of fertilizers for each application see table 19.
- Basal application: all manure and a part of NPK fertilizer are applied before planting.
- Top-dressing: NPK fertilizers can be applied at stem root area, or dissolved in water and then irrigated for each stem root.



Table 19. FERTILIZER APPLICATION FOR LETTUCE [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 7–10 DAYS	AFTER 20–25 DAYS
Organic fertilizers	15–18 t	–	–
NPK 16–16–16-TE	150 kg	–	–
NPK 25–9–9-TE	–	120 kg	–
NPK 18–6–18-TE	–	–	100 kg

NUTRIENT ANNUAL CROPS

RADISH

Environmental condition requirements:



Temperature

Radish requires cool climates, suitable temperatures from 17–20 °C, not suitable for areas with heavy rainfall or shallow groundwater table.



Soil requirements

Red radish and sugar beet prefer to grow on sandy, light texture soils, alluvial soil, good drainage, with soil pH from 6–7.0.



Planting time

Radish can be grown from August–September, or later cropping season from October – November. Spring–summer crop can be sown from April to May. However, spring–summer season often gives lower yield. The harvesting season for summer–autumn crop is in 70–80 days after sowing. For the spring summer crop, radish can be harvested in 35–40 days after sowing.



Nutrition requirements:

To achieve a yield of 17–25 t/ha, radish requires the amount of fertilizer per hectare as follows: Manure 20–25 t/ha, combined with mineral fertilizers at dosage of 30–50 kg N + 30–40 kg P₂O₅ + 50–60 kg K₂O.



Methods of fertilizer application:

- Fertilizer application for radish is divided into 4–5 times, the amount of fertilizer for each application see table 20.
- Basal application: all manure, phosphate fertilizer and a part of NPK fertilizers are applied before planting.
- Top-dressing: NPK fertilizer and potassium can be applied on the bed and irrigate, or dissolved in water and then irrigated.



RADISH

Table 20. FERTILIZER APPLICATION FOR RADISH [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 12–15 DAYS	AFTER 30–35 DAYS	AFTER 50–60 DAYS
Organic fertilizers	20–25 t	–	–	–
NPK 19–16–8–TE SSP	80 kg 50 kg	–	–	–
NPK 18–6–18–TE	–	100 kg	–	–
NPK 18–6–18–TE KCl 60%	–	–	70 kg 15 kg	–
NPK 18–6–18 –TE KCl 60%	–	–	–	50 kg 15 kg

NUTRIENT ANNUAL CROPS

MUSTARD

Environmental condition requirements:



Temperature

Mustard is suitable for sub-tropical and tropical climates. Can be grown in different areas and the most suitable temperature in the range of 26–27°C.



Soil requirements

Mustard can grow on various soil types, but needs soil porous, rich of organic matter, with good drainage during rainy season and regularly watered during dry season and soil pH from 5.5–6.8.



Planting time

Summer–spring crop season: from February to June

Winter–autumn crop season: from August to November.



Nutrition requirements

To achieve a yield of 15–20 t/ha, mustard requires a fertilizer of 1 ha as follows: Manure 15–20 t/ha, combined with mineral fertilizer 50–70 kg N + 45–50 kg P₂O₅ + 30–35 kg K₂O.



Methods of fertilizing

- Fertilizer application for mustard is divided into 3 times, the amount of fertilizer for each application see table 21.
- Basal application: all manure and a part of NPK fertilizer are applied before planting.
- Top–dressing applications: NPK fertilizers can be applied on the soil bed surface and watered or mixed in water to irrigate.



MUSTARD

Table 21. FERTILIZER APPLICATION FOR MUSTARD [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 7–10 DAYS	AFTER 15–20 DAYS
Organic fertilizers	15–20 t	–	–
NPK 16–16–16–TE	140 kg	–	–
NPK 25–9–9–TE	–	115 kg	–
NPK 25–9–9–TE	–	–	80 kg

CELERY

Environmental condition requirements:



Temperature

Celery can grow all year round, but grows well in the cold season with cool weather, and temperatures ranging from 15–20 °C.



Soil requirements

Celery grows well on various soil types, most suitable on sandy soils, rich in organic matter with good humidity, soil pH ranges from 5.8–6.8. Celery is not suitable for growth on acid sulfate soil and/or saline soils.



Planting time

If water irrigation available, celery can be grown on any season of the year.



Nutrition requirements

To achieve a yield of 15–20 t/ha, celery requires a fertilizer of 1 ha as follows: Manure 4–5 t/ha, combined with mineral fertilizer 70–80 kg N + 50–60 kg P₂O₅ + 30–40 kg K₂O.



Methods of fertilizing

- Fertilizer application for celery is divided into 4 times, the amount of fertilizer for each application see table 22.
- Basal application: all manure, phosphate fertilizer and a part of NPK fertilizers are applied before planting.
- Top-dressing: NPK fertilizers can be applied on the soil bed surface and watered or dissolved in water and then irrigated.



Table 22. FERTILIZER APPLICATION FOR CELERY [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 7–10 DAYS	AFTER 30 DAYS	AFTER 40 DAYS
Organic fertilizers	4–5 t	–	–	–
NPK 19–16–8–TE	80 kg			
SSP	60 kg			
NPK 19–16–8–TE		80 kg		
NPK 18–6–18–TE			120 kg	
NPK 25–9–9–TE				70 kg



EGGPLANT

Environmental condition requirements:



Temperature

Eggplant is a hot resistant plant, but the most suitable temperature parameters for crop growing is 21–24 °C. Eggplant grows slowly at temperature below 10 °C and above 35 °C.



Soil requirements:

Eggplant can be grown on different soil types, most suitable sandy or sandy-loam soils with good drainage and pH 6.0–6.5. Do not grow eggplant on the soil where tomato had been planted as previous crop [or any other plants belonging to the Solanaceae family].



Planting time:

Eggplant can be grown all year round, preferring cool weather, avoiding the cold months [November, December, December] and hot in summer [May, June]. After planting it can be harvested in 2–2,5 months.



Nutrition requirements:

To achieve a yield of 60–80 t/ha, eggplant requires the amount of fertilizer per ha as follows: Manure 25–30 t/ha, combined with mineral fertilizer 180–200 kg N + 100–120 kg P₂O₅ + 140–160 kg K₂O.



Methods of fertilizing

- Fertilizer application for eggplant is divided into 6 times, the amount of fertilizer used at each application see table 23.
- Basal application: all manure and a part of NPK fertilizer before planting
- Top-dressing: NPK fertilizers can be applied in the stem root area and watered or dissolved in water and irrigated after that.

Table 23. FERTILIZER APPLICATION FOR EGGPLANT [per ha]

TYPE OF FERTILIZER	BASAL APPLICATION	AFTER 15–20 DAYS	AFTER 40–60 DAYS	AFTER 80–90 DAYS	AFTER 120–130 DAYS	AFTER 140–160 DAYS
Organic fertilizers	25–30 t	–	–		–	
NPK 16–16–16-TE	300 kg	–	–		–	
NPK 25–9–9-TE	–	100 kg			–	
NPK 25–9–9-TE	–	–	120 kg			
NPK 25–9–9-TE				160 kg		
NPK 18–6–18-TE					200 kg	
NPK 18–6–18-TE						150 kg

NUTRIENT PERENNIAL CROPS

PERENNIAL CROP

ORANGE

Environmental condition requirements:



Temperature

Orange is a sub-tropical fruit tree, grown from 45 south latitude to 35 north latitude and suitable for growing in areas with temperatures range between 23 and 29°C.



Soil requirements

Orange trees can be grown in different soil types conditions (valleys soil, ancient alluvial soil, newly reclaimed hill soils in the upland region) The most suitable soil is soil rich in organic matter with good drainage and groundwater table below 1m. Soil for orange cultivation has to have a thickness at least 0.8 to 1m, and soil pH can range 5–7.0.



Planting time

The best planting season is the first months of rainy season, for the all regions of country.



Nutrition requirements

Orange tree at young stage needs nutrients to develop branches and leaves. In the fruit formation period plant needs more nutrients for fruits formation. Depending on the varieties and annual yield that harvesting the amount of fertilizer applied to the oranges can be varied as shown in Table 24. It is possible to apply NPK fertilizers together with some others fertilizers (micro, foliar...) to make a proper balance of all requested nutrients. Fertilizer rates for orange at business stage depend on the targeted yields [see tables 25, 26].



Method of fertilizing

- After harvesting: All organic fertilizer and a part of NPK fertilizer are applied at soil depth from 10–20cm around the shadow of orange tree canopy
- The third fertilizer application time: put fertilizers into the soil around tree canopy and watering, also fertilizers can be dissolved in water and then irrigated to root around shadow of canopy.



Table 24. FERTILIZERS APPLICATION FOR ORANGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At young stage (basic construction stage)							
1-2	10-15	50-150	50-100	100-150	20-60	20-40	40-60
2-3	15-20	150-200	100-150	150-200	60-80	40-60	60-80
At the business period (at fruit formation stage upward)							
4	20-30	200-300	150-200	250-300	80-120	60-80	100-120
5-6	20-30	300-400	250-300	400-500	120-160	100-120	140-200
≥7	30	400-600	350-400	500-600	160-240	140-160	200-240

Note: Tree density 400 trees/ha

NUTRIENT PERENNIAL CROP

ORANGE

Table 25. FERTILIZER APPLICATION FOR ORANGE AT YOUNG/BASIC CONSTRUCTION STAGE

TREE AGE	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
Fertilizer dosage (g/tree)			
1	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 250 g	NPK 19–16–8–TE: 200 g	NPK 18–6–18–TE: 150 g KCl 60%: 40 g
2	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 350 g	NPK 19–16–8–TE: 250 g	NPK 18–6–18–TE: 250 g KCl 60%: 50 g
3	Organic fertilizer: 15–20 kg NPK 16–16–16–TE: 500 g	NPK 16–16–16–TE: 400 g	NPK 18–6–18–TE: 300 g KCl 60%: 80 g
4	Organic fertilizer: 20–30 kg NPK 19–16–8–TE: 650 g	NPK 18–6–18–TE: 550 g	NPK 18–6–18–TE: 450 g KCl 60%: 120 g

Table 26. FERTILIZER APPLICATION FOR ORANGE AT FRUIT SET (GENERATIVE) STAGE

TARGET YIELD	AFTER HARVESTING	BEFORE FLOWERING	AT FRUIT SETTING TIME
Dose of fertilizer per tree (g/tree)			
10–15 t/ha	Organic fertilizer: 20–30 kg NPK 16–16–16–TE: 1000 g	NPK 25–9–9–TE: 600 g	NPK 18–6–18–TE: 500 g KCl 60%: 150 g
15–20 t/ha	Organic fertilizer: 20–30 kg NPK 16–16–16–TE: 1200 g	NPK 25–9–9–TE: 800 g	NPK 18–6–18–TE: 600 g KCl 60%: 200 g
20–30 t/ha	Organic fertilizer: 20–30 kg NPK 16–16–16–TE: 1450 g	NPK 25–9–9–TE: 1000 g	NPK 18–6–18–TE: 800 g KCl 60%: 200 g
>30 t/ha	Organic fertilizer: 20–30 kg NPK 16–16–16–TE: 1600 g	NPK 25–9–9–TE: 1400 g	NPK 18–6–18–TE: 1200 g KCl 60%: 100 g



NUTRIENT PERENNIAL CROPS



MANDARIN

Environmental condition requirements:



Temperature

Mandarin is a sub-tropical fruit tree, grown from 45 south latitude to 35 north latitude and suitable for growing in areas with temperatures between 23 and 29°C.



Soil requirement

Mandarin trees can be grown in different soil types conditions (valleys soil, ancient alluvial soil, newly reclaimed hill soils in the upland region) The most suitable soil is soil rich in organic matter with good drainage and groundwater table below 1m. Soil for mandarin cultivation has to have a thickness at least 0.8 to 1m, and soil pH can range 5–7.0.



Planting time

The best planting season is the first months of rainy season, for all regions of country.



Nutrition requirements

Mandarin tree at young stage needs nutrients to develop branches and leaves. In the fruit formation period plant needs more nutrients for fruits formation. Depending on the varieties and annual yield that harvesting the amount of fertilizer applied to the oranges can be varied as shown in Table 27. It is possible to apply NPK fertilizers together with some others fertilizers (micro, foliar...) to make a proper balance of all requested nutrients. Fertilizer rates for orange at business stage depend on the targeted yields [see in table 28 and table 29].



Method of fertilizing

- After harvesting: all organic fertilizer and a part of NPK fertilizer put into the soil around shadow of tree canopy in depth 10–20 cm.
- Top-dressing: put fertilizers into the soil around the shadow of tree canopy and watering, fertilizers also can be dissolved in water and then irrigated to root around shadow of canopy.

Table 27. FERTILIZER APPLICATION FOR MANDARIN

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At young stage (basic construction stage)							
1-2	10-15	50-150	50-100	100-150	20-60	20-40	40-60
2-3	15-20	150-200	100-150	150-200	60-80	40-60	60-80
At the business period (at fruit formation stage upward)							
4	20-30	200-300	150-200	250-300	80-120	60-80	100-120
5-6	20-30	300-400	250-300	400-500	120-160	100-120	140-200
≥7	30	400-600	350-400	500-600	160-240	140-160	200-240

Note: Tree density 400 trees/ha

NUTRIENT PERENNIAL CROP

MANDARIN

Table 28. NPK FERTILIZER APPLICATION FOR MANDARIN AT YOUNG (VEGETATIVE) STAGE

TREE AGE, year	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
Fertilizers/tree			
1	Organic fertilizer: 10-15 kg NPK 19-16-8-TE: 150 g SSP: 300 g	NPK 25-9-9-TE: 180 g	NPK 18-6-18-TE: 150 g
2	Organic fertilizer: 15-20 kg NPK 19-16-8-TE: 430 g SSP: 80 g	NPK 19-16-8-TE: 450 g	NPK 18-6-18-TE: 450 g
3	Organic fertilizer: 20-30 kg NPK 19-16-8-TE: 630 g	NPK 19-16-8-TE: 650 g	NPK 18-6-18-TE: 550 g

Table 29. NPK FERTILIZER APPLICATION FOR MANDARIN AT FRUIT SET STAGE

TREE AGE, year	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
Dose of fertilizer per tree			
4	Organic fertilizer: 20-30 kg NPK 19-16-8-TE: 810 g	NPK 19-16-8-TE: 180 g	NPK 18-6-18-TE: 150 g KCl 60%: 45 g
5	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1100 g SSP: 390 g	NPK 18-6-18-TE: 1000 g	NPK 18-6-18-TE: 800 g
≥6	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1200 g SSP: 730 g	NPK 18-6-18-TE: 1150 g	NPK 18-6-18-TE: 1100 g



NUTRIENT PERENNIAL CROPS



POMELO

POMELO

Environmental condition requirements:






- 
Temperature
 Average temperature suitable for growth and development of pomelo is 23–29°C. Pomelo can be planted in areas with an average temperature of over 20°C and a total annual accumulation of temperature between 2,500 and 3,500°C.
- 
Soil requirements
 Soils for planting pomelo must have the thickness at least 0.6–1 m, with light to medium texture, be porous and well drained and with pH range of 5.5–6.0.
- 
Planting time
 The best time to grow pomelo is at the beginning of the rainy season from April to May or at the end of the rainy season in 8–9 months if irrigation is available.
- 
Nutrition requirements
 Pomelo at young stage needs nutrients to develop branches and leaves. In the fruit formation period plant needs more nutrients for fruits formation. Depending on the varieties and annual yield that harvesting the amount of fertilizer applied to the pomelo can be varied as shown in Table 30. It is possible to apply NPK fertilizers together with some others fertilizers (micro, foliar...) to make a proper balance of all requested nutrients. Fertilizer rates for pomelo at business stage depend on the targeted yields [see table 31 and table 32].
- 
Method of fertilizing
 - After harvesting: all organic fertilizer and a part of NPK fertilizer put into the soil around shadow of tree canopy in depth 10–20 cm.
 - Top-dressing: put fertilizers into the soil around the shadow of tree canopy and watering, fertilizers also can be dissolved in water and then irrigated to root around shadow of canopy.

Table 30. FERTILIZER APPLICATION FOR POMELO

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At the young stage							
1	10–15	50–100	50–80	60–80	20–40	20–32	24–32
2	15–20	150–200	90–120	140–160	60–80	36–48	56–64
3	20–30	300–320	140–160	200–240	120–128	56–64	80–96
At the buseness stage							
4	20–30	450–480	200–250	400–450	180–192	80–100	160–180
5	20–30	550–600	300–320	450–500	220–240	120–128	180–200
6	20–30	700–750	350–400	600–650	280–300	140–160	240–260

Note: tree density of 400 tree/ha

NUTRIENT PERENNIAL CROPS

Table 31. FERTILIZER APPLICATION FOR POMELO AT YOUNG STAGE

TREE AGE, year	START OF RAINING SEASON	MIDDLE OF RAINING SEASON	END OF RAINING SEASON
Fertilizer per tree			
1	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 250 g	NPK 19-16-8-TE: 200 g	NPK 18-6-18-TE: 150 g KCl 60%: 25 g
2	Organic fertilizer: 10-15 kg NPK 16-16-16-TE: 400 g	NPK 19-16-8-TE: 300 g	NPK 18-6-18-TE: 250 g KCl 60%: 30 g
3	Organic fertilizer: 15-20 kg NPK 16-16-16-TE: 500 g	NPK 16-16-16-TE: 400 g	NPK 18-6-18-TE: 300 g KCl 60%: 50 g

Table 32: FERTILIZER APPLICATION FOR POMELO AT BUSINESS STAGE

TARGET YIELD	AFTER HARVERT	AT FLOWERING	FRUIT SET
Fertilizer per tree			
20-30 kg/tree	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 800 g	NPK 25-9-9-TE: 1000 g	NPK 18-6-18-TE: 800 g KCl 60%: 150 g
40-50 kg/tree	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1000 g	NPK 25-9-9-TE: 1200 g	NPK 18-6-18-TE: 1000 g KCl 60%: 200 g
60-70 kg/tree	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1200 g	NPK 25-9-9-TE: 1400	NPK 18-6-18-TE: 1200 g KCl 60%: 250 g
≥80 kg/tree	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1400 g	NPK 25-9-9-TE: 1600	NPK 18-6-18-TE: 1400 g KCl 60%: 350 g



NUTRIENT PERENNIAL CROP



LITCHI

Environmental condition requirements:



Temperature

The litchi is tropical fruit, suitable temperature range for growing is at 24–29°C, however to be flower developed, it requires temperature for at least 200 hours below 17°C. During the period of flowering an appropriate air humidity is 80–85%. If the air humidity is too high it will negatively affect on a rate of fruit setting.



Soil requirements

Litchi can be grown on various soil types: such as hill soil, paddy fields, or alluvial soils, It is very important that the soil thickness must be more than 1 m.



Planting time

Litchi can be grown all year round, but there two most suitable planting time:
Spring crop: February–April,
Autumn crop: August–October.



Nutrition requirements

Litchi at the basic construction stage do not require much nutrition, but they must be enough to develop branches and leaves. At the business stage tree needs more nutrients (see table 33). The amount of fertilizer applied to litchi at different stages is indicated in table 34 and table 35.



Method of fertilizing

- After harvesting: all organic fertilizer and a part of NPK fertilizer are applied at soil depth from 10–20 cm around the shadow of litchi tree canopy.
- The 2nd fertilizer application time: put fertilizers into the soil around tree canopy and watering, fertilizers also can be dissolved in water and then irrigated to root around shadow of canopy.

Table 33. FERTILIZER APPLICATION FOR LITCHI

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Young stage (basic construction stage)							
1	10–15	100–120	80–90	80–90	40–48	32–36	32–36
2	10–15	150–170	100–120	120–150	60–68	40–48	48–60
3	15–20	200–220	150–170	150–180	80–88	60–68	60–72
4	20–30	300–350	200–250	200–250	120–140	80–100	80–100
Business stage							
5–6	20–30	500–550	250–280	450–500	200–220	100–112	180–200
7–8	20–30	600–650	300–350	550–600	240–260	120–140	220–240
8–9	20–30	700–750	350–400	650–700	280–300	140–160	260–280
≥10	20–30	850–900	450–500	800–850	340–360	180–200	320–340

NUTRIENT PERENNIAL CROP

Table 34. NPK FERTILIZER APPLICATION FOR LITCHI AT YOUNG STAGE

TREE AGE, year	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
fertilizer / tree			
1	Organic fertilizer: 10-15 kg NPK 16-16-16-TE: 250 g	NPK 19-16-8-TE: 200 g	NPK 18-6-18-TE: 200 g
2	Organic fertilizer: 10-15 kg NPK 16-16-16-TE: 400 g	NPK 19-16-8-TE: 300 g	NPK 18-6-18-TE: 250 g
3	Organic fertilizer: 15-20 kg NPK 16-16-16-TE: 500 g	NPK 19-16-18-TE: 400 g	NPK 18-6-18-TE: 300 g
4	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 700 g	NPK 19-16-8-TE: 650 g	NPK 18-6-18-TE: 500 g

Table 35. NPK FERTILIZERS APPLICATION FOR LITCHI AT BUSINESS STAGE

TREE AGE, year	AFTER HARVEST	AT FLOWERING	FRUIT SETTING
fertilizer /tree			
5-6	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 800 g	NPK 25-9-9-TE: 1000 g	NPK 18-6-18-TE: 800 g KCl 60%: 150 g
7-8	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1000 g	NPK 25-9-9-TE: 1200 g	NPK 18-6-18-TE: 1000 g KCl 60%: 200 g
8-9	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1200 g	NPK 25-9-9-TE: 1400 g	NPK 18-6-18-TE: 1200 g KCl 60%: 250 g
≥ 10	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1400 g	NPK 25-9-9-TE: 1600 g	NPK 18-6-18-TE: 1400 g KCl 60%: 350 g



NUTRIENT PERENNIAL CROPS



LONGAN

Environmental condition requirements:



Temperature

The longan is a tropical fruit tree, but longan is less tolerant of hot and cold weather compared to litchi. The most suitable temperature range for longan growth and flowering is 17–21°C.



Soil requirements

Longan can be grown on several soil types such as hill soil, paddy field soil, or river alluvial soils. It is a critical factor that the soil thickness must be more than 1m.



Planting time

The longan can be grown all year round, but the best time to plant is the spring crop season in February – April and in the autumn crop season – in August.

Nutrition requirements

Nutritional requirements of the longan are relatively similar to litchi and at the basic construction period longan does not require much nutrition, but it must be enough to develop branches and leaves. Later, in the business stage, longan trees need more nutrients. The amount of fertilizer applied to the longan can be calculated according to table 36 and the fertilization plan for different years is explained in table 37 and table 38.



Method of fertilizing

- After harvesting: all organic fertilizer and a part of NPK fertilizer are applied at soil depth from 10–20 cm around the shadow of longan tree canopy.
- The 2nd fertilizer application time: put fertilizers into the soil around tree canopy and watering, fertilizers also can be dissolved in water and then irrigated to root around shadow of canopy.

Table 36. FERTILIZERS APPLICATION FOR LONGAN

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At the young stage							
1	10–15	100–120	80–90	80–90	40–48	32–36	32–36
2	10–15	150–170	100–120	120–150	60–68	40–48	48–60
3	15–20	200–220	150–170	150–180	80–88	60–68	60–72
4	20–30	300–350	200–250	200–250	120–140	80–100	80–100
At business stage							
5–6	20–30	500–550	250–280	450–500	200–220	100–112	180–200
7–8	20–30	600–650	300–350	550–600	240–260	120–140	220–240
8–9	20–30	700–750	350–400	650–700	280–300	140–160	260–280
>10	20–30	850–900	450–500	800–850	340–360	180–200	320–340

NUTRIENT PERENNIAL CROPS

LONGAN

Table 37. NPK FERTILIZER APPLICATION FOR LONGAN AT YOUNG STAGE

TREE AGE, year	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
fertilizer / tree			
1	Organic fertilizer: 10-15 kg NPK 16-16-16-TE: 250 g	NPK 19-16-8-TE: 200 g	NPK 18-6-18-TE: 200 g
2	Organic fertilizer: 10-15 kg NPK 16-16-16-TE: 400 g	NPK 19-16-8-TE: 300 g	NPK 18-6-18-TE: 250 g
3	Organic fertilizer: 15-20 kg NPK 16-16-16-TE: 500 g	NPK 19-16-18-TE: 400 g	NPK 18-6-18-TE: 300 g
4	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 700 g	NPK 19-16-8-TE: 650 g	NPK 18-6-18-TE: 500 g

Table 38. NPK FERTILIZERS APPLICATION FOR LONGAN AT BUSINESS STAGE

TREE AGE, year	AFTER HARVEST	AT FLOWERING	FRUIT SETTING
fertilizer /tree			
5-6	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 800 g	NPK 25-9-9-TE: 1000 g	NPK 18-6-18-TE: 800 g KCl 60%: 150 g
7-8	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1000 g	NPK 25-9-9-TE: 1200 g	NPK 18-6-18-TE: 1000 g KCl 60%: 200 g
8-9	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1200 g	NPK 25-9-9-TE: 1400 g	NPK 18-6-18-TE: 1200 g KCl 60%: 250 g
≥ 10	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 1400 g	NPK 25-9-9-TE: 1600 g	NPK 18-6-18-TE: 1400 g KCl 60%: 350 g



NUTRIENT PERENNIAL CROPS



PINEAPPLE

Environmental condition requirements:



Temperature

Pineapple is a tropical fruit, prefers high temperature and the most suitable temperature range for pineapple growth and development is 20–30°C. Temperatures above 32°C can be burnt leaves and cause black spots on fruits.



Soil requirements

Pineapple is grown on different soil types from alluvial soil, hilly soil, and can be grown on acid sulphate soil. Due to weak development of root system, pineapple requires porous soil, especially surface layer. Pineapple prefers acid soils, soil pH from 4.5–5.0.



Planting time

In the North, it is possible to plant 2 crops per year: spring crop from March to April and autumn crop from August to September. In the South pineapple should be planted at early rainy season, from April to June. In the central provinces 2 crops per year can also be planted: in April–May and October–November.



Nutrition requirements

Nutritional requirements of pineapple are very high and large amount is needed. In order to ensure productivity from 30–40 t/ha, pineapple required fertilizer amount per hectare: 15–20 t/ha of organic fertilizer; together with 400–480 kg N; 160–200 kg P₂O₅ + 500–640 kg K₂O.



Methods of fertilizing

- Fertilizer application for pineapple is divided into three times, the amount of fertilizer for each application see table 39.
- Basal application: All organic fertilizer and a part of NPK fertilizer are applied before planting.
- Top dressing application: NPK fertilizer can be applied on surface and watering.
- Note: Do not apply fertilizer after pineapple flowering and fruit formation.

Table 39. FERTILIZER APPLICATION FOR PINEAPPLE (per ha)

TYPE OF FERTILIZER	BEFORE PLANTING	AFTER PLANTING 60–80 DAYS	BEFOR FLOWERING 40–60 DAYS	
Organic fertilizers	15–20 t/ha	–	–	
NPK 16–16–16-TE	400 kg/ha	–	–	
NPK 25–9–9-TE KCl 60%	–	720 kg/ha 150 kg/ha	–	
NPK 18–6–18-TE KCl 60%	–	–	1000 kg/ha	250 kg/ha

NUTRIENT PERENNIAL CROPS



DRAGON FRUIT TREE

Environmental condition requirements:



Temperature

Dragon fruit belongs to the cactus family, so the tree needs more light for its proper growth and development. Dragon fruit has good drought tolerance and suitable for growing in areas with high temperatures.



Soil Requirements

Dragon fruit is grown on various soil types, can grow well on sandy soils, however, the soil must be porous and draining well, with suitable soil pH range of 5.5–6.5.



Planting time

Dragon fruit can be grown all year round, but two seasons are common: main season is from April to August every year, Second season – be planted from September current year to April next year.



Nutrition requirements

At the basic construction stage (age 1–2) dragon fruit needs less nutrition, but with growth and development the amount of fertilizer for dragon fruit increased significantly (see tables 40–41).



Method of fertilizing

- Fertilizer application for Dragon Fruit is divided into four or five times, depending on tree age and for the amount of fertilizer for each application see tables 42–43.
- Basal application: half of organic fertilizer and a part of NPK fertilizer are applied before planting.
- Top dressing application: the rest of organic fertilizer and NPK fertilizer can be applied on surface and watering.
- Note: Do not apply fertilizer at least 10 days before the fruits be harvest.

Table 40. FERTILIZER APPLICATION FOR DRAGON FRUIT TREE AT YOUNG STAGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENT (g/pillar*)			PURE NUTRIENT (kg/ha)		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At the young stage							
1	10–20	100–120	90–100	120–125	100–120	90–100	120–125
2	10–20	150–170	100–120	150–170	150–170	100–120	150–170

Tree density: 1.000 tree/ha * The young dragon fruit is based on the pillar to grow

Table 41. FERTILIZER APPLICATION FOR DRAGON FRUIT AT BUSINESS STAGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENT (g/pillar)			PURE NUTRIENT (kg/ha/crop)		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At the business stage							
3	8–10	120–150	80–90	120–150	120–150	80–90	120–150
4	8–10	150–200	100–120	170–200	150–200	100–120	170–200
5	8–10	220–250	130–150	220–250	220–250	130–150	220–250

Tree density: 1.000 tree/ha

NUTRIENT PERENNIAL CROP

Table 42. NPK FERTILIZER APPLICATION FOR DRAGON FRUIT TREE AT YOUNG STAGE

TREE AGE, year	1 ST APPLICATION	2 ND APPLICATION	3 RD APPLICATION	4 TH APPLICATION
1	Organic fertilizer: 5-10 kg NPK 16-16-16-TE: 250 g	NPK 18-6-18-TE: 120 g	Organic fertilizer: 5-10 kg NPK 16-16-16-TE: 250 g	NPK 18-6-18-TE: 120 g
2	Organic fertilizer: 5-10 kg NPK 16-16-16-TE: 300 g	NPK 18-6-18-TE: 150 g	Organic fertilizer: 5-10 kg NPK 16-16-16-TE: 300 g	NPK 18-6-18-TE: 150 g

Table 43. NPK FERTILIZERS APPLICATION FOR DRAGON FRUIT TREE AT BUSINESS STAGE

TREE AGE, year	AFTER HARVEST	AT FLOWERING	FRUIT SETTING
	Fertilizer/pillar		
3	Organic fertilizer: 8-10 kg NPK 16-16-16-TE: 300 g	NPK 25-9-9-TE: 150 g	NPK 25-9-9-TE: 150 g
4	Organic fertilizer: 8-10 kg NPK 16-16-16-TE: 350 g	NPK 25-9-9-TE: 200 g	NPK 25-9-9-TE: 200 g
≥5	Organic fertilizer: 8-10 kg NPK 16-16-16-TE: 450 g	NPK 25-9-9-TE: 250 g	NPK 25-9-9-TE: 250 g

TREE AGE, year	YOUNG FRUIT	BEFORE HARVEST 20-25 DAYS
	Fertilizer/pillar	
3	NPK 18-6-18-TE: 100 g KCl 60%: 40 g	NPK 18-6-18-TE: 50 g KCl 60%: 20 g
4	NPK 18-6-18-TE: 150 g KCl 60%: 60 g	NPK 18-6-18-TE: 80 g KCl 60%: 40 g
≥5	NPK 18-6-18-TE: 200 g KCl 60%: 80 g	NPK 18-6-18-TE: 100 g KCl 60%: 80 g



DRAGON FRUIT TREE

NUTRIENT PERENNIAL CROPS

BANANA

Environmental condition requirements:



Temperature

Banana is Tropical fruit, it grows and develops conveniently in the range of 25–35°C. If the temperature drops to 10°C, the banana grows stunt, fruits became small, what is leading to low and/or no yield.



Soil requirements

Banana trees prefer alluvial soils, and hill Acrisols suitable as well, but with a thickness of soil layer more than 0.6m. Soil pH can range 5–7.



Planting time

Planting season is most appropriate at the beginning of the rainy season, Northern provinces from April to June, Central provinces from August to September, Southern provinces from May to June.



Nutrition requirements

To get the yield of 20–25 t/ha, banana trees require amount of fertilizer for 1 ha as follows: Manure 8–10 t/ha, combined with mineral fertilizer 320–360 kg N + 160–180 kg P₂O₅ + 500–550 kg K₂O. If the yield is 30–40 t/ha, except adding more organic fertilizer, the amount of mineral fertilizer should be 500–550 kg N + 240–260 kg P₂O₅ + 650–700 kg K₂O.



Methods of fertilizing

- Basal application: mix well organic fertilizer and NPK fertilizer and apply in the pit before planting in.
- Top dressing: NPK fertilizer, together with potassium fertilizer are put into the soil around roots and watering to create a good condition for nutrient absorption by roots.



Table 44. FERTILIZER APPLICATION FOR BANANA (per ha)

APPLICATION TIME	TARGET YIELD	
	20–25 t/ha	30–40 t/ha
Before planting time	Organic fertilizer: 8–10t NPK 16–16–16–TE: 450 kg	Organic fertilizer: 8–10t NPK 16–16–16–TE: 650 kg
20–30 days after planting	NPK 25–9–9–TE: 400 kg KCl 60%: 180 kg	NPK 25–9–9–TE: 600 kg KCl 60%: 200 kg
90–120 days after planting	NPK 25–9–9 –TE: 400 kg KCl 60%: 180 kg	NPK 25–9–9–TE: 600 kg KCl 60%: 200 kg
150 days after planting	NPK 25–9–9–TE: 650 kg KCl 60%: 100 kg	NPK 25–9–9–TE: 650 kg KCl 60%: 150 kg

NUTRIENT PERENNIAL CROPS



PLUM

Environmental condition requirements:



Temperature

Plum trees prefer cool climate with the most appropriate temperature range 22–24 °C. If temperature is above 35 °C, the plum tree stops growing and has no yield.



Soil requirements

Plum trees can be grown on many kinds of soil, but the best option is to cultivate on porous silt, rich in organic matter, with pH 5–7, with good drainage and the soil layer must be thicker than 0.6 m in depth.



Planting time

Spring crop season: plum planting from February to April, Autumn crop season: from July to August every year.



Nutrition requirements

At the basic construction stage (age 1–2) plum need nutrition as follows (see table 45) At the business stage plum trees need for nutrition increases significantly. Recommended rates, depending on the tree age, indicated in table 46.



Method of fertilizing

- Fertilizer application for Plum trees is divided into three or four times, depending on tree age and for the amount of fertilizer for each application see tables 47–48.
- Basal application: all of organic fertilizer and a part of NPK fertilizer are applied after the finish of harvesting period.
- Top dressing application: NPK fertilizer can be applied on surface and watering.

Table 45. FERTILIZER APPLICATION FOR PLUM TREES IN YOUNG STAGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENT [g/tree]			PURE NUTRIENT [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At the young stage							
1	10–15	100–120	50–60	70–80	40–48	20–24	28–32
2	10–15	160–180	80–100	100–120	64–72	32–40	40–48

Note: tree density 400 tree/ha

Table 46. FERTILIZER APPLICATION FOR PLUM TREES AT BUSINESS STAGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENT [g/tree]			PURE NUTRIENT [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At the business stage							
3–4	20–25	300–350	150–200	250–300	120–140	60–80	100–120
5–6	20–25	450–500	250–300	350–400	180–200	100–120	140–160
>7	20–25	600–650	300–350	500–550	240–260	120–140	200–220

NUTRIENT PERENNIAL CROPS

Table 47. NPK FERTILIZER APPLICATION FOR PLUM TREE AT YOUNG STAGE

TREE AGE, year	MARCH	JUNE	NOVEMBER
	Fertilizer/pillar		
1	Organic fertilizer: 15–20 kg NPK 16–16–16–TE: 150 g	NPK 25–9–9–TE: 200 g	NPK 18–6–18–TE: 200 g
2	Organic fertilizer: 15–20 kg NPK 16–16–16–TE: 250 g	NPK 19–16–8–TE: 300 g	NPK 18–6–18–TE: 250 g

Table 48. NPK FERTILIZERS APPLICATION FOR PLUM TREE AT BUSINESS STAGE

TREE AGE, year	AFTER HARVEST	BEFORE FLOWERING
	Fertilizer per tree	
3–4	Organic fertilizer: 20–25 kg NPK 16–16–16–TE: 500 g	NPK 18–6–18–TE: 450 g
5–6	Organic fertilizer: 20–25 kg NPK 16–16–16–TE: 600 g	NPK 18–6–18–TE: 650 g
≥7	Organic fertilizer: 20–25 kg NPK 16–16–16–TE: 800 g	NPK 18–6–18–TE: 850 g

TREE AGE, year	AT THE FRUIT SETTING	FRUIT DEVELOPMENT
	Fertilizer/pillar	
3–4	NPK 25–9–9–TE: 400 g	NPK 18–6–18–TE: 450 g
5–6	NPK 25–9–9–TE: 600 g	NPK 18–6–18–TE: 650 g
≥7	NPK 25–9–9–TE: 800 g	NPK 18–6–18–TE: 850 g



NUTRIENT PERENNIAL CROPS



DURIAN

DURIAN

Environmental condition requirements:



Temperature

Durian grows and produces stable yields at temperatures of 24–30°C. The low temperature will cause the fall off of flower buds and slow development. Durian requires rainfall of 1600–4000 mm per year and soil moisture of 75–80%.



Soil requirements

Durian can be grown in main Vietnamese soil types, but the best results can be demonstrated on soils rich in organic matter and soil pH 5–6, with good drainage and a soil thickness of more than 1 m.



Planting time

Durian can be grown all year round, but most suitable time for planting is the beginning of the rainy season – from September to October.



Nutrition requirements

In the basic construction period [tree age from 1 to 4 years] durian needs relatively small amount of nutrients for growth and development [see in table 49]. Mature trees require significant quantity of nutrients and rates increase by many times [see table 50].



Method of fertilizing

- Basal application: all organic fertilizer, phosphate and part of NPK fertilizers have to be mixed and placed into the pit before planting.
- Top-dressing: NPK fertilizer have to be put into the soil in the root area and watering after that to create good condition for the best nutrients absorption by roots.

Table 49. FERTILIZER APPLICATION FOR DURIAN AT YOUNG STAGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENT [g/tree]			PURE NUTRIENT [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At the young stage							
1	10–15	70–80	70–80	70–80	14–16	14–16	14–16
2	–	120–150	120–150	120–150	24–30	24–30	24–30
3	10–15	300–350	300–350	300–350	60–70	60–70	60–70
4	–	400–450	400–450	400–450	80–90	80–90	80–90

Note: tree density 400 tree/ha

Table 50. FERTILIZER APPLICATION FOR DURIAN AT BUSINESS STAGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENT [g/tree]			PURE NUTRIENT [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
At the business stage							
5	10–15	450–500	400–450	600–650	90–100	80–90	120–130
6–7	–	750–800	700–750	1100–1300	150–200	140–150	220–260
≥ 8	10–15	900–1000	800–900	1200–1400	180–200	160–180	240–280

NUTRIENT PERENNIAL CROP

Table 51: TIME AND QUANTITY OF FERTILIZER APPLICATION FOR DURIAN AT BUSINESS STAGE

TREE AGE, year	JANUARY	BEFORE RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
Amount of fertilizer per tree				
Before planting	Organic fertilizer: 10–15kg NPK 16–16–16–TE: 190 g			
1	NPK 16–16–16–TE: 150 g SSP: 140 g	NPK 18–6–18–TE: 100 g	NPK 16–16–16–TE: 100 g	NPK 18–6–18–TE: 100 g
2	Organic fertilizer: 5–10kg NPK 16–16–16–TE: 280 g SSP: 290 g	NPK 18–6–18–TE: 200 g	NPK 16–16–16–TE: 200 g	NPK 18–6–18–TE: 200 g
3	NPK 16–16–16–TE: 550 g SSP: 300 g	NPK 16–16–16–TE: 400 g	NPK 16–16–16–TE: 450 g	NPK 18–6–18–TE: 400 g
4	Organic fertilizer: 5–10kg NPK 16–16–16–TE: 750 g SSP: 480 g	NPK 18–6–18–TE: 600 g	NPK 16–16–16–TE: 700 g	NPK 18–6–18–TE: 650 g

Table 52: TIME AND QUANTITY OF FERTILIZER APPLICATION FOR DURIAN AT BUSINESS STAGE

TREE AGE, year	AFTER HARVEST	BEFORE FLOWERING	DURING FRUIT SETTING
Amount of fertilizer/tree			
5	NPK 16–16–16–TE: 1000 g SSP: 600 g	NPK 16–16–16–TE: 900 g	NPK 18–6–18–TE: 900 g
6	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 1230 g SSP: 2360 g	NPK 18–6–18–TE: 1230 g	NPK 18–6–18–TE: 2000 g
7	NPK 16–16–16–TE: 1230 g SSP: 2360 g	NPK 18–6–18–TE: 1230 g	NPK 18–6–18–TE: 2000 g
≥ 8	Organic fertilizer: 15–20 kg NPK 16–16–16–TE: 1300 g SSP: 2700 g	NPK 18–6–18–TE: 1300 g	NPK 18–6–18–TE: 2500 g



NUTRIENT PERENNIAL CROPS



AVOCADO

Environmental condition requirements:






- 
Temperature
 Avocado trees are growing from 40 degree north latitude to 39 degrees south latitude and they are suitable for cool climates. An optimal temperature range for avocado's growth and development is 14–25°C, level of rainfall from 200 mm and up to 2000 mm per year, and with air humidity 70–80%.
- 
Soil requirements
 Avocado trees prefer soils with quick drainage, without waterlogging, and the depth of soil layer more than 2 meter. Soils must not be affected by high salinity and with soil pH in range 5–7. Groundwater table must be deeper than 1.5 m.
- 
Planting time
 The best season for avocado planting is May–June at the starting of rainy season. Avocado tree can also be planted in September (during dry season), but only if irrigated water available.
- 
Nutrition requirements
 At the basic period (from 1 to 4 years) avocado needs nutrition as follows (see table 53). The needs of mature trees are higher and particular rates are indicated in table 54.
- 
Method of fertilizing
 - Basal application: all organic fertilizer, phosphate and part of NPK fertilizers have to be mixed and placed into the pit before planting.
 - Top-dressing: NPK fertilizer have to be put into the soil in the root area and watering after that to create good condition for the best nutrients absorption by roots.

Table 53. FERTILIZER APPLICATION FOR AVOCADO IN YOUNG STAGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENT (g/tree)			PURE NUTRIENT (kg/ha)		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
In the young stage							
1	10–15	100–150	100–120	90–100	18–27	18–22	16–18
2	–	150–200	120–150	180–200	27–36	22–27	32–36
3	10–15	300–320	250–300	280–300	54–57	45–54	50–54
4	–	350–400	300–350	380–400	63–72	54–63	68–72

Note: tree density 180 tree/ha

Table 54. FERTILIZER APPLICATION RATES FOR AVOCADO IN BUSINESS STAGE

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENT (g/tree)			PURE NUTRIENT (kg/ha)		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
In the business stage							
5	20–30	450–500	250–300	500–600	81–90	45–54	90–108
6	–	550–600	300–350	600–650	99–108	54–63	108–117
≥7	20–30	650–700	400–450	700–750	117–126	72–81	126–135

Note: tree density 180 tree/ha

NUTRIENT PERENNIAL CROP

Table 55. TIME AND RATES OF FERTILIZER APPLICATION FOR AVOCADO IN YOUNG STAGE

TREE AGE, year	APRIL	JULY	OCTOBER
Amount of fertilizer/tree			
Before planting	Organic fertilizer: 15–30 kg SSP: 200 g		
1	Organic fertilizer: 5–10 kg NPK 16–16–16–TE: 250 g SSP: 240 g	NPK 18–6–18–TE: 170 g	NPK 18–6–18–TE: 150 g
2	Organic fertilizer: 5–10 kg NPK 16–16–16–TE: 450 g SSP: 510 g	NPK 18–6–18–TE: 350 g	NPK 18–6–18–TE: 350 g
3	Organic fertilizer: 5–10 kg NPK 16–16–16–TE: 650 g SSP: 780 g	NPK 18–6–18–TE: 500 g	NPK 18–6–18–TE: 600 g
4	Organic fertilizer: 5–10 kg NPK 16–16–16–TE: 850 g SSP: 1030 g	NPK 18–6–18–TE: 750 g	NPK 18–6–18–TE: 700 g

Table 56. TIME AND AMOUNT OF FERTILIZER APPLICATION FOR AVOCADO IN BUSINESS STAGE

TREE AGE, year	NOVEMBER	MAY	DECEMBER
Amount of fertilizer/tree			
5	Organic fertilizer: 15–20 kg NPK 19–16–8–TE: 900 g	NPK 18–6–18–TE: 900 g	NPK 18–6–18–TE: 900 g
6	Organic fertilizer: 15–20 kg NPK 19–16–8–TE: 1350 g	NPK 18–6–18–TE: 350 g	NPK 18–6–18–TE: 350 g
≥7	Organic fertilizer: 15–20 kg NPK 16–16–16–TE: 1500 g	NPK 18–6–18–TE: 1300 g	NPK 18–6–18–TE: 1300 g



NUTRIENT PERENNIAL CROPS



MANGO

Environmental condition requirements:



Temperature

Mango trees can withstand wide temperatures range – from 10°C up to 46°C, but the most suitable range 24–27°C and soil moisture 80–85%. If the moisture level too high during flowering it will affect the rate of fruits later.



Soil requirements

Mango tree can be grown on various soil types, but in Vietnam they are growing well on alluvial soils and hills Acrisols with soil layer up to 1m depths and soil pH about 5.5–7.



Planting time

- Mango In the Northern Vietnam, appropriate planting season is from February to April,
- In the Mekong Delta suitable planting season is in June–July,
- In the South Central Coast from September to October.



Nutrition requirements

Mango tree needs for nutrients increases with every year of tree growth and development and mature trees require significant quantity of nutrients and rates increase by many times [see table 57].



Methods of fertilization

All type of fertilizers are put into the soil around the shadow of tree canopy in 15–20 cm depth, then filling the soil and watering. Also fertilizer can be dissolved in water and then irrigated around the root.

Table 57. FERTILIZER APPLICATION FOR MANGO IN YOUNG AND BUSINESS STAGES

TREE AGE, YEAR	ORGANIC FERTILIZER (KG/TREE)	PURE NUTRIENTS (G/TREE)			HARVESTING DAYS		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
In the young stage							
1	15–20	70	50	70	28	20	28
2	15–20	140	100	140	56	40	56
3	20–30	210	150	210	84	60	84
4	30–40	280	200	280	112	80	112
In the business stage							
5	60	350	250	350	140	100	140
6	70	420	300	420	168	120	168
7	80	490	350	490	196	140	196
8	80	560	400	560	224	160	224

Note: tree density 400 tree/ha

NUTRIENT PERENNIAL CROP

Table 58: TIME AND RATES OF FERTILIZER APPLICATION FOR MANGO IN YOUNG STAGE

TREE AGE, year	JANUARY-FEBRUARY	MAY-JUNE	SEPTEMBER-OCTOBER
Amount of fertilizer/tree			
1	Organic fertilizer: 15-20 kg NPK 16-16-16-TE: 200 g	NPK 25-9-9-TE: 150 g	NPK 18-6-18-TE: 150 g
2	Organic fertilizer: 15-20 kg NPK 16-16-16-TE: 350 g	NPK 25-9-9-TE: 300 g	NPK 18-6-18-TE: 300 g
3	Organic fertilizer: 20-30 kg NPK 16-16-16-TE: 550 g	NPK 25-9-9-TE: 350 g	NPK 18-6-18-TE: 350 g
4	Organic fertilizer: 30-40 kg NPK 16-16-16-TE: 650 g	NPK 25-9-9-TE: 400 g	NPK 18-6-18-TE: 550 g

Table 59: TIME AND RATES OF FERTILIZER APPLICATION FOR MANGO IN BUSINESS STAGE

TREE AGE, year	AFTER HARVEST	BEFORE FLOWERING	AT THE FRUIT SETTING
Amount of fertilizer/tree			
5	Organic fertilizer: 30-40 kg NPK 16-16-16-TE: 800 g SSP: 300 g	NPK 25-9-9-TE: 500 g KCl 60%: 50 g	NPK 18-6-18-TE: 550 g KCl 60%: 80 g
6	Organic fertilizer: 30-40 kg NPK 16-16-16-TE: 1000 g SSP: 300 g	NPK 25-9-9-TE: 600 g KCl 60%: 80 g	NPK 18-6-18-TE: 650 g KCl 60%: 80 g
7	Organic fertilizer: 30-40 kg NPK 16-16-16-TE: 1200 g SSP: 320 g	NPK 25-9-9-TE: 600 g KCl 60%: 90 g	NPK 18-6-18-TE: 650 g KCl 60%: 100 g
>8	Organic fertilizer: 30-40 kg NPK 16-16-16-TE: 1400 g SSP: 350 g	NPK 25-9-9-TE: 800 g KCl 60%: 90 g	NPK 18-6-18-TE: 850 g KCl 60%: 100 g



NUTRIENT PERENNIAL CROP



RAMBUTAN

RAMBUTAN

Environmental condition requirements:



Temperature

Rambutan trees prefer a range of temperature 22–30°C. In case the temperature is above 40°C, flower buds and young fruit are falling off considerably. When temperature is below 22°C it stimulates the sprout growth and it causes delay in flowering.



Soil requirements

Rambutan in Vietnam can be cultivated on many different soil types, but the most suitable are the reddish basaltic soil and alluvial soil in the Mekong River Delta with soil thickness of over 1m and soil pH from 4.5–6.5. Rambutan can not grow on alkaline soils.



Planting time

In Mekong Delta – at the beginning of the rainy season: from May to June,
In the South East and Central Highlands regions – from June to July,
In the South Central Coastal areas – from August to September.



Nutrition requirements

Rambutan needs for nutrients increases with every year of tree growth and development and mature trees require significant quantity of nutrients and fertilizer rates increase significantly [see tab. 60].



Method of fertilizing

All type of fertilizers are put into the soil around the shadow of tree canopy in 15–20 cm depth, then filling the soil and watering. Also fertilizer can be dissolved in water and then irrigated around the root.

Table 60. FERTILIZER APPLICATION FOR RAMBUTAN IN YOUNG AND BUSINESS STAGES

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
In young stage							
1	10–15	60–65	65–70	60–65	9–10	10–11	9–10
2	–	150–200	80–100	80–100	25–30	12–15	12–15
3	10–15	250–300	150–200	250–300	38–45	23–30	38–45
In business stage							
4	15–20	350–400	200–250	350–400	50–60	30–40	50–60
5	20–30	500–600	300–350	500–600	75–90	45–55	75–90
≥6	30–40	750–800	400–450	800–850	110–120	60–70	120–130

Note: tree density 150 tree/ha

NUTRIENT PERENNIAL CROP

Table 61. TIME AND RATES OF FERTILIZER APPLICATION FOR RAMBUTAN IN YOUNG STAGE

TREE AGE, year	START OF RAINY SEASON	END OF RAINY SEASON
	Fertilizer/tree	
1	Organic fertilizer: 10–15kg NPK 16–16–16–TE: 200 g	NPK 16–16–16–TE: 170 g SSP: 36 g
2	NPK 16–16–16–TE: 300 g SSP: 140 g	NPK 25–9–9–TE: 350 g
3	Organic fertilizer: 5–10 kg NPK 18–6–18–TE: 800 g SSP: 300 g	NPK 18–6–18–TE: 850 g

Table 62. TIME AND RATES OF FERTILIZER APPLICATION FOR RAMBUTAN IN BUSINESS STAGE

TREE AGE, year	AFTER HARVESTING	FLOWERING	FRUIT FORMATION	FRUIT DEVELOPMENT
	Fertilizer/tree			
4	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 600 g	NPK 18–6–18–TE: 550 g	NPK 18–6–18–TE: 550 g	NPK 18–6–18–TE: 550 g
5	NPK 16–16–16–TE: 1100 g	NPK 18–6–18–TE: 800 g	NPK 18–6–18–TE: 800 g	NPK 18–6–18–TE: 700 g
≥6	Organic fertilizer: 20–30 kg NPK 16–16–16–TE: 1400 g	NPK 16–16–16–TE: 1200 g	NPK 18–6–18–TE: 1100 g	NPK 18–6–18–TE: 900 g



NUTRIENT PERENNIAL CROPS



GUAVA

Environmental condition requirements:



Temperature

Guava trees prefer high temperature and they can be grown in deserts with sufficient water condition. Temperatures below 18–20°C cause slow development and very bad quality. Guava tree prefers soils with high level of moisture, and has a high tolerance of waterlogging.



Soil requirements

Guava can be grown on many different soil types but in Vietnam the preferable choice is to grow on alluvial soil, sloping hill (Acrisols) and acid sulphate soil in Mekong Delta. Soil pH varies 4.5 to 8.2. The soil layer has to be as thick as possible.



Planting time

The best season for guava growing is at the beginning of the rainy season, In the Northern provinces – from April to August, In the South Central Coastal areas – from September to October, In the Mekong Delta – from May to June.



Nutrition requirements

Guava tree needs for nutrients increases steadily with every year of tree growth and development and mature trees require more nutrients and fertilizer rates increase accordingly [see tab. 63].



Method of fertilizing

All type of fertilizers are put into the soil around the shadow of tree canopy in 15–20 cm depth, then filling the soil and watering. Also fertilizer can be dissolved in water and then irrigated around the root.

Table 63. FERTILIZER APPLICATION FOR GUAVA

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
1	10–15	70–80	100–120	90–100	42–48	60–72	54–60
2	10–15	100–130	60–80	150–200	60–78	36–48	90–120
3	15–20	130–160	70–90	200–250	78–96	42–54	120–150
4	20–25	180–200	80–100	230–260	108–120	48–60	138–156
≥5	25–30	250–300	130–150	350–400	150–180	78–90	210–240

Note: tree density 600 tree/ha

NUTRIENT PERENNIAL CROPS

Table 64. TIME AND RATES OF FERTILIZER APPLICATION FOR GUAVA

TREE AGE, year	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
	Amount of fertilizer/tree		
1	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 200 g SSP: 420 g	NPK 19–16–8–TE: 170 g	NPK 18–6–18–TE: 150 g
2	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 180 g	NPK 19–16–8–TE: 250 g	NPK 18–6–18–TE: 250 g KCl 60%: 90 g
3	Organic fertilizer: 15–20 kg NPK 16–16–16–TE: 250 g	NPK 18–6–18–TE: 250 g	NPK 18–6–18–TE: 300 g KCl 60%: 116 g
4	Organic fertilizer: 20–25 kg NPK 16–16–16–TE: 320 g	NPK 18–6–18–TE: 350 g	NPK 18–6–18–TE: 350 g KCl 60%: 100 g
≥ 5	Organic fertilizer: 25–30 kg NPK 16–16–16–TE: 500 g	NPK 18–6–18–TE: 620 g KCl 60%: 50 g	NPK 18–6–18–TE: 600 g KCl 60%: 100 g



NUTRIENT PERENNIAL CROPS



MANGOSTEEN

MANGOSTEEN

Environmental condition requirements:



Temperature

Mangosteen fruit trees are native from South East Asia and hot tolerant. The most suitable temperature range for growing and development is 25–35°C and humidity of 80–85%. Temperatures below 20°C and above 35°C have negative effect on growth, flowering and fruit bearing. The tree dies when the temperature falls below 5°C.



Soil requirements

Mangosteen can grow in various soil types, but the best is loamy clay soil, rich in organic matter, with thickness of soil layer 1 m, good drainage, and pH 5.5–7.0. Mangosteen is not resistant to alkaline soils.



Planting time

In Vietnam Mangosteen grows only in southern part, and it is planted at the beginning of the rainy season – from May to June.



Nutrition requirements

Mangosteen tree needs for nutrients increases steadily with every year of tree growth and development but mature trees require significantly more nutrients and fertilizer rates increase accordingly [see tab. 65].



Methods of fertilizing

All type of fertilizers are put into the soil around the shadow of tree canopy in 15–20 cm depth, then filling the soil and watering. Also fertilizer can be dissolved in water and then irrigated around the root. As Mangosteen roots grow only in 2/3 in diameter of canopy projection, therefore fertilizer application is only applied at 2/3 in diameter of canopy projection, taking from the stem root.

Table 65. FERTILIZER APPLICATION FOR MANGOSTEEN

TREE AGE, year	ORGANIC FERTILIZER [kg/tree]	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
1	10–15	150–200	150–200	150–200	25–30	20–30	25–30
2	10–15	200–250	200–250	200–250	30–40	30–40	30–40
3	10–15	350–400	350–400	350–400	50–60	50–60	55–60
4	15–20	450–500	450–500	450–500	65–75	70–75	70–75
≥5	25–30	1000–1200	1500–1700	1500–1700	180–225	225–255	225–255

Note: tree density 150 tree/ha

NUTRIENT PERENNIAL CROP

Table 66. TIME AND RATES OF FERTILIZER APPLICATION FOR MANGOSTEEN

TREE AGE, year	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
	Amount of fertilizer/tree		
1st app. tion	Organic fertilizer: 10–20 kg NPK 19–16–8–TE: 200 g		
1	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 350 g SSP: 240 g	NPK 16–16–16–TE: 450 g	NPK 18–6–18–TE: 400 g
2	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 450 g SSP: 320 g	NPK 16–16–16–TE: 550 g	NPK 18–6–18–TE: 450 g
3	Organic fertilizer: 10–15 kg NPK 16–16–16–TE: 750 g SSP: 570 g	NPK 16–16–16–TE: 850 g	NPK 18–6–18–TE: 800 g
4	Organic fertilizer: 15–20 kg NPK 16–16–16–TE: 900 g SSP: 670 g	NPK 16–16–16–TE: 1200 g	NPK 18–6–18–TE: 900 g
≥5	Organic fertilizer: 20–30 kg NPK 16–16–16–TE: 2500 g SSP: 240 g	NPK 18–6–18–TE: 2450 g	NPK 18–6–18–TE: 2000 g



NUTRIENT PERENNIAL CROP

PAPAYA

Environmental condition requirements:



Temperature

Papaya trees prefer to grow and develop in the range of 20–25°C and humidity of 80–85%. In case of high temperature above 35°C and if humidity exceeds 90%, papaya stops growth and formation of fruits.



Soil requirements

Papaya can grow in various soil types, but the best is alluvial soil or hill Acrisols, good drainage, and pH 6–6.5. Papaya is not tolerant to acid soil and shallow groundwater table



Planting time

Papaya can be grown all year round, but there are two main seasons: in the spring – from February to March, at the end of the rainy season – from July to August.



Nutrient requirements

Nutritional requirements of papaya are high and large amount is needed. In order to ensure productivity from 30–40 t/ha, papaya required fertilizer amount per hectare: 10 t/ha of organic fertilizer; together with 370 kg N; 200 kg P₂O₅ + 360 kg K₂O. 500 kg lime (powder) must be applied as well before planting to manage soil pH.



Methods of fertilizing

- Fertilize application for papaya is divided into 4 times, the amount of fertilizer used per fertilizer see table 67.
- Basal application: apply all manure and a part of NPK before planting.
- Top-dressing applications: NPK fertilizer have to be put into the soil in the root area and watering after that to create good condition for the best nutrients absorption by roots. Also fertilizer can be dissolved in water and then irrigated around the root.



Table 67. FERTILIZER APPLICATION FOR CELERY [per ha]

TYPE OF FERTILIZER	BEFORE PLANTING	45–60 DAYS AFTER PLANTING	AT FLOWERING STAGE	AFTER HARVESTING
Organic fertilizer	10 t	–	–	–
NPK 16–16–16-TE	100 kg			
NPK 16–16–16-TE		300 kg		
NPK 18–6–18-TE			300 kg	
NPK 18–6–18-TE				350 kg

NUTRIENT PERENNIAL CROPS



COFFEE

Environmental condition requirements:



Temperature

Robusta coffee best grows in the temperature ranges from 22–26 °C, rainfall ranges 1.800–2.000 mm and it requires the short drought period after harvesting for initial flower development.



Soil requirements

Robusta coffee can well grow in difference soil types such as redish ferrasol, yellow ferasol and grey soil. It is important that the soil thickness must be more than 1 m.



Planting time

The most suitable planting time for Robusta coffee is a rainy season from May to June.



Nutrition requirements

To achieve productivity of 3–4 tons of coffee bean per hectare, coffee plant needs following quantities applied per 1 ha: manure 10–15 t/ha, combined with mineral fertilizer: N 300–350 kg, P₂O₅ 100–150 kg and + K₂O 250–300 kg.



Method of fertilizing

- Fertilizer application for coffee is divided into four times per year and the amount of fertilizer for each application indicated in table 70–71.
- Organic fertilizer has to be applied around canopy and put into the soil with depth 15–20 cm.
- NPK fertilizers applied as a top-dressing into the soil, in root zone. Proper watering required after that to create good condition for best nutrient absorption by root system.

Table 68. FERTILIZER APPLICATION FOR COFFEE AT BASIC CONSTRUCTION STAGE (per ha)

TREE AGE, year	ORGANIC FERTILIZER (t/ha)	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
1	15	50–75	70–80	30–40	60–80	80–90	30–40
2	15	90–110	70–80	80–90	100–120	80–90	90–100
3	15	110–140	80–90	90–110	120–150	90–100	100–120

Note: density 1100 trees/ha

Table 69. FERTILIZER APPLICATION FOR COFFEE AT FRUIT SET (VEGETATIVE) STAGE (per ha)

TARGET YIELD	ORGANIC FERTILIZER (t/ha)	PURE NUTRIENTS [g/tree]			PURE NUTRIENTS [kg/ha]		
		N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
3.0–3.5 t/ha	15	225–270	90–110	200–230	250–300	100–120	220–250
3.5–4.0 t/ha	15	270–320	110–135	230–270	300–350	120–150	250–300

Note: density 1100 trees/ha

NUTRIENT PERENNIAL CROPS

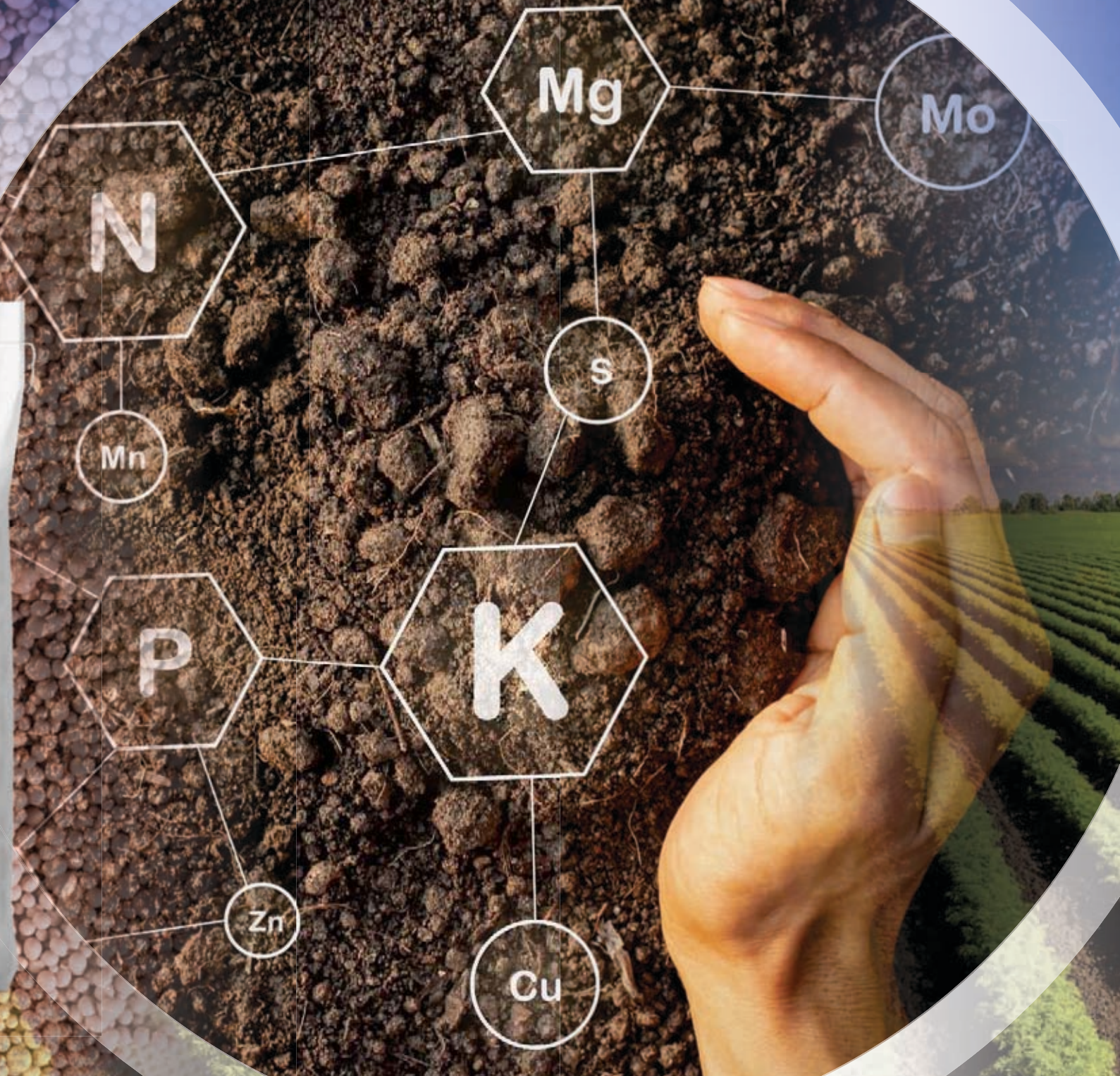


Table 70. FERTILIZER APPLICATION FOR COFFEE AT BASIC CONSTRUCTION STAGE (per ha)

TREE AGE, year	DRY SESAON	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
1	NPK 16-16-16-TE: 60 kg	Organic fertilizer: 15 t/ha NPK 16-16-16-TE: 90 kg Themor: 300 kg	NPK 25-9-9-TE: 100 kg	NPK 25-9-9-TE: 100 kg
2	NPK 16-16-16-TE: 100 kg	Organic fertilizer: 15 t/ha NPK 16-16-16-TE: 150 kg FMP [Fused Magnesium Phosphate]: 100 kg	NPK 25-9-9-TE: 200 kg	NPK 18-6-18-TE: 180 kg KCl 60%: 30 kg
3	NPK 16-16-16-TE: 150 kg	Organic fertilizer: 15 t/ha NPK 16-16-16-TE: 150 kg FMP [Fused Magnesium Phosphate]: 100 kg Urea 46%: 50 kg	NPK 25-9-9-TE: 200 kg	NPK 18-6-18-TE: 200 kg KCl 60%: 30 kg

Table 71. FERTILIZER APPLICATION FOR COFFEE AT FRUIT SET (VEGETATIVE) STAGE (per ha)

TARGET YIELD, t/ha	DRY SESAON	START OF RAINY SEASON	MIDDLE OF RAINY SEASON	END OF RAINY SEASON
3-3.5	NPK 16-16-16-TE: 300 kg	Organic fertilizer: 15 t/ha NPK 25-9-9-TE: 250 kg Urea 46%: 60 kg	NPK 18-6-18-TE: 500 kg	NPK 18-6-18-TE: 400 kg KCl 60%: 30 kg
3.5-4.0	NPK 16-16-16-TE: 360 kg	Organic fertilizer: 15 t/ha NPK 25-9-9-TE: 300 kg Urea 46%: 45 kg	NPK 18-6-18-TE: 600 kg	NPK 18-6-18-TE: 500 kg KCl 60%: 30 kg





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