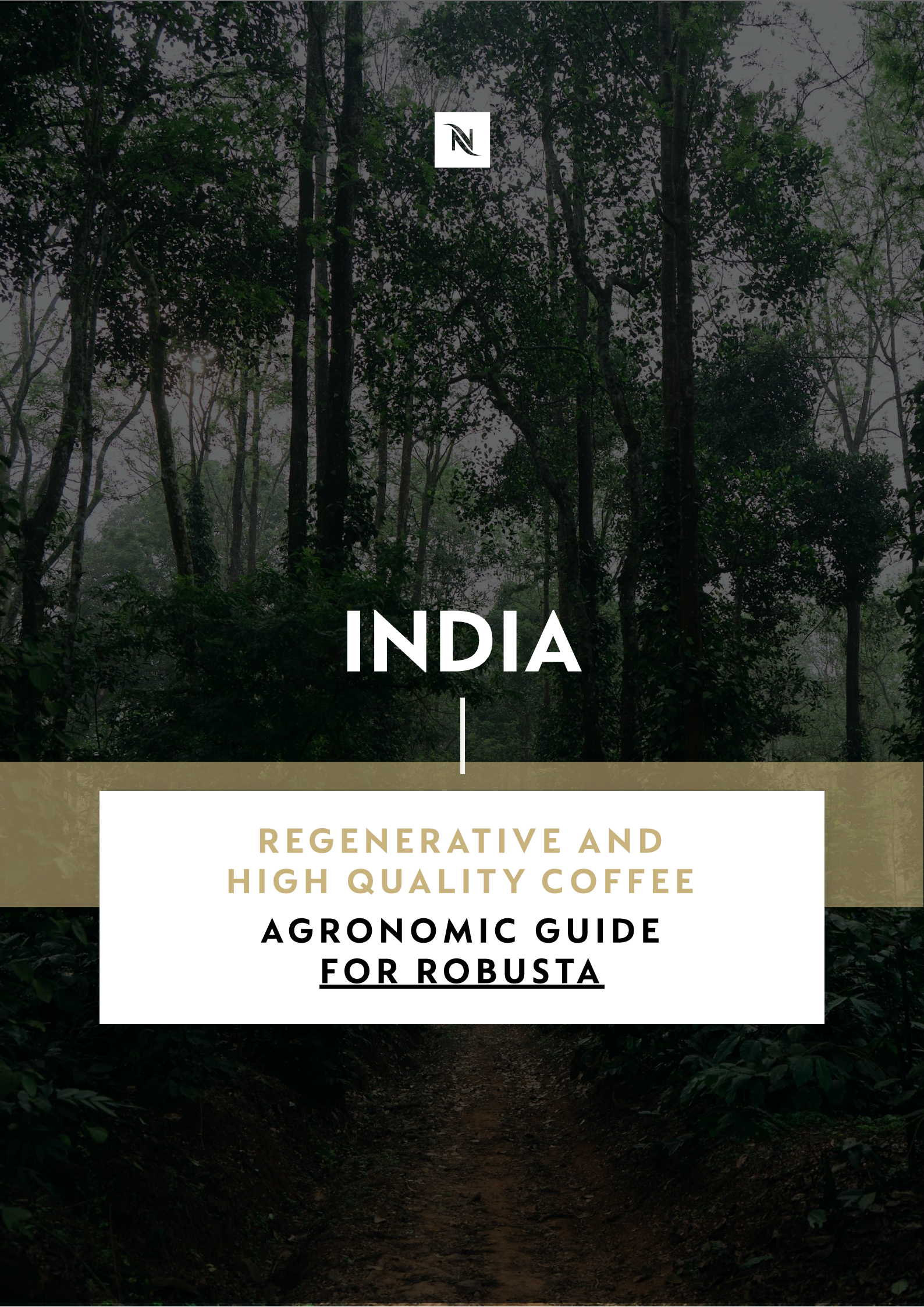


INDIA

REGENERATIVE AND HIGH QUALITY COFFEE

AGRONOMIC GUIDE FOR ROBUSTA

Preamble

At Nespresso, we believe that nature is our greatest ally in securing the future of coffee in general, especially the high-quality coffees we source for our business.

For 20 years, our sourcing programme, the Nespresso AAA Sustainable Quality™ Programme, has been the vehicle for adopting innovative agricultural practices. In this new chapter, the AAA Programme will further promote investment into Natural Capital. The transformative power of nature can deliver the services that farmers and society critically need: resilience, yield, quality consistency, new sources of income, carbon sequestration and biodiversity conservation.

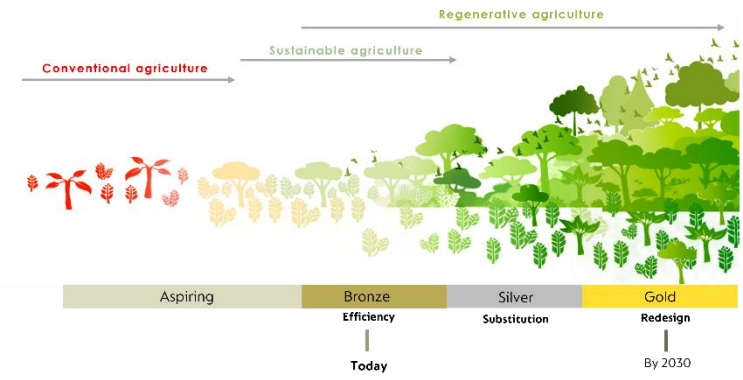
In this new chapter, Sustainable Quality will further integrate high-quality coffees with healthy ecosystems, quality of life and thriving communities.

Nespresso and the Rainforest Alliance share a common vision of regenerative agriculture building on 3 foundational principles:

I. Produce in ways that actively restore and protect biodiversity in and around production areas.
II. Reduce greenhouse gas emissions by adapting to climate change and building resilience in the farm.
III. Preserve the farmers' livelihoods in the short and long term.

We are convinced these three foundational principles are the only way to guarantee a long-term sustainable supply of high-quality coffee.

The co-created Rainforest Alliance's Regenerative Coffee Scorecard helps understand where one stands in the transition: **FROM BRONZE TODAY TO GOLD BY 2030**



Once classified as Gold Standard, the farms will, in turn, offer many benefits to society: offering habitats or corridors for species, sequestrating carbon and replenishing watersheds. Thanks to the availability of organic matter, the farms' soil will maintain living organisms needed for nutrient cycling.
Equally, Nespresso and its partners will continue to enrich this document with new scientific insights towards an integrated quality concept, i.e., cup profiles, healthy soil, healthy ecosystems and thriving communities.

We invite you to read this agronomic guide describing the pathway towards the Gold Standard.

INDIA

This document aims to guide the implementation of regenerative coffee-growing in the field, with training, support work for coffee growers, and cluster planning actions. The Agronomic Guide connects the vision of the Rainforest Alliance Regenerative Coffee Scorecard with the technical and environmental research and recommendations available in India. In the Indian context, where farmers could produce Arabica and Robusta coffee, we decided to focus on the production of Robusta.

Regenerative agriculture is about change management and, therefore, relies on motivation, knowledge, and resources to ensure the transition of the practices. *Nespresso* provides the enabling conditions to the AAA farmers for a smooth management change, price premiums paid by AAA coffee, investment, infrastructure, alternative solutions, and technical assistance.

To motivate behavioural change among producers and their families, field teams implement an adoption strategy through producer networks supported by successful producers and influential leaders. They encourage the exchange of experiences in their local contact networks. The innovation and creativity among the AAA producers, agronomists, *Nespresso* and their partners guarantee optimism for transforming coffee production with a positive impact.

Nespresso acknowledges the contributions of coffee partners in India, ECOM, and NKG. Their experience in the field has been a fundamental input to building an agronomic guide and consolidating the work of the AAA Program.

RAINFOREST ALLIANCE

RAINFOREST ALLIANCE ENDORSES THIS GUIDE as a set of recommendations for the journey toward Gold Standard regenerative coffee production in AAA coffee farms in India; this guide is in alignment with the Rainforest Alliance Regenerative Coffee Scorecard.

AT NESPRESSO, WE BELIEVE THAT NATURE IS OUR GREATEST ALLY IN SECURING THE FUTURE OF COFFEE

Regenerative Agriculture ...a farming approach that emphasizes protecting and restoring natural resources (primarily soil, but also water and biodiversity) to deliver multiple benefits to farmers, environment and society. By strengthening soil health and ecosystem services, regenerative agriculture helps make agroecosystems more productive and resilient, while also improving farmers' livelihoods. A focus on regenerative agriculture further creates important opportunities to mitigate greenhouse gas (GHG) emissions[1].

THE GUIDANCE DEFINED BELOW IS PREPARED FOR AAA AGRONOMISTS AND TEAMS IN THE CLUSTER TO GUIDE FARMERS IN THE TRANSITION PROCESS.

THE AGRONOMIC GUIDE BUILDS ON THREE PRINCIPLES that will be conveyed to the farmers as the Cluster Operational Plan is deployed. These three principles require a mindset change of the producers and the coffee partners with whom *Nespresso* works.

I. By design, the farm generates organic materials and natural biocontrol.
II. Soil Health first before plant nutrition
III. Resilience and profitability vs. productivity

IT REFLECTS THE NESPRESSO JOURNEY TOWARD REGENERATIVE AGRICULTURE WITH ONE CHAPTER OF KEY PRACTICE AREAS:

1. FARM DESIGN
2. SOIL HEALTH
3. PLANT NUTRITION
4. PLANT HEALTH
5. WATER MANAGEMENT
6. FARM FINANCIALS

THROUGHOUT THE DOCUMENT, WE WILL PROVIDE DIFFERENT SECTIONS FOR EACH CHAPTER.

01 → **PERFORMANCE EXPECTATION** is primarily based on the criteria of the Rainforest Alliance Regenerative Coffee Scorecard.

02 → **IMPLEMENTATION RECOMMENDATIONS** that AAA Agronomists present to AAA Farmers.

03 → **ACTIONS** that are planned at the cluster level to facilitate the adoption and change towards regenerative practices.

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1. FARM DESIGN

1.1 REHABILITATION & RENOVATION

Planning for coffee renovation presents a critical opportunity to restore heavily damaged or senescent coffee plants and, to some extent, support rehabilitation efforts. This phase is ideal for integrating regenerative agricultural practices that enhance the long-term sustainability of coffee systems.

Key rejuvenation strategies—such as stumping and grafting with high-yielding or locally adapted varieties—are essential for maintaining plantation productivity and addressing declining yields due to ageing trees. These interventions help secure the long-term economic viability of coffee cultivation.

Renovation also provides a platform to introduce complementary regenerative practices, including diversified intercropping, agroforestry designs suited to local conditions, and soil conservation techniques that improve soil health.

Here, we will illustrate some terms that may be confusing in their translation and technical description.

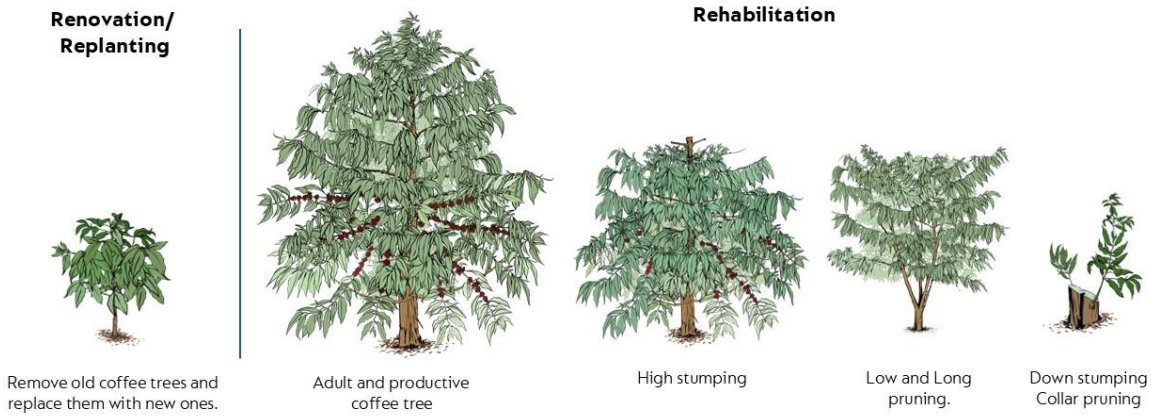


Figure 1. Renovation and rehabilitation terms.

Note: Please review Annex 2 for further details on these terms in the context of the Rainforest Alliance Regenerative Coffee Scorecard.

REHABILITATION:

"Rehabilitation involves pruning and stumping the coffee trees, while maintaining the current root stock." [1]

"Frequent pruning to maintain coffee tree health and productivity"
RA Scorecard – Gold Level. [2]

RECOMMENDATIONS

- The rehabilitation is carried out of the end of the coffee harvest.
- The rehabilitation must include a comprehensive assessment of the current state of coffee crops, evaluating key parameters such as plant quality, planting density, the net number of productive trees per plot, current production potential, and plot area. This information should be systematically recorded and will provide a solid foundation for informed planning and decision-making.
- The definition of the rehabilitation frequency of coffee tree tissue depends on the evolution of yearly productivity. To prevent a decline in productivity, early intervention in tree tissues is essential to promote young growth that sustains production. When coffee trees have few productive branches, implementing stumping (low or high, see Figure 1) or pruning at the right stage can help restore and maintain coffee productivity.[3] [4]
- The rehabilitation includes stumping (down stumping – high stumping) and collar pruning techniques. The approach can be selective, in rows, across an entire plot, or a combination of these methods.
- Desuckering, removal of newly emerging suckers on the main stem, which otherwise divert nutrients from the productive primary branches. This practice is essential for preserving the health and yield potential of the crop-bearing branches. De-suckering should be performed two to three times annually, depending on plant growth dynamics. [5]

[1] Pulleman et al., 2023, p. 48.
[2] Rainforest Alliance, 2022 a.
[3] Pulleman et al., 2023, p. 51.
[4] Coffee Board of India, 2023. p.69
[5] Coffee Board of India, 2023. p.69

– Topping, truncating the vertically growing main stem when it attains a height of approximately 1.0 to 1.2 meters. This practice is critical for maintaining the optimal height and architectural structure of the coffee plants, facilitating the ease of harvest and management. Typically, topping is carried out when the plant reaches an age of 1.5 to 2 years. [6]

RENOVATION:

"Renovation involves uprooting old trees and filling gaps with new plantings to replace the current coffee variety as well as the rootstock. This practice also makes it possible to increase planting densities or change to a different system design." [7]

"Replanting or renovation, implemented to ensure at least 60-70% of the plot is in young or middle age (≤ 50 years) trees."

"Coffee variety is selected based on quality, productivity, and low irrigation requirement."

"The main limitations to the implementation of renovation and rehabilitation are the high upfront investments in planting materials and labour, especially in the case of renovation. A further disadvantage is that the practice leads to an initial, short-term loss of yield and income." [8]

RECOMMENDATIONS

- The installation of a nursery:

Nurseries can be built on the ground in planting beds (1.0 m wide, 10-15 cm high, maximum 6 m long) or individual polybags (Basket). The basket size can be 22.5 cm high x 15 cm wide and 150 gauge thickness to ensure they have 3 mm holes in the bottom half for adequate drainage of excess water. For the nursery mixture, combine six parts of sieved virgin soil, two parts of good cattle manure and one part of fine sand. The recommended coffee variety seeds are to be sourced from a coffee board or certified farmers. The farmers can also practice grafting or top-working to renovate the aged trees.

[6] Coffee Board of India, 2023. p.69
[7] Pulleman et al., 2023, p. 48.
[8] Pulleman et al., 2023, p. 54.

Before the renovation, soil correction (pH and aluminium) is carried out one month before sowing based on soil analysis, using options such as calcium carbonate, magnesium carbonate, calcium hydroxide, calcium sulphate, and agricultural gypsum. [9]

The plantlets, which are about 6 to 8 months old with about 6 leaves, are used for the planting. These are generally recommended for planting during the main planting season between August and September. Seedlings raised on special beds or baskets have about 8 to 12 leaves at 16 to 18 months and are planted at the start of the monsoon season. The plants of 16 to 18 months of age have low mortality and better establishment rates in the main field. [10]

- Jan Y0: planting of seedlings
- June Y0-Sept Y0: monsoon 1, seedlings growing
- June Y1: plant seedlings on the farm
- Grow seedlings in a basket
- Low mortality rate
- Better establishment

- The main coffee varieties in terms of planted area in India are:

CULTIVAR	*Irrigation requirement*	*Productivity*
Contingency (Old Robusta)	Low	Low
Robusta Variety -Selección 274	Low	High
Robusta Variety - CxR	High	High

Table 1. *Improved coffee cultivars planted in India (The Indian coffee Board. Coffee Guide . p.58)*

- The AAA Agronomists will advise and encourage farmers to choose a suitable variety or cultivar (hybrid) based on their analysis of local variables. All varieties and cultivars listed in Table 1 adhere to *Nespresso* quality profiles associated with each cluster. Given the investment required for a change in varieties, the renewal process should be undertaken gradually, at 5% annually, for the total coffee area.

- Recommended density/spacing depends on technical criteria such as climate conditions, soil fertility, rejuvenation cycle duration, and agronomic practices. Different planting distances can be applied between trees and lines, with some models based on dry season prevalence over the year (Table 2).

[9] Coffee Board of India, 2023. p.60
[10] Coffee Board of India, 2023. p.60

RAINING PATTERN	DISTANCE BETWEEN LINES (M)	DISTANCE BETWEEN TREES (M)
Contingency (Old Robusta)	*3*	*3*
Robusta Variety -Selección 274	*3*	*2,4*
	2,4	*0,80*
C xR	*2.4*	*2.4*

Table 2. *Some planting distance alternatives for coffee renewals in India (The Indian coffee Board. Coffee Guide . p.58)*

STEPS IN THE CLUSTER ACTION PLAN

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Define and implement the renovation plan considering the variety, density, arrangement, pruning, and cycle.		☑
Adoption strategy for the defined acceleration group of AAA farmers.	☑	☑
Define and implement the renewal plan by considering the variety, density, arrangement, pruning, and the renewal cycle. Each farm defines the renovation plan with the assistance of the AAA Agronomist. Clusters monitor the annual progress regarding the area and the number of trees renovated or rehabilitated.	☑	☑
Identify alliances and coordination with the renovation and rehabilitation programmes from the government, coffee institutes, or private companies.	☑	

1.2 AGROFORESTRY

"Maintaining agroforestry cover, including a diversity of trees on the overall farm (coffee plots and/or surroundings), with at least eight species (ideally native), manages species diversity, as described in the Silver level, and provides two strata of tree levels. If agroforestry cover is not suitable for the local environmental conditions, trees may also be planted around the infrastructure, borders, etc. RA Scorecard – Gold Level."[11]

The coffee plantations in the Western Ghats are part of a broader agroforestry system that combines coffee cultivation with diverse tree species, creating a sustainable and ecologically balanced environment. This agroforestry system is characterised by the integration of coffee plants with both native and exotic trees such as *Grevillea robusta*, *Ficus sp.*, *Erythrina sp.*, and *Cedrela sp.*, forming a multi-layered canopy that provides crucial shade for the coffee plants. The trees not only protect the coffee plants from excessive sunlight but also regulate the microclimate, especially during the monsoon season, by reducing temperature fluctuations and ensuring optimal growing conditions. This shade is vital in maintaining consistent moisture levels in the soil, preventing dehydration and waterlogging, which can negatively affect coffee yields.

The legal prohibition on cutting trees in this region is rooted in these trees' essential role in the agroforestry system. By maintaining tree cover, the system promotes soil conservation by preventing erosion, a critical concern in the hilly terrain of the Western Ghats. The trees' leaf litter enhances soil fertility, contributing organic matter that supports the microbial ecosystem essential for healthy plant growth. In addition, this practice fosters biodiversity by providing habitats for pollinators, birds, and other wildlife, creating a resilient ecosystem that supports the long-term health of the coffee plants.

Agroforestry in the Western Ghats offers a model for sustainable coffee farming, where the trees and coffee plants work in tandem to improve soil health, increase biodiversity, and enhance the farm's resilience to climate change and other environmental challenges. This approach not only ensures the stability of coffee production but also supports the larger environmental and social systems that depend on this unique ecosystem. By preserving the integrity of these agroforestry systems, the region maintains a delicate balance between agricultural productivity and environmental sustainability, essential for the long-term success of coffee farming.

[11] Rainforest Alliance, 2022 a.

a. Temporary Shade is provided by fast-growing, nitrogen-fixing species, such as Dadap (*Erythrina variegata),* which is commonly planted in coffee agroforestry systems. These species are selected for their rapid growth rates and ability to enhance soil nitrogen levels. This early-stage shade remains in place until slow-growing shade species provide more durable shade, are established and begin to take over.

b. The selection of tree species is informed by detailed on-site evaluations, considering the specific environmental conditions and the needs of the farmers. The tree species are chosen based on their proven adaptability to the local climate, soil type, and functional goals within the agroforestry system, such as timber production, soil fertility improvement, or shade provision. Native species predominate in the planting, as they are well-suited to local ecological conditions. These species are selected through consultations with farmers to ensure the arrangement aligns with the goals of the coffee production system, considering factors like shade provision during different coffee growth stages.

c. The spatial distribution of the selected tree species will be determined based on site-specific factors, including tree density and canopy height. These factors will be optimised according to the agronomic requirements of coffee production and the ecological characteristics of the site, ensuring that trees complement the coffee crop's growth without causing competition for resources.

d. The planting of the tree species is strategically aligned with the onset of the monsoon season. This timing ensures that the trees receive adequate water during their establishment phase, promoting strong initial growth and reducing the need for supplementary irrigation.

COMMON NAME	SCIENTIFIC NAME	TYPE (NATIVE/NON-NATIVE)
Atthi	*Ficus glomerata*	*Native*
Dadap	*Erythrina lithosperma*	*Non-native*
Gliricidia	*Gliricidia sepium*	*Non-native*
Jack	*Artocarpus heterophyllus*	*Native*
Legume tree	*Albizzia stipulate*	*Native*
Legume tree	*Albizzia lebbek*	*Native*
Mitli	*Ficus macrocarpa*	*Non-native*
Rosewood	*Dalbergia latifolia*	*Native*

Table 3. *The most common shade tree species*

e. The tree species commonly planted within agroforestry systems in India, particularly for coffee cultivation, are outlined in Table 3. These species are selected for their suitability to the region's agroecological conditions and their multifunctional roles within the farming systems, including enhancing soil fertility, providing shade, and supporting biodiversity.

f. During the renovation phase, implement multi-strata agroforestry systems that incorporate a diverse range of at least eight native tree species, assuming the local environmental conditions are suitable for such a variety. Species selection should consider key factors such as tree morphology (growth form and structure), physiological requirements (e.g., water and nutrient needs), pruning needs (for maintenance and optimal growth), species complementarity and compatibility (ensuring the trees support each other ecologically), nitrogen fixation capacity, multifunctionality (e.g., shade, soil improvement, biodiversity enhancement), and economic value (including timber, fodder, or other products). This approach aims to optimise the ecological and economic benefits of the agroforestry system while enhancing sustainability. We integrate a landscape approach, integrating biodiversity into the agroforestry model by promoting diverse shade species, which help improve local biodiversity, particularly in the Western Ghats, a region rich in endemic species and critical ecosystems.

g. The recommended planting density for service shade trees, particularly those with a pruning model such as *Erythrina lithosperma* (Dadap), ranges from 100 to 160 shade trees per hectare. This density will vary depending on factors such as site luminosity (sunlight availability) and the planting density of the coffee crop. Careful attention should be paid to the balance between shade and light requirements for both the trees and the coffee crop to ensure optimal growth conditions for both.

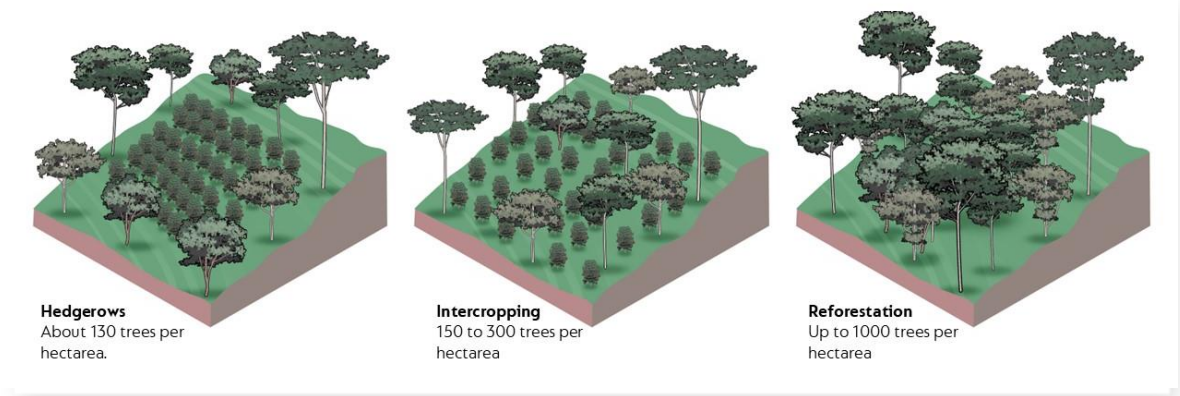


Figure 5. *Different agroforestry models implemented in AAA farms.*
Source: Nespresso, PUR Project, 2021

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Evaluate the possibility and need to diversify shade trees within the coffee farm.		☑
Define the plots with the producers for planting the trees according to the local climate, soils, and associated crops.		☑
Select the best tree species according to the expected benefit, local adaptation, availability, and possibility of local propagation.		☑

1.3 CONSERVATION AREAS

"If agroforestry cover is not suitable for the local environmental conditions, trees may also be planted around the infrastructure borders, etc., maintaining an area equivalent to 15% of the farm area with natural vegetation." RA Scorecard – Gold Level.[12]

"Natural vegetation: Vegetation made up predominantly of native or locally adapted species, where the species' composition and structure resemble the vegetation that occurs or would occur in the absence of human interference. Natural vegetation may be managed (or, in the case of restoration, established) to incorporate a minority component of exotic species if these are beneficial for regenerating the land, adapting the ecosystem to current or future climates, and/or enhancing biodiversity. If invasive species are present, natural vegetation is managed to reduce their presence."[13]

RECOMMENDATIONS

a. There are areas of natural vegetation on AAA farms, (i) tree planting in the forest systems described in Figure 2, (ii) buffer zones, as described later in section 5.1, Water Use & Conservation, according to the area and location description, , (iii) Conservation areas within the farm, (iv) Border plantings, live fences and barriers around housing and infrastructure, or in other ways [14].

b. Conservation areas can contribute more to biodiversity conservation if they are defined with the criteria of corridors or connections with other vegetation areas in coordination with other farmers at a landscape level.

[12] Rainforest Alliance, 2022 a.
[13] Rainforest Alliance, 2022a.
[14] Rainforest Alliance, 2022 a.

STEPS IN THE CLUSTER ACTION PLAN

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Identify the geographical location of farms regarding areas of conservation interest, buffer zones, and biological corridors.	☑	☑
Plan conservation areas with each farm, especially when implementing agroforestry models, is not feasible.		☑
Maintain an inventory of conservation areas on AAA farms.		☑

2. SOIL HEALTH

2.1 SOIL HEALTH ANALYSIS

Soil health is a foundational principle of regenerative agriculture. Soil Health is defined as the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans. Important functions are retaining and cycling nutrients, sequestering carbon, allowing infiltration, facilitating storage and filtration of water, suppressing pests and diseases, and detoxifying harmful chemicals. **Soil Health is linked to Plant Health** and vice versa.

Each soil has a functioning capacity. The more you understand its capacity, the less you need external input. This is a virtuous cycle!

Soil health involves integrating biological, physical, and chemical conditions. While laboratories are still in the early days of providing such integrated analysis to measure soil health, it is the only way to inform regenerative practices adoption for enhanced soil quality and stability, ahead and beyond fertilisation optimisation.

A soil health analysis can indicate if the soil is at full functioning capacity, degrading, or regenerating.

Agroforestry systems in India significantly enhance soil health by promoting higher levels of soil organic carbon (SOC) and soil organic matter (SOM). Integrating diverse tree species, including nitrogen-fixing trees, increases carbon inputs through leaf litter, roots, and organic matter decomposition. These systems also support a greater diversity of soil organisms, such as earthworms, which enhance SOM content and soil structure. The perennial nature of the trees and their deep root systems help prevent soil erosion and contribute to better water retention and nutrient cycling. Agroforestry systems generally improve soil fertility, carbon sequestration, and ecosystem resilience.

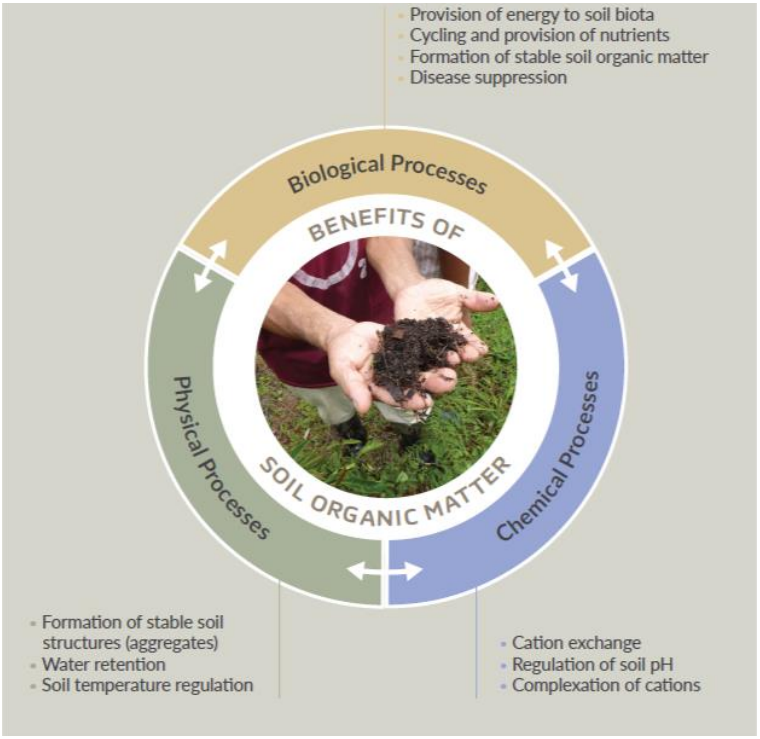


Figure 4. *The benefits of soil organic matter through its effect on biological, chemical and physical processes. Source: Pulleman, M. M., Rahn, E. y Valle, J. F. (2023). CIAT., p. 23*

Healthy soils are essential for high-quality and resilient agricultural production at scale. Agricultural practices such as applying pesticides and synthetic fertilisation are unbalancing the soil's biological conditions. Mechanised activities (when existing) are compacting the soil's physical conditions. On the other hand, practices such as tree planting, organic matter applications, cover crops, and biochar applications positively impact the soil conditions, leading to improved water retention, reduced erosion, and nutrient retention. Maintaining healthy soils is an investment in the farm's natural capital and assets. It challenges us to shift our temporal perspective in management decisions. We are accustomed to planning activities based on the coffee crop cycle, and even fertilisation is often limited to the expected results of a single year or harvest. However, this short-term horizon is insufficient to observe improvements that require more time and persistence. Soil improvement and health must be considered over the long term, as many changes cannot be evaluated with immediate results.

Beneficial microorganisms contribute to soil health. These microorganisms encourage biological activity in the soil, improving its structure and increasing nutrient retention, leading to more vigorous coffee plant growth. In addition, they help control pathogens that could damage crops, reducing the need for chemical pesticides.

Soil health for sustainable coffee farming is essential to maintain healthy soils to ensure high-quality, resilient, and scalable agricultural production. Healthy soils rich in organic matter, nutrients, and beneficial microorganisms are critical for supporting robust plant growth, improving water retention, and enhancing nutrient cycling.

RECOMMENDATIONS

a. Regenerating degraded soil takes time, and optimal regenerative practices will not yield productive results instantly. A new approach to fertilisation should focus on enhancing the functioning capacity of the soil. Guidance on soil health analysis and practice recommendations will continue to evolve and be published for informed decision-making.

b. Incorporation of beneficial microorganisms in coffee farming improves soil health and nutrient efficiency, it encourages sustainable coffee production, reduces environmental impact, and improves the quality of the final product. These microorganisms, therefore, become fundamental allies for coffee producers committed to sustainability and excellence in production. [15]

– Practices that promote soil fertility and microbial diversity should be prioritised, as they contribute to long-term productivity, reduce dependency on synthetic inputs, and enhance the resilience of agricultural systems against climate variability and other stressors. Adopting soil conservation techniques is vital for achieving sustainable crop yields over time.

– Minimising soil disturbance is highly recommended to minimise soil disturbance to preserve soil structure, fertility, and ecosystem functions. Practices such as reduced tillage, no-till farming, or minimal soil handling should be implemented to prevent erosion, compaction, and loss of organic matter. Minimising soil disruption helps

[15] Anacafé, 2024 b.

maintain soil porosity, supports healthy root systems, and promotes beneficial soil microbial activity. This approach enhances water infiltration, reduces soil degradation, and promotes the long-term health and productivity of agricultural systems.

- Measuring soil health is a broad topic, and tools are currently being developed to define indicators that enable effective management at the local level. Conducting soil analyses to determine carbon and organic matter levels is a fundamental starting point, as these are key elements closely linked to the concept of soil health.

2.2 SOIL CONSERVATION

"In addition to soil cover (...), physical structures, such as terraces, trenches, vegetative erosion barriers, or stone barriers, can help control erosion and runoff. Drainage canals and planting in furrows can allow water to infiltrate the soil during high-rainfall events. Terracing has the additional advantage of facilitating farm operations on steep hills, but it requires considerable labour and initial investment. Vegetative solutions should be prioritised over the construction of physical structures whenever possible, as the latter generally involve considerable investment in labour and/or machinery." [16]

"Monitoring soil cover and loss, implementing basic soil conservation practices according to the slope of the farm, and adjusting conservation practices as needed." RA Scorecard – Gold Level. [17]

[16] Pulleman et al. , 2023. p. 82
[17] Rainforest Alliance, 2022 a.

RECOMMENDATIONS

a. Identify areas of the farm that are susceptible to or affected by erosion by conducting thorough assessments based on factors such as slope, soil texture, vegetation cover, and water runoff patterns. Prioritise these areas for targeted erosion control strategies, such as planting cover crops or installing barriers to reduce water flow velocity to prevent soil degradation and maintain crop productivity.

b. Implement soil conservation techniques such as mulching, trenches, and pits to conserve soil and manage erosion. Mulching protects the soil surface from erosion, reduces water evaporation, and increases organic matter. Trenches and pits, such as contour trenches or water-harvesting pits, capture water runoff, reduce erosion, and enhance water retention, thus promoting soil fertility and moisture conservation.

c. Follow a structured soil conservation and erosion prevention programme tailored to the farm's conditions, particularly the slope. Implement a combination of vegetation and structural interventions to minimise erosion and preserve soil health.

d. Integrate agroforestry systems into the farm for enhanced soil protection. These systems provide continuous organic litter input and a canopy that helps protect the soil from wind and water erosion, improving soil structure and fertility while fostering biodiversity.

e. Contour farming (suitable for slope of 10-20%) involves planting crops along the contours of the land to reduce soil erosion. This method uses natural topography to slow down water runoff, helping conserve soil and water while improving crop yield stability. It is particularly effective on sloped terrain, where the risk of erosion is greater.

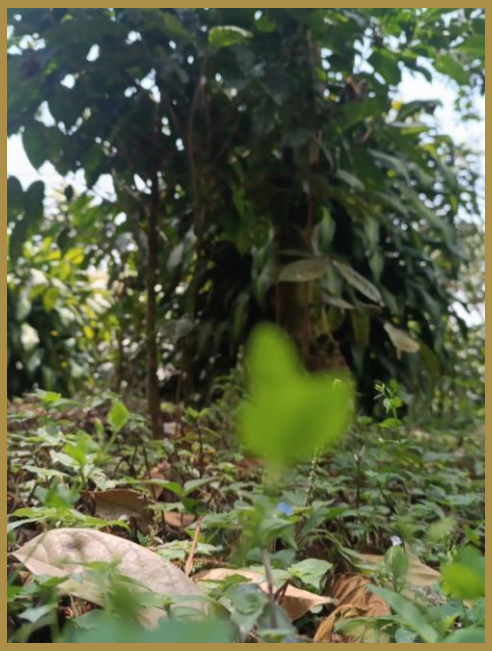
f. Terracing involves creating stepped levels on slopes to prevent soil erosion, especially in hilly or mountainous areas. Each terrace is designed to retain soil and water, reducing runoff. Vegetation should be planted between the terraces to anchor the soil and provide additional erosion control. This practice is crucial for maintaining soil integrity and ensuring the long-term productivity of the land.

2.3 SOIL COVER

"Although cover crops can be established in existing plantations, this may prove challenging in plantations with high planting densities and shade levels (e.g., agroforestry systems). This practice is most suitable in the first years after crop establishment or on farms with larger inter-row distances and/or no shade (as on mechanised farms and in coffee monocultures). During the first years after coffee establishment, smallholders may prefer to use intercropping (e.g., with banana, which also provides sufficient biomass residues), and thus strengthen household food and income security."[18]

"Maintaining at least 80% of bare ground covered with mulch or cover crops (preferably flowering)."

RA Scorecard – Gold Level.[19]



RECOMMENDATIONS

a. Evaluating the existing coverage, including low interference weed cover, is essential as a first step to establishing a soil cover. This will help identify areas where additional cover crops are necessary and feasible to enhance soil protection.

b. For newly established coffee plantations, it is essential to implement cover crops to protect the soil, enhance soil fertility, and promote healthy soil structure. Cover crops help prevent soil erosion, improve moisture retention, and provide organic matter to the soil. They also offer a habitat for beneficial microorganisms that enhance soil health. Leguminous cover crops are particularly beneficial as they fix nitrogen, improving soil fertility. Non-leguminous crops, such as grasses, provide excellent ground cover to prevent weed growth and soil compaction. A balanced mix of cover crops should be selected to suit the soil type, climate, and local environmental conditions.

[18] Pulleman et al., 2023, p. 85.
[19] Rainforest Alliance, 2022a.

c. Green manuring crops (May-June) involve growing specific crops that are then incorporated into the soil to increase its fertility. For coffee plantations, green manuring crops should be planted during the monsoon months of May and June to take advantage of the rainy season. These crops, which include nitrogen-fixing legumes such as Crotalaria, Mucuna, and Vigna, can significantly improve soil health by increasing organic matter and nitrogen levels. Green manure crops should be planted between coffee rows or within intercropping systems to ensure they do not compete with coffee trees for resources but provide complementary benefits.

d. In established coffee plantations, the direct application of cover crops is not always necessary, as coffee and shade trees can provide natural soil cover. The canopy of shade trees and the dense foliage of mature coffee trees naturally protect the soil from erosion, reduce water evaporation, and limit the growth of weeds. This living mulch, combined with the organic matter from falling leaves and branches, helps maintain soil structure and fertility. However, regular monitoring of the soil's health and fertility is necessary to ensure that these natural covers continue to meet soil protection and fertility needs.

e. Assessment of the topography, soil fertility, and microclimates of different plots is essential before introducing additional crops. Some areas may be more suitable for growing cover crops or green manure than others due to soil type, slope, or exposure to sunlight. Identifying areas where soil erosion is a concern or where nutrient deficiencies are present can help guide the introduction of appropriate species that can improve soil health in these locations. Selecting crops that are well-suited to local environmental conditions ensures greater success and benefits for the farm system.

f. Several species can be used as live cover crops in coffee plantations to improve soil health and prevent erosion. Selecting a mix of species based on their compatibility with local conditions and the specific needs of the plantation is recommended for optimal results.

SPECIE	CHARACTERISTICS	MANAGEMENT RECOMMENDATIONS
Crotalaria spectabilis	*Annual coverage* *Slow growth rate* *Fixation of 200-240 Kg Atmospheric N/year* *Mowing before flowering is recommended to extend the useful life of the coverage.* *Pollinator attractant* *Nematicide effect* *Incorporation of organic matter* *Improve the soil structure*	***Planting in lines*** *Sow 3 cm deep* *It must be covered with soil.* ***Spread*** *Maximum 6 kg of seeds/Ha* *Risk of loss of planting density because of attacks from ants and birds*
Vigna radiata	*Annual coverage* *Fixation of nitrogen* *Pollinator attractant* *Excellent establishment* *Does not compete with the crop.* *Allows getting closer to the coffee trees without affecting them.*	***Planting*** *2 seeds/hole* *Sow 3 cm deep.* *Distance between plants of 15-20 cm* *It must be covered with soil.* ***Spread*** *Maximum 6 kg of seeds/Ha* *Risk of loss of planting density because of attacks from ants and birds*
Lolium perenne Rye grass	*Annual grass* *Medium growth* *Does not compete with the crop* *Does not produce stolons* *Low demand for labour* *May present tolerance-resistance to the herbicides.* *Does not allow the development of other weeds*	***Planting in lines*** *Sow 3 cm deep* *It must be covered with soil* ***Spread*** *Maximum 6 kg of seeds/Ha* *Risk of loss of planting density because of attacks from ants and birds*

Table 4. *Live cover species*

g. Introduce cover crops during the renovation to conserve soil health and remove herbicides in the renovation areas. Cover crops enhance soil fertility, prevent erosion, and improve water retention, which benefits coffee production. However, it is crucial to manage cover crops carefully, as they may compete with the coffee plants for water and nutrients, potentially resulting in yield losses. Cover crops should be confined to the inter-row spaces to mitigate this possibility, clearing the area around the coffee plant canopy. Additionally, cover crop clippings can be spread around the base of coffee plants, providing natural mulch that improves soil quality and moisture retention while avoiding competition with the main crop. This approach ensures that cover crops contribute to the sustainability of the coffee farm without negatively impacting coffee growth.[20]

h. The leaves from shade trees should be left on the ground to decompose and provide mulch. This practice has multiple benefits, including soil protection, moisture retention, and organic matter enrichment. Mulching with shade tree leaves helps prevent soil

[20] Pulleman et al., 2023, p. 81.

erosion, improves soil structure, and promotes beneficial microbial activity. Additionally, it reduces the need for synthetic fertilisers and herbicides by enhancing soil fertility naturally. Keeping mulch on the ground also helps maintain the soil temperature, ensuring a more stable environment for the coffee plants. This practice should be consistently maintained to support the long-term health and productivity of the plantation[21].

2.4 INTEGRATED WEED MANAGEMENT

"Use of at most one herbicide active ingredient from the list of risk mitigation pesticides in Annex Chapter 4 of the Rainforest Alliance Standard."

RA Scorecard – Gold Level.

(Mandatory criteria)[22]

- Integrated Weed Management (IWM) is an approach designed to modify the composition of weed populations in the production system, promoting beneficial weeds while limiting the growth of aggressive ones. This approach seeks to classify and manage weeds based on their level of interference with crops, as shown in Table 7, which category the main weeds affecting coffee crops.

RECOMMENDATIONS

- In agroforestry systems, where cover crops and shade trees are present, soil cover is maximised, which helps to suppress weed growth naturally. This practice significantly reduces weed populations by limiting sunlight availability to the weeds, preventing their germination and establishment. By promoting soil cover from cover crops and tree canopy, agroforestry systems help control weeds with minimal intervention, making them an effective and sustainable approach. Regular

[21] Farfán, 2014, pp. 146, 159.
[22] Rainforest Alliance, 2022a.

monitoring, however, should still be conducted to ensure that no invasive or aggressive weed species take root.

- Where sunlight reaches the ground, particularly in the inter-row spaces, weed competition is more pronounced. These areas may need additional management, as weeds can proliferate when exposed to direct sunlight. To address this problem, it is recommended that these areas be monitored carefully for weed presence and that integrated management techniques are applied. This could involve using cover crops, mulching, or manual or mechanical weeding to control weeds in these sun-exposed areas.

- Manual weeding (flash weeding) should be employed as a short-term solution for high-density weed infestations. This method involves quickly removing weeds during their early stages of growth before they have a chance to spread or interfere with crop production. Manual weeding is particularly effective in smaller areas or where mechanical options may not be feasible. It ensures targeted weed removal while minimising soil disturbance. Mechanical weeding can be an effective option for larger areas, particularly in inter-row spaces or areas where weeds are concentrated. This method involves using equipment to remove weeds from the soil physically. It can help reduce weed biomass and crop competition while promoting soil aeration. However, care should be taken in the process to avoid damaging coffee roots and other beneficial plants.

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Run a soil health analysis and define soil conservation and improvement practices prior to analysis, focusing on plant nutrition.		☑
Promote actions with producers to protect and conserve the soil, such as slope and runoff management, terraces, drainage, and living barriers.		☑
Implement soil conservation actions, such as integrated weed management, cover planting, and cover crops.		☑
Eliminate the use of herbicides.		☑

3. PLANT NUTRITION

3.1 SOIL ANALYSIS

"Key components of Integrated Nutrient Management (INM) include: (i) addressing constraints that limit crop response to fertilisation, such as soil acidity, ageing of coffee plants, and shade density; (ii) balanced and efficient fertiliser use based on the 4R concept (right source, right rate, right time, and right place); and (iii) management of organic resources to improve soil health and stimulate biological nutrient cycling. In line with the principles of circular agriculture, INM seeks to recycle nutrients from residue and waste streams generated on and around the farm. Agroecological conditions (such as soil type, topography, and climate), production practices, and the age and phenological stage of the coffee plants all have a strong effect on nutrient requirements, which should be taken into account when making fertilisation plans."[23]

"Conducting a soil assessment and analysis including, if relevant: Erosion-prone areas and slope; Soil structure; Soil depth and soil horizons; Densification of compaction areas; Soil moisture and water level in the soil; Drainage conditions; Identification of areas with visual symptoms of nutrient deficiencies; Soil organic matter". RA Scorecard – Gold Level.[24]

"Soil testing must be done at the right time (at least three to four months after the last fertilisation) and repeated regularly (every two to three years). The use of proper sampling protocols is also critical for ensuring that results are representative of the specific plot or farm; large, heterogeneous farms require multiple tests."[25]

[23] Pulleman et al., 2023. pp. 107-108
[24] Rainforest Alliance, 2022 a.
[25] Pulleman et al., 2023. p.113

RECOMMENDATIONS

a. Soil analysis should be understood as soil health analysis, i.e., including physical, chemical, and biological indications of the soil's condition. Evaluating soil fertility requires chemical, physical, and biological analyses.

b. Conduct (at least every three years) a soil assessment for a representative sample of the coffee area.

c. Based on the soil assessment, identify soil management measures and relevant actions to maintain the best-growing conditions and enhance productivity.

d. Visual symptoms of nutritional deficiencies and foliar analysis can also be observed.[26] Chemical soil analysis is the primary diagnostic tool for assessing the soil's nutritional status and supporting crop nutrition decisions.[27]

e. Design and follow a fertilisation plan based on the soil assessment results, soil management measures identified, and any additional recommendations from an expert.

[26] Sadeghian & Gonzáles–Osorio, 2022, p. 135-136.
[27] Pulleman et al., 2023, pp. 110.

STEPS IN THE CLUSTER ACTION PLAN

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Identify the soil's chemical, physical, and biological composition with soil analysis.		☑
Identify constraints to the fertilisation response. Consider soil acidity correction, crop age, shade level, compaction, or degradation.		☑
Consider solutions based on improving soil organic matter levels and the diversity of microorganisms among the alternatives to mitigate soil acidity.		☑
Propose fertilisation plans considering the agroecological conditions of the crop, crop management practices, and soil analysis results.		☑

3.2 LOW CARBON & EFFICIENT FERTILISATION

For AAA Indian coffee farms, the analysis of CO_2 equivalent emissions highlights that a significant portion of the greenhouse gas (GHG) footprint at the farm level is linked to the production and use of fertilisers. To reduce this footprint, the focus will be on three key principles:

(i) **Healthy soil is fertile soil**: Improving soil health is the foundation for enhancing the entire ecosystem. By prioritising soil management, we can naturally increase fertility, ultimately benefiting coffee production.

(ii) **The nitrogen source matters**: Different nitrogen sources, such as nitrate, ammonium, and urea, have varying impacts on GHG emissions. Careful selection and management of these sources are crucial to reducing emissions.

(iii) **Balancing nitrogen and production**: Nitrogen is the primary contributor to GHG emissions, but it must be managed in relation to coffee yield. Optimising nitrogen use ensures that emissions are minimised without sacrificing productivity.

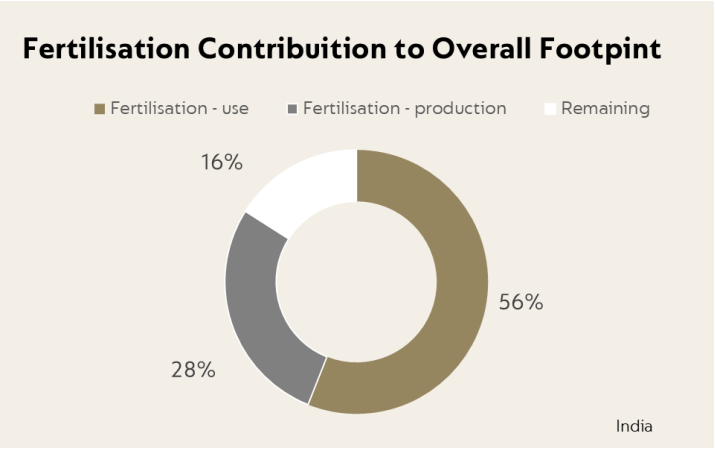


Figure 5. *Fertilisation contribution to overall GHG Footprint – India. Source: Nespresso, 2023/2024 cycle*

N SOURCE	NUTRIENT CONTENT (%)			
	N-Total	N-Ureic $CO(NH_2)_2$	N-ammonium NH_4	N-Nitrate NO_3
Yara Vera Neem Coated Urea	46	46		
YaraLiva-Tropicote	15.5			15.5
YaraLiva-Nitrabor	14.6			14.6
YaraTera-Calcinit	15.5			15.5
YaraMila Complex	12		6	6
YaraMil Winner	15		7.5	7.5

Table 7. Nitrogen content of common YARA fertilisers.

RECOMMENDATIONS

a. Fertiliser application should be tailored to the specific crop requirements as determined by crop yield goals and comprehensive soil analysis. Soil tests provide valuable insights into nutrient deficiencies or excesses, allowing for precise fertiliser application to match the nutrient requirements of the coffee plants. Aligning fertiliser use with soil nutrient status and crop demand maximises fertilisation efficiency, reducing unnecessary inputs.

b. Fertilisers should be applied within the drip circle of the coffee tree, forming a circular soil patch about 45-60 cm around the coffee stem. This method ensures that nutrients are placed where the root system is most active and can absorb them efficiently. In sloped areas, fertilisers should be applied on the upper side of the slope in a semi-circular shape, minimising runoff and maximising nutrient absorption. This method of localised fertilisation ensures that nutrients are concentrated where they are most needed, reducing losses and improving efficiency.

c. Fertiliser applications should be made in split doses for better nutrient uptake and use efficiency. A recommended approach is to apply fertilisers in three stages: once during the pre-monsoon season, again during the monsoon, and a third time during the post-monsoon season. This strategy allows the plant to receive nutrients at key growth stages, improving absorption rates and minimising nutrient losses, especially during rainfall events when nutrients are prone to leaching.

d. Adhering to the 4R concept—Right Source, Right Rate, Right Time, and Right Place—is essential for maximising fertiliser efficiency and productivity. The concept emphasises the need to apply the correct type of fertiliser in appropriate amounts, at the most effective times, and in the right locations to support crop growth. This approach not only optimises fertiliser use but also reduces environmental impact by preventing nutrient overuse. In addition to synthetic fertilisers, organic fertilisation should complement synthetic inputs, improving soil health and providing long-term sustainability (see section 3.3)

e. When applying nitrogen fertilisers, it is crucial to consider how much nitrogen will remain available to the coffee plants. Nitrogen fixation in the soil's organic matter, its retention in the cation exchange complex, and potential losses due to denitrification, volatilisation, or leaching must all be accounted for when determining the appropriate nitrogen application rates. Overapplying nitrogen can lead to environmental pollution and reduced nutrient efficiency, so careful management is essential.

f. Selecting efficient nitrogen sources is key to optimising nutrient uptake. Fertilisers with a low proportion of nitrate nitrogen (<50% NO_3) are more efficient, as they are less prone to ammonia volatilisation and are assimilated more quickly by the plants. By

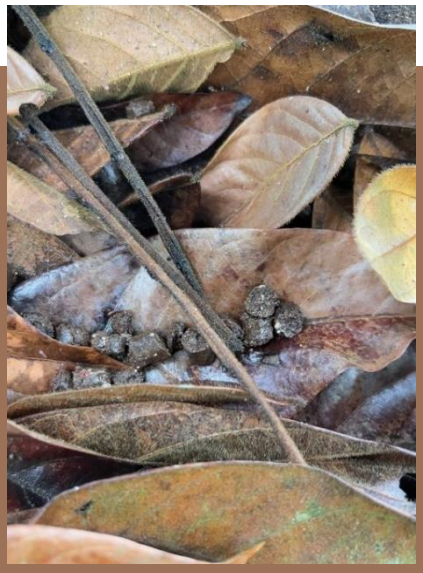
choosing nitrogen sources that are readily available to coffee plants, farmers can enhance fertiliser use efficiency and minimise nutrient losses, promoting better growth and higher yields.

g. Adjusting the nitrogen rate throughout the growing season to match the crop's nitrogen demand is essential for efficient fertilisation. Nitrogen demand varies during different growth stages, and its application should align with the coffee tree's nutrient uptake patterns. This calibration is guided by the nitrogen requirements at different growth stages of the coffee tree, soil analysis results, and field diagnostics.

STEPS IN THE CLUSTER ACTION PLAN

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Recommend fertilisation sources with the best nitrogen use efficiency (NUE) and proper planning of dosage, timing, and place of application.		☑
Define interventions to promote and encourage adopting efficient nitrogen fertiliser use based on the previous recommendations.	☑	☑

3.3 ORGANIC FERTILISATION



"The availability of organic residues determines to what extent organic inputs can substitute for or complement mineral fertilisers. Coffee farms generally do not generate sufficient organic residues to fully satisfy plant nutrient demand. Synchronising nutrient availability with crop demand can also pose challenges when using organic inputs. Therefore, combining mineral and organic fertiliser is the recommended option. The establishment of local capacity to produce quality organic inputs from local waste streams on larger coffee

Each year, 10 to 14 metric tons of organic matter per hectare are added to the soil through shade tree leaves, which improves soil structure and enhances microbial activity.

RECOMMENDATIONS

- Farmers should apply compost from external sources, with a recommended application rate of 5 metric tons per hectare every five years. The use of vermicompost should also be considered as an alternative or supplement to improve soil fertility.

- Biofertilisers, particularly those that promote nitrogen fixation, phosphorus recycling, and potassium mobilisation, should be incorporated into farming practices. These biofertilisers enhance nutrient availability to coffee plants and boost plant health and disease resistance. Microbial inoculants play a crucial role in accelerating specific microbial processes that make nutrients more accessible, contributing to overall plant health and growth.

- The integration of biodigesters on farms can significantly enhance organic matter recycling. Biodigesters convert organic waste into biogas and nutrient-rich organic slurry, which can be used as an organic fertiliser. This practice helps maintain or restore soil organic matter (SOM), improves soil structure, and enhances microbial activity. The slurry produced from biodigesters is a valuable source of nutrients that can be applied directly to the soil, improving nutrient cycling and enhancing soil fertility.

- Cover crops and mulching provide significant sources of biomass and organic matter. These practices reduce soil erosion and contribute to soil fertility by adding

organic material to the soil and protecting the soil surface from compaction and water loss. Effective management of cover crops can also help to fix nitrogen in the soil, further enhancing its fertility.

STEPS IN THE CLUSTER ACTION PLAN

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Promote composting according to the availability of organic matter on the farm. *Prioritise using this and other available sources of organic matter on the farm. Integrate the organic sources into the coffee fertilisation plan.*		☑
Identify the availability of other sources of organic matter in commercial products within the local context.	☑	☑

4. PLANT HEALTH

4.1 INTEGRATED PEST MANAGEMENT (IPM)

"Reducing the use of pesticides (two or fewer ingredients from the risk mitigation list) and limiting the use of synthetic herbicide on the farm."
RA Scorecard – Gold Level (Mandatory criteria)[28]

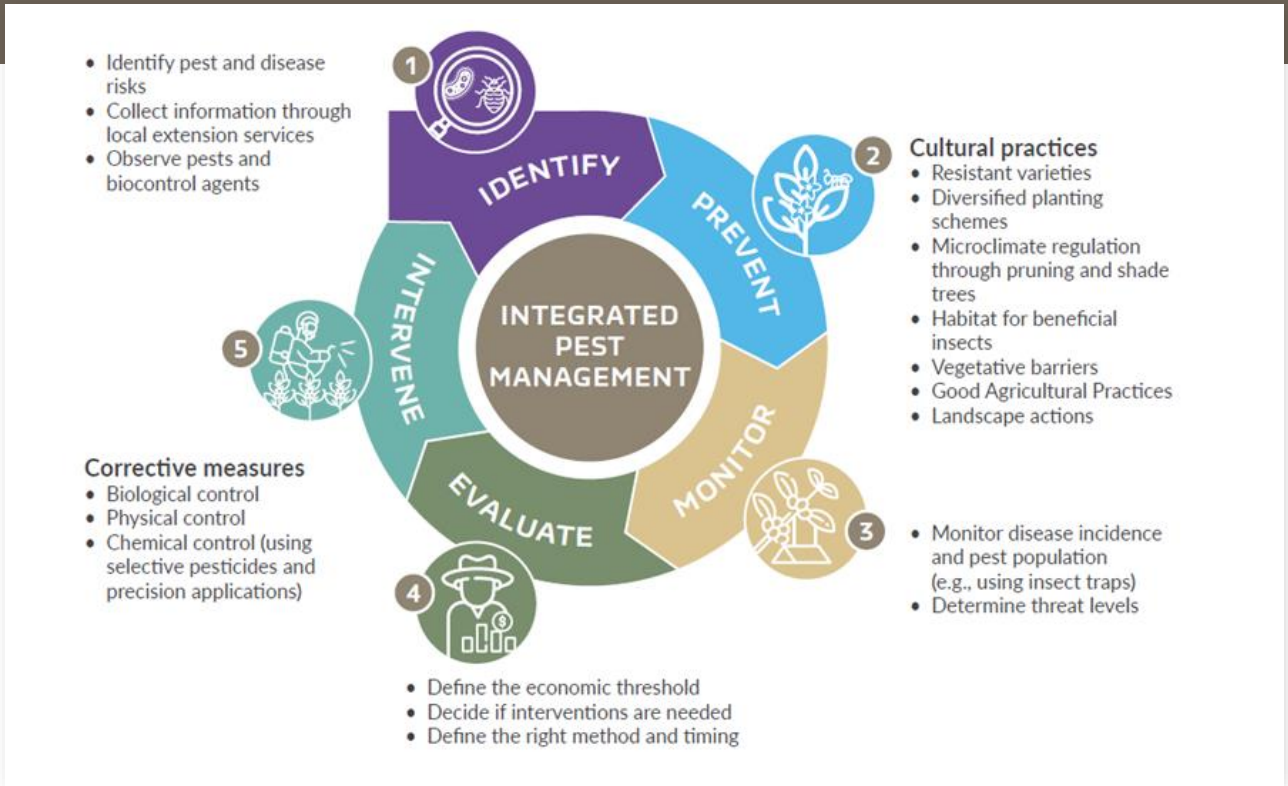


Figure 6. *Key components of an integrated pest management approach.*
Source: Pulleman, M. M., Rahn, E. y Valle, J. F. (2023). CIAT., p. 97

In India, Robusta coffee is generally resistant.

The coffee berry borer (CBB) is the most damaging pest in Indian Robusta cultivation. Effective management of CBB can be achieved through Integrated Pest Management (IPM) practices, such as regular monitoring, sanitation (removal of infested berries), and using pheromone traps to capture adult pests. Biological control with natural predators like parasitoid wasps and cultural practices, such as pruning and optimising shade, also help control CBB. These measures are crucial for maintaining healthy and productive coffee plantations.

[28] Rainforest Alliance, 2022a .

For all phytosanitary problems:

a. Follow the IPM principles and create IPM plans at cluster and farm levels.

b. Use agrochemical application only when cultural and physical methods have been exhausted, and threshold levels of pests and diseases have been reached.

c. Use agrochemicals with the lowest possible toxicity and highest selectiveness.

d. Apply agrochemicals only to the impacted coffee areas/plants.

e. Apply chemical control only as a last resort and keep usage to a minimum. Use only the correct dosage and precision applications of selective pesticides (two or fewer ingredients from the RA risk mitigation list) following directions for usage, as described on the label, in line with *Rainforest Alliance Standard Annex Chapter 4, Farming*.[29]

COFFEE BERRY BORER

f. Cultural control is the most crucial component of integrated CBB management. Cultural control consists of manipulating the environment to make it less favourable to pest insect populations. In the case of the borer, cultural control includes actions such as (i) the age of the crop and the planting distance to allow a good harvest; (ii) timely renovation and rehabilitation of coffee plantations and avoiding the spread of the borer when doing these tasks; (iii) good control of the coffee picking during harvest and at the end of the season to reduce the borer population in the coffee plantation.[30] [31]

g. Using traps, use pheromones placed in shaded areas of the coffee plantation, both at ground and canopy levels. Set traps at the beginning of the flowering season and monitor them weekly to assess infestation levels. Replace pheromone lures regularly to maintain effectiveness. For better results, combine trapping with other integrated pest management practices, such as pruning and biological controls. Educate farmers on trap usage and monitoring to enhance CBB management efforts.

h. Using biocontrol, integrate the use of Beauveria bassiana, a beneficial fungus that infects and kills CBB. Apply it to affected plants and soil, ensuring good coverage, especially after rainy periods. Combine this with pheromone traps placed in shaded areas and at multiple heights, set early in the flowering season. Monitor traps weekly and refresh pheromone lures as needed. Combining biological control and regular

[29] Rainforest Alliance, 2022 b.
[30] Benavides et al., 2013.
[31] Constantino, 2023.

monitoring can effectively reduce CBB populations while maintaining environmental sustainability.

Black rot, *Koleroga noxia*

Proper handling of coffee plants is crucial for maintaining their health and preventing pest infestations. Removing unwanted vegetation, such as young leaves, is important, as it can harbour pests and diseases. As a preventive measure, applying a Bordeaux mixture at 1% concentration, made with 2 kg of copper sulfate, 2 kg of calcium oxide, and 200 litres of water, can effectively protect against fungal infections. This application is particularly important during the monsoon season when heavy rains can exacerbate disease spread. In cases of infection, physical management techniques, such as removing and burning affected branches or leaves, should be implemented to minimise further contamination and maintain the overall health of the coffee plants.

Brown spot disease, *Cercospora coffeicola*

Proper handling of coffee plants is crucial for maintaining their health and preventing pest infestations, including brown spot disease, which often occurs during the peak of the monsoon season when heavy rains increase disease spread. It is important to remove unwanted vegetation, such as young leaves, that can harbour pests and diseases. As a preventive measure, applying a Bordeaux mixture at 1% concentration, made with 2 kg of copper sulfate, 2 kg of calcium oxide, and 200 litres of water, can effectively protect against fungal infections. Additionally, avoiding the use of brush cutters during the monsoon is essential to prevent the infestation and spread of diseases. In cases of infection, physical management techniques, such as removing and burning affected branches or leaves, should be implemented to minimise further contamination and maintain the overall health of the coffee plants.

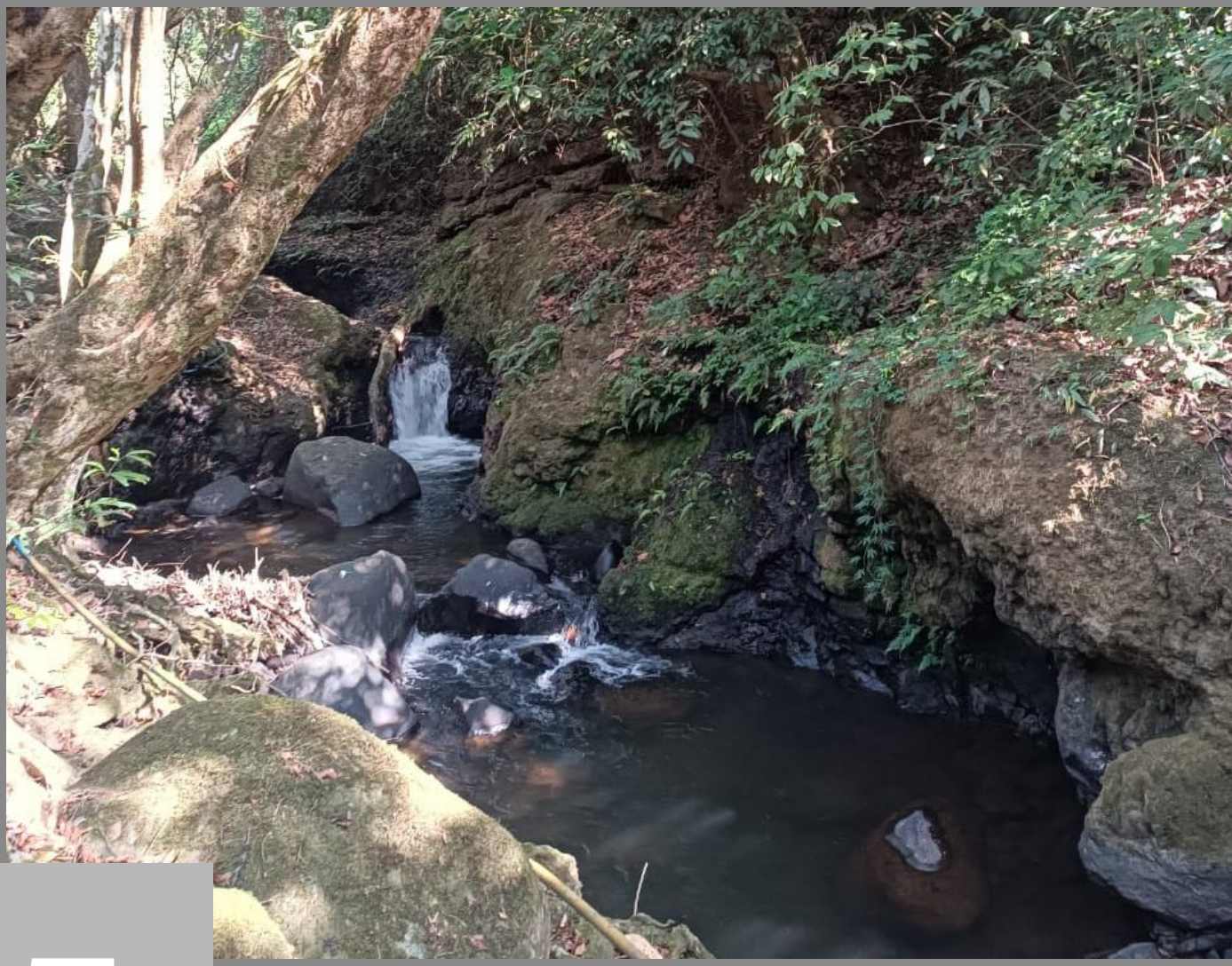
GROUP	ACTIVE INGREDIENT	CAS NUMBER	RAINFOREST ALLIANCE CATEGORY
Fungicide	Bordeaux bordelaise	7758-98-7 1305-62-0	Rust and black rot

Table 8. *Active ingredients are registered in India, following RA Standard 2020 and its requirements.* (Updated: April 30-2024)[32]

[32] Rainforest Alliance: https://www.rainforest-alliance.org/wp-content/uploads/2023/07/SA-P-SD-9-V1.5-Rainforest-Alliance-Exceptional-Use-Policy.pdf

STEPS IN THE CLUSTER ACTION PLAN

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Promote the implementation of Integrated Pest and Disease Management.	☑	☑
Use plant protection products according to the lists of prohibited products and restricted use. Chemical pesticides should be applied only as a last resort and in spot applications. Favour the application of biological products or other low-toxicity products.		☑
Eliminate the use of prohibited pesticides and fungicides.		☑



5. WATER MANAGEMENT

5.1 WATER USE & CONSERVATION

"Reducing total water usage during processing (per unit of product) and significantly reducing irrigation from off-farm water sources." RA Scorecard – Gold Level. [33]

"Ensuring that aquatic ecosystems are surrounded by riparian buffers of natural vegetation following the RA standard width parameters." RA Scorecard – Gold Level.[34]

Water usage in Robusta coffee cultivation is crucial for ensuring healthy growth and optimal yield. Robusta coffee plants are generally more resilient to water stress than Arabica varieties, but they still require adequate moisture, especially during the flowering and fruiting stages. In regions with low rainfall, irrigation becomes essential to supplement natural water sources and maintain consistent growth. The irrigation system typically focuses on providing water during dry spells, with methods such as drip or furrow irrigation commonly used to ensure efficient water distribution. Proper irrigation management is necessary to avoid waterlogging, which can lead to root diseases, while ensuring the plants receive enough moisture for nutrient uptake and development.

RECOMMENDATIONS

a. Establish buffer zones around coffee farms, especially near water sources, to protect against soil erosion, reduce nutrient runoff, and preserve water quality. These buffer areas should contain vegetation or cover crops that help absorb excess water, stabilise the soil, and enhance biodiversity. Buffer zones also serve as natural barriers to prevent weed encroachment and pest invasions.

b. Implement efficient irrigation methods such as drip or sprinkler systems to ensure water is delivered directly to the root zone, minimising waste. Irrigation should be scheduled based on soil moisture levels, weather forecasts, and crop requirements to avoid over-irrigation or water stress.

[33] Rainforest Alliance, 2022 a.
[34] Rainforest Alliance, 2022a.

c. Integrate rainwater harvesting systems to capture and store excess water during the monsoon season, which can be used during drier periods. This helps reduce dependency on external water sources and enhances water security for the farm.

d. Mulching around coffee trees reduces water evaporation and maintains consistent soil moisture. Mulch also improves soil structure and helps with nutrient retention, promoting healthier plants and better water utilisation.

e. Regularly monitor soil moisture levels and adjust irrigation schedules to prevent overwatering or underwatering. Using soil moisture sensors or weather data can help optimise irrigation practices, ensuring efficient water use and promoting healthy growth.

f. Plan irrigation needs and timing based on the phenological stage of the coffee crop, climatic conditions, and soil type and depth. Consider the need for irrigation to ensure the synchronisation of flowering.[35]

g. Use clean water to avoid spreading plant pathogens or pests, such as nematodes. Clean water is free from harmful contaminants, pathogens, or pests that could negatively impact plant health or the surrounding environment. It should also be tested for water quality, including parameters like conductivity, hardness, and heavy metals, to assess the risks of salinization and contamination. This ensures that the water supports plant growth without introducing harmful substances.[36]

h. Perform maintenance and periodic irrigation system checks to ensure no leaks or obstructions. [37]

i. Keep records of the amount of water used and compare it to the amount of coffee produced to assess water-use efficiency.

j. Farmers should adopt optimal irrigation techniques according to their reality, such as smart irrigation equipment and soil sensors. They should keep a rainfall record, as irrigation is critical to retain soil moisture at optimal levels.[38]

[35] Pulleman *et al*., 2023.
[36] Pulleman *et al*., 2023.
[37] Pulleman *et al*., 2023.
[38] Vinivius and Texeira, 2013.

As shown in Figure 13, farmers should adopt the optimal level and best soil moisture to allow the best soil capability to hold water. Using sensors is very important. According to field trials, the optimal levels are between 0.1 and 0.3 atm.

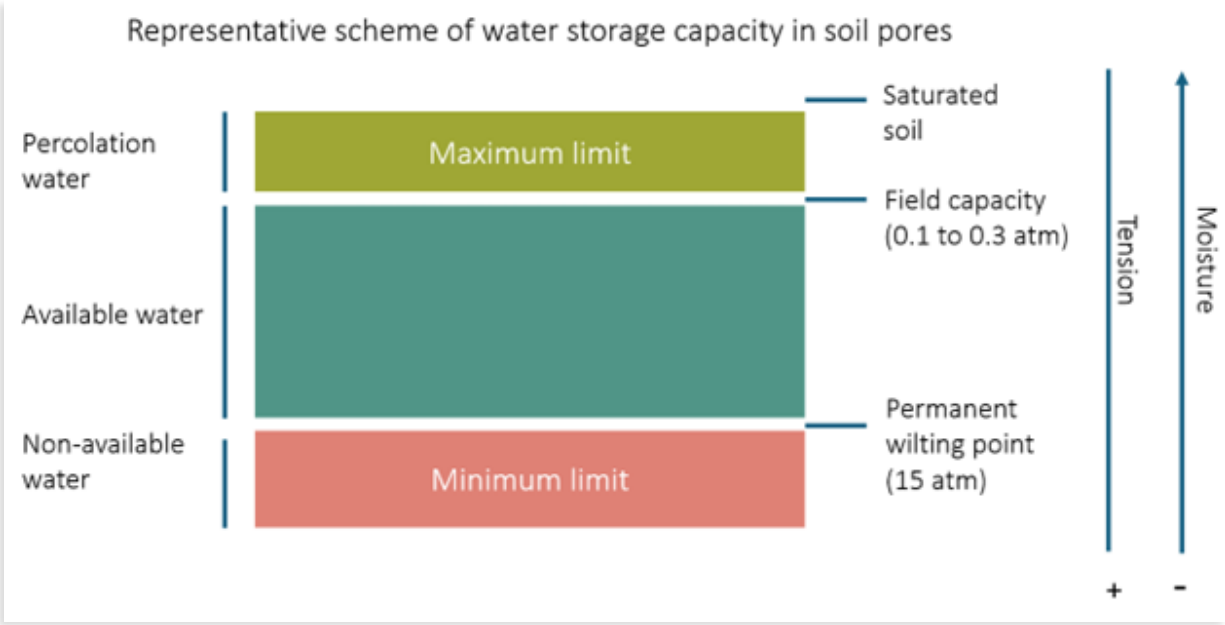
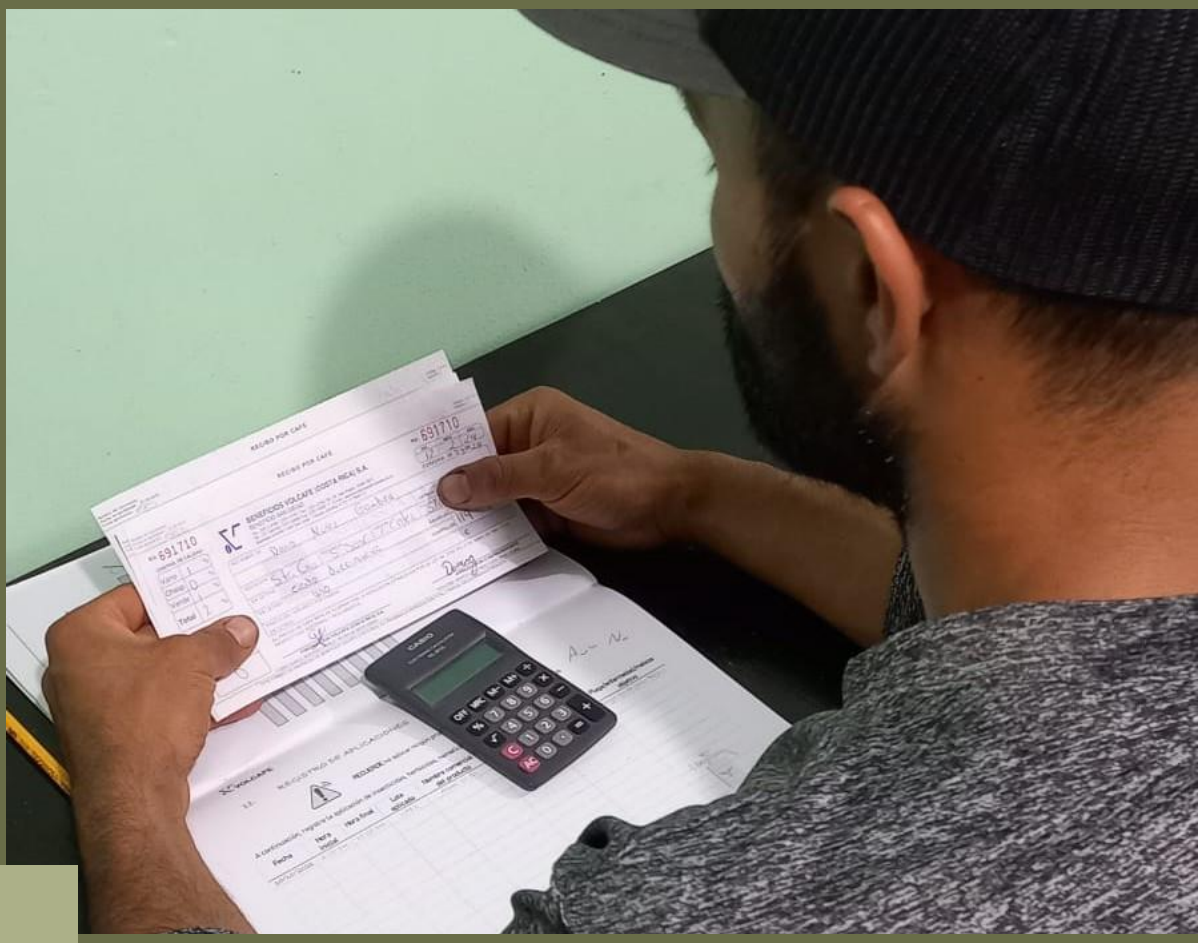


Figure 13. *Water moisture in the soil keeps the best levels for plant growth.*
Source: Vinivius and Texeira, 2013.[39]

[39] Vinivius and Texeira, 2013.

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Promote and incentivise technology adoption to reduce water consumption for coffee processing and other home uses.	☑	
Define actions with the producers for the rational use of water, considering the maintenance of water distribution networks and the reduction of consumption in the home.		☑
When farmers use efficient irrigation systems, such as the Smart Irrigation System,		☑
Implement wastewater treatment according to the capacity and conditions of each farm.		☑
Identify and conserve the riparian buffer zones in each farm following the criteria of the Rainforest Alliance Regenerative Coffee Scorecard (Gold level)		☑



6. FARM FINANCIALS

6.1 FARM FINANCIALS

"Regenerative agriculture seeks to improve coffee farmers' livelihoods by achieving these objectives:

- ***Improving productivity and income.***
- ***Strengthening food security.***
- ***Ensuring good labour conditions, health, and safety.***
- ***Diversifying production and sources of income."*** [40]

"Monitoring costs of production and calculating revenue from the sale of coffee", "Creating farm management or business plans", "When appropriate, diversifying income streams, and adjusting business practices as necessary." RA Scorecard – Bronze, Silver & Gold. [41]

RECOMMENDATIONS

a. Reduce production costs by adopting regenerative practices such as soil conservation, integrated nutrient management (using organic material from the farm), natural weed and pest control, and efficient water management.

b. Monitor production costs and calculate revenue from coffee sales.

c. Create a farm business plan, including rehabilitation and renovation, machine investments, infrastructure, and training.

d. Farmers should also diversify their crops and balance their income from other crops. Diversify income streams through agroforestry and generate revenue from selling wood, like mahogany, teak, or cedar, or consider planting fruit trees, such as avocados, which combine with coffee trees.

e. Farmers should also have good financial and cash flow management once they establish a coffee plot and medium- and long-term payback.

[40] Pulleman et al., 2023, pp. 34-35
[41] Rainforest Alliance, 2022 a.

STEPS IN THE CLUSTER ACTION PLAN

STEPS	CLUSTER MANAGER	AAA AGRONOMIST
Schedule farmers' training and field days to share positive experiences in the gold-level farms (most advanced farms)	☑	☑
Promote technical debate between farmers and agronomists from the clusters to share experiences on decreasing the use of chemicals and not using the agrochemicals on the mitigation list.	☑	☑
Promote training in using bio inputs and quality control of such inputs.		☑

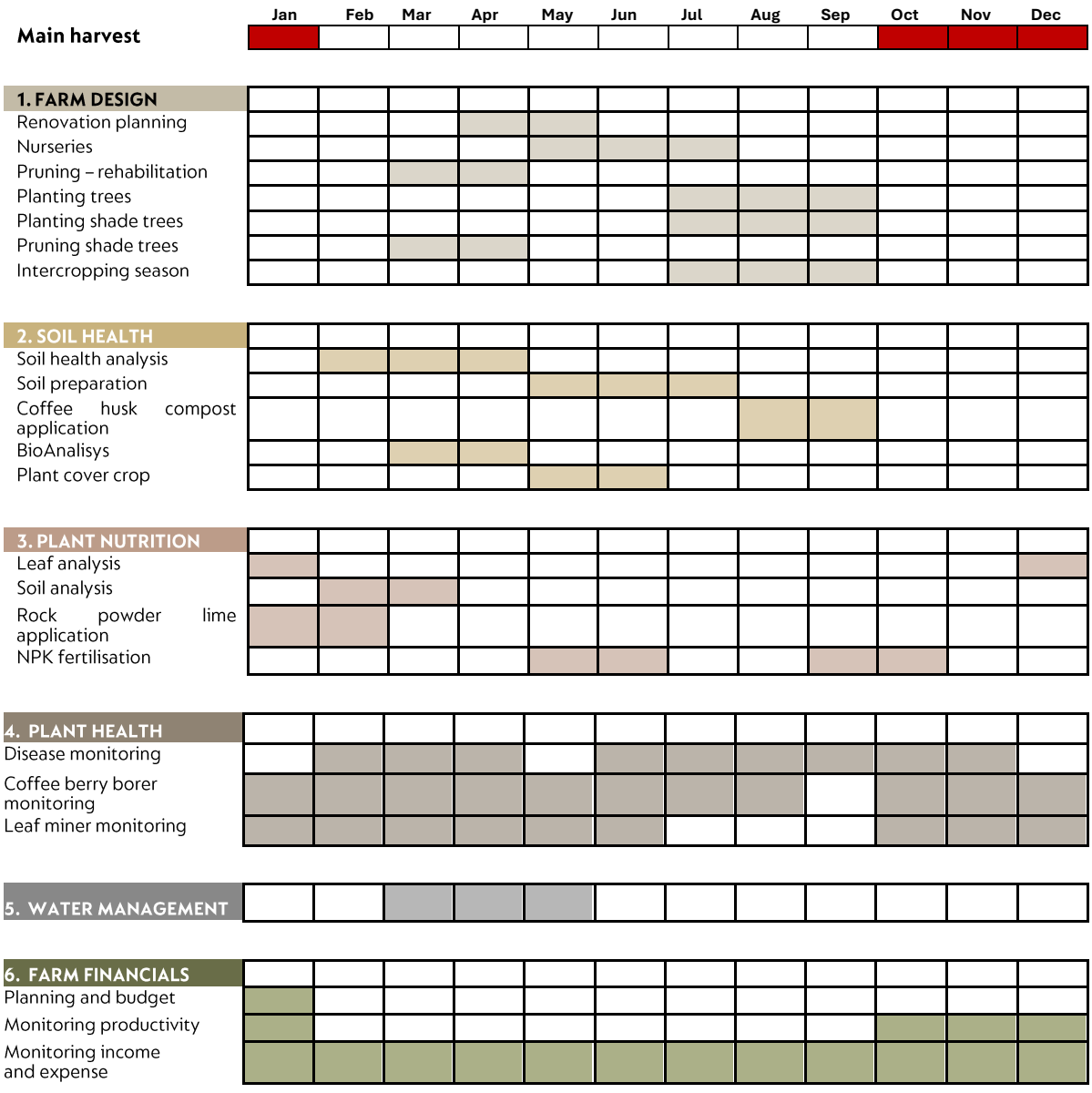
ANNEXES

ANNEX 1

AGRONOMIC REGENERATIVE GUIDE - INDIA

Calendar for the main activities in the different clusters based on weather and harvest distribution.

Coffee Year Calendar for India Custers



ANNEX 2

LOCALISATION OF IMPLEMENTATION CRITERIA FOR THE REGENERATIVE COFFEE SCORECARD OF RAINFOREST ALLIANCE

The Rainforest Alliance has reviewed these criteria based on the recommendations and arguments of this agronomic guide.

	LEVEL	SCORECARD CRITERION
CROP RESILIENCY **FARMS IMPLEMENT GOOD AGRONOMIC PRACTICES INCLUDING:**	Gold	Replanting or renovation, implemented to ensure at least 50% of the plot in young or middle age (≤ 8 years) trees
LOCALISATION FOR INDIA	As illustrated in Figure 1, there are local definitions to understand the different interventions that help keep coffee trees young, thereby promoting better productivity and quality. All these interventions, whether through tissue management (pruning) or replacing trees with new trees, are equivalent to the concepts of "Replanting and Renovation" in the Rainforest Alliance Regenerative Coffee Scorecard.	

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