RUBBER PRODUCTON

Introduction

The rubber tree is a robust, perennial crop scientifically known as Hevea brasiliensis. Its product is called Natural Rubber (NR) which has elastic property. Natural rubber exists as latex, a milky white sap, which is colloidal suspension of rubber particles in liquid form. The latex is extracted from the rubber tree and collected for processing into a either dry rubber or latex concentrate. The economic life of latex-yielding tress ranges from 20 to 30 years.

Production

Rubber production in the Philippines is concentrated in Mindanao with about 500,000 has. It is considered as one of the most profitable agro-industrial ventures in the country. It give s the farmer an annual net income ranging from P19, 809 to P39, 544/ha from cup lumps from the 7^{th} to the 12th year. Income may increase until the productive years of rubber. (25-30 years after establishment).

The substantial value of rubber wood produced at the end of tree's economic life makes rubber farming much more attractive. At present, there are about 40,000 ha of rubber which are more than 25 years old and considered no longer economically viable for latex production.

On the environmental side, rubber as a reforestation crop can help control the level of carbon dioxide in the atmosphere, thus, combating the "greenhouse effect".

Prospects

According to the International Rubber Research and Development Board (IRRDB), NR as a commodity is traded in the world markets so that its price is not related to the cost of production, but its parly governed by the law of supply and demand.

Uses

The primary product of rubber in the manufacture of a variety of rubber products are for the automotive, mining, agriculture, shipping, chemicals, pharmaceutical, and consumer industries. A secondary product is lumber. Other rubber products is manufactured for medical and consumer use are inflatable, footwear, sporting goods, toys, bicycles and motorcycles tires, and latex products such as globes, prophylactics, medical tubings, and feeding bottle nipples.

Climate

Rubber is generally grown within the geographical zones lying 10°C to 15°C on either side of the equator. For optimum growth and productivity, it requires warm humid climate with temperatures ranging from 20°C to 35°C. and a fairly-distributed rainfall throughout the year.

The climatic condition in Mindanao is highly favorable t the growth of rubber. It has an annual precipitation of over 1,800 mm/year, which most evenly distributed throughout the year. The mean monthly temperature ranges from 23°C to 33°C the annual solar radiation is 2,163 hours. Its most distinct advantages is the most parts of Mindanao are relatively free from destructive typhoons.

Soil

Generally, rubber can grown on a wide range of soil types, provided drainage is not a problem and soil pH is favorable. It requires a fairly deep surface soil of at least 1.0 m and a moderately-to slightly-acidic soil reaction at pH 5.0 – 6.8.

Undulating and rolling lands with deep surface soil are ideal for rubber growing. Steep slope (less than 40%) can also be planted to rubber, provided contour planting is adopted. Flat or level lands are likewise good for rubber, provided they are well-drained.

Rubber grows well on elevation higher than 250m above sea level. For normal growth of rubber trees, the soil should contained adequate levels of major nutrients such as organic matter (N), more than 4.5% phosphorous (P). more than 20 ppm; and potassium (K), more than 150 ppm.

Fertilization

Fertilizer is applied during these stages of rubber growing:

1. nursery seedlings (ground and polybag seedlings);
2. Immature plants from fields transplanting to tappable age; and
3. mature trees and old trees still in their productive age.

Fertilization must begin in the nursery to raise healthy and fast-growing planting materials that can reach tappable size earlier and to develop healthy stand of trees with long productive life.

A sound fertilization program for seedling stock in the country has the following advantages:

1. Uniform growth of plants that can be budded within a short period, thereby reducing the cost of maintenance;
2. More successful budding.

Apply balanced fertilizer to the nursery seedlings starting on the first month after planting at two-month interval, until the right of budding (pencil size) is attained. The rate of fertilizer mixture depends upon soil analysis

In the absence of the soil analysis, apply 10-15 g at NPK fertilizer mixture per seedlings in the two or three dosages.

Place the fertilizer at about 10 cm away from the base of each young plant to avoid injury and wilting. If the plants show deficiency symptoms, consult experienced planters or specialist for corrective measures.

For immature and mature rubber trees, fertilizer recommendations based on soil test values must be followed. Rubber plantations with effective and efficient fertilization program during the immature stage may or may be fertilized depending on the inherent fertility of the soil except when rubber trees are stimulated.

Land Preparation

Land preparation in the flat lands, hilly and mountainous lands, forest areas, and cultivated lands do not differ much except between flat and hilly lands.

Clear the land preferably during summer months. In areas with big trees, in virgin forest, or in second growth forest, clear the undergrowths first to facilitate the cutting bigger trees; then cut into logs the large trees of economic value and remove these from the site. Cut and heap the smaller trees or the trees with lesser economic value found along the expected rows and rubber.

Burn the cut vegetation and the trees or those left to the rot in the area at this point, avoid cultivating the land because of the obstruction from the remaining tree stumps. do not burn too much to avoid losing the organic matter and humus in the soil. Burning is done only to facilitating lay outing and planting.

In cogonal areas, remove the cogon grass (Imperata cylindrical) completely since it can stunt the growth of the rubber. In hilly areas where cultivation is difficult, remove the cogon along the rubber rows only.

a. In flat but cultivated areas, plow the area twice before lay outing.
b. In hilly lands, prepare the land following contour lining and the land

Planting distance

Planting distance depends largely on the soil fertility, types of clones to be planted, type of planting materials, and plant population density (which will consider scheme).

Set the rows of the rubber at east-west orientation to get minimum exposure to sunlight if possible. The longest straight boundary line along the east-west orientation is made as a convenient base line. Use the following equipment for lining: two pieces of rope of at least 100 –m long, compass, measuring tape, and bamboo sticks of at least 1.0-m long. Lining ropes can either be plastic or common wire no. 14. One of the ropes is used as the base line and the other as a guide line.

Layouting in Hilly Lands

Use contour lining in the hilly lands of more than 20 deg gradient. Mark the planting points in the level lines across the slope. Select a line of average slope and divide the slope according to the distance between the rows of rubber.

To locate the level lines along the slope, use an A-frame. After indicating the distance between rows with stick as markers, place the A-frame level at the base of the guide stick and determine the level by carpenter's level.

When the flat label is found, as indicated by the instrument, drive a stick to the second foot of A-frame level. Turn around the instrument around to locate the point leveling with the guide stick. This is the distance between rubber plants within the row.

Holing and Planting

Holes provide the young plants with good conditions for establishment and quick growth. Hole size and shape depend largely on soil conditions and planting materials.

Compact hard soils need bigger holes than loamy soils. Likewise, large planting materials need bigger holes than smaller ones. Planting should be done preferably when a reliable rainy weather is expected.

Polybag buddings are ready for planting when the leaves from the second top storey are fully – expanded, dark green, and mature. Before planting, cut the bottom of the bag with a sharp knife. Make a vertical cut starting from the bottom of the plastic sleeve, taking care not to damage the lateral. Lower the polybag budding to the planting hole. Pull the plastic sleeve upward and fill the hole with top soil or any fertile soil. However, to ensure adequate supply of planting materials for replanting dead hills, set aside about 10% - 15% of the total planting materials requirement and maintain these in the nursery.

Weed Management

Weeds in the rubber farms can be controlled by herbicides, slashing, line weeding, and ring weeding. Chemicals weed control is more practical and less expensive especially in rolling and hilly areas. Use herbicides as glyphosate (Round – up) following the manufacturer's recommended dosage to control cogon and other grasses. "Basta" herbicide is used for mixed weeds in the plantation.

Slashing is done by cutting the weeds of the entire plantation. In line weeding, cut only the weeds along the rows of the rubber; in ring weeding, cut the weeds around the base of the plant.

Replanting

Replanting of missing hills is done up to the second year of the plantation established only so the replant can develop fully before the closing of the canopy. Use polybags

buddings that are of the same as that of the initial plants in the field.

Pruning

Pruning to a height of 2.0-2.5m allows the development of a smooth trunk without branches or large scars. In polybag budding; allow the plant to grow without branches until 2.0-2.5 m from union, then prune. Pruning also allows the development of a balanced canopy. Maintain 4-5 well-spaced branches to avoid wind damage.

Branch Induction

Some clones branch late grows spindly without branches which consequent produce trees with slender stems. These trees are induced to branch artificially by making two-ring incisions immediate above a whorl of bud eyes 2.5 m from the union of an 18-month old rubber tree. Allows only 4-5 vigorous and well-spaced branches to develop. This technique induces girthing and helps the tree to develop resistance to wind damage.

Diseases

Rubber can be affected by disease which may become serious if left unchecked. Early disease detection helps prevent their spread and damage both in rubber nurseries and plantations.

Foliar diseases

a. *Bird's eye spot or Helminthosporium leaf spot*

The disease is caused by the fungus, *helminthosporium heveae* . The infected leaf surface has numerously-scattered small, circular spots. The spots have transparent centers and distinct brown borders. Infected young leaves are blackened and winkled; olderleaves have necrotic tissue which produce shot holes caused some tissue drop-offs.

b. *Anthracnose leaf spot*

The disease is caused by the fungus, *Colletotrichum gloeosporioides.* Infection start from the edge of the leaf and move towards the center. This disease produces brown-to-strawcolored lesions that are usually a few cm in diameter. As the disease advances, the infected portions or lesions merge to form concentric lines, thus, malformation occurs. The disease is found mainly on young budded plants and young trees. Rain and high humidity favor disease development.

c. *Powdery mildew or Oidium leaf disease*

This disease is caused by the fungus, Oidium haveae. It is characterized by white, cotton-like, hairy borders along the lesions. The mycelia (thread-like structures) of the pathogens are visible even without the aid of a magnifying lens. In the most advance stage of the disease, the entire lamina is covered by the mycelia, then, leaf dries, and finally falls off.

The presence of numerous immature leaflets in the ground indicates infection. By the time this is noticed, the cause fungus is already well- entrenched. Unfolding leaflets about 5-cm long are shriveled and blackened progressively from the leaf. The causes the leaf to fall, leaving the stalks for a while still attached to the tree. The shiny filamentous colonies of Oidium are clearly visible on the freshly fallen leaves. These are associated with the outbreaks of the yellow tea mite (Hemetorsemus latus). Careful examination may also reveal the mites eggs beneath the leaf surface.

d. *Fusarium blight.*

The disease is caused by the fungus, *Fusarium solan.* It is indicated by the death of infected tissue. Early indication is the presence of irregular, brownish lesions, which enlarge later on. As the disease progresses, the infected leaf eventually withers and a pinkish, shiny, cotton-like, hairy growth is evident on the infected area beneath the surface. Symptoms on the stems causes panel necrosis.

e. ***Zonal leaf spot***

The disease is caused by fungus, Rhizoctonia solani. Symptoms of this disease include small circular spots with yellowish margins. Black outgrows are found in dead areas of the leaves. Portion with advanced infection become papery. Black outgrowth found in advanced lesions form into several rings with common center.

Nursery Diseases

Bird's eye spot – caused by the fungus *Helminthosportium hevaea.* This leaf disease seldom kills but can retard growth and cause defoliation.

Collectotrichum and anthracnose leaf spot – caused by fungus C. *gloeosporioides.* It primarily infect the leaves, stems, and other green parts of the seedlings. It is easily recognized by the numerous protrusions on the leaf surfaces with corresponding pin-head sized depression beneath. Diseased young leaves are wrinkled and they eventually fall.

Seedling blight – a complex one or two causal agents may caused blighting of rubber in the nursery. These may species belonging to the genera of *Pythium, Pytophthora, Rhizoctonia, Fusarium, Corynespora, Guignaria, etc.*

Lower portion of the plant have discolored tissues around the base. When cut, brown stripes that extend towards the last bud are observed. As the disease progresses, the pit (spongy substance inside the stem) shrink. Consequently, the plants dies.

Shoot-tip blight. This is one disease of young budded rubber caused by fungus, *Fusarium oxysporum.* The cause wilting and eventually death of the budded seedling.

Vascular disease. This is a new disease, noted in Agusan effecting stems of rubber seedlings, causes by fungus, *Fusarium sp.* Causes premature wilting.

Stem or Branch Disease

Stem bleeding

The disease is caused by the fungus, *Botrydipliodia theobromae.* It is characterized by excessive latex flow on the infected stem or branches. In the early stage of disease development, affected stem or branches develop.

Stem ustulina

The diseased is caused by fungus, Ustilina zonata. Latex abnormally comes out of the effected branch or stem. The fungus develops into fruit-like bodies and can be seen when the effected branch or stem is already dead. Infection is marked by sharp lines caused by coagulated latex on the branch or trunk.

Knob gall

Physiological factors are believed to preempt infection of the casual fungus. *Botryodiplodia theobromae.* Immature trees (seven years old below) are susceptible to the disease. Knob gall is characterized by enlarge swellings of the trunk, about the size of a door knob. These swelling galls may pose a problem to tapping because of the uneven surfaces created.

Pink disease

The disease is caused by fungus, either Corticium salminicolor. The fungus produces two types of spores: the Corticium stage over the surfaces of the pink crust and the Necator stage which produces the orange-red pustules.

Die Back

There are a number of die –back diseases which are caused by different parasitic agents. Under field conditions parasitic agents. Under field conditions, differentiation of die-back is difficult to achieve since various species of the organisms such as *Phytophtora, Colletotrichum, and Botrydiplodia,* are associate with the disease. The disease is characterized by the progressive death of the branches starting from the terminal bud to the main stem or trunk until the whole brash or tree is dead. It is indicated by leafless branches at the upper part of the canopy.

Panel Diseases

Black stripe

The disease is caused by the fungus, *Phytophthora palmivora.* It develops in the panel through fresh tapping cuts. The early symptoms can be recognized by the appearance of the sunken and discolored areas above the cut. As the disease advances, vertical figures develop on the renewing bark above

the cut. Below these tissues are discolored brown or black tissue.

Moldy rot

The disease is caused by the fungus, ***Ceratocystis fimbriata.*** The first symptom of infection is the appearance, just above the tapping cut, or slightly depressed spots resembling the early symptoms of the black stripe. The later darkens and becomes covered with graying mold.

As the disease progresses, the spots spread and soon form an irregular band of infection that runs parallel with the tapping panel. The disease can penetrate into the wood and causes patches of exposed areas similar to big tapping wounds.

Root Disease

Chemical control is not applicable to root rots in rubber. When detected early, dig the soil around the base of the tree, then scrape the fungal growths. Drench with fungicide for the rubber diseases. Construct canals around the effected trees to avoid spreading the disease to healthy trees. Maintain cleanliness in the plantation and supply proper fertilization

White root rot disease

The disease is caused by the white fungus, ***Rigidoporus lignosus.*** In its early stages, this disease is hardly observed unless collar inspection (slight digging) at the base of the trunk is done. Slightly off-green leaves attaining ripened appearance, in contrast with the deep green color in unaffected branches that soon turn yellow, is a possible indication of root disease. The typical symptom of the disease in the presence of the rhizomorphs firmly attached to the infected roots or ramifying into a network as they grow along. They are white flat at the growing end, but becomes rounded and yellow or faint reddish brown as they grow old.

Red root disease

The disease is caused by the fungus, ***Ganoderma pseudoferreum***. The infected root is covered with red shiny mycelium to which the soil adheres. The growing margin of the fungus is usually white; the characteristic red colors is formed only a few centimeter behind the advancing front as the mycelium becomes old. In the early stage, the rot produced is pale brown and hard.

In the advance stage, fruit bodies, which are outgrowths, are hard woody brackets with dark reddish brown, but wrinkled at the upper surface with ash white beneath the bark of the root and with prominent creamy white fringe.

Brown root disease

The disease is caused by the fungus, ***Phellinus noxius.*** As in white root rot, the rhizomorphs found in the infected roots form a continuous fungal skin, but unlike the red root, their color is tawny brown, becoming almost black with age. The diseased roots develop a very rough and irregular surface through a thick layer of soil adhering to them.

In the early stage, the rot is pale brown;later. Brown zigzag lines appear in the wood. At the fairly advance sgae, the brown network of lines can also be seen on the wood surface beneath the bark. The fruit body is very hard, dark brown and rather small bracket, which is dark gray on the underside.

Physiological Disorders

Brown bast

This physiological disorder is characterized by tapping panels that turn dry and develop hard scales, irregular nodules, and corrugation. This is more commonly observed on seven-year old trees.

Bark bust

The appearance of bark is quite similar to brown bast except that the no-dules crack or split open, vertically exposing the bark tissues. Vertical cracks result in the stem bleeding in younger trees. Bursting in order trees result in scale-like panel that turn hard and dry.

Other pests of rubber and their control.

Common Name	Control Measures
1. Termites	• Practice good sanitation in plantation • Destroy early colonies of termites. • Regularly inspect termite tunnels and destroy them.
2. Roof-feeding grubs	• Do not apply insecticides since the grubs have many natural enemies. • Use polybags in raising rubber seedlings to prevent grub attack.
3. Bark Borer	• Chemical control is not needed since bark borers have many natural enemies and occur only in low population. • Prevent the occurrence of rubber disease to avoid attracting the beatles.
4. Sucking insects (scale insects, mealybags, aphids)	• Grow rubber seedling in polybags • Practice good sanitation. • Chemical control is needed since sucking insects have many natural enemies.
5. Rodents	• Sustain baiting by putting five bait stations per hectare. • Visit stations every day to move dead rats.

	• Practice good sanitation in the nursery and plantation.
6. Slugs/Snails	• Bait with metaldehyde if the population is high. • Collect and destroy slugs/snails in nurseries. • Reduce growth of cover crops during wet season.

Rubber Marketing

In the Philippines, natural rubber (NR) marketing is not as complex as other commodities. The marketing flows involve only a few intermediaries such as commission agents, traders, processor, and manufacturers until it reaches the final outlets or end-users.

One unique phenomenon of the industry, however, is that a bigger portion of the NR produced is retained, processed, manufactured, and consumed in the country.

Types of Marketed NR Products

The various types of raw NR sold by producers either to trader in a buying station or directly to processors include cuplumps, blocklumps, coagula, and fresh latex. But some big rubber planters in Cotabato have their particularly cuplumps processed. The resulting high-value outputs are sold to rubber processors- traders rather in a raw form.

Domestic Market

The types of NR sold in the domestic market include Ribbed Smoke Sheet (RSS), Air-Dried Sheets (ADS), crepes, crumbs, and centrifuge latex. The buyers are mostly concentrated in Metro Manila and Cebu, which include both the tire and non-tire sectors (particularly footwear industries).

Export and Import Market

The country is net exporter of rubber. According to the National Statistics Office, the trade balance in 1996 registered US$ 33 million, a huge jump from only US$ 10.4 million in 1993. The industry export about 40% of its production and the rest is absorbed by local manufacturers. In 1996, exports to crepe sheets amounted to US$34 million compared to US $9.3 million in 1992. Malaysia, China, Taiwan, USA, Singapore, and Hong Kong accounted for 99% of the country's NR export. Unfortunately, the quality of the NR products exported have been allegedly of poor quality, except those purchased by US manufacturers, who received good quality rubber from their rubber-holding companies in the Philippines.

Marketing Problem and Suggested Solutions

Marketing problem of (NR) such as fluctuation; lack of market information; poor road and lack of transport facilities; lack of quality standards have not changed over the decades.

Improving the efficiency of NR marketing is synonymous to improving the income of various marketing participants.

Among the recommendations are the following:

At the production level

Producers, particularly the small holders, should try to organize into collective groups, such as cooperatives, in order to have a strong bargaining power in selling their raw rubber. Likewise, if the organized small holders can go into rubber processing them selves, they will be earning more in selling the processed than merely selling the rubber in raw form.

At the distribution and processing levels:

Emphasis should be in a quality of raw rubber being sold by the producers. To be assured of good quality supply, premium price can be offered. The traders and processors can take advantage of PRTC at USM, Kabacan, and North Cotabato to assist them in determining the quality of raw rubber being supplied to them.

At the manufacturing level:

Manufacturers should insist the processed rubber being supplied to them should have passed through the quality testing laboratory likewise, premiums could be provided as incentives as good-quality processed rubber supplied to them.