Non-food crops – Natural rubber – Code of Good Agricultural Practices (GAP)
Foreword

The Philippine National Standard (PNS) for Good Agricultural Practices (GAP) for Natural Rubber was developed by the Bureau of Agriculture and Fisheries Standards (BAFS) as per the request of the Philippine Council for Agriculture and Fisheries (PCAF) Committee on Commercial Crops Rubber Industry Development Sub-committee. A Technical Working Group (TWG) for the development of the Standard was created as per Department of Agriculture Special Order Nos. 298 and 528 Series of 2017. This Standard has been approved by the Secretary of the Department of Agriculture in 2019.

This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part2.
Introduction

The development of GAP for Natural Rubber aims to assist farmers/processors to provide assurance on the quality of raw and semi-processed rubber products that will enhance competitiveness of natural rubber for domestic use and international trade. It also aspires to help increase productivity and income, compliance to relevant national legislations, proper use of natural resources and promotion of sustainable agriculture.

The PNS GAP for Natural Rubber considers the relevant provisions of the PNS GAP for Non-food Agricultural Commodities (PNS/BAFS 203:2017), Malaysian Standard for GAP – Part 3: Rubber (Hevea brasiliensis Muell. Arg.) and other relevant national and private standards for the production and postharvest, on-farm processing and handling of natural rubber. Relevant provisions that pertain to practices that minimize hazards affecting product quality, worker’s health, safety and welfare and environment are expounded in this PNS.
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1 Scope

This Standard covers relevant practices for the primary production, harvesting, postharvest, on-farm processing, handling, transport, and storage from field latex to cuplump, and semi-processed form such as Standard Philippine Rubber or technically specified rubber, non-technically specified rubber, and centrifuged latex. The provisions of this document address produce quality, worker's health, safety and welfare and environmental management.

This Standard, however, does not provide recommendations on the manufacturing of natural rubber into products with industrial use that include but not limited to tires, slippers, shoes, surgical gloves and prophylactic sheath or condom.

2 Normative references

There are no normative references used in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1 budding
method of asexual propagation where a scion of a recommended clone is fused to a selected seedling stock and developed as a new plant

3.2 budwood garden
established area where mother trees of recommended and improved clones are cultivated to serve as source of budsticks for budding operation

3.3 coagulation
irreversible agglomeration of particles originally dispersed in a rubber latex to form a continuous phase of the polymer and a dispersed phase of the serum

3.4 cuplump
coagulated rubber latex in a collecting cup

3.5 field layout
fixing of points in the field where planting is to be carried out. There are two types of layout- straight lining for flat and slightly undulating areas and contour lining for hilly areas
3.6 
latex
milky sap coming from the trees of *Hevea brasiliensis* from which natural rubber is derived

3.7 
natural rubber
* cis-1,4-polyisoprene obtained from the tree *Hevea brasiliensis*

3.8 
nursery
established area where seedlings are propagated and raised before field planting

3.9 
rubber sheet
prepared from the fresh coagula of latex under conditions where all processes are carefully and uniformly controlled. The rubber is milled and dried to produce the desired thickness

3.10 
semi-processed rubber
consists of pale crepes, ribbed smoke sheets, air dried sheets, crumb rubber and centrifuged latex

3.10.1 
non-technically specified rubber
semi-processed rubber that does not require grading

3.10.1.1 
air dried sheet (ADS)
rubber sheet prepared in the same way as ribbed smoked sheets but dried in air usually in a shed or tunnel without smoke or additives other than those generally accepted, such as sodium bisulfate and paranitrophenol

3.10.1.2 
pale crepe
rubber sheet prepared from the fresh coagula of natural liquid latex under conditions where all processes are carefully and uniformly controlled. The rubber is milled to produce crepe in thickness corresponding approximately to the pieces in the respective samples of pale crepe

3.10.1.3 
ribbed smoke sheet (RSS)
rubber sheet produced from coagulated natural rubber latex which is evenly dried and smoked. Block, cuttings or other scrap or frothy sheets, weak, heated or burnt sheets, air dried or smooth sheets are not permissible
3.10.2 technically specified rubber
Standard Philippine Rubber
Philippine natural rubber obtained from the latex of *Hevea brasiliensis* (typically processed into blocked rubber), and having properties complying with the criteria for the grade concerned

3.10.2.1 centrifuge latex
rubber concentrate of which has been increased by the removal of serum by centrifugal force

3.10.2.2 crumb rubber
semi processed rubber from cup lump

3.11 tapping
carefully controlled incision in the bark of the rubber tree to permit the latex to flow

3.12 tapping materials
tools that are used for tapping activities

3.13 tree lace
strip of coagulated latex that is dried in the tapping cut

4 Primary production

4.1 Environmental hygiene

In order to ensure that the establishment of rubber farm in a certain site or location will have minimum impact to the environment, the following should be evaluated through risk assessment with its results to be recorded and monitored:

a) history of land use and cropping pattern;
b) potential impact of activities carried on adjacent areas;
c) slope and potential for run-off from nearby fields;
d) proximity to high risk production sites;
e) potential microbial hazards including fecal and organic waste contamination and potential environmental hazards that could be carried to the growing site; and
f) access of domestic and wild animals to the site and water sources used in primary production.

4.1.1 Location of production site

The production site and its adjoining areas should be evaluated for its suitability for agricultural land use based on the following criteria stated on Section 4.1 of this Standard.
Topographic maps should be used to assist land clearing, preparation and planting. Furthermore, the land for growing rubber should be an open area where there is good accessibility to farmers, safety and security.

If necessary, the production site including its facilities should follow all relevant requirements or regulations set by the competent authority/ies.

4.1.1.1 Land and climatic requirement

Rubber is recommended to be planted on areas based on the following considerations:

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topography</td>
<td>Land should be flat/plain but well drained or gently sloping terrains/undulating to rolling at an average of 5 degrees slope and not more than 25 degrees slope.</td>
</tr>
<tr>
<td>Elevation</td>
<td>All new rubber plantings should not be located more than 600 meters above sea level. Ideally, the recommended elevation for rubber is within 0 to 500 m above sea level.</td>
</tr>
<tr>
<td>Rainfall</td>
<td>Average rainfall of 2000 mm (Type III and IV) evenly distributed throughout the year is recommended.</td>
</tr>
<tr>
<td>Climate</td>
<td>No distinct dry and wet seasons</td>
</tr>
<tr>
<td>Atmospheric humidity</td>
<td>80% relative humidity with moderate wind speed</td>
</tr>
<tr>
<td>Temperature</td>
<td>Temperature range should be within 20°C to 34°C.</td>
</tr>
<tr>
<td>Water table</td>
<td>Ground nursery: &gt; 75 cm from the surface Rubber plantation: &gt; 1 m depth in the soil</td>
</tr>
<tr>
<td>Complementation with existing plants/crops</td>
<td>From first three to four years of planting, leguminous and annual crops can be intercropped using carefully planned and designed cropping systems following the recommended planting distance.</td>
</tr>
<tr>
<td></td>
<td>It can also be integrated with other perennial crops (coffee, fruit crops and ornamental crops) and annual crops (rice and corn)</td>
</tr>
<tr>
<td></td>
<td>If annual crops will be used as intercrops, planting distance is not recommended for adjustment.</td>
</tr>
</tbody>
</table>

4.1.1.2 Soil

Suitability plan should be prepared for the farm to facilitate infrastructure planning, land preparation, intercropping, livestock integration and replanting programs.
Table 2 – Recommended soil properties

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil depth</td>
<td>30 cm to 100 cm</td>
</tr>
<tr>
<td>Soil pH</td>
<td>4.0 to 6.5</td>
</tr>
<tr>
<td>Soil type and texture</td>
<td>Almost all types of soil are suitable provided that there is good drainage. Preferably, clay loam to sandy loam with topsoil containing abundant organic matter should be used. Rubber plants require weathered soils which consist of laterite and lateritic soils and grow best in well drained porous soil. However, rubber plant also thrives in red alluvial soils.</td>
</tr>
</tbody>
</table>

4.1.2 Water supply

4.1.2.1 Quality of water

Based on risk assessment, water sources should be analyzed at least once a year and submitted to an accredited laboratory for analysis. Water should be tested for the presence of microbial, chemical and mineral pollutants. Results of the laboratory analysis should be kept and recorded.

Water exposed to any risk of contamination like wastewater from industrial factories or activities that can cause hazardous effects like sewage water shall not be used.

4.1.2.2 Irrigation

The most efficient and commercially practical water delivery system should be used to ensure the best utilization of nutrient and water resources as well as to protect water sources and avoidance of pollution. The irrigation system should be checked for operational efficiency during each use and maintained according to operator’s instructions or other appropriate methods. Consideration should be given to a water management plan to optimize water usage and reduce wastage (e.g., systems for reuse, application at night, maintenance of equipment to reduce leakage, collection of rainwater, and the like) if applicable, water collection, storage, delivery and use shall be managed.

4.1.3 Production site preparation

4.1.3.1 Land preparation

Land preparation for rubber should include appropriate land clearing, proper removal of weeds and other sources of contaminants, adjustment of soil pH in accordance to the soil fertility management program, and installation of drainage canal to avoid water logging. Suitable land clearing techniques and disposal of vegetation that minimizes pollution should be adopted. Old rubber trees shall be uprooted to prevent root diseases. The methods on land preparation are listed in Annex A.
4.1.3.2 Field planting

Budded seedlings ready for planting should have at least one leaf storey with healthy and vigorous appearance. They should be hardened to withstand transplanting stress in the field.

The size and shape of the planting hole would depend largely on the soil condition and planting materials. In fertile and loose soils, holes should have at least a diameter of 25 cm and depth of 40 cm. In poor and hard/compact soils, bigger holes are required with a diameter of 40 cm to 45 cm and depth of 50 cm to 60 cm in preparation for basal fertilizer application.

4.1.3.3 Planting distance

The choice of planting distances largely depends on the topography of the area and possibility of planting intercrops (both annual and perennial crops). Rows of rubber are usually set at east-west orientation on flat to undulating lands to obtain maximum sunlight exposure. The longest straight line along the east-west orientation is made as a convenient base line. The recommended planting distance for rubber depending on the kind of topography is shown in Annex B.

4.1.3.4 Field lay-outing

For straight lining, measuring materials such as guide poles, planting pegs (1 m stick), lining ropes (100 m), measuring tape and compass may be used to construct a lining with a rectangular or square design.

Contour lining is highly recommended on hilly areas of more than 16° gradient.

4.1.4 Site management

Cultivation practices proven to improve or maintain soil structure and avoid soil compaction and erosion should be adopted. Where rubber is grown on sloping land (within permissible level), appropriate soil conservation measures shall be undertaken to prevent soil erosion and silt deposition into drains, waterways and the like. Entry of stray animals and unauthorized personnel should be prevented from the production site, as they can cause damages that may affect the production, quality of product and pose risk to worker’s health and safety. A visual identification or reference system through site signage should be established. The site signage should include the name of the farm and be displayed at the entrance.

Adequate separate collection sites for biodegradable and non-biodegradable wastes should be provided in the field. Waste segregation and composting is highly encouraged. For the proper disposal of empty pesticide containers and packaging materials, procedures should be followed in accordance to the rules and regulations set by the competent authority/ies for inorganic materials and organic inputs.
4.2 Production of quality planting materials

Rubber clones to be grown should be sourced from the competent authority and its accredited nurseries. The data on government registered rubber varieties is shown in Annex C. Seedlings in nursery used for planting in the farm should be insect- and pathogen-free. Measures shall be undertaken to maintain purity of the clones in the source-bush or budwood nurseries through periodic identification by inspectors. The records of all clones and sources of seeds for rootstocks and budsticks should be kept and made available for inspection. For purposes of traceability of planting materials, a record shall be kept for:

a) any indexing result;
b) date of pathogen indexing;
c) treatment used and reason for its usage;
d) dosage of treatment applied; and
e) name of the supplier and date of supply.

To ensure good quality, the planting materials should pass morphological, horticultural and isozyme or molecular marker evaluation. The selection and handling of planting materials should be evaluated in terms of the following:

a) vigor;
b) pest and disease incidence; and
c) agronomic performance.

In cases where transport is necessary, the planting materials should comply with the rules and regulations of the competent authority/ies to prevent the proliferation of pests and diseases.

4.2.1 Establishment of seedling nursery

The seedling nursery to be established should be preferably located near the area where the planting materials will be planted. It should be situated in a shaded area with a suitable terrain which is level to gently sloping in order to facilitate the establishment of planting materials and for ease of maintenance. Deep, good structured and easily pulverized soil is desirable for the use in polybags for seedlings in the nursery. Since ground and polybag nurseries need constant water supply, the nursery should be located near a source of water.

The nursery beds should be prepared prior to seed germination which includes removal of debris, harrowing of the land 2 to 3 times at weekly interval, and deep and thorough cultivation to produce fine soil and to kill germinating weeds.

Polybag nursery should be arranged either by single row or double row. If single row, it shall be a distance of at least 60 cm between row while at least 90 cm between rows in double row arrangement. The following parameters recommended for seeds and seedlings are shown in Table 3.
### Table 3 – Recommended parameters for seeds and seedlings

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition of the seeds for rootstock production</td>
<td>Big, shiny, fresh and heavy seeds should be collected preferably from PB 260 and other latex timber clones for rootstock production. Seeds with holes or seeds that are starting to germinate shall be discarded.</td>
</tr>
<tr>
<td>Seedbed preparation</td>
<td>10 kg of rubber seeds should be sown in the seedbed measuring 1 m width by 2 m length with 15 cm thick of aged sawdust or 10 cm of fine river sand as germination medium.</td>
</tr>
<tr>
<td>Sowing of seeds</td>
<td>The seed should be pressed firmly into the bed until the top of the seed level with the surface of the soil. A medium can be used to protect the seeds from direct exposure to sunlight. The seed bed should be watered regularly.</td>
</tr>
<tr>
<td>Age of seedling for transplanting in plastic bags/pots</td>
<td>Seedling with well-developed taproot system and with stem devoid of leaves are recommended to attain uniform growth and less mortality in the field. Pictures are shown in Annex D</td>
</tr>
<tr>
<td>Growth and vigor</td>
<td>Seedlings shall be robust and vigorous. Discard disease-infected, albino and seedlings with distorted roots.</td>
</tr>
<tr>
<td>Size of rootstock seedling</td>
<td>7 mm to 8 mm in diameter</td>
</tr>
<tr>
<td>Height of bud union</td>
<td>The height of bud union should be at least 5 cm above the ground.</td>
</tr>
<tr>
<td>Growth media composition</td>
<td>Topsoil</td>
</tr>
<tr>
<td>Condition of foliage</td>
<td>Healthy, matured flush and free from pests and diseases are preferred for budding</td>
</tr>
<tr>
<td>Condition of roots</td>
<td>No large roots should be growing out from the bag.</td>
</tr>
<tr>
<td>Dimension of polybag</td>
<td>Budded seedlings should be planted in a polybag (e.g. 17.78 cm by 35.56 cm, 20.32 cm by 35.56 cm, or 20.32 cm by 50.8 cm) with thickness of 0.003 mm.</td>
</tr>
<tr>
<td>Growth condition of planting materials</td>
<td>All planting materials ready for disposal should have at least one storey of hardened leaves.</td>
</tr>
</tbody>
</table>

The budding operation should be done based on the following steps:

a) The base of the stock should be wiped with a piece of clean cloth.

b) Two parallel vertical cuts at the base of the rootstock stem with dimensions of 7.5 cm long and 1 cm apart and about 5 cm from the ground should be made. The exposed panel shall not be touched or allowed to be dirtied or left too long as it becomes dry.

c) The two parallel vertical cuts should be joined by a horizontal cut either at the upper or lower end.
The bark should be stripped off either upward or downward depending on where the horizontal cut was made.

The bark should be cut away leaving 1 cm of tongue to hold the bud patch in position later on.

The bud patch should be extracted from the bud stick by making similar incisions made on the rootstock but a little bit smaller of 1 mm to fit in the incision made on the rootstock.

The inner side of the budpatch shall not be touched, dirtied, bent, bruised or exposed too long.

The budpatch should be inserted immediately in the budding panel made on the rootstock, ensuring at the same time that the budpatch is not placed upside-down.

The budpatch should be secured firmly by tying a piece of transparent budding tape of about 2 cm wide and 30 cm length. All the cuts should be ensured to be covered with a budding tape with the edges of the budding tape overlapping.

The budding tape should be opened 21 days after budding. Green budpatch indicates successful budding operation whereas brown or black budpatch indicates budding failure.

The rootstock stem should be cut-back 10 cm above the budpatch 7 days after the opening of the budding tape. The budeye is expected to sprout in 2 or 3 weeks after cutback.

4.2.2 Establishment and maintenance of budwood garden

The nursery operator should have enough (total number of buddable seedlings + 20%) production of budstick from their budwood garden corresponding to the number of rootstocks eligible for budding.

Each row of propagated seedling from registered source shall be labelled properly. Each clonal material should be planted in distinct rows or plots, properly identified or coded with visible markers. Properly tagged clonal materials will prevent possible mix-ups when harvesting. The distance of planting should be at least 1.5 m by 1.5 m and 2 m between each clone. The size of the planting hole may be 45 cm by 45 cm or 60 cm by 60 cm.

Budwood/source-bush garden should be well established and maintained in order to produce healthy bud-eyes. Condition of the trees in the budwood garden should be regularly inspected to determine that the trees are free from any pests and diseases.

The budwood to be collected shall be well expanded, healthy and mature terminal whorl or new sprouted terminal shoot (candle-like stage). Leaves at the growing points shall be mature. Budsticks with green to dark green are normally used. Dormant buds shall not be used. The eye of the growing point shall be opened. At least 10 to 15 usable and active bud-eyes/meter (brown budwood) and 2 to 3 usable bud-eyes for 30 cm green budstick should be used. Budwood/stick should be compatible to the rootstock and should be used immediately after harvest. The seedling leaf stage is presented in Annex D.

As much as possible, manual weeding should be carried out to control weeds since herbicidal spraying may affect the scion or the success of budding. Thinning out runts, genetic yellows, defective and chronically diseased plants should be done from time to
time. Leaf disease control should be carried out regularly similar to the practice in polybag nurseries. No copper-based fungicide should be applied since it will make the bark difficult to peel off.

Complete fertilizer (14-14-14) of 40 g per plant should be applied 2 months after planting and every month thereafter to 5 months. Same amount of complete fertilizer per plant should be applied during the 7 month and every 2 months thereafter up to 15 months old. After 15 months and onwards, fertilizer application should be continued after every harvesting of budstick.

4.2.2.1 Harvesting of budwood

The source of scion should come from registered and certified budwood nursery. The scion shoot is allowed to grow until it reaches 60 cm to 90 cm of brown bark. At this height, the scion shoot should be pruned off above the whorl of buds. Several side shoots will emerge, but only two should be retained to form branches. After repeated pruning, the plant gives a bush-like crown formation. Each budstick multiplication nursery should be productive for at least ten years.

Harvesting of budsticks should be done early in the morning when transpiration rate is still very low. Immediately after the budsticks are harvested, leaf petioles should be removed by pruning to avoid loss of water in the budstick. Over mature budstock should be regularly removed when not in use for budding. This is to ensure the maintenance of the juvenile budstick in the budwood nursery.

4.2.2.2 Packaging and transport

Harvested budwood/budstick should be packed properly to prevent damage and minimize transpiration of the bud patch during transit. Wooden boxes lined with layers of moist sawdust or newspaper may be used as packaging materials for harvested budwood/budstick. The material to bundle the budwood/budsticks may be moist dried banana leaf sheaths or moist jute sack.

The budwood/budstick should be transported from the source to the nursery for a maximum of 5 days.

4.3 Fertilizer application

Complete nutrition should be provided during the most critical period of growing rubber which is the first three years of plantation establishment. The fertilizer application should take into consideration the result of soil analysis to ensure optimum amount is applied. In the absence of soil analysis, the recommended fertilizer application should be followed as shown in Annex E. For productive trees, soil and plant tissue analyses should be done. The use of organic and inorganic fertilizers should be managed to limit potential risk of contamination. If these inputs are found to be contaminated with heavy metals or other chemicals at levels that may affect product quality, usage of such products should be stopped. For organic fertilizer, level of heavy metals and other potential pollutants on the organic soil amendments should be in accordance to the Philippine National Standard for
Organic Soil Amendments (PNS/BAFS 183:2016) or its latest issuance in order to avoid pollution by heavy metals or by nitrate leaching.

The application procedures shall follow the recommendation set by the competent authorities. Whenever applicable, split application of the recommended dosage shall be done. Fertilizer application machinery should be kept in good working condition and calibrated to ensure that correct quantity is applied. Fertilizer stock records should be kept up-to-date and made available for inspection.

Farmers, growers or agricultural workers shall not use undecomposed farm wastes nor liquid sewage and human and animal waste. In cases when the farm produces its own organic inputs, proper treatment procedures should be adopted to reduce or eliminate the pathogens present in the raw material and to minimize the probability of environmental contamination and decrease in yield. The composting site should also consider the production area including the source of water and substrate, topography, and proximity to the farm and residential areas in order to prevent cross contamination from run-off or leaching.

Green manuring is the establishment of leguminous cover crops in rubber plantation either before planting, during planting or after planting the rubber buddings. For farmers who practice intercropping, planting cover crops should be done after the farmer stopped planting short season crops as intercrops. Legume cover crops are beneficial to the growth of rubber trees and improve the fertility, texture and structure and water holding capacity of the soil. Legume cover crops may either be planted as seeds or polybag cuttings. Leguminous cover crops to be used in green manuring is listed in Annex F.

4.4 Use of agricultural chemicals

The crop protection product utilized should be appropriate for the control required. Whenever possible, rubber growers should adopt recognized Integrated Pest Management (IPM) techniques. Growers should use only agricultural chemicals, which are registered by the competent authority for the cultivation of rubber. Agricultural chemicals should be used according to the label or manufacturer's instructions in order to ensure effective application and avoid risks to operators, processors, end-users and the environment. Selective products that are specific to the target pest and which have minimal effect on populations of beneficial organism, aquatic life, workers, processors, end-users and not detrimental to the ozone layer should be used. An anti-resistance strategy (e.g. use of correct dosage and alternative chemicals) should be adopted to avoid reliance on any one chemical. Rubber growers shall not use chemicals that are banned or disallowed.

Only trained and authorized farm workers should handle agricultural chemicals and crop protection products. Protection of workers from pesticide exposure through the use of Personal Protective Equipment (PPE) should be ensured. The PPE used by the workers should be cleaned after use and stored separately from pesticides.
4.5 Use of biological control

Growers should only use biological control agents, which are recommended by authorized manufacturer/crop protection specialist and should use them for its intended purpose and according to the manufacturer’s instructions.

Registration of biological control agents should be based on existing regional and national standards and regulations as set by the competent authority.

4.6 Harvesting

Hygiene protocol should be put in place in order to prevent physical, microbiological and chemical contamination from tapping to processing.

4.6.1 Tapping Census

In order to determine the tappable trees, rubber tree girths should be measured from time to time. Tapping census or survey starts when the girths of at least 50% of the rubber trees planted have reached 35 cm circumference. The girth of each tree is measured at height of 150 cm from the ground. Marking through dots should be done to indicate the girth size of the tree that will determine the data to be used in planning the harvesting activities.

Table 4 – Girth size of the rubber tree and its corresponding marks

<table>
<thead>
<tr>
<th>Girth size (cm)</th>
<th>Marks dot/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 45</td>
<td>3</td>
</tr>
<tr>
<td>40 to &lt; 45</td>
<td>2</td>
</tr>
<tr>
<td>35 to &lt; 40</td>
<td>1</td>
</tr>
</tbody>
</table>

NOTE: Additional marks (dot/s) may be done provided these will give an information to the tapper that the rubber tree is ready to be harvested.

Dots are placed on the tree trunks at the height of measurement. Dots are circular in shape of 1 cm in diameter and arranged vertically at 0.5 cm apart. The census is repeated every three (3) months to monitor the girth size of the tree. Usually, tapping commences when 70% of the stand attained at least 45 cm girth and at least 8 mm bark thickness. The recommended size for tapping is where the rubber tree is already economically and physically viable.

4.6.2 Tapping

To obtain optimum yield, prolong economic life and avoid damage of the tapping panel, tapping should be done only by a trained and authorized tapper under supervision of a responsible personnel. Sharp tapping knives should be used to avoid damage to the bark and contamination. Immediately after usage, these materials and tools should be cleaned and stored. Examples of tapping tools are shown in Annex G.
Latex flows spirally from low left to high right at an inclination of 3.7° to 5° from the vertical of the bark. Latex vessels should be cut by tapping in order for the latex to flow. Tapping cut should be done from high left to low right direction of the bark to produce more latex. The recommended slope of tapping cut is 30° for downward and 45° for upward tapping cut. Retapping of the bark should be done at least 6 years.

### 4.6.2.1 Depth of tapping

In order to get higher latex yield, tapping cut should be deep enough but should avoid damaging the cambium. There shall be a 0.5 mm to 1 mm bark left untapped before the cambium to avoid wounds, bumpy scars and uneven renewed bark. These damages can make the succeeding tapping difficult and will result to product with lower dry rubber content (DRC). Good tapping will result to smooth and thick regenerated bark that can be tapped again after six years.

### 4.6.2.2 Time of tapping

Tapping of trees shall be done before sunrise to maximize latex dripping and take advantage of the high turgor pressure in latex vessels before sunrise. Excessive tapping will result to Tapping Panel Dryness (TPD).

### 4.6.2.3 Speed of tapping

Tapping speed is greatly dependent on land topography, condition of the tapping panel, tapping system, bark thickness, distances of planting, condition of the tapping knife and health of the tapper. Normally, a rubber tree with a trunk circumference of at least 45 cm and a smooth tapping panel can be tapped using a half spiral for a maximum of 10 seconds only. One tapper should be able to handle a tapping task of at least 400 trees per day for flat and undulating areas. For hilly areas, at least 300 trees should be tapped.

The recommended tapping system is half spiral cut, every third day (S2/D3) for downward tapping and one fourth spiral cut (S4/D3) upward tapping. Both tapping system is done with a frequency of every three days.

### 4.6.3 Maintenance of tapped rubber trees

All forms of tapping injuries to the trees shall be avoided. The slope of the tapping cut shall always be maintained. Steps to control bark consumption shall also be carried out. Bark consumption should not exceed the designed corresponding measurements to achieve the maximum productive years. The front and back vertical channels marking the panel boundary shall be regularly serviced (deepened). Dot marking may be done monthly to monitor the bark consumption.

The trunks of trees shall be cleaned of mosses and tree laces from time to time prior to tapping. The appropriate distance of the latex cups and spouts shall be regularly observed.
4.6.4 Latex collection

Latex should be collected at about 2 hours to 3 hours after tapping in normal condition. Clean plastic collecting cups (500ml/1000ml) should be used to collect latex. The latex should be bulked into clean plastic containers with cover to avoid spillage during transportation from the field to collection centers. The collected latex should be strained to remove dirt and impurities. Anti-coagulants should be used to prevent natural or pre-coagulation prior to transport to the processing plant. To avoid contamination, latex containers should be kept clean and not used for other purposes.

4.6.5 Cuplump collection

Cuplumps should be collected when the latex is sufficiently coagulated using clean plastic containers to avoid contamination. The cuplumps should not be left in the field for a long period. During collection, the cuplumps shall not rest directly on the ground. Cuplumps should not be exposed to sunlight.

5 Postharvest handling and processing

5.1 Latex coagulation

The standard coagulant is formic acid for pale crepe, RSS, ADS and crumb rubber production. Soft and uniform coagulum suitable for milling and drying can be expected using correct mixture of 2% formic acid (20ml:980ml water) for 20 L of latex.

5.2 Semi processed rubber

5.2.1 Non-technically specified rubber – rubber sheets

For pale crepe production, the addition of sodium metabisulfite should be done before coagulation to prevent discoloration due to contamination. After coagulation, the resulting coagulum or slabs should be subjected to rubber sheeter or crepe machine with abundant supply of clean water to obtain thin sheets. The sheets are cured for 12 days to 15 days of hanging.

For RSS production, latex coagulum is subjected to a series of roller mills to produce thin sheets. The rubber sheets can be cured through smokehouse or air drying. Using smokehouse, rubber sheets should be placed in the hangers inside the chamber with heated air. The fuel should never be allowed to produce flame, because it will produce excessive heat and damage rubber. The temperature range required in the smokehouse is 50°C to 60°C, which can be determined using thermometer. Rubber sheets are usually cured for four days. Using air drying, the sheets are cured for 30 days.

For ADS or brown crepe, cuplump is used as raw material and subjected to slab cutter and a series of roller mills to produce thin sheets and can be cured using air drying or smokehouse. Using air drying, the sheets are cured for 30 days. Using smokehouse, the sheets are cured for 8 days.
After curing, dried rubber sheets should be folded and baled. The bale should be packed by several pieces of sheets to attain the weight required by the buyers, wrapped with transparent plastic, labelled and stored. For pale crepe rubber, the sheets should be rolled in bundles and wrapped in plastic to be free from dirt prior to shipping or storing.

5.2.2 Technically Specified Rubber (TSR)

5.2.2.1 Crumb rubber

5.2.2.1.1 Production from latex (SPR5/5L)

The following are the steps in producing crumb rubber from latex:
   a) The latex should be strained to remove impurities.
   b) The latex should be diluted with clean water in same amount as the latex.
   c) Sodium metabisulfite should be added to improve the color of the latex.
   d) Formic acid should be added for the coagulation of latex.
   e) The resulting coagulum should be subjected to roller mills to produce rubber sheets.
   f) The rubber sheets should be subjected to shredder machine to produced shredded pieces.
   g) The shredded pieces should be subjected to crumb dryer with temperature of 120 °C for 4 hrs.
   h) The dried crumb should be baled according to buyer’s preference.

5.2.2.1.2 Production from cuplumps (SPR10/SPR20)

The following are the steps in producing crumb rubber from cuplump using roller mill:
   a) The cuplump should be subjected to a series of slab cutters to remove impurities and until the desired size is attained.
   b) A turbo mill should be used to further remove impurities of the rubber.
   c) The pieces of rubber should be subjected to a series of roller mills of at least 8 passes to produce rubber sheets.
   d) The rubber sheets should be hanged for 12 days for aging purposes.
   e) The rubber sheets should be subjected to shredder machine.
   f) The shredded pieces should be subjected to crumb dryer with temperature of 120 °C for 4 hrs.
   g) The dried crumb rubber should be baled according to buyer’s preference.

The following are the steps in producing crumb rubber from cuplump using extruder:
   a) The cuplump should be subjected to a series of slab cutters to remove impurities and until the desired size is attained.
   b) A turbo mill should be used to further remove impurities of rubber.
   c) The pieces of rubber should be set aside for two weeks for aging purposes.
   d) The pieces of rubber should be subjected to extruder machine.
   e) The extruded pieces should be subjected to crumb dryer with temperature of 120 °C for 4 hrs.
   f) The dried crumb rubber should be subjected to a post breaker to ensure curing.
   g) The dried crumb rubber should be baled according to buyer’s preference.
5.2.2.2 Centrifuge latex

The process of centrifugation is essential to the separation of the lighter particles (skim) of rubber from the heavier serum (concentrate) in a rapidly rotating bowl of the centrifuge machine. The two fractions, the concentrate and the skim, are separated in the centrifugation process. The concentrate should be re-centrifuged to increase the percentage of the separation from 30% to 40% that constitutes from 60% DRC to 70% DRC. The accumulated fraction of skim is usually coagulated and processed into inferior grade rubber. After centrifugation, the latex concentrate should be preserved again.

To obtain high quality latex concentrate, proper preservation of latex in the field should be done. Ammonia at 0.3% should be used as an anticoagulant or preservative since it is found to be very effective in preventing bacterial growth in latex. A well-preserved latex should have a volatile fatty acid (VFA) number of 0.02 to 0.04.

6 Handling and transport

In order to minimize contamination and ensure good quality of the rubber products, proper post handling should be done. Cuplumps should be kept clean and free from contamination such as soil, plastics sacks and plant materials. Latex should be placed in plastic containers that are free from contaminants and not in a container made from iron.

The latex should be transported to collection centers within the same day of harvest to minimize microbial contamination and latex deterioration. Latex transporters should ensure that the quality of rubber is maintained by taking necessary precautionary measures during transport such as using tarpaulin as cover. The containers and vehicles used for transport of rubber should be clean, covered and kept in a protected location when not in use. Damaged containers or transport trailers should be replaced as necessary.

7 Storage

Cuplumps /coagulum should be placed on a clean cemented flooring with drainage and should be stored in an area that is shaded to maintain its quality.

8 Establishment: design and facilities

8.1 Premises and lay-out

All facilities and structures for rubber production should be properly designed, constructed, and maintained to minimize postharvest losses and risk of contamination. Thorough cleaning and, if necessary, disinfection of the facilities should be done. All premises should adhere to the guidelines set by the local government and other relevant authorities.

Agricultural inputs such as fertilizer, pesticide and biocontrol agents should have separate storage areas. Storage of agrochemicals should be located in an area far or separate from the living quarters of the workers and where the rubber is handled. If this
is not possible, the fertilizer and the pesticides shall be physically separated and labelled accordingly.

All hazard and risk areas to humans should be clearly indicated.

8.2 Drainage and waste disposal

All possible waste products and sources of pollution should be identified in all areas of the rubber production.

Having identified the wastes and pollutants, a plan should be developed and implemented to avoid or reduce wastage and pollution in compliance with the rules and regulations set by the competent authority. The management plan should include the sewage, waste disposal and drainage systems. Whenever possible, land-filling or burning should be avoided. Crop debris may be composted and reused for soil conditioning. Recycling of wastes should be considered.

Unused fertilizers and nutrient solutions should be properly kept/disposed of according to the approved label recommendations. Obsolete pesticides should be disposed in accordance to the rules and regulations set by the competent authority.

9 Worker’s health, safety and welfare

9.1 Labor conditions

Workers shall be treated in accordance to rules and regulations set by the competent authority. All workers should comply with the country’s regulation of the minimum working age which is 18 years of age and above. All tappers shall be promptly and accurately paid for work done. It is necessary to keep a complete record of the tappers’ daily crops especially if it is going to be used as the basis for payment of their wages. Incentive should also be considered for those showing exemplary work.

There should be no cases of forced labor and forced eviction. There should be no prohibition on membership or representation by labor union. Where provided by an employer, living quarters should be suitable for human habitation and contain basic services and facilities.

9.2 Personal hygiene

All agricultural workers including contractors or visitors should maintain an appropriate degree of personal hygiene in order not to contaminate the product. Wearing of protective clothing, gadgets and safe manual handling practices should be followed.

9.3 Safety

Accident and emergency procedures with clear instructions in the appropriate language of the workforce shall be displayed to all workers. In cases of emergency, the farm should be able to provide first aid measures and appropriate fire prevention and control measures.
9.4 Training

All workers should be trained on GAP for Natural Rubber. Thorough training should be given to workers operating dangerous or sophisticated equipment. Workers should receive basic training in cleanliness requirements. The training program should outline the need for general safety.

To assure sustainable rubber production, training for tapping rubber tree should be given for tappers. Tappers should be encouraged to participate on trainings for tapping rubber. The frequency of the trainings to be conducted should depend on the level of expertise of the tapper.

10 Documentation and records

Documentation and records should be prepared and maintained to facilitate traceability, recalls and product safety investigations. All relevant information during the primary production, harvesting, postharvest, on-farm processing, handling, transport, and storage of rubber should be recorded in a logbook or on a record form.

The following data shall be recorded:

- soil analysis;
- weather condition during harvesting of rubber (when applicable);
- types, clones and sources of planting materials;
- types and usage of agricultural inputs (pesticides, fertilizer, growth regulators, etc.);
- agricultural inputs (supplier, lot number);
- farm plan/ design;
- water (source, quality and management practices);
- processing including the date, method and final volume of product;
- pest control (dosage, schedule, frequency, and cleaning schedules of equipment, etc.);
- raw material used, start and end date of treatment in case of farm producing its own inputs; and
- cost of inputs and return of investment during production.

Specifically, the information needed to be recorded is shown in Annex H.
Bibliography


Rubber Production and Management in the Philippines. 2012.

Annex A  
(informative)  
Methods for land preparation

Land preparation is facilitated by proper plowing, laying out and staking for consequent planting. After clearing, terraces or other soil conservation works should be properly established on sloping land. Ground cover of controlled naturally regenerating vegetation or leguminous cover plants may be sown or planted between the rubber rows. On cogonal areas, cogon grasses whether on land to be cleared or as a weed in the rubber plantation is normally controlled.

A. Flat areas:
1. Clearing
2. Cultivation
3. Lay-outing / Staking
4. Planting

B. Hilly areas
1. Clearing
2. Cultivation (if applicable)
3. Contour lining / Lay-outing
4. Terracing
5. Planting leguminous cover crops
6. Planting

Mechanized land preparation for replanting and new planting of non-rubber tree crops is recommended.

Replanting and new planting of non-rubber tree crops is recommended.
# Annex B

(informative)

**Recommended planting distance**

<table>
<thead>
<tr>
<th>Topography</th>
<th>Distance (m)</th>
<th>Number of trees per ha</th>
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<tr>
<td>Flat or undulating</td>
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<td>5.0 by 4.0</td>
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<td>2.0 by 3.0 by 21.0</td>
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<td>Hilly (contour planting)</td>
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<td>10.0 by 2.0</td>
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### Table C.1 NSIC registered rubber varieties

<table>
<thead>
<tr>
<th>NSIC registration no.</th>
<th>Variety name</th>
<th>Tree characteristics</th>
<th>Age (mo)</th>
<th>Growth habit</th>
<th>Growth vigor</th>
<th>Girth size (cm)</th>
<th>Girth increment during tapping (cm)</th>
<th>Withering Characteristics</th>
<th>Virgin Bark thickness (cm)</th>
<th>Response to stimulation</th>
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<tr>
<td>NSIC Rb 01 1999</td>
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<td>Straight</td>
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**NOTE** The list of registered rubber varieties were obtained from the National Seed Industry Council (NSIC) of the Bureau of Plant Industry (BPI)
Annex D
(informative)
**Seedling leaf stages**

Figure D.1 Growth stages of seedling leaf
Annex E
(informative)

Fertilization recommendation for Immature Rubber

Table E.1 Monthly fertilization recommendation per immature rubber tree

<table>
<thead>
<tr>
<th>Age Month</th>
<th>Fertilization g per tree</th>
<th>Ammonium sulfate (21-0-0)</th>
<th>Rock phosphate (0-30-0)</th>
<th>Muriate of Potash (0-0-60)</th>
<th>Kieserite 25% Mg</th>
<th>Total g</th>
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Table E.2 Yearly fertilization recommendation per immature rubber tree

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<tr>
<th>Age Year</th>
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<th>Kieserite 25% Mg</th>
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</table>
Annex F
(informative)

Common leguminous cover crops: creepers

1. *Calopogonium mucunoides*
2. *Calopogonium caeruleum*
3. *Centrosema pubescens*
4. *Mucuna cochinchinensis*
5. *Phaseolus pubescens*
6. *Mucuna bracteata*
Annex G
(informative)

Examples of tapping tools

Figure G.1 template

Figure G.2 tapping knife

Figure G.3 tapping knife sharpener

Figure G.4 latex collecting cup

Figure G.5 plastic pail

Figure G.6 plastic drum
Annex H
(normative)

Information to be recorded relevant to GAP

Table F.1 Details to be recorded relevant to GAP

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<tr>
<th>Process</th>
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<td>Pesticide's brand</td>
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<tr>
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<td>Dosage</td>
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<td>Location where it was used</td>
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<td>Reason of application</td>
</tr>
<tr>
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<tr>
<td></td>
<td>Fertilizer rate</td>
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<td>Method of application</td>
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<td>Location where it was used</td>
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<td>Date of application</td>
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<td>Operator's name</td>
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<td>Source (if organic fertilizer is used)</td>
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Annex I
(informative)
Rubber diseases and control measures

A. Leaf Diseases

1. Bird’s eyespot – Symptoms appear as small necrotic spots with dark/brown margins and pale center. It commonly occurs during hot season where nursery seedlings are susceptible. It can be treated by repeated spraying with Bordeaux mixture 1% or Mancozeb 0.2% (Dithane/ Indofil M 45 2.5 g/l) or Carbendazim 0.02% (Bavistin 0.4 ml/ l). Shading the nursery plants reduces the disease incidence. Maintain seedlings in vigorous condition through adequate balanced fertilization.

2. Anthracnose Leaf Spot – Symptoms are brown in color and irregular-shaped lesions on the leaves. Spots are small, brown in color and surrounded by yellow halos. Numerous spots coalesce and dry up leading to defoliation. It can be treated by spraying with Bordeaux mixture 1%, Copper Oxylchloride 0.125% (Fytddan 2.5 g/l), Mancozeb 0.2% (Dithane/ Indofil M 45 2.66 g/l) or Carbendazim 0.05% (Bavastin 1 g/l) at 10-15 day intervals.

3. Powdery Mildew - Produces thin and membranous spores, white, cottony, hairy or powder-like borders along the lesions. The shiny filamentous colonies are visible on both sides of the affected freshly-fallen leaves. It can be treated by dusting during the re-foliation period commencing from bud break in about 10% of the trees, giving 3 to 5 rounds at weekly to fortnightly interval using 11 to 14 kg 325-mesh fine sulfur dust per round per hectare. Sulfur mixed with an inert material like Talc (70:30) is commonly used. Wettable sulfur (Carbendazim 2.5 g /l) is also effective in nurseries and for young plants as a spray. Bavistin 0.05% a.i. (Bavistin 1 g in 1 l water) spraying is more effective than sulfur for nurseries and young rubber. Alternate use of Bavistin and sulfur is recommended to avoid resistance problem. For efficiency, dusting may be carried out in the early morning hours when the leaves are moist and fine weather.

4. Corynespora Leaf Fall/Spot - Symptoms vary from eyespot lesions, circular or rarely irregular spots, papery center, blackening on the midrib and veins with distinct “railway” lesion or “fishbone” pattern, and with prominent yellow halos. Treatment is repeated spraying with Bordeaux mixture 1% or Dithane (Indofil) M-45 0.2% or Bavistin 0.02% is recommended for nursery. Shading the nursery reduces the disease incidence. Maintain seedlings in vigorous condition through adequate balanced nutrition. High volume spraying with Mancozeb 0.2% (Dithane/Indofil M-45 2.66 g/l), Carbendazim 0.05% (Bavistin 1g/l) at 2-3 week interval during refoliation is effective in mature plantation. Micron spraying with oil dispersible copper oxychloride 56% (8kg) or oil dispersible Mancozeb 70% (7 kg) dispersed in 40 liter spray oil per ha is also effective.

5. Leaf Blight / Seedling Blight and Fusarium wilt - Early symptom shows irregular, brown lesions, which later enlarge. In young budded seedlings the fungus causes seedling shoot tip blight. It can be treated by spraying of Mancozeb 0.2% (Dithane/Indofil M-45 2.66 g/l), Carbendazim 0.05% (Bavistin 1g/l) at 2-3 week interval during refoliation.
6. Leaf Blight and Seedling Blight caused by fungus *Phytophthora palmivora* - It is noticeable especially during rainy season. In severe cases, yellowing with defoliation will happen and dieback takes place. Phytophthora leaf blight is indicated by the chlorosis at leaf margin and advances until a brown colored lesion develops and becomes water soaked. It is commonly observed in field plantations. Spraying Mancozeb 0.2% (Dithane/Indofil M-45 2.66 g/l), Carbendazim 0.05% (Bavistin 1g/l) at 2-3 week interval is effective for treatment.

7. **Leaf Blight and Seedling Blight caused by fungus Rhizoctonia solani** - Symptoms start from the tip of the leaf with a chlorotic lesion. Brown mycelial growth of the fungus *Rhizoctonia solani* are easily seen at the underside of the leaves. Spraying Mancozeb 0.2% (Dithane/Indofil M-45 2.66 g/l), Carbendazim 0.05% (Bavistin 1g/l) at 2-3 week interval is effective for treatment.

8. Sooty molds - This disease is seasonal and depend largely if scale insects are in abundance as their excreta (honey dew) favors the growth of the fungus. It may be a minor disease but when the leaves are covered, photosynthesis is greatly affected. Spraying Mancozeb 0.2% (Dithane/Indofil M-45 2.66 g/l), Carbendazim 0.05% (Bavistin 1g/l) at 2-3 week interval is effective for treatment.

B. Stem, Trunk and Branch Diseases

1. Black stripe - symptom appears sunken with slightly discolored areas on the tapping panel. When renewing bark is scraped, dark vertical lines are visible with presence of black lines in the tapping cut; clogging of the latex flow result to spillage; uneven renewal resulting to galls and depressions on the tapping panel. Scraping off the affected tissues and applying the fungicide is the effective treatment for this disease. When the fungicide dries up, a wound dressing compound may be applied. The disease can also be treated by spraying or brushing with fungicide such as Difolatan at 2% or Ridomil 25WP at 0.8% or mancozeb 0.375% a.i (Dithane/Indofil M-45 5 g/l) three times per week. Phosphorous acid formulations at 0.08% (Akomin and Phosjet 2 ml/l) are also effective. The tapping knife should be disinfected in the fungicide.

2. Stem canker - The clone PB 260 is highly susceptible to this disease. Symptoms are observed on the tapping panel region, or anywhere on the stem including the collar region and occasionally on the roots. Swelling and bark burst with yellowish orange-colored liquid oozing out. To treat this disease, the affected region should be scraped first, to remove all the rotting bark and the coagulated rubber before brushing a fungicide Mancozeb 0.75% (Dithane/Indofil M-45 10 g/l) or Benomyl on the scraped area.

3. Pink disease - The symptom shows fungal salmon pink incrustations on the fork region of the tree or branches where moisture is easily trapped. The dirty white silky threads (mycelia) of the fungus appear under favorable conditions during rainy season. To treat the disease, it is important to scrape off or wipe with a clean rug the fungal growth without damaging the cambium layer. Collect the shavings that fall off and burn. The disease can be controlled by fungicide known as *Bordeaux* mixture of 1 kg copper sulfate + 25 L water and 2 kg dehydrated lime + 75 L water through spraying on to the infected branch. It can also be brushed on the affected fork area using the fungicide Calixin.
hexaconazole, Benomyl or it can be sprayed using Daconil F500 at the rate of 3 liters in 97 liters of water. The disease can also be treated using organic-based fungicides such as Timorex Gold and Ecotiera through brushing on the affected area.

4. Stem bleeding - This disease could attack budwood gardens, immature, mature and senile rubber trees. Open circular cracks with latex ooze, dried, excessive latex or dried black latex flow on what looks like bullet-ridden shots are the common symptoms of this disease. To treat the disease, scrape off affected portions and brush or apply the open raw portion with fungicide solution to prevent entry of disease-causing pathogens or secondary insect pests and follow the same procedure as in pink disease treatment.

5. Brown bast / tapping panel dryness (TPD) - Symptoms of this shows partial dryness of the tapping panel to total dryness of the tree. Under severe condition, the bark develops hard galls or cracks, dries up, disintegrates or falls off and the production of latex is totally stopped. The most effective method to treat this is to stop it from spreading along the latex vessels, by creating a separation between the dry and the yielding areas of the bark. Apply Antico solution or organic-based vermitea evenly on the opened bark through brushing after all infected bark was removed, leaving 3 mm of bark from the cambium. It is also recommended to rest the tree for at least 1 year while treating the tree until the bark grows back again before re-tapping.

C. Root diseases

1. White root rot disease - Its common symptoms are rhizomorphs firmly attached to the roots, which is white in color. Rhizomorphs are threadlike rounded structures but have flattened-form towards the end which later on, the color changes to reddish-brown. To treat this, completely killed and dried roots may be traced, pruned off and burnt along with any rotting stump in the immediate vicinity and partially affected and healthy roots drenched with tridemorph 0.5% (Calixin 6.25 ml/l) or propiconazole 0.13% (Tilt 5 ml/l) solution or difenoconazole (Provisional recommendation). When the fungicide dries up, a thin coating with a wound dressing compound may be given. Refill the soil and drench the base with fungicide solution. Drench the nursery beds having affected plants with any of the abovementioned fungicide solution. Thorough land preparation is highly recommended to prevent the occurrence of this disease in the long run.

2. Brown root rot disease – Symptoms are rhizomorphs found in the infected roots that form a continuous fungal skin, tawny brown, becoming almost dark with age. Similar control measures applied to White Root Rot Disease will be done in Brown Root Rot Disease.
D. Insect pest

1. **Termites** - Indications of a termite infestation can be observed when mound is formed near the base of rubber tree, in which workers of the termite colony feed on the underground and basal part of the tree. Termites also cover their runways or tunnels on the trunk with mudwork for an easy point of entry connecting to other tunnel networks. The leaves of infested rubber show some signs of yellowing and wilting. To control this pest, during heavy infestation, chemical control such as the use of carbofuran, chlorpyrifos imidaclopid (based on manufacturer’s recommendation) can be drenched or sprayed directly on the soil nearest to the roots. The sprayed portion should be covered with ample soil. Cultural control such as digging up the termite colony near the rubber tree or under the roots system and eradicate the termite queen is also recommended.

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