

COFFEE

Introduction

Coffee occupies an important place in the world economy, being widely consumed as the most prestigious beverage. In the world trade coffee ranks first among non-staple food and its rated as the fifth most important agricultural product.

The Philippine used to be the top coffee producer and exporter in Asia but declining yields and conversion of coffee plantations to other exports crops resulted to an importation to coffee since 1997. The average green bean yield per hectare per year is less than 500 kilos. The total local green bean production has been declining significantly.

Throughout the period 2006-2010, coffee production went down by an average annual rate of 2.38 percent lower than the 2009 production of 96.43 thousand metric tons. The declining production was attributed to the cutting trees due to land use conservation and dry spell to some regions like Davao and Iloilo. Area planted and number of bearing trees contracted annually by 0.94 and 1.52 percent. As of 2010 the Soccsksargen was the top coffee producer with 29.37 percent contribution to the total country's production followed by Davao region with 23.99 percent share. Robusta had the highest share of 71.85 percent in the total production of all varieties.

Crop Varieties

1. Arabica

This is considered to be the best coffee in other countries because of its excellent flavor and aroma. It is known locally "kapeng tagalong". The shrub of this variety is smaller than Liberica and Robusta, with lateral branches in opposite arrangement, horizontal and in pairs. It leaves are fragrant, with creamy in color. Beans are oblong-ellipsoid they are green in color, and later turn in yellow when ripe. The size of seeds range from 8.5 to 12.7cm long. This variety is early. Two years after transplanting, it produces berries.

2. Robusta

Known for its umbrella – shaped growth. The Robusta plants produces berries four years after transplanting. A well tended one hectare field can yield about 1,200kg per year of coffee green beans. Leaves are thinner than Excelsa and the edge is scalloped. Its flowers are also white with 5 to 6 petals. The bearers are smaller than Arabica, closely clustered and blood when ripe with thin pulp and parchment.

3. Liberica

This variety is locally known as kapeng barako. Trees are upright with straight trunks, weedy and grow to height of about nine meters. This variety is tolerant to drought and can grow to wider soil types. It starts bearing four to five years after transplanting. A one hectare farm planted can yield about 1,000 kg per year.

4. Excelsa

This has wide leaves that are thicker than Robusta, but thinner, smoother and more rounded than Liberica. This variety is resistant to drought. Bearing starts four to five years after transplanting. It yields approximately 1,000 kg of clean dry coffee beans per hectare.

Cultural Management

Planting

Throughout the coffee producing areas in Uganda, a vast number of coffee trees have been lost mainly as a result of Coffee Wilt disease but also due to mismanagement and neglect. It is estimated that about 100 million trees have died since 1993. It is therefore important for farmers to plant new trees to recuperate the lost production.

When deciding to plant seedlings or clonal cuttings, farmers should ensure that the planting material originates from registered and approved nurseries. The planting holes should be dug about 3 months before planting and filled with a mix of soil and manure. Planting will then be carried out just at the onset of the rainy season.

It is important to keep the young seedlings shaded and protected from the hot sun especially at mid-day. During dry spells it is important that they are watered every couple of days.

Weeding

Weeds compete with coffee for nutrients and water especially during the dry season and therefore farms should be kept weed free. Weed control can be done physically through slashing and digging or chemically using a herbicide. Mulching is also very effective because the mulching material helps suppress weed growth.

Pruning

Coffee pruning is one of the most critical factors for good production. Its contribution to total yield has been rated at about 30%. It is a vital agricultural practice that rejuvenates the plant through the removal of unproductive wood and through the promotion of new suckers which will develop into new stems.

It is important to limit the number of stems on each tree to a maximum of 3-4 because a higher number will result in lower productivity due to increased competition for nutrients. De-suckering should be carried out several times a year whereby well positioned suckers are promoted and the rest are eliminated. It is also important to remove most of the inside primaries to encourage the stems to lean out in order to let light in for the development of the new suckers. When production on the bearing branches at the top of the stems is no longer significant, it becomes necessary to prune the tree and to remove the unproductive stems.

Pruning should be carried out at the end of the main crop after the harvest, at which point the tree is exhausted having carried a crop for 9 months. A pruning saw is the most effective tool to use for pruning and as it leaves a “clean cut” and allows the plant to recuperate 30% faster than if pruning was carried out with a panga.

Mulching

Mulching is a practice by which the soil is covered with vegetative material. Any dry grass or crop residue including banana leaves and stems can be material. Mulching is very beneficial for the coffee trees because it:

- Preserves moisture in the soil during the dry months
- Slows down runoff, improves rainwater penetration
- Suppresses weed growth
- Nutrients are returned to the soil when the mulch decomposed

It is important that the mulching material does not touch the trunk of the tree to avoid any possibility of infections and rotting.

The best time for mulching is at the beginning of the rainy season.

Erosion Control and Rainwater Harvesting

Water is the most critical element for the survival of coffee and therefore farmers should carry out any techniques that will maximize the availability of water to their coffee trees. Whenever the land is sloping and water flows over the field, the farmer has to put place to reduce or stop runoff. Apart from protecting the top soil from being washed away, holding rainwater on the land is also very beneficial because the more water that infiltrates into the soil, the longer the soil will stay moist during the dry periods. The benefits of water harvesting are of course enhanced if the field is

also mulched. Various soil conservation measures can be adopted to reduce runoff such as digging trenches and growing bands of grasses across the slope.

If proper rain water harvesting techniques are in place, most of the water requirements of the coffee trees will be met and they will also be protected during dry periods.

When cultivation on slope, the farmers have to ensure to plant across the slope (along contours)

This will slow down any runoff and protect the land against erosion. Terracing is a very effective cultivation technique to hold water on the land.

Composting and Manuring

Composting and Manuring are very effective organic methods of improving soil fertility. They increase the organic matter content of the soil, improve the soil structure and improve the water holding capacity which helps maintain the soils moist during dry periods.

There are various methods of producing compost however some methods like Pit Composting are advisable as they are effective, cheap and easy to set up for the farmers.

Three pits are enough to go through a 45 day composting cycle and the composting material is passed from one pit to the other every 15 days. From the third pit it will then be ready to be used in the field. Its appearance and texture would have changed to look like a dark brown soil. When filling the first pit, the farmer should layer the material in such a way that the more difficult materials to decompose (woody material and crop stalks) are at the bottom, and the easiest materials to decompose (soft vegetables and fruit peels) at the top. Some animal manure and a little top soil which already contains decomposing material should also be added to provide the microorganisms that will start the decomposition process. Once all the material has been layered in the first pit, it should be covered with leaves (banana leaves for example, as they are readily available) to reduce moisture loss. If the materials placed in the pit are very dry, then the farmer may need to add some water to increase the moisture in the pit.

Fertilizing

It is normal for soils, after years of cultivation, to start becoming exhausted and deficient in certain important elements that support high productivity. Fertilization is the process by which deficient elements are returned to the soil and thereby made available again for plant uptake. Fertilization can be organic through the use of manure and compost, or inorganic through the application of chemicals products such as NPK, DAP and Urea.

It is recommended that farmers start utilizing chemical fertilizers only after having employed organic methods which are cheaper, available at farm level, safer to use and, if properly carried out, very effective. Chemical fertilizers are more complicated to utilize because the timing and the rates of application have to be carefully respected otherwise undesirable results may be obtained. For example, applying fertilizers at the wrong time can result in excessive vegetative growth (stem, branch and leaf formation) and no cherry development.

Before starting to use chemical fertilizers, the farmers should seek advice and training to properly understand the different types available, application rates and correct timing for application. Generally fertilizers are applied twice a year during the rainy seasons.

Coffee trees need good nutrition especially during the berry expansion stage which is usually 2 to 3 months after flowering.

Pest and Diseases and Their Management

Pest

1. Coffee berry borer

It is the most destructive and hardest to control coffee pest. Young coffee berries infected by coffee borer turn from normal green to yellow orange. Shortly afterwards, the fruits fall prematurely. Infected mature and ripe berries are mummified and remain attached to the tree.

To control berry borer, collect and destroy all infected berries before and after harvest including those that fall to the ground to eliminate suitable breeding and feeding site of the insect.

Apply insecticide at recommended rates only when necessary. If applied application should be done for months after flowering for two times at 21 day interval

2. Stem or twig borer

Extensive tunneling of stem or twig borer larvae in young coffee branches. To control borer, collect and burn affected branches.

3. Mealy bugs

The gray mealy bug is abundant during the dry season. It lives on the tender parts of the plant and sucks the sap and secretes honey dew which encourages the growth of the sooty mold. Gray mealy bug and sooty mold cause falling and softening, wilting and curling of leaves.

4. The cotton cushion mealy bugs and filamentous mealy bug

It occurs year round and produce waxy secretions on the shoots, leaves and in between berries. Plants attacked by these bugs become stunted with under developed berries. To control mealy bugs, remove weeds and scales that harbor the insects. Apply insecticides if needed.

5. White Grub. White grub

It is a big larva that eats the roots of the coffee, causing death in young plants and stunting in old plants. Control by killing the grubs or by applying appropriate insecticides if necessary.

Diseases

1. Coffee rust

Coffee rust is the most destructive disease of coffee. Coffee rust is caused by *Hemileia vastatrix*. Initially, coffee rust is manifested by small yellowish translucent spots in the lower surface of the leaf. As the spots enlarge, powdery yellow to orange spores are produced on the underside of the affected leaves. The affected leaves drop leaving bare branches and the tree may eventually die if left unchecked.

To prevent coffee rust, use resistant strains like India S-288, S-333, S-446, S-795, Kenya S-36, Bourbon, Granica and Mundo Nuvo. For susceptible strains, spray with copper-based fungicides at 2-3 weeks interval at the onset of the rainy season until the berries mature.

2. Die back

Die back is characterized by drying of branches and twigs from the top progressing downwards. It has two forms: physiologic and pathologic. The former may be caused by overbearing, nitrogen deficiency or inadequate carbohydrate supply hence vigor of trees should be maintained by fertilizing with the right kind and amount of nutrients at the proper time. The latter could be due to fungi, e.g. *Colletotrichum coffeanum*, *Cercospora coffeanum* or *Hemileia vastatrix*. Pathologic die back is manifested by the appearance of spots with concentric areas on the leaves of coffee seedlings and grown twigs causing falling off of twigs and berries. To minimize pathologic die back, apply copper-based fungicides.

3. Thread blight

This is caused by a fungus known as *Pellicularia koleroga*. This disease affects coffee located at high altitude especially during the rainy season. This is characterized by growing-grayish white threads that are tightly glued to the branches which later cover the petiole and send outside shoots to undersurface

of the leaves and berries; thus leaves overlap and twigs come together. At the later stage of the disease, the plants turn brownish.

To control this disease, prune infected trees and burn diseased plants parts in order to allow sunlight penetration and proper aeration.

4. Anthracnose

This disease is manifested by the appearance of light brown to dark brown spots with grayish white center that turns completely gray as the disease progresses . The spots first appear at the margin of the leaves which then spread to the twigs. Infection in berries appear as sunken black spots.

To control the disease, prune and burn affected branches. Apply fungicides as needed.

Rejuvenation

What is Rejuvenation?

Rejuvenation in coffee is generally defined as the cutting of vertical stems of old trees to induce growth of new sprouts. It's a widely accepted practice for revitalizing coffee farms and has been found to be more advantageous than replanting.

When to rejuvenate?

Rejuvenation should be done at the start of the rainy season in areas with distinct wet and dry periods. During this period, sufficient water is available and growing conditions are more favourable to support the newly growing shoots of coffee. In areas where irrigation is available or rainfall is evenly distributed throughout the year, rejuvenation may be done immediately after harvesting.

System of Rejuvenation

- Rotation of verticals within the tree
 - Rejuvenation of trees in alternate rows
 - Block rejuvenation
- For Multiple Vertical Systems
- Select the lowest vertical stem that grows farthest towards the outside of the crown. This is the vertical stem that shall remain uncut, to serve as the “lung” branch.
 - Except for the vertical stem that shall remain uncut, remove the upper branches of the other vertical stems with a sharp bolo, ax or hand saw. This will reduce the weight of the stems during falling and thereby avoiding cracking or splitting of the stem during cutting.

- To cut each vertical stem, use a sharp chain saw, hand saw or bolo. Make the cut slanting outward at about 30 cm from ground.
- Clean the rim of the cut with a sharp bolo or knife to remove serrated bark or wood.
- When the sprouts are about 10 cm high, select and maintain five to seven sprouts.
- Remove extra sprouts, usually those weak and damaged by pulling them out. Water sprouts that grow on the other parts of the stem should also be removed
- When the sprouts are 30 cm high, select and maintain three to five uniformly distanced sprouts around the stem. All other sprouts must be removed as they come out.
- When the sprouts are 30 cm high, cut the remaining vertical stem. However, if the vertical stem carries laterals with berries, cutting them may be postponed until the berries have been harvested.
- As the vertical sprouts grow, train them towards outside the crown.

➤ For Single Vertical Stems

- Make an upward slanting cut up to about 75 percent of the stems diameter and about two feet from the base. To cut use a sharp chain or hand saw.
- Bend the stem towards the ground slowly to avoid splitting or cracking of the main stem. Do not cut and separate the upper portion of the main stem. This will provide nourishment to the growing new sprouts and minimize dying of the tree particularly when rejuvenate is done during the dry months.
- When the sprouts are about 10 cm high, cut and separate the upper portion of the tree from the main stem. The cut should be slanting and about 30 cm from the ground.
- Select and maintain five to seven sprouts that are uniformly distanced around the stem. Remove the other sprouts.
- When the sprouts are to 30 cm high, select the maintain three to five sprouts uniformly distanced around the stem. All other sprouts must be removed as they come.
- As the vertical sprouts grow, train them towards outside the crown. This will encourage maximum sunlight penetration and better growth and fruiting.

Grafting

Coffee trees that give very poor yield but have well- developed root system can be made highly productive by means of grafting .Rejuvenation alone will not greatly improve the yield of these low- yielding trees but grafting could. Cleft grafting of selected sprouts on newly – rejuvenated coffee trees is usually done when the sprouts are more than 30 cm high or when the stems are about pencil- size.

Harvesting

Harvesting normally refers to the handpicking of berries when they turn red or yellow. Only ripe berries are harvested because immature and over ripe berries.

Three types of Ripeness

1. Green Ripe – mature berries but not fully ripe, still yellowish- green color.
2. Hard Ripe – mature red in color.
3. Soft Ripe – mature, red to dark, skin no longer firm.

Principles in Harvesting

1. Index of Maturity- the berry of normal size is hard when pinched or bitten at about $\frac{1}{2}$ of its breadth. Another index of maturity is the slight yellowing of the upper portion of the berry.
2. Time of Harvest-the berries of coffee mature from nine to eleven months while varieties mature earlier.
3. Procedure of Harvesting – a twig are yellowing or have already turned red, they are most often stripped together rather than picked one by one. This is usually done when the trees are expected to flower while still in fruits, a fact that always occurs when rain falls during a dry spell.

Processing

After harvesting, start processing the coffee bean within 12 hours. Delaying the pulping operation for more than 48 hours causes deterioration of the quality of beans.

Processing Methods

1. Dry Processing- this is recommended for dry areas during the harvest season. Sinkers are separated from floaters and dried separately. Simple steps in drying
 - Place the harvested berries on a mat or on the ground and sun- dry
 - Spread the harvested berries evenly with the aid of rake or with bare hands.
 - Turn over the mat of coffee berries 3 or 4 times a day
 - Gather the berries on the heap before sun down and cover them either with buri mat or thin bamboo splits.
 - Remove the cover and expose the berries again to sunlight the following day. These steps are followed for several days until the moisture content reduced to about 14 percent.

Hulling

The parchment and part of the silver skin of beans are removed by hauling. This process must be done carefully because improper adjustment of the hauling machine may result to the unnecessary breakage of the beans and incomplete removal of the parchment.

Polishing may also be done while hulling. It is the removal of the silver skin of the beans.

Sorting process - separating the good or high grade beans from defective ones which appear as black, broken, unhulled, infected or immature.

Packaging - coffee beans may be placed in bags, bamboo basket or wooden bins. The beans should be allowed to cool before it is packed.

2. **Wet Processing** – recommended technique during the rainy season .Steps in wet processing are:

- Floating- these are light berries often infested by berry borers .Black dry berries and floaters are processed separately and considered low grade.
- Pulping – should be performed immediately after harvesting to prevent fermentation.
- Fermentation- removal of mucilage. Ferment in boxes until parchment does not stick to the hand.
- Washing- removes mucilage, pulp and skin. Wash until water becomes clear.
- Drying- after washing, the coffee beans should be thoroughly dry under the heat of the sun or with use of artificial dryers.
- Hulling
- Sorting
- Packaging
- Delivery

REFERENCE S:

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