

Role of Training, Pruning and Nutrient Management in Enhancing Growth, Yield and Sustainability of Cocoa (*Theobroma cacao* L.)

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INTRODUCTION

Cocoa (*Theobroma cacao* L.), belonging to the family Malvaceae, is native to the tropical rainforests of Central and South America. It is widely cultivated in tropical regions of the world, including India, where it is commonly grown as an intercrop under coconut and arecanut plantations. Cocoa exhibits a unique growth habit. The seedling initially grows vertically as an orthotropic stem. At a certain stage, the terminal bud ceases growth and forms a whorl of 3–5 lateral plagiotropic branches called fan branches. This branching point is known as a jorquette. A new vertical shoot called a chupon then develops below the jorquette and continues upward growth. Under natural conditions, cocoa trees may reach heights of up to 20 m however, under cultivation, tree height is regulated through training and pruning for efficient management and harvesting.

Training in Cocoa

Training is an important canopy management practice in cocoa that involves developing a strong, well-balanced framework during the early growth stage of the plant. The main objectives are to maintain a manageable tree height, improve light penetration and air circulation within the canopy, facilitate cultural operations, harvesting and pest and disease management and ultimately enhance yield and bean quality. In cocoa, the first jorquette is ideally maintained at a height of **1.5–2.0 m** above ground level. If the jorquette develops at a lower height, it should be removed to encourage upward growth before canopy formation. Generally, **three to four healthy fan branches** are retained to develop a strong and balanced canopy, while unwanted **chupons** arising below the jorquette are removed regularly. Proper training ensures an optimum canopy structure, allowing efficient utilization of sunlight, water, and nutrients, thereby improving plant health, productivity, and the quality of cocoa beans.

Pruning in Cocoa

Pruning is the selective removal of unwanted, dead, diseased, damaged or unproductive plant parts to maintain the health, vigor and productivity of cocoa trees. It is an essential canopy management practice that helps maintain the desired tree shape and a well-balanced canopy, ensuring optimum light penetration and air circulation throughout the tree. Regular pruning improves the distribution of sunlight within the canopy, enhances photosynthetic efficiency and creates favorable conditions for flowering, fruit set and pod development. It also facilitates intercultural operations, harvesting and plant protection measures by providing easy access to the canopy. The timely removal of diseased, dead, crossing and overcrowded branches reduces the incidence of pests and diseases, minimizes competition for nutrient and encourages the growth of healthy and productive shoots. Proper pruning ultimately improves tree vigor, increases pod production, enhances bean quality and contributes to sustained higher yields throughout the productive life of the cocoa plantation.

Formation pruning

Formation pruning is carried out during the early stages of growth to regulate jorquette height and develop a strong framework. Low jorquettes are removed when necessary and 3–4 vigorous fan branches are retained.

Maintenance pruning

Maintenance pruning is performed on mature trees to maintain canopy structure and productivity. Dead, diseased, broken and overcrowded branches are removed regularly. Unwanted chupons, climbing plants and ant nests are also eliminated.

Sanitary pruning

Sanitary pruning involves the removal of diseased branches, insect-infested plant parts, damaged pods, overripe pods and parasitic plants. This practice improves orchard sanitation and minimizes the spread of pests and diseases.

Nutrient Management in Cocoa

Nutrient management plays a vital role in maintaining soil fertility and ensuring sustained cocoa production. Cocoa trees continuously extract nutrients from the soil through vegetative growth, flowering, pod development and bean production. Therefore, nutrients removed from the soil must be replenished through organic manures and fertilizers. Balanced nutrition improves growth, flowering, fruit set, pod development, bean quality and overall productivity. Nutrient management should be based on plant age, soil fertility status and cropping system.

Impact of Manures and Fertilizers on Growth

Organic manures and inorganic fertilizers are essential for healthy vegetative growth and canopy development in cocoa. Their balanced application promotes plant height, stem girth, root growth, leaf production and the development of strong jorquettes and fan branches. Organic manures such as farmyard manure (FYM), compost, vermicompost and green manures improve soil structure, moisture retention, microbial activity and nutrient availability. Nitrogen promotes vegetative growth, phosphorus supports root development and potassium enhances plant vigor, stress tolerance, flowering, pod development, and bean quality. Integrated nutrient management helps maintain soil fertility, improves plant health, and increases cocoa productivity.

Impact of Manures and Fertilizers on Yield

Adequate nutrient supply is essential for improving flowering, fruit set, pod development, and bean production in cocoa. Balanced fertilization increases the number of flower cushions, enhances flowering and fruit set, reduces cherelle wilt and flower drop, and improves pod retention and development. It also increases bean size, weight, cocoa butter content, bean recovery and overall dry bean yield per tree. Among the major nutrients, phosphorus promotes flowering and healthy root activity, while potassium plays a key role in pod filling, bean quality and stress

tolerance. Proper nutrient management ensures sustained productivity, better bean quality and higher economic returns.

Integrated Nutrient Management (INM)

Integrated Nutrient Management (INM) is the combined use of organic manures, chemical fertilizers, biofertilizers, and crop residues to maintain soil fertility and achieve sustainable yields.

- Improves soil physical, chemical, and biological properties.

- Enhances nutrient-use efficiency.
- Increases soil organic carbon content.
- Improves microbial activity.
- Reduces nutrient losses and environmental pollution.
- Maintains long-term soil fertility.
- Improves yield and bean quality.

INM is considered an effective strategy for sustainable cocoa production because it ensures balanced nutrition while preserving soil health.

**Recommended Fertilizer Schedule for Cocoa
(Fertilizer Requirement per Tree per Year)**

Age of Plant	FYM (kg)	Nitrogen (g)	P ₂ O ₅ (g)	K ₂ O (g)
1st Year	10	50	20	70
2nd Year	15	100	40	140
3rd Year	20	150	60	210
4th Year and Above	25	200	80	280

- Apply FYM or compost once annually during the rainy season.
- Apply fertilizers in two equal split doses during June–July and September–October.
- Fertilizers should be placed in a circular band around the tree basin and incorporated lightly into the soil.
- Mulching is recommended to conserve soil moisture and improve nutrient-use efficiency.

Relationship Between Training, Pruning and Nutrient Management

Training, pruning, and nutrient management are interrelated practices that collectively determine the productivity of cocoa plantations. Proper training and pruning create an efficient canopy that improves light interception and air circulation, thereby enhancing photosynthesis and nutrient utilization. Balanced nutrition supports vigorous vegetative growth, flowering, pod development, and recovery from pruning operations. Trees receiving adequate nutrients

respond more effectively to training and pruning practices, while well-managed canopies utilize applied nutrients more efficiently. Therefore, the integration of these practices is essential for maximizing growth, yield, and orchard health.

CONCLUSION

Training, pruning, and nutrient management are key components of scientific cocoa cultivation. Training establishes a strong framework and maintains an optimum canopy structure, while pruning improves light penetration, air circulation, and tree health. Balanced application of organic manures and inorganic fertilizers promotes vigorous growth, enhances flowering and pod development, improves bean quality, and increases yield. Integrated Nutrient Management further ensures sustainable soil fertility and long-term productivity. The combined adoption of these practices enables cocoa growers to achieve higher yields,

superior bean quality, and sustainable economic returns.

REFERENCES

- Goldsworthy, P.R. and Fisher, N.M., 1984. *The physiology of tropical field crops*. John Wiley & Sons.
- Awazi, N.P., 2025. Introduction to the Role of Cocoa-Based Agroforests for Carbon Credits and Markets, Soil Fertility Improvement, and Soil Macro-Fauna Conservation. *Agroforestry for a Sustainable Future: The Place of Carbon Credits and Markets*, pp.1-77.
- Wood, G.A.R. and Lass, R.A. (2008). *Cocoa*. 4th Edition. Blackwell Science, London.
- Wessel, M. and Quist-Wessel, P.M.F. (2015). *Cocoa production in West Africa: A review and analysis of recent developments*. *NJAS – Wageningen Journal of Life Sciences*, 74–75: 1–7.
- International Cocoa Organization (ICCO). (2023). *Cocoa Production and Sustainable Management Practices*. International Cocoa Organization (ICCO)
- Central Plantation Crops Research Institute (CPCRI). (2024). *Package of Practices Recommendations: Cocoa*. Kasaragod, Kerala, India. CPCRI
- Awazi, N.P., 2025. Introduction to the Role of Cocoa-Based Agroforests for Carbon Credits and Markets, Soil Fertility Improvement, and Soil Macro-Fauna Conservation. *Agroforestry for a Sustainable Future: The Place of Carbon Credits and Markets*, pp.1-77.