

# Plant Propagation of ENGP Priority Species, Management, Maintenance and Protection Techniques

Enhanced National Greening Program (ENGP) Extension Officers  
Orientation and Capacity Building for CY 2022



**Ecosystems  
Research and  
Development  
Bureau**  
INNOVATING FOR  
SUSTAINABLE ECOSYSTEMS

## Background information

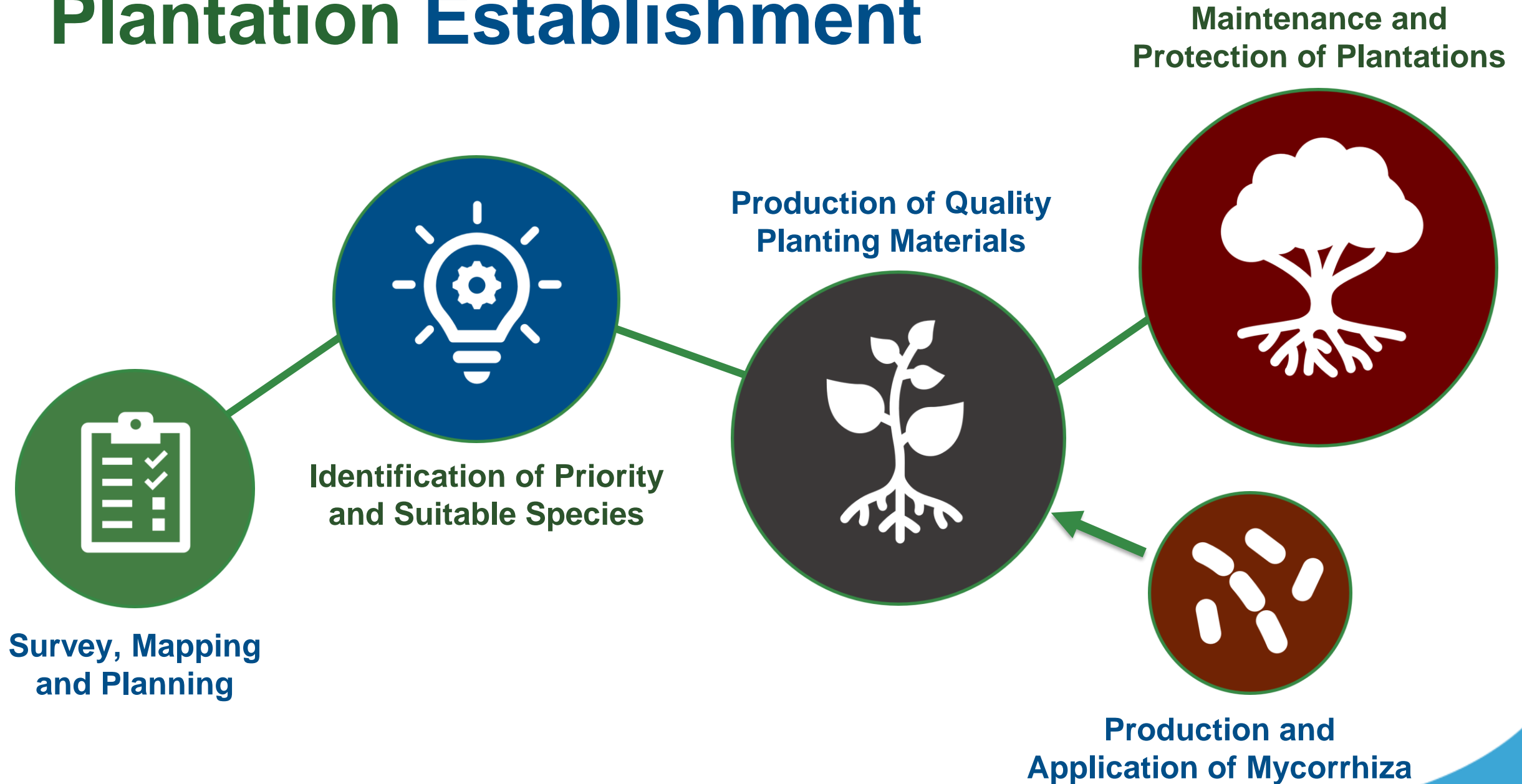
- Based on the DENR MC No. 2011-01 section 8.7, ERDB shall be responsible for **overseeing the production and procurement of seedlings and quality planting materials requirements**
- **ERDB - NGP activities include:**
  - Maintenance and Operationalization of Clonal Nurseries and Forest Tree Seed Centers
  - Maintenance and Protection of established plantation in Fort Magsaysay, Nueva Ecija
  - Production and Distribution of mycorrhizal inoculants; and
  - Conduct technical assistance on soil analysis of NGP sites

## Objectives

- The presentation aims to develop the knowledge of EOs and other technical staff on important reforestation processes
- Specifically, it aims to impart knowledge on:
  - The use of soil test kits for soil analysis
  - Plant propagation techniques
  - Production and application of mycorrhizal inoculants; and
  - Maintenance and protection techniques



# Plantation Establishment



## Survey, Mapping and Planning



- The goal of SMP is to characterize the NGP site to formulate strategies on how to successfully establish the plantation
- One of the activities of SMP is the soil characterization of the planting site

## Soil Characterization of Planting Sites

- Soil characterization is important as it helps us determine the condition of the soil
- It provides information on soil chemical and physical properties as well as the availability of nutrients in the soil, and helps determine soil amelioration strategies
- The most common soil characteristics analyzed are:
  - Nutrient elements (N, P, K)
  - Soil pH
  - Soil Texture
  - Bulk density
  - Organic matter



## Soil Characterization of Planting Sites

- Soil characterization is done by collecting soil samples throughout the NGP site and analyzing the soil collected
- Soil analysis may be done in a laboratory facility (ERDB, DA, other soil testing facilities), or using the Soil Test Kit



## Soil Analysis using STK

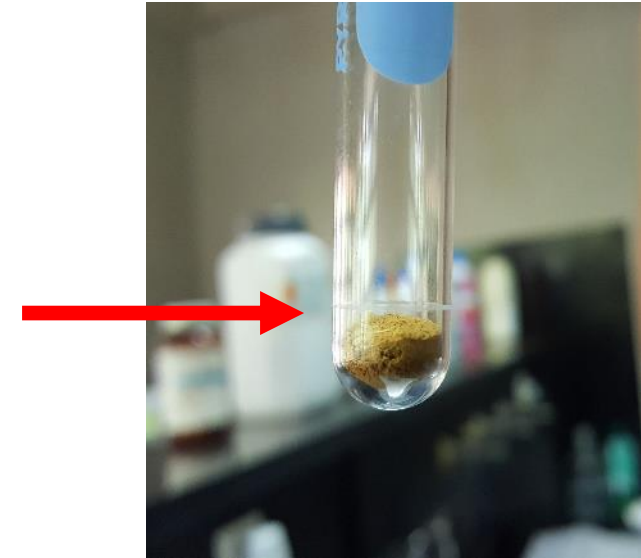
- The soil test kit is designed to provide a quick result on the general condition of the soil
- For the purpose of the lecture, the procedure will be based on the STK produced by the Agricultural systems cluster of UPLB





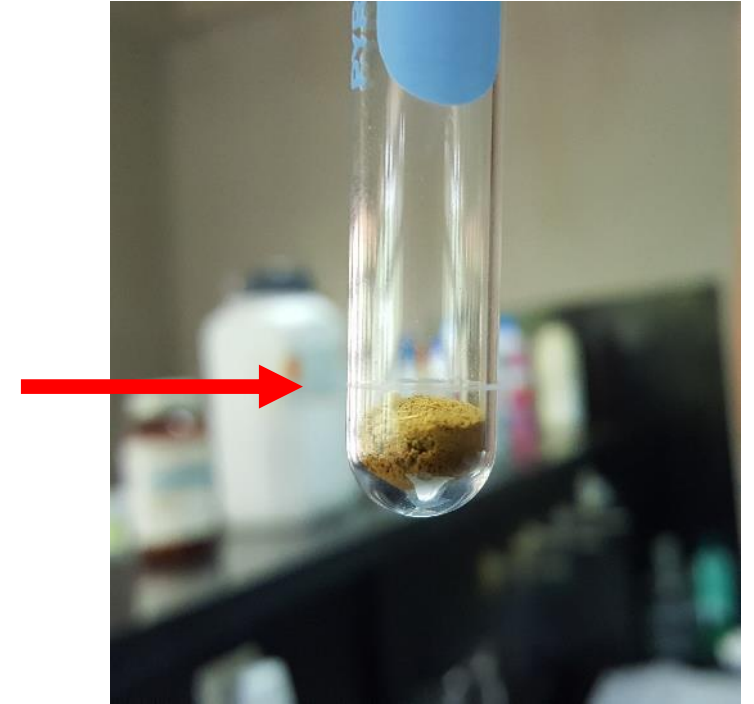
## Test for Nitrogen (N)

- Fill the test tube with soil sample up to the scratch mark
- Add 16 drops (1 ml) of Solution B
- Mix well by gently swirling the tube 30 times
- Repeat step 3 after about 5 minutes and let the test tube stand for 30 minutes
- Match the color of the resulting solution on top of the soil with the color chart and take note if the soil is low, medium or high in available oxygen



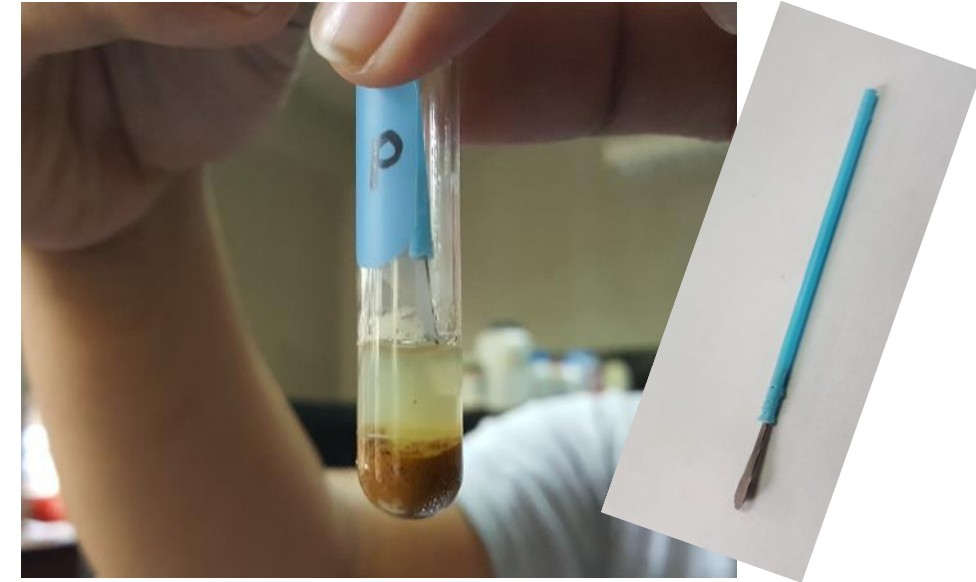
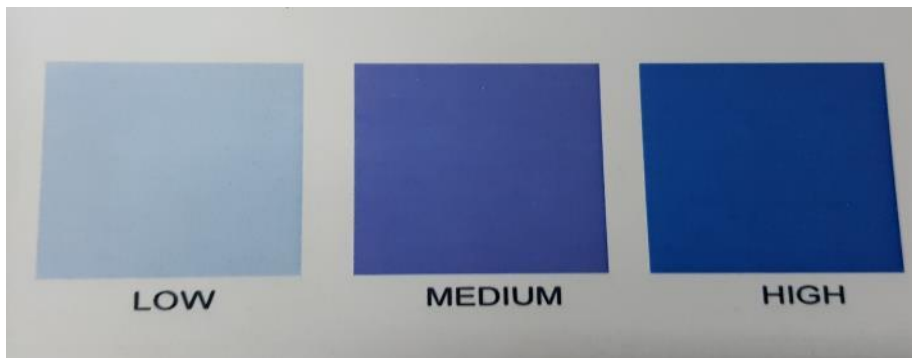
## Test for Phosphorus (P)

- Fill the test tube with soil sample up to the scratch mark
- Add 16 drops (1 ml) of Solution C and 2 drops of Solution C1
- Mix well by gently swirling the tube for about 1 minute
- Repeat step 3 after about 3 minutes and let stand for 5 minutes until the soil particles have settled at the bottom of the tube



## Test for Phosphorus (P)

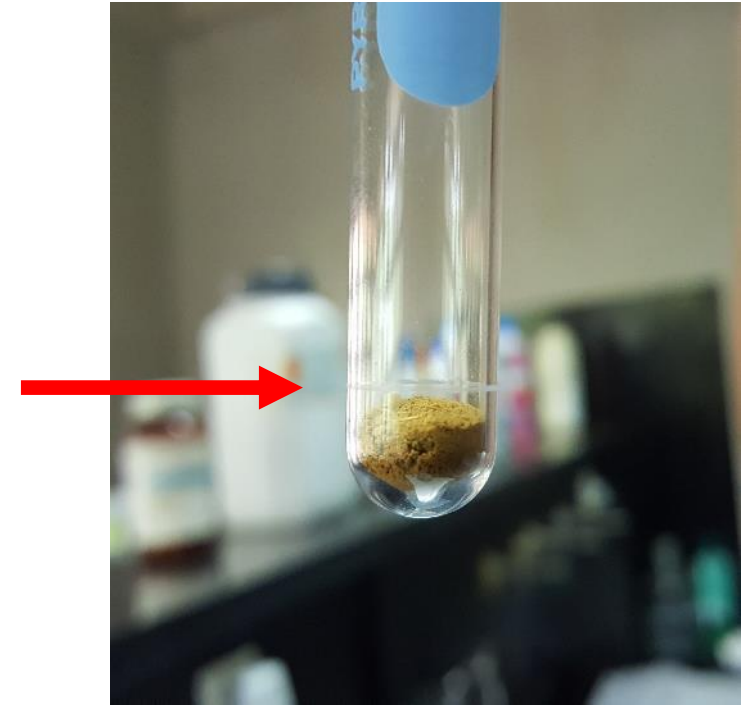
- Without disturbing the soil, stir the solution slowly with the tin strip for 1 minute. Repeat this step after about 2 minutes.
- Match the blue color on the chart and take note if the soil is low, medium or high in available phosphorus



- **Note:** The tin strip attached to the plastic can be used for another set of 4 samples provided that the analyses are done on the same day. Rinse the tin strip with distilled water after each analysis.

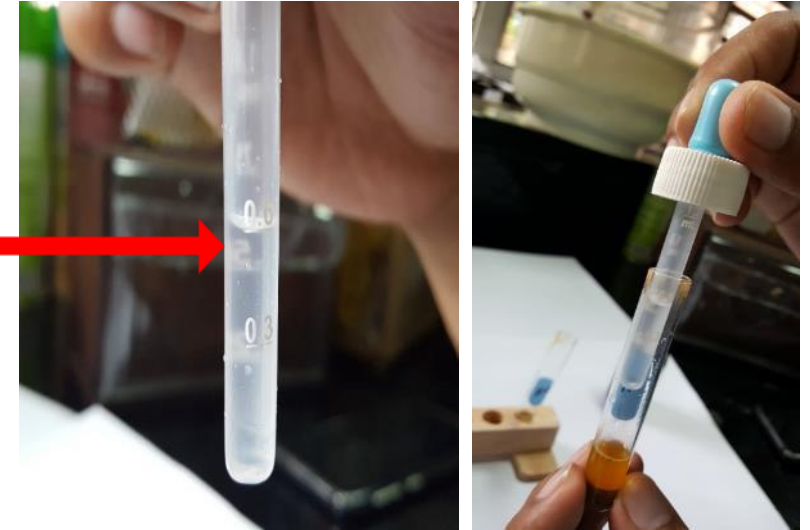
## Test for Potassium (K)

- Fill the test tube with soil sample up to the scratch mark
- Add 16 drops (1 ml) of Solution D and 4 drops of Solution D1
- Mix well by gently swirling the tube for about 1 minute
- Repeat step 3 after about 3 minutes and let stand for 5 minutes until the soil particles have settled at the bottom of the tube



## Test for Potassium (K)

- Add Solution E
- Slowly insert the dropper containing 0.6 ml of Solution E inside the test tube so that its tip is about 2 cm above the solution
- Slowly add the 0.6 ml Solution E one drop at a time



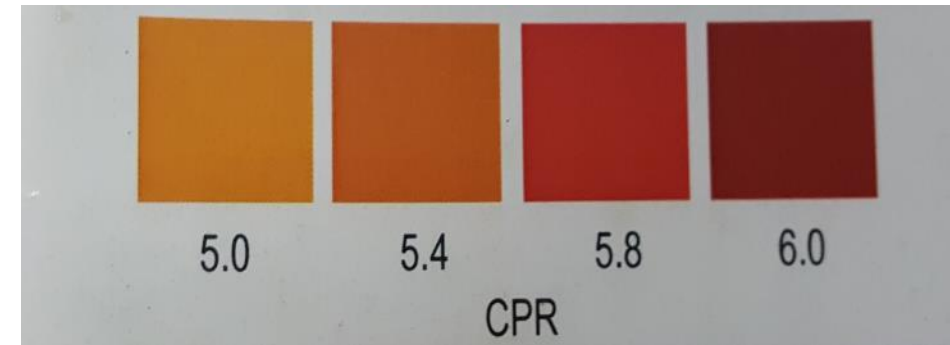
## Test for Potassium (K)

- Do not mix or shake the solution
- Let it stand for 2 minutes
- Observe the appearance of a cloudy yellow layer on top of the orange solution.
  - A distinct cloudy yellowish layer indicates that the soil has a sufficient available Potassium. If none, the soil is deficient in available Potassium



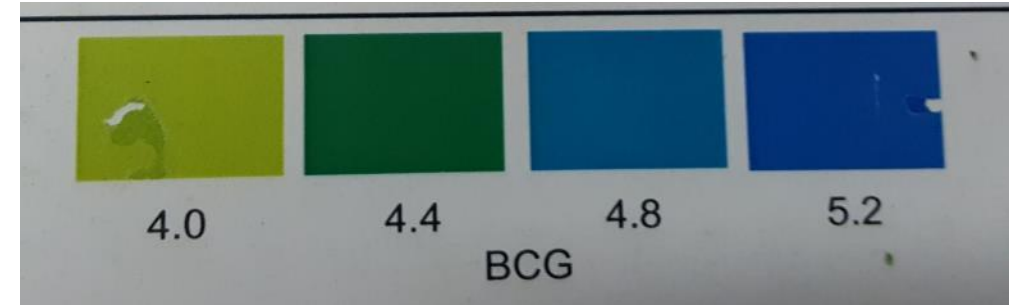
## Test for Soil pH

- Fill the test tube with soil sample up to the scratch mark
- Add 7 drops of CPR pH indicator dye
- Mix by gently swirling the test tube 20 times
- Repeat step 3 after about 2 minutes and let the test tube stand for 5 minutes
- Get the pH of the soil with the corresponding color chart of pH indicator dye used



## Test for Soil pH

- If the soil pH is equal or greater than 6, repeat steps 1 to 5 using BTB.
- However, if the soil pH is less than or equal 5, repeat steps 1 to 5 using BCG.
- Wash test tube/s with tap water and then rinse with distilled water





## Advantages and Disadvantages of STK

- Advantages
  - Provides immediate results
  - Relatively easy to use
  - Portable and can be used on-site
- Disadvantages
  - Results are qualitative in nature (High, Medium, Low)
  - Does not provide accurate numerical value needed for the computation of fertilizer requirement





## Soil Amelioration Strategies

If the soil is not favorable for plant growth, soil amelioration strategies can be applied. Soil amelioration strategies include, but is not limited to:

- Lime application (for pH)
- Fertilizer application
- Mulching
- Application of mycorrhiza

## Identification of Priority and Suitable Species



- Tree species to be planted in the NGP site are identified based on the data gathered in the SMP activity.
- Species are identified base on several factors which are the ff:
  - Indigeneity of the species
  - Commodity road map of POs
  - Priority species of POs and projects
  - Site-suitability of the species (if species to be planted are not indigenous)

## Species Recommendation

- Suitability of species is usually based on the existing climate and soil condition of the area, hence, it is important to conduct soil analysis in the NGP site, especially if the species to be planted is not endemic to the area.
- To aid in the site-suitability of tree species to be planted, publications on propagation of common tree species are available in ERDB.



## Production of Quality Planting Materials



- QPMs are planting materials that generally have superior phenotypic characteristics that allow it to compete with existing vegetation and survive a wide range of conditions
- These phenotypic characteristics may include good root system, vigorous growth performance, etc.
- QPMs are needed to ensure the success of reforestation project and plantation establishment

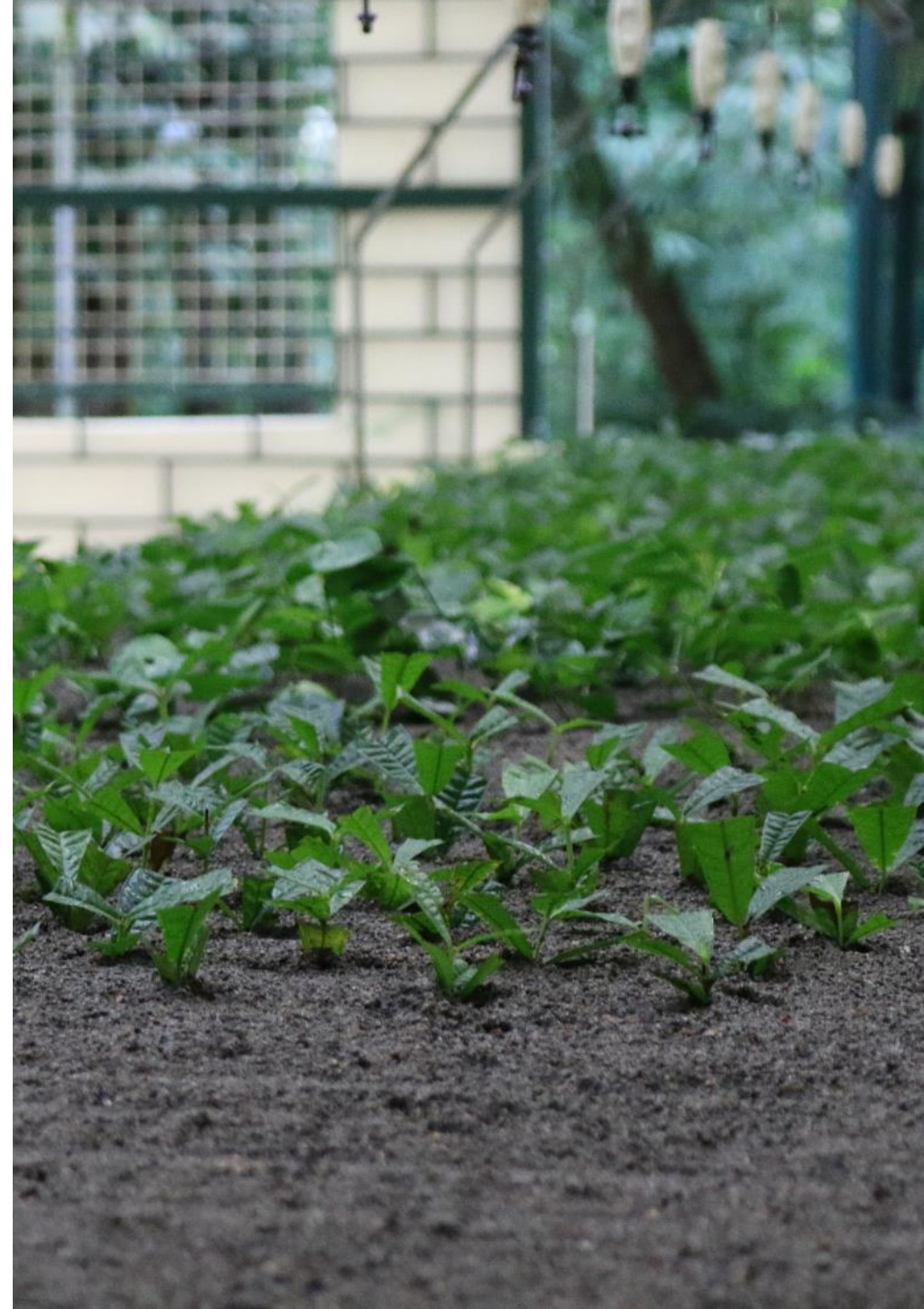
## Two sources of QPMs



**SEED SOURCE**



**MACRO-SOMATIC  
PROPAGATION**



## SEED SOURCE



- Seeds are the most used source of planting materials
- However, in order to produce quality planting materials, quality seeds from plus trees are needed
- To ensure continuous supply of quality seeds, seed sources were established in each province nationwide (Total of 75 seed source areas)
- Management, maintenance and operation of seed sources were transferred to PENROS and CENROs effective January 2018



- Seeds collected from seed sources are typically planted immediately (for recalcitrant), or a portion of it will be sent to the Forest Tree Seed Center (for orthodox)
- Establishment and Management of Seed Source Areas are stipulated in the DAO 2021-21



## Types of Seed Source Areas

- Cluster of Individual Plus Trees (IPT)
- Seed Production Areas (SPA)
- Seedling Seed Orchard (SSO)
- Clonal Seed Orchard (CSO)

Note: Only SPA and IPT areas were established for the NGP





## Forest Tree Seed Center

- To ensure the quality of the seeds, six (6) FTSCs were established by the ERDB and its research centers to provide services that include the processing, testing, storage, and distribution of seeds submitted by the seed sources
- The FTSC also conducts various researches to improve knowledge on seed technology.
- This includes seed protocol development which helps in determining the best germination protocol with the highest possible germination rate for specific species



## Forest Tree Seed Center

- Also includes seed protocol development which helps in determining the best germination protocol with the highest possible germination rate for specific species
- Publication on seed processing, storage, and germination of different forest tree species are available in the ERDB website if needed.

## MACRO-SOMATIC PROPAGATION



- With the implementation of NGP, the production of QPMs of premium indigenous and other economically important tree species became a top priority.
- However, depending on the species, trees usually do not produce seeds regularly.
- To resolve this issue, clonal propagation (macro-somatic) techniques are used for the mass production of these QPMs.
- A total of 22 DENR clonal facilities and nurseries were established nationwide in CY 2012 and 2013 by ERDB under the management of ERDS with budget from NGP
- 16 of the clonal nurseries were already turned-over to regional offices while 6 were retained by ERDB and its research centers effective 2018
- The clonal facilities are aimed to mass produce cloned QPMs using the macro-somatic propagation through rooted cuttings

## Essential Components of Clonal Facilities

- Laboratory Area
- Processing area for collected cuttings
- Soil Sterilization and potting area
- Water storage and pump area
- Rooting unit/chambers
- Recovery unit/chamber
- Hardening Area
- Hedge garden - are the factory of **juvenile** stem cuttings. Without these, the clonal **facilities** cannot operate efficiently as intended.



# PROCESS OF MACRO-SOMATIC PROPAGATION

- Macro-somatic propagation through the use of cuttings involves taking plant parts, usually a portion of a root, shoot, leaf or stem from its mother tree and setting them in controlled conditions where they will be able to develop.
- A large number of high quality planting materials can be produced through this method.



# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

## 1. Selection of Plus Trees



## 1. Collect Cuttings or Wildlings from the selected plus trees



# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

## 3. Raise Stockplants and Establish Hedge Garden





# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

## 4. Collect Orthotropic Shoots from the hedge plants



*Newly Emerged  
Orthotropic shoots \*  
(unharvestable)*



*Harvestable Juvenile  
Orthotropic shoots \**



*\* vertically grown shoots*

# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

5. Process the collected cuttings by trimming the leaves



# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

6. Sterilize the cuttings by soaking into a fungicide solution for 15 minutes to 1 hour



# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

7. Immediately soak the scraped basal portion of the cuttings into recommended concentration of rooting hormone (e.g. IBA, NAA) for 1 hour



# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

8. Set up the treated cuttings in the controlled condition for rooting. For non-mist system, plant them in hyko trays or root containers filled with pure or mixed river sand and coconut coir dust as rooting media and place in enclosed rooting chamber



# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

9. Once the cuttings rooted, transplant them into polyethylene bags filled with growing media



# General Procedures on Macro-Somatic Clonal Propagation (Juvenile Shoot Cuttings)

10. Put the potted rooted cuttings back into the enclosed chambers for a month-long acclimatization period



10. Then, harden off the rooted cuttings in a partly shaded area in the nursery in preparation to field planting



# Time Frame in Mass Propagation of Cloned Seedlings

Dipterocarps and Other  
Hardwood Species

Fast Growing Species

10 to 15 months  
to establish

4 to 6 months  
to establish

3 to 5 months

1 to 2 months

2 to 4 months

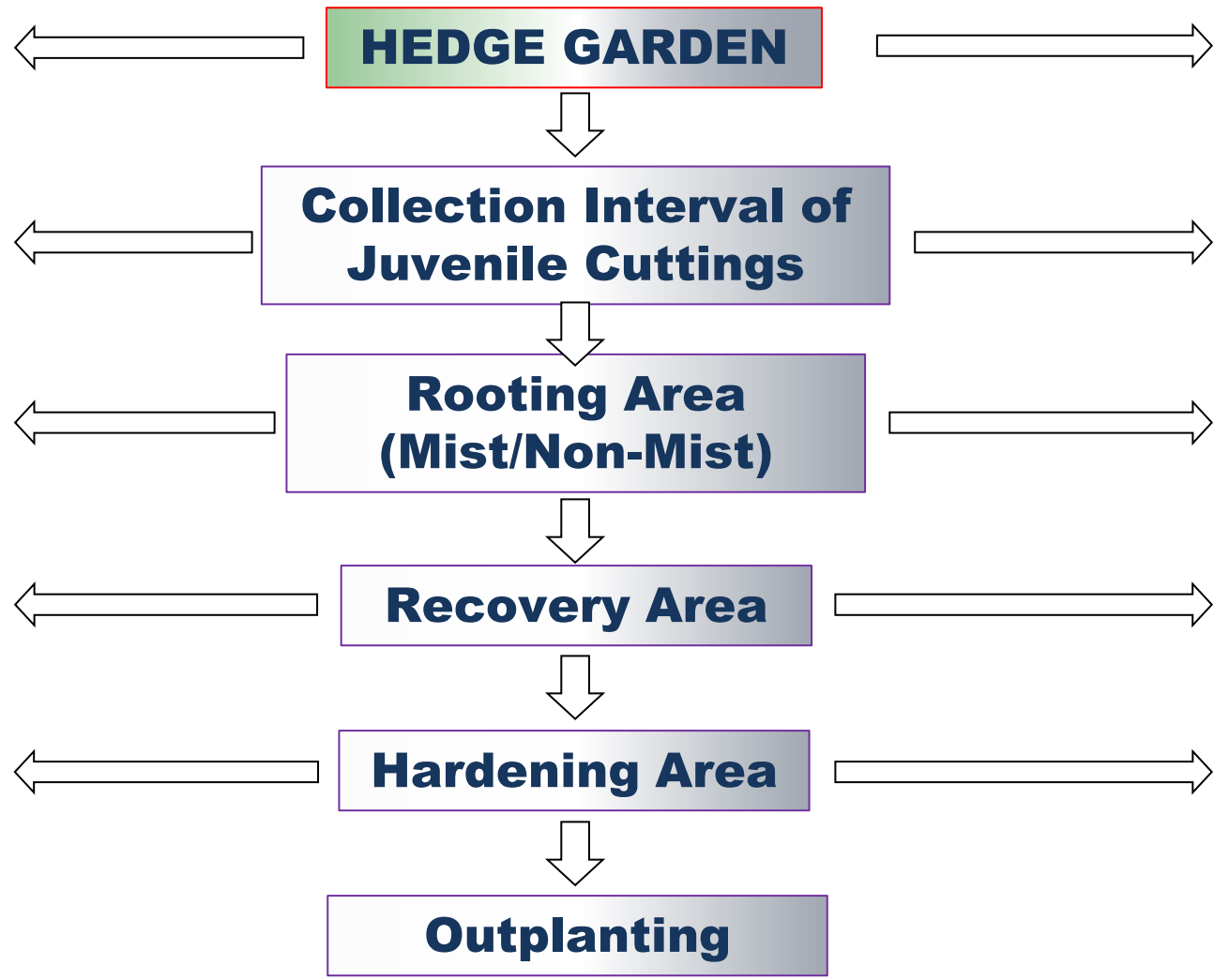
3 to 4 weeks  
(*Mangium, Yemane,  
Eucalyptus*)

1 month

2 weeks

6 to 8 months

2 to 3 months





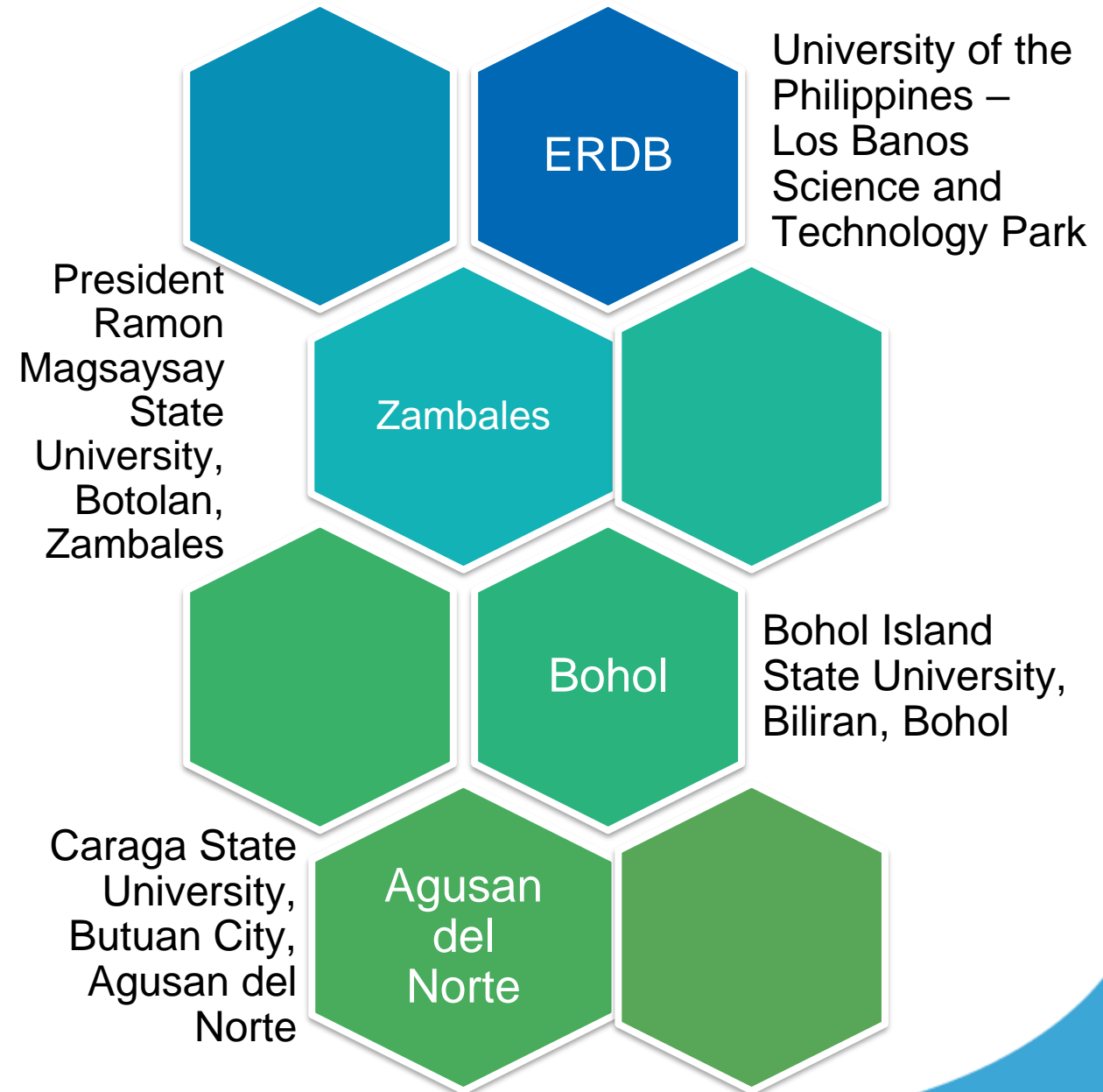
## Production and Application of Mycorrhiza



- MYCORRHIZA – is a symbiotic versatile fungi associated with plant roots
- ERDB’s mycorrhizal technology was IPO registered and patented in 2012. Its trade name is “Hi-Q VAM 1”.
- These fungi increases nutrient uptake of the plants, and even help prevent other harmful fungi and bacteria from infecting the plant

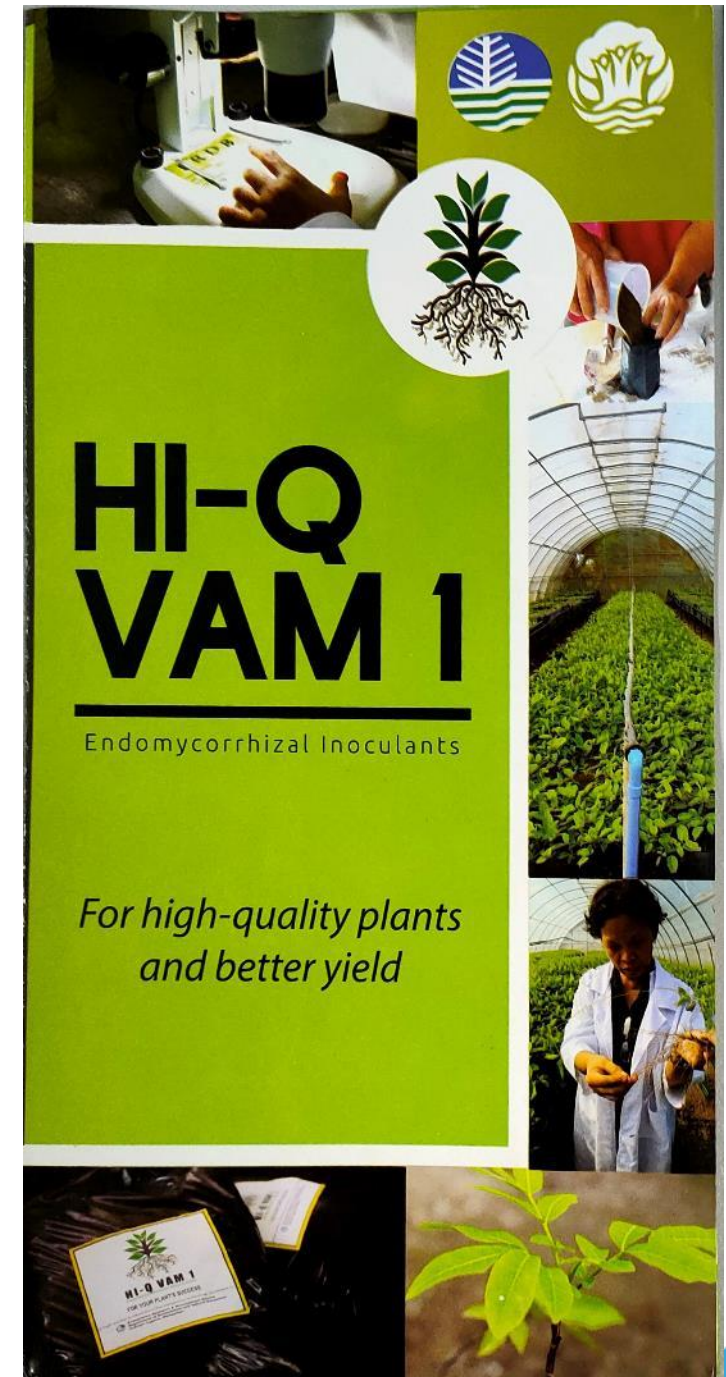
## Production and Application of Mycorrhiza

- ERDB in partnership with the National Research Development Corporation (NRDC) established a four (4) mycorrhizal production facilities mass produce mycorrhizal inoculants.



## Application of Mycorrhiza in QPMs

- Application of Hi-Q VAM 1 is best done at nursery stage at 1.5 to 2 months, when the secondary roots of seedlings in the seedbed have emerged.
- Seedlings are pricked from the seedbed
- A polyethylene bag (4x6 or larger) is filled to about one-third with garden soil
- Half teaspoon or 2.5g of Hi-Q VAM 1 is spread evenly on the top layer.
- Add another 1/3 of soil
- The seedling is then place in the polyethylene bag and the remaining 1/3 of space is filled with soil



**HI-Q  
VAM 1**

Endomycorrhizal Inoculants

*For high-quality plants  
and better yield*

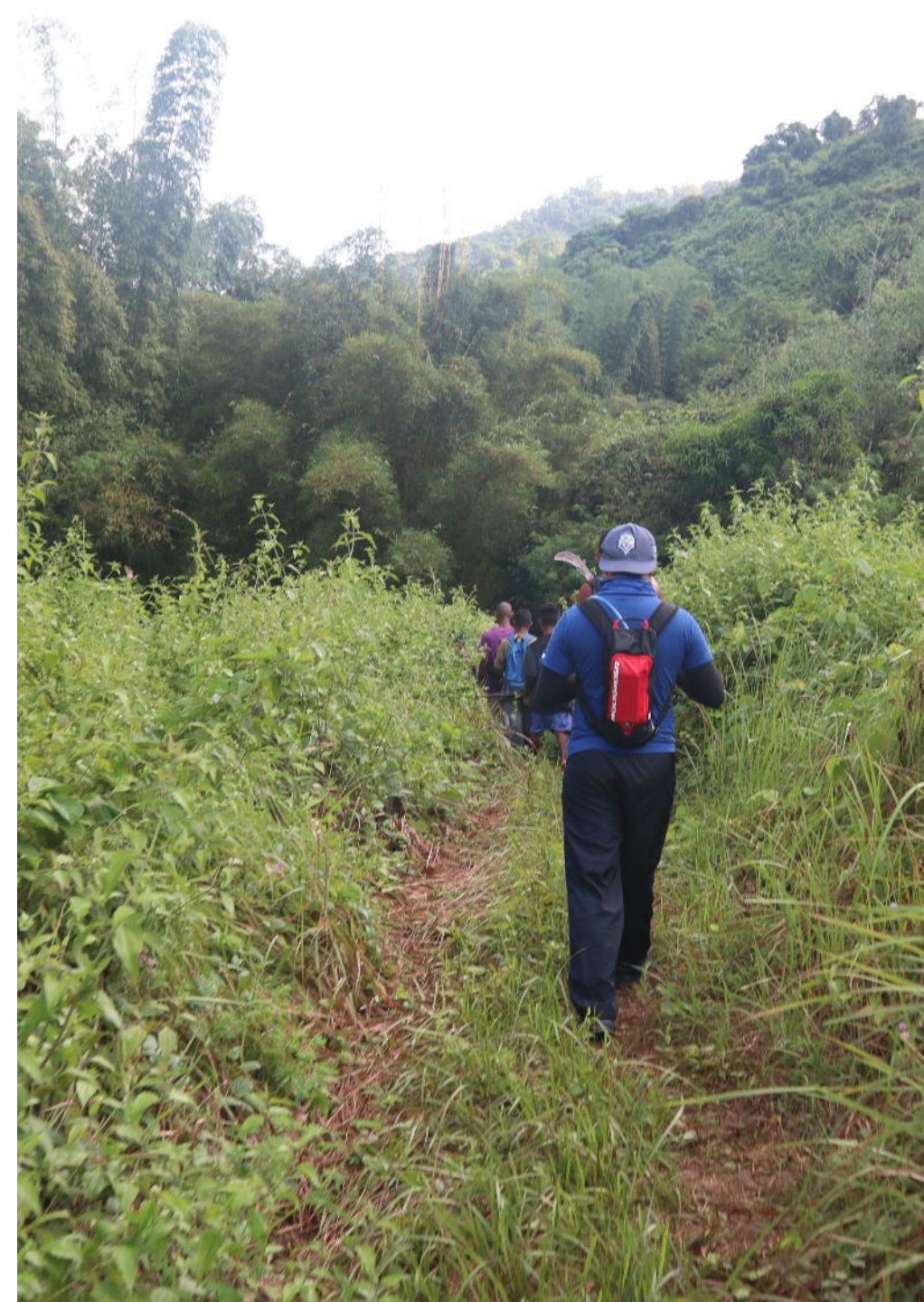
## Maintenance and Protection of Plantations



- To ensure survival and optimal growth rate of the planting materials within the NGP plantation, M&P activities must be implemented
- M&P activities include:
  - Foot patrolling
  - Establishment of Firebreaks
  - Brushing/Weeding
  - Mulching
  - Replanting

## Foot Patrolling and Monitoring

- Foot patrolling and monitoring is done to observe the status of the plantation
- Survival and growth of planted QPMs are observed to ensure that the plantation is healthy
- Patrolling also ensures that damage inside the plantation are kept to a minimum through the early detection of fire, pests and diseases, and animal or human disturbances.





## Establishment of Firebreaks

- Firebreaks are strips of open space that lacks vegetation, and established around the boundary of the plantation
- The lack of vegetation around the plantation will prevent fire from outside to enter the plantation due to the lack of fuel materials
- Firebreaks, however, are only fire mitigation strategies and does not completely prevent fire within and outside the plantation area

## Brushing/Weeding

- Brushing and weeding is done to reduce competition of QPMs from grasses and other unwanted vegetation for resources such as soil nutrients, sunlight, etc.
- This activity also prevents fire by removing vegetation that can easily burn, e.g. cogon (*Imperata cylindrica*) , talahib (*Saccharum spontaneum*)





## Mulching

- Mulching is a process of covering the soil with organic material in order to preserve moisture and improve the condition of the soil
- This is especially helpful grasslands where soil is vulnerable to dryness due to lack of vegetation cover
- Mulching also protect the soil around the newly planted QPMs from the impact of rain, preventing the roots to be exposed in this manner



## Replanting

- Due to extreme weather conditions within the plantation site, it is expected to observe mortality within the plantation site
- Hence, replanting activities are done to replace the lost QPMs



# OPEN FORUM



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# THANK YOU



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