World Agroforestry Centre

Shade Management for Cacao as Agroecological Practice

Sustainable Farming in Tropical Asian Landscapes (SFITAL)

Current Issues

1. High density of shade with poor management and the <u>lack</u> of **proper tree maintenance** for cacao can lead to the emergence of common pests and diseases such as cacao pod borer (CPB), termite infestation, cacao pod rot (CPR), vascular streak dieback (VSD) and others resulting into rapid declining of production in the long run.

2. Poor shade management -can hamper the light penetration, which leads to low air humidity causing **fungal diseases** in cacao pods.

Agroecological practices which relate to shade management

- Input reduction
- Minimise the use of harmful chemicals (e.g., Pesticides).
- integrated pest and disease management (IPDM)
- Improved farm sanitation
- Proper pruning
- Shade management to reduce the risk of pest and disease outbreaks and associated costs.
- Increase production

Certification Standards – related to Shade Trees

- Cacao certification refers to cacao that has been officially certified by an organization (a certification body) as having **met certain standards**.
- Certification shows whether the various stakeholders in a supply chain meet these standards.
- Cocoa certification is an effort to safeguard **human rights, improve agricultural practices, reduce deforestation,** and ensure **better conditions for cacao farmers.**

Certification Standards – related to Shade Trees

Indicator	RA	UTZ
Shade cover (%)	30-40	
Number of permanent (Mature) shade trees/ha. in cacao farms	18	18
Number of different native tree species/ha.	12	

Indicators that are required to become certified by Rainforest Alliance or UTZ.

(Source: Sustainable Agriculture Network, 2009 and UTZ Certified, 2009).

Shade requirement of cacao

- Cacao as a forest tree species requires shade.
- Shade can be considered to ameliorate the cacao micro-environment.
- In the **right spatial arrangement** and **meticulous selection of morphological structures** of shade tree species (e.g., Tall cylindrical boles with relatively small crowns with open canopies) it positively affected yield **under low input systems** as compared to full-sun cacao cultivation.

Shade requirement of cacao

- The symptoms of under-shaded cacao trees:

1. Stunted growth.
2. Scalding of leaves and stems.
3. Flower cushions damaged.
4. Fewer leave.
5. Water stress.

Shade requirement of cacao

- Over-shaded cacao trees are showing symptoms of:

1. Stunted growth.
2. Elongated stems and leaves
3. Low flowering
4. Fewer pods
5. Incidence of diseases (e.g., such as cherelle rot, pod rot, swollen shoot virus);
6. Incidence of pests (e.g., pod borer) which result to low yield.

Shade requirement of cacao

- Intensity of shade requirement by age of cacao trees and inherent soil fertility status

Age (Year)	Soil with high inherent fertility	Soil with low fertility status
1	30% - 70%	30% - 70 %
2	30% - 50 %	30% - 70 %
3	20% - 40 %	20% - 50 %
4	20% - 30 %	20% - 40 %
5	10% - 25 %	20% - 30 %
>5	10% - 25 %	20% - 30 %

- The range of values is associated with moisture stress expected. More shades are required if moisture stress is severe.

Proper selection of shade tree species

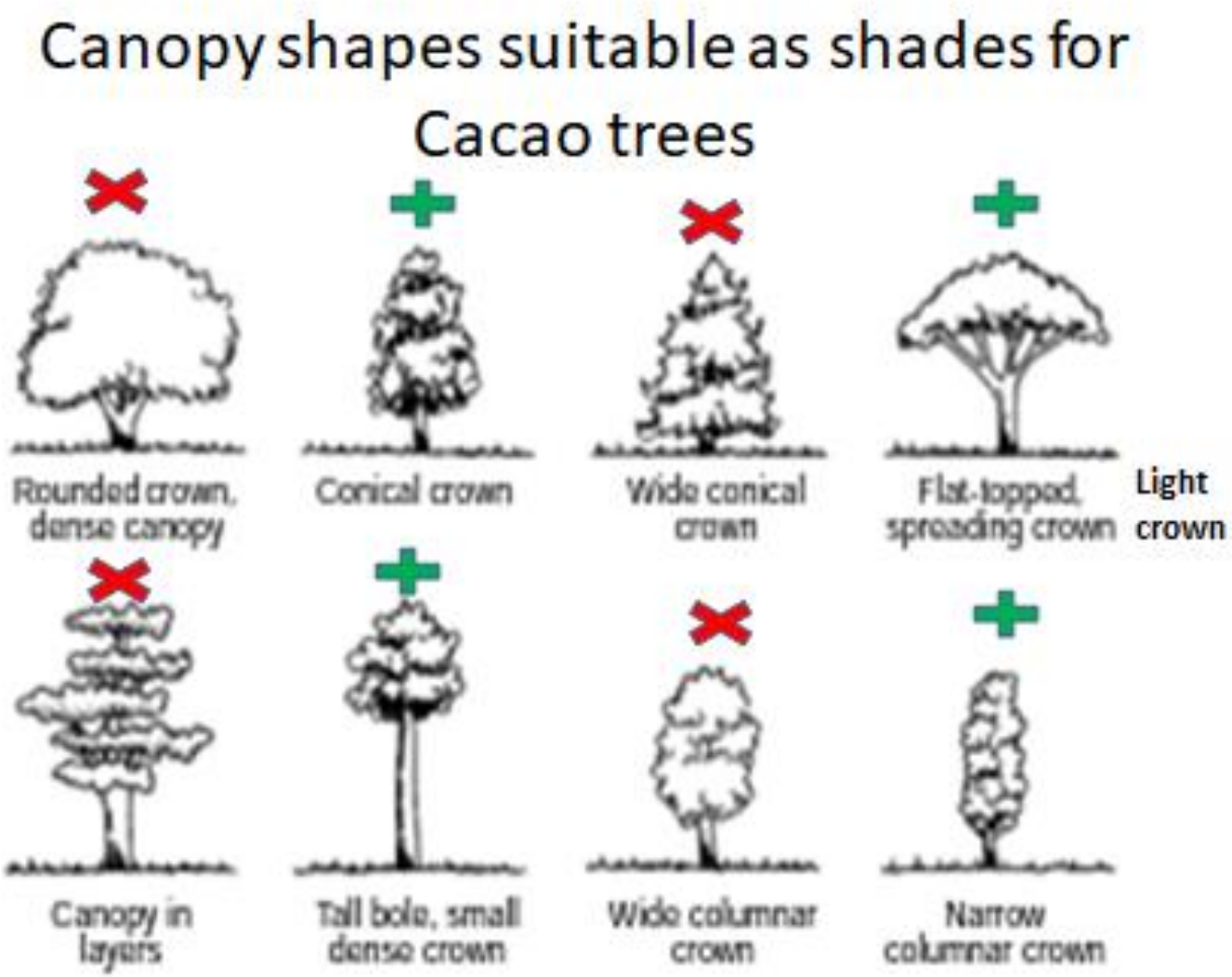
- The quality and quantity of light received by cacao trees depend on the characteristics of the shade trees such as **height, density, arrangement**, and **canopy shape**.
  - Taller shade trees allow diffused light to reach the understory cacao trees, and therefore provide less shade to cacao.
  - Shorter shade trees allow less light to penetrate the understory. Similarly, a lower tree canopy provides more shade.

Proper selection of shade tree species

- The density of shade trees and tree arrangement also affects the amount of light received by the understory cacao.
- For example:
  - Rubber trees (PB260 clone) arranged at 3mx7m spacing with a tree density of 476 trees per hectare produce more shade as opposed to rubber trees arranged at 2mx10m spacing with a tree density of 500 trees per hectare.

Proper selection of shade tree species

- The canopy shape of shade trees also has a profound effect on the amount of direct and diffused light received by the cacao trees.
- The rounded dense, wide conical, canopy conical in layers and wide columnar shapes are not suitable shade trees.
- The conical, flat-topped spreading light crown, tall bole small dense crown, and narrow columnar crown shapes are recommended.



Proper selection of shade tree species

- **Mango** and **rambutan** are examples of rounded dense canopies which are not suitable as shade trees for cacao (apart from being susceptible to common pests like fruit/pod borer, etc.).
- Similar species can also have a variety of canopy shapes depending on the clone. For example, in rubber, RRIM 600 and PB330 produce more shades than **PB260** and **GT1**.
- Fruit trees like **durian** differ in canopy shapes depending on the **variety.**

Important consideration in selecting shade trees

- **Functional characteristics** (e.g., nutrient cycling abilities of fertilizer trees, biodiversity functions of Ficus species, and economic functions of fruit trees).
- An example of a **fertilizer tree** is madre de cacao/kakawate (Gliricidia sepium) or Falcata (Paraserianthes falcataria). Apart from providing shade, this tree also fixes atmospheric nitrogen (N2) and mobilizes soil nutrients (e.g., phosphorus, etc.) by secreting enzymes that make soil nutrients become more available.

Appropriate spacing of cacao and shade trees

- The most recommended planting distance of cacao is 3mx3m between hills and rows for clones UF18 (60-70% of all cacao in the farm), W10 (10-20%), BR25 (10%), and PBC123 (10%), with planting density of 1,111 trees per hectare.

Appropriate spacing of cacao and shade trees

- When intercropped with e.g., coconut and banana, cacao trees are planted not closer than 3 meters from the base of the coconut, at 3.5 meters between hills and 3.5 meters between rows of cacao with a planting density of 816 trees per hectare.
- Bananas are planted in between rows of cacao during the early stage of cacao growth and will be reduced after 3 years to minimize space and light competition.

Appropriate spacing of cacao and shade trees

- Timber trees can be used as shade trees such as dap-dap (*Erythrina variegate*), bagalnga (*Melia dubia*), falcata (*Paraserianthes falcataria*) and others with conical, flat-topped spreading light crowns, tall bole small dense crowns, and narrow columnar crowns can be planted **20m** apart.
- Fruit trees, like lanzones, can be planted in the middle of a cacao row or along the contour lines at 10 meters apart with 100 trees per hectare.

Appropriate spacing of cacao and shade trees

- In agroforestry practice with cacao + coconut + banana + fruit trees, the cacao trees are planted in 4mx3m spacing, with a planting density of 833 trees per hectare.
- Bananas are planted in between rows of cacao.
- Coconuts are spaced 10mx10m between hills.
- Fruit trees can be planted randomly in between cacao and coconut hills.

Appropriate spacing of cacao and shade trees

- In sloping areas, the contour lines with 0.5-meter natural vegetative filter strips are laid out 10-12 meters apart. On the alley, cacao is planted 3.5 meters from the contour strips and 3 meters between hills.
- Coconut or fruit trees like lanzones can be planted 10 meters apart and approximately 25 cm above the grass strips as shade trees for cacao.

Pruning regime

- **Pruning** is an essential activity in the management of a cacao farm.
- It involves cutting or removing undesirable and excessive parts of the plant such as branches, twigs, and leaves into its desired productive plant shape and form.

Pruning regime

- Benefits of pruning:

1. Increase cacao pod production by (a) Stimulating the flowering and enhancing fruiting, (b) Increasing the capacity of plants to produce more pods and (c) Increasing productivity by producing better quality cacao beans.
2. Control the shape and height of the tree, to ensure easy access for harvesting and other farm practices.
3. Reduces pest and disease infestation on the farm.

Pruning regime

- Principle of pruning:

1) There should be an adequate amount of water in the ground or irrigation water is necessary during pruning.
2) Avoid pruning during on dry season.
3) Use standard sharp tools when pruning to prevent damaging the cacao.
4) Avoid over-exposing the crown of the cacao to sunlight.

Pruning regime

- Principle of pruning:

5) Don’t over-prune the cacao such that more than 30% sunlight can enter.
6) Don’t climb the cacao tree while pruning.
7) It should provide good air circulation in the farm and the sight space is up to 50 meters.
8) Prune shade trees first before pruning cacao trees.

Types of pruning and intensity

1. **Formative pruning:**

a) Tip pruning should be done approximately 3 months after planting and 3 months thereafter within the first 2 years.

b) Shape pruning, 15 months after planting when the cacao starts flowering.

Types of pruning and intensity

2. **Maintenance pruning:**

a) Production pruning should be done after the end of each peak fruiting period. Minimize pruning during long dry spells and avoid over-pruning.

b) Access pruning is usually done upon flowering (May to June) and before high peak harvesting (September to October).

c) Sanitary pruning should be conducted at a bi-monthly or 6-week interval.

Types of pruning and intensity

3. **Productive pruning** which categorized into two by the intensity of the trim, these are:

a) Light pruning – cutting of water shoots, orthotropic shoots, sick branches, hanging branches, small "worm" branches and other unproductive branches and must be done once a year (middle of April to May).

Types of pruning and intensity

3. **Productive pruning** which categorized into two by the intensity of the trim, these are:

b) Heavy pruning – reducing the plant canopy to be 3 – 3.5 meters in height, overlapping branches with the next plant, all types of unproductive branches and also must be done once a year (middle of October to November) after the end of its peak fruiting period and at the time that the flowering is not in full swing.

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Thank you!