

REFORESTATION AND MAINTENANCE GUIDELINES



MACH project

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1 Introduction

Reforestation and bio-diversity restoration in the devastated habitats, and afforestation in the new wetland habitats are important environmental restoration programs of MACH project. Since the program is executed by a large number of field staff, Resource Management Organizations (RMOs) and plantation committees, most of whom are not technically qualified in plantation raising and upkeep, a set of handy, easily intelligible and implementable guidelines are needed so that field works can be carried out routinely and without the need for frequent reference back to specialists. It is with this objective in view that these simple guidelines have been developed for the guidance of the persons and organizations concerned in reforestation and afforestation program execution.

Use of these guidelines should be supported by a one day training of all concerned people (project staff and community participants) that includes practical demonstration of various planting activities, so that all begin work with a clear conception of what each one of them is called upon to do for raising successful plantations in their respective areas.

The chronological sequence of reforestation/afforestation steps are portrayed in the remaining sections of this guideline.

2. Potential reforestation/afforestation sites for MACH plantation program

Potential sites for reforestation/afforestation program implementation under MACH project may fall under the following land categories:

- i. **Riparian Sites:** Reforestation/afforestation on the banks and shoulder lands of rivers, streams (charas/jharas); *haor/beel* fringes and peninsulas;
- ii. **Swamp forest Sites:** Elevated lands inside *haors/beels*, dykes/kandis, sanctuary/katha banks;
- iii. **Roadsides:** Berms, slopes and borrow pits of roads and highways;
- iv. **Block/patch Forest Sites:** Alluvium along river and streams that is not cultivated or that has soil not yet suitable for crop cultivation;
- v. **Institution Compound Sites:** Premises of schools, colleges, madrashas, mosques, temples, graveyards, playground peripheries, office compounds and similar other public places.

3. Proper timing of reforestation/afforestation program

MACH project targeted reforestation/afforestation sites fall under two distinct terrain situations:

- a). **Elevated lands not ordinarily submerged/flooded by rainwater:** These areas belonging to categories (i), (iii) and (v) above. The best time for planting in such areas is May-July which may be extended to October on exceptional circumstances. However, late plantings run the risk of poor survival of saplings, and lesser height and diameter growth of plants in the year of planting;
- b). **Lands that are invariably submersed deeply in the rainy season and/or where water stagnates in the site for a long period:** Lands falling under categories (ii)

and (iv) above. In case of such sites, planting may be done either before floods rise in May-June (if annual weather cycle permits) or conveniently on receding floods in October- December. May-June planting is advisable only when planting could be completed at least one month before submersion of the newly planted saplings by approaching floods.

4. Reforestation/afforestation scheme selection procedure

- i) **Preliminary selection by site coordinators:** Reforestation/afforestation schemes for execution in a given fiscal year should be identified by the concerned partner NGOs (CNRS/Caritas) and ISM staff of the site, in consultation and agreement with the local RMO/plantation committee in July (i.e. at the start of the fiscal year). In course of preliminary selection, the land owning agency (viz., UP, LGED, R&H, BWDB, land administration - AC (Land) for Khas land, relevant institutions, Tea Estates, private land owners) should be consulted and their written consent obtained regarding the proposed plantation program.
- ii) **Feasibility survey and final selection by site coordinators:** For each and every preliminarily selected reforestation/afforestation scheme, a feasibility survey will be conducted in July-August in the format included as Annex-1 of this guideline. Such survey shall be conducted jointly by the partner NGO and ISM staff of the concerned site office before its final selection for planting in a given year. In this feasibility survey, among other things, the soil and land types will be assessed for deciding the species suitability and species mix proposed to be planted and the estimated number of plants for the scheme.
- iii) **Proposal submission for selected scheme list to MACH HQ:** A consolidated list of schemes finally selected by each site office for a given fiscal year will be submitted to MACH headquarters by the Site Coordinators in September. The scheme list will show the name and location of the scheme, the extent of area (km/ha) and the estimated number of plants proposed for each scheme.

5. Approval of the reforestation/afforestation scheme

MACH Headquarters after examining the schemes finally selected and proposed by site coordinators for a given fiscal, and also having examined the fund position of the fiscal, will convey the CoP's approval of the tentative scheme list to the site in October and advise the site coordinator to prepare a detailed reforestation execution plan.

6. Preparation of reforestation/afforestation plan

On receipt of approval of the tentative annual plantation scheme list from MACH HQ, the site coordinator will prepare a detailed plantation plan which should include the species name and number of the tree species proposed to be planted in each scheme, the extent of proposed reforestation area (km/ha). This can be done fairly accurately when the feasibility survey is carefully carried out using Annex 1 format. Whenever needed, the SCs should freely discuss species selection issues with and seek advice from Habitat Restoration Specialist (HRS) of MACH HQ.

The reforestation implementation plan should also indicate the source of sapling supply for the proposed reforestation program i.e., the species wise saplings to be available from beneficiaries (Resource User Groups – RUG) or partner NGO (CNRS) sources, and the stock needs to be

purchased from commercial nurseries. The plan should be submitted to MACH, HQ by 30 November.

7. Tree species selection for reforestation/afforestation: matching site with species

The growth and vigor response of tree species planted at a given site depends largely on the soil type and nutrient status, and the type of inundation the plant is subjected to. If matching of site with species is not appropriate, plantation efforts will be doomed to failure. Species suitability for different land types and situations are as follows:

- (i). **High land situations including hilly terrains (site not inundated):** All tree species except swampy land species; i.e. **not** - *Hijal* (*Barringtonia acutangula*), *Korocho* (*Pongamia pinnata*), *Borun* (*Crataeva nurvula*), and *Pitali* (*Trewia nudiflora*).
- (ii). **Temporary inundation or shallow submersion ground:** Species suitable are: *Jarul* (*Lagerstromia flosregine*), *Arjun* (*Terminalia arjuna*), *Kainjal* (*Bischophia javanica*), *Semul* (*Salmalia malabaricum*), *Kadam* (*Anthocephalus kadamba*), *Babla* (*Acacia nilotica*), *Sissoo* (*Dalbergia sissoo*), *Chalta* (*Dillinea indica*), *Bot* (*Ficus bengalensis*), *Pakur* (*Ficus religiosa*), and *Khude Jaam/Puti Jaam* (*Syggium fruticosum*).
- (iii). **Chara/Jhara (stream), canal and river banks:** Species suitable are: Bamboo (all species) and trees listed in either (i) or (ii) above depending on bank elevation and inundation status.
- (iv). **Swamp/waterlogged sites (haor/beel situations)**
 - (a). Areas remaining permanently under water or the inundation is very deep (>1.5m) and for long duration – Site not fit for growing trees;
 - (b). Comparatively elevated ground (<1.5m inundation) and site colonized by woody vegetation like Dolkolmi (*Ipomea* species) - suitable tree species for planting on such sites are: *Hijal* (*Barringtonia acutangula*), *Korocho* (*Pongamia pinnata*), *Borun* (*Crataeva nurvula*), *Pitali* (*Trewia nudiflora*), *Jarul* (*Lagerstromia flosregine*), *Sheora* (*Streblus asper*), and *Khude Jaam/Puti Jaam* (*Syggium fruticosum*).

8 Sapling specifications for reforestation/afforestation program

MACH plantation program is contemplated on both public and private lands that are regarded generally as marginal or wastelands i.e., lands that are unsuitable or unfit for agriculture. The present uses of these lands are for cattle grazing or as public thoroughfares or for collecting fuel and fodder from bush land. These situations are thus highly disturbed places where plants are not protected. Although the soil and nutrient status of the sites may be suitable for plant growth, physical protection against cattle and children is the biggest hurdle to overcome for successful plantation establishment. At the same time, to be fair to the rural populace, dense population pressure and the lack of private pasture or grazing means that these places are important for rearing their cattle. Grazing on public lands including wetlands cannot be overcome by any legislation or other protective measures, MACH looked for a technical solution to this problem. It sought to overcome the problem by planting tall saplings that are beyond the reach of cattle and children, i.e. saplings at least 1.8 m tall. The plant specifications for MACH reforestation program are prescribed as follows:

- (i). For all species in the category of timber, fruit and ornamental plants (except typical swamp species *Hijal, Koroch, Borun*) minimum height should be 1.8m (6ft);
- (ii). For typical swamp species (*Hijal, Koroch* and *Boru*) minimum height requirement is 1.5 m (5ft);
- (iii). Only potted saplings should used for reforestation/afforestation. Saplings must be raised in pots having minimum size of 20 cm height and 15 cm width. Saplings must be healthy and stout [identification of a healthy sapling being that it has a cone-shaped stem, can stand erect on its own axis without need for extra support and looks stout by physical appearance].

9. Sources of sapling supply

Except for swamp species (*Hijal, Koroch, Borun*), saplings of all other tree species recommended for use in the reforestation/afforestation program may be purchased from commercial nurseries through competitive bidding system. However, MACH encourages Caritas organized RUGs to raise saplings especially of swamp species like *Hijal, Koroch, Borun* as an income generating activity (IGA) with assurance of buying such saplings for MACH reforestation/afforestation program. At times, sapling raising arrangement is also agreed for specified tree species with CNRS, a MACH partner NGO.

Since MACH reforestation program uses tall saplings, usually such plants, depending on the growth peculiarities of individual species, need 10-20 months to grow up to the required size. Thus advance contracts for sapling production are necessary and should be made with reputed nursery firm or project related nurseries. When made, such contracts should be a year in advance for all species other than swamp trees, and two years in advance for swamp forest species.

10. Reforestation/afforestation planting contract

Awarding contracts for sapling supply and for plantation establishment with guaranteed rate (%) of surviving saplings has been found to be the best working arrangement for plantation raising programs. Reforestation/afforestation planting contracts should therefore be awarded for all future planting programs setting 90% as the achievable targeted success rate, assessed one month after planting date and regular monitoring done to ensure timely progress and desired success.

Contract bid invitation and contract deal finalization should be completed in January-February for riparian, roadside and institution plantations, and in August–September for swamp plantations.

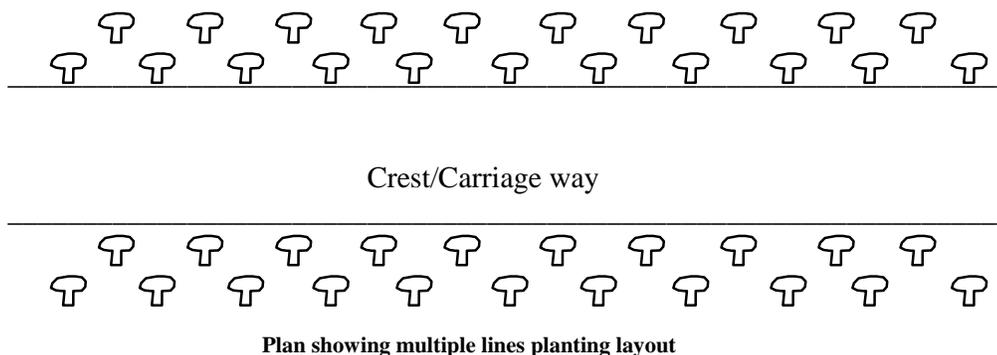
11. Reforestation/afforestation techniques

Field execution of reforestation/afforestation program involves the following technical steps:

11.1 Plantation spacing

Planting will be done in lines in a systematic manner. Plant-to-plant distance in a given line as well as distance between two adjacent lines (if more than one line planting becomes possible) will be two meters. In case of linear planting along road/embankment slopes, a single line planting on either side of the carriageway is a simple planting plan to follow and implement. If, however, more than one line planting becomes possible on either side of the crest/carriageway of the roads/embankments, then planting in a second line instead of following a square layout should follow a triangular pattern,

as outlined in the layout plan below. This arrangement allows a wider plant to plant distance in between lines than the square layout.



11.2 Planting pit/hole digging

Pit digging is the first pre-planting soil preparation work. Pits of size 30x30x30 cm should be dug in the proposed planting spot in the first fortnight of May. The top soil up to 15-20 cm depth are the most mature and fertile soils for plant growth. Full advantage of this naturally fertile soil should be taken in reforestation/afforestation endeavor. Therefore, while digging planting pit/hole, the dug out soil of the top 15 cm depth shall be kept to one side of the pit and the bottom 15 cm soils on the other side so that at the time of planting a sapling, the fertile top soil can be placed at the bottom of the pit around the root zone of the plant saplings for better assimilation of soil nutrients and better plant growth.

Since after pit digging identification of which pile is the top soil and which one is the bottom soil would be difficult, it is important to follow a systematic earth dumping procedure. For identification convenience, it is recommended to starting digging work from one end of the plantation scheme and while proceeding towards the other end, the top soil from each pit should be dumped on the right hand side of the pit and the bottom fraction on the left hand side so that these two piles stand permanently identified and no confusion arises.

11.3 Drying of dug out soil

The dug out soil should be allowed to dry in the sun for a fortnight. The sun drying has two important advantages: (a) it sterilizes the soil of fungal and insect spores; and (b) it helps pulverization of soil clods which is essential for plant root penetration and aeration to root zones. After about a fortnight's sun drying, the dug out soil should be pulverized by breaking clods and cleaned of debris, grass roots, brickbats, stones etc.

11.4 Manure and fertilizer application to pit soil

In the third week of May 2 kg of decomposed cow dung, 100 g of TSP and 100 g of MP should be thoroughly mixed with the pit soil and the pit filled with this manure-mixed soil. While pit filling, it should be remembered that the top soil fraction should be put in first i.e., at the bottom and the original bottom fraction put at the top (i.e., in the reverse order of digging). The pit is now ready for sapling planting.

11.5 Sapling Planting

The best result with planting success is obtained when it is done after a few good showers of early monsoon rains (occurring in late May or early June) and the soil is fully saturated. In such planting,

sapling mortality remains low and plants get the advantage of a full growing season of 6-7 months before the growth-ceasing winter sets in.

MACH project prescribes planting of only potted saplings. At the time of actual planting, a hole big enough to accommodate the earth ball around the sapling root is dug at the center of the manure-mixed pit soil, the potting material (polyethylene or other polymer pots or earthen pot) is removed carefully so that the earth clod is not broken and roots are not exposed. The soil around the root ball is then gently pressed for compaction. Care should be exercised to ensure that the sapling is planted perpendicular to the ground, not leaning to any side.

11.6 Stake Fixation

Planting is not safe and complete without fixing a stout stake by the side of the sapling to support it from leaning or wind-shake before new roots develop to firmly anchor it at the new site. Thus, after planting, a stout bamboo stake should be fixed beside the sapling at a distance of 15-20 cm from its base driven to a depth of 30-40 cm in the ground in a perfectly vertical fashion; the above ground section should be 2 m tall. The planted sapling should be tied to the stake with a twine of jute fiber or polymer product. The sling length of the twine shall be the same as the distance between the plant and the stake. Bamboo stakes are the most convenient ones and may be made from round shaped *Konkoi* or *Mitenga* bamboo (minimum bottom girth 10 cm) or from *Bariala* bamboo by splitting the round log; the strip width should be a minimum of 5 cm.

11.7 Mulching

Mulching means putting a thick mat of organic matter (decomposed/undecomposed) on the ground around the stem of the planted sapling up, to a radius of about 30 cm, in a bid to reduce moisture loss from the soil through direct sun scorch. Mulching conserves soil moisture and prevents plant mortality and grass invasion in the worked and manured soil. Mulching can be accomplished by using organic matter like straw, farm waste, grass or water hyacinth. Mulching should be done soon after planting of saplings.

12 Caretaking

Caretaking involves: physical protection against cattle, humans, insect and fungus; irrigation during drought period; cleaning out weeds; and soil working around sapling base for better aeration, easy root penetration, better percolation of rain and irrigation water to sub-soil. These caretaking operations are indicated below more elaborately.

12.1 Guard/Caretaker employment

Intensive caretaking in all its connotations is required for a minimum period of 24-26 months for successful establishment of a plantation. This is to be accomplished through engagement of whole time plantation guards/caretakers. As per latest MACH policy decision, guarding and caring for the first 12-14 months will be done at the project cost while from second year onwards, all guarding and caring activities will be the responsibilities of the concerned Resource Management Organizations (RMOs) or plantation committees.

One guard will be assigned the responsibility of guarding and caring for 1 km of plantation length or 1,000 plants in case of linear plantations like roadsides, river/stream banks, embankments/dykes etc. In the case of block plantations, a guard will be responsible for guarding and caring of 3,000 plants.

If the RMOs or plantation committees so decide or insist, because of the existence of overwhelming numbers of poor people in a given community, two guards may be appointed for 1 km of plantation

length but in such case, the wages meant for guarding 1 km of plantation or 1,000 plants will be apportioned equally between two individuals.

12.2 Guard/caretaker selection

Both men and women are eligible for selection as plantation guards/caretakers to protect and care for saplings. Guards/caretakers should be selected from the landless (according to national definition of landless) and poor community members, including widows, from the concerned RMO or plantation committee command area. They must be physically fit, active and willing workers, sincerely doing the job required of him/her.

12.3 Guard/caretaker's responsibility

A guard/caretaker will be responsible for:

- a. dawn to dusk guarding of the plantation section entrusted to his/her charge against physical damage by cattle or humans.
- b. regularly weeding out grass or other weeds from the base of saplings up to a radius of 30 cm from the foot of the plant. Weeding can be done by regular guards as well as by outside laborers. When done by regular guards, he/she will be entitled to get extra wages at the approved scale for such weeding. If he/she cannot do weeding due to guarding and other pressing work, outside laborers may be employed for the weeding job.
- c. hoeing soil around the foot of the sapling up to a radius of minimum 30 cm (i.e., the ground that is cleaned off weeds as specified under item b above).
- d. watering of the saplings during the drought months. If planting is done in June-August, watering may not be needed in the following winter and summer. But if late planting (September onwards) is done, watering will be invariably needed in the next drought months.
- e. fix and re-fix on a regular basis the dislodged, stolen or broken stakes.
- f. replace dead/damaged plants through gap filling.
- g. keep updated account of the surviving saplings under his/her care.

12.4 Weeding and cleaning

Weeding shall be done whenever weeds are noticed around the foot of the planted saplings. The frequency of weeding cannot be fixed in advance; the frequency will vary with season, the interval may be 2-3 weeks in rainy season and about a month in winter/droughty summer.

For weeding, the guard/laborer will use only *nirani* (indigenous weeding tool locally also called *pachon*); no spade or shovel shall be used.

12.5 Caring for defective plants

Plantation saplings may become defective on any of the following accounts:

- a. apex of the leading shoot or branches may be broken and shattered due to storm surge or deliberately by humans;
- b. badly browsed by cattle;
- c. die-back (dying from apex to downwards). This may be due to severe root injury at the time of sapling uprooting from the nursery beds or root exposure due to breaking of earth ball or planting defects or, shoot boring insect attacking the plant.

In all cases, caring begins by minutely examining the dead/defective top section of the sapling and correctly identifying how far the defect has gone down the stem. After identification, give a sharp slanting cut at the green healthy point of the stem or branch about a centimeter below the defect point so that the plant is now completely free from disease or infected injury. The cut surface may be

sealed off by paints or by raw cow dung paste so that fresh attack by insect or fungus does not take place. Such operative cut at the healthy point usually heals up very quickly and further deterioration is thwarted, fresh sprouting erupts and height growth sets in.

12.6 Fertilizer application - top dressing

No additional fertilizer should be needed if the planting preparations detailed in 11.4 are followed. However, if the parent soil is poor and quick growth is desired, chemical fertilizer may be applied as top dressing. Mixed fertilizer comprised of equal proportions of Urea and MP should be applied @ 25-30 grams per plant per application by pegging method (which involves making 4 holes on 4 sides of the plant base at a distance of 10-15cm from the foot of the sapling by driving spear shaped pegs in the soil to a depth of 5-7 cm, putting mixed dose of Urea + MP fertilizer in the holes and plugging the holes with earth). Fertilizer should be applied during growing season. Four applications may be done in July, August, Sept-Oct and May-June of the following year respectively; the first dose to be applied a month after the actual date of planting.

12.7 Pruning

This section applies for trees that are grown to produce timber (not swamp forest for ecological restoration). To achieve a higher value straight trunk, the lowest branches of young plants are chopped off progressively on the lower trunk as the plant grows. This is called pruning.

The factory for plant food manufacture is the leaves, and branches support the leaves. The more branches a tree has, the more leaves it will have and the more food it can manufacture to grow healthier. But a percentage of the lowest branches of a tree can be cut without detriment to overall growth rate. Depending on the branching character of a species and individual tree, one-sixth to one-fourth of its lowest branches could be cut to help shape its trunk for valued timber fetching.

Branch cutting should be done by sharp implements (Dao, pruning knife, secateurs or saw) so that splitting of branch or bark injuring does not take place. Branch cutting should be done close to the tree trunk so that the wound heals over soon and the plant grows healthy. Early age pruning heals up quickly and no sign of cut or scar is visible.

12.8 Climbers in swamp plantations

Swamp plantation grounds usually remain under water for more than half of the year but when water recedes and ground dries up, profuse weed growth starts. In *Kandi* (dyke) situations of Hail Haor, a creeper, locally called "Refugee Lata" (*Michinia scandens*) invades the high grounds and creeps on to the tree top. Plants soon bend down under the creeper weight; at times they lie flat on the ground and shoots develop from the whole body of the prostrate tree trunk. When that happens, such plants never stand erect nor grow upright. Creeper/climber cutting in the infested stand should be a regular operation, done on need basis through inspection. The creeper is so fast growing that 2-3 days after cutting, fresh tendrils develop and will again invade the trees. This means that in new plantings for the first 2 years or so frequent creeper cutting operations will be needed.

12.9 Caring for swamp plantation against water hyacinth

Water hyacinth is often a menace for swamp plantations. When the plants are small and fully submerged by flood water in the rainy season, water hyacinth often drifts in and accumulates on the trees; it can grow so fast that it soon forms a thick, almost impenetrable blanket preventing sunshine penetration into the water. If tree saplings underneath the water hyacinth blanket can get no sunlight then they gradually rot. When water recedes after the monsoon, the water hyacinth mass settles down totally burying the plants underneath, and often killing them.

Solutions are to remove floating water hyacinth as soon as they are observed in a plantation. Invasion of water hyacinth may be guarded against by erecting a bamboo fence along the probable invading boundary of the plantation. A cheaper fencing may be erected by fixing bamboo poles at 15-20m distance and tying nylon rope at the level of water surface that will keep the water hyacinth stranded at the rope point and prevent their drifting on the plantation. The rope height may be elevated or lowered depending on water level fluctuation, by regular visit by the plantation watchers.

12.10 Thinning

At the time of a new plantation establishment, saplings are deliberately planted closely. The objectives are grossly three fold viz., (a). to give opportunities to plants to prove individual's biological superiority over its neighbors (following the theory of 'survival of the fittest'); (b). to secure natural self-pruning of branches because branches that remain constantly in shade ultimately dies out naturally; (iii). in the early years, plants are less branchy and do not need wide space to grow; the early years' growth is thus not materially obstructed by closeness of saplings. On the other hand, a good harvest of pole/fuel wood is obtained through removal of congestions by felling the inferior stems through what is called 'Thinning' process.

When the growth of plants is exceptionally high, then in the fourth year or otherwise in the fifth year, a plantation should be visited and the inferior plants removed by thinning keeping the most promising plants to constitute the future timber crop. After the thinning operation, the number of plants would come down to almost 50% of the originally planted number i.e., about 500 plants per kilometer of linear plantation of 1000 plants or to 1250 per hectare of block plantations of 2500 plants.

12.11 Pest control:

Incidence of pests and diseases should be constantly observed, carefully assessed and out break of disease quickly located. Usually at the young stage, tree saplings are attacked by leaf eating insects. For many of the tree pests, the agricultural crops are the alternate hosts i.e., when conditions are favorable, they attack trees and when trees are leafless or leaves grow old and tough, the pests move to tender agricultural crops. The control measures for most tree pests are thus similar to agricultural crop pests. As such, for emergency remedy, the advice of local agricultural officers (Block Supervisors)/subject matter specialists (Upazila level DAE officials) should be sought and the suggested remedial measures acted upon.

Under normal situations, whenever pest and disease attacks are observed, the MACH Habitat Restoration Specialist (HRS) should be consulted for recommending quick remedial measures.

IPM as the First Choice against Pest Control

As a general principle, IPM (Integrated Pest Management) methods should be the first choice for pest control. IPM in its simplest form involves physically picking up the pests from the plants and their neighborhood, and destroying them physically by crushing or burning including destroying the attacked organ of the plants contaminated with pest eggs, larvae and droppings.

IPM also involves spraying of insect repellent plant or animal products like spraying of animal urine, dilute slurry of animal dung, Neem extract, tobacco leaf extract. on the plant leaf, branch and trunk. (non-organics such as kerosene/diesel are also used elsewhere but must be avoided as they will pollute water and are harmful to aquatic life) Many of these solutions are locally familiar and should be used at the insipient stage of the pest attack or when the attacks are few and far between.

Insecticide use

When pest attack is widespread and of massive scale, application of chemical insecticide may have to be resorted to. **On no account should this be done where the insecticide would run off or drift into fishing grounds or fish sanctuaries.** Some of the common tree pests and their rule-of-thumb control measures with chemical pesticides are indicated below.

A. Leaf eating insects

Common insecticides that are found effective against leaf eating insects of nursery or young plantations, and their dosage include:

- a. Cymbush: Dosage- 10 ml of insecticide in 10 liters of water; spray on leaf and stem.
- b. Diazinon: Dosage- 35 ml of insecticide in 10 liters of water: spray on leaf and stem.
- c. Sevin: Dosage - 20 ml in 10 liters of water; spray on leaf and stem.
- d. Melathione, Sumatheone, Anthio; Dosage-20 to 30 ml in 10 liters of water; spray on leaf and stem.

B. Mahogany shoot borer attack:

Furadon 5G-Systemic granular insecticide: Dosage – 5 to 10 gm/plant applied in the soil around the plant base and watered mildly.

C. Termite and ant attack: Control measures involve application of any of the following insecticides:

- a. Dieldrin: Dosage-35 ml in 10 liters of water; apply in soil around the sapling base.
- b. Floredon/Heptachlore: Apply 5–10 gm of amorphous Floredon or Heptachlore per plant in soil around the plant base to a radius of 30 cm and water mildly.
- c. Regent : Apply 10-15 gm of granular Regent per plant in soil to a radius of 30 cm around plant base and water mildly.

12.12 Fungus Attack

(a). **Fungal attack in leaf and root:** In the early life of plants, most fungal infection occur in tree leaf or tender roots. Most of these fungal infections are however cured by application of **Bordeaux mixture**, a simple chemical solution that could be prepared very conveniently by anybody at domestic level following the under-mentioned recipe:

- (1). Prepare a solution of 100 gm of Blue vitriol (CuSo₄) in 5 liters of water in a non-metal container (Blue vitriol is locally called *Tuitta* or *Tuichha*, and commonly available in local market).
- (2). Prepare another solution of 100 gm of lime (Cao) in 5 liters of water in a second non-metal container;
- (3). Add both the solution in a third non-metal container and stir well*; the Bordeaux mixture is made.
- (4). Apply the Bordeaux mixture in the tree leaf by a sprayer.
- (5). If less or more quantity of the mixture is required, prepare the quantity by reducing or enhancing the quantity keeping in mind the proportion of different ingredients.

*** Note: Use three containers. Do not mix all ingredients together in a single container. If that is done, the efficacious power of the mixture will not be there.**

(b). **Root Rot disease:** patented fungicide like Cupravit or Diathene may be applied. Instructions about the dosage and method of application are generally contained in the top label of the patent which should be followed.

Schedule-A

SUMMARY OF REFORESTATION AND MAINTENANCE GUIDELINES IN TABULAR FORM

Sl. #	Item of work	Specification	Cut-off date for implementation	
			High land (not submerged)	Haor/Beel (swamps)
1	Preliminary selection of the fiscal year's plantation scheme by the Site Coordinators (SCs)	Preliminary scheme selection done by SC and site staff by ocular survey & discussion with UP chairman, members, RMOs, LGED, WDB	July	January
2	Reconnaissance survey of the preliminarily selected plantation scheme for assessing soil and land types, deciding species to be planted (i, e, matching site with species)	Reconnaissance survey carried out using format appended as Annex-1.	August	February
3	Final scheme proposal submission to MACH, HQ by SCs	Final scheme proposal with reconnaissance survey sheets (Annex 1)for each scheme submitted by SCs.	September	March
4	Approval of scheme proposals by MACH, HQ	CoP, MACH approves scheme proposals for the fiscal year	October	April
5	Detailed plantation plan preparation and submission to MACH, HQ by SCs	Plan should indicate site-wise areas and species-wise number of plants, source of seedling supply. Species suitable for different land types and elevation situations are as follows : i). High land situations including hilly terrain- All tree species except swamp species like Hijal, Koroch, Pitali, Borun, Jarul and Kainjal. ii). Temporary and shallow submersion locations – Jarul, Arjun, Kadam, Semul, Babla, Koroi, Chalta, Kainjal and Sissoo. iii). Chara/Jhara (stream), canal and river banks – Bamboo and other species of sub – item (i) and (ii) above, depending on bank elevation & submersion level. iv). Swamp/water logged situations- Hijal, Koroch, Pitali, Borun and Jarul.	November	May-June
4	Sapling specifications	Sapling specifications will be as follows: i). All species (except typically swampy land species like Hijal, Koroch and Borun, : Height- 1.8 m (6 ft.), ii). Typical swampy land species viz., Hijal, Koroch and Borun: Height- 1.5 m (5ft.) iii). Plants must be raised in poly pots of size greater than 20cm long x15cm width, must be stout, healthy having cone-shaped stem section.	-	-
5	Selection of sapling supply & plantation contractor, plantation	Tender invitation/re-invitation, tender acceptance, contract signing and work order issuing.	December- January	July- September

Sl. #	Item of work	Specification	Cut-off date for implementation	
			High land (not submerged)	Haor/Beel (swamps)
	ingredients supplier including organic manure, bamboo stake, plantation maintenance tools & implements etc.			
5	Pit digging in the selected plantation sites as prior preparation for plantation establishment	a). Plant to plant distance in lines – 2m for tree sapling and 4-5m for bamboo. b). Planting line to line distance – 2m for tree saplings and 4-5m for bamboo b). Pit size- 30cmx30cmx30 cm c). 7-14 days time be allowed for the pit soil to dry	16 April -15 May	16 October -15 November (Dependant on water recession speed)
6	Pulverizing pit soil by breaking clods; cleaning debris/ grass/ dead roots/ brick bats/ stone etc. mixing soil with decomposed cow dung and chemical fertilizers, refilling the pits with manure-mixed earth.	Manure applied per pit should be : i). Cow dung – 2 kg. ii). MP- 100gm. iii). TSP – 100gm	16 - 31 May	–
7	Planting Saplings	Planting will begin after heavy showers of rains and saturation of soil with moisture in June. (MACH, HRS will be consulted for green signal on appropriate plantation timing)	June. (planting, if followed by prolonged drought, watering shall be done till rain sets).	November-December
8	Stake fixation alongside newly planted seedling	a). Stout bamboo or wooden stake, 2.4 m (8 ft.) tall and having girth of 12cm (4.5 inches). b). Stakes must be supplied and be in stock before sapling planting operation begins	June (sapling planting and stake fixation must be done by one operation).	Nov. –Dec. (sapling planting and stake fixation must be done by one operation).
9	Mulching	Top surface of the planting pit to a radius of 30cm from the sapling base be covered with thick mat of debris of uprooted grass or straw or water hyacinth, as is available.	June (soon after sapling planting).	November-December (soon after sapling planting).
10	Application of Urea fertilizer by side dressing	Urea fertilizer @ 30 gm per plant shall be applied by pegging method (making 4 holes from 4 opposite sides by a pointed peg) at a depth of 8cm (3 inches) inside the soil and at a distance of 10-15 cm (4 -6 inches) from the base of the plant.	4 doses of fertilizer applied; once in July, once in August, once in Sept.-October, and once in next May-June; the first dose to begin one month after the date of sapling planting	4 doses of fertilizer applied, once in February, once in March, once in April and once in next years February - March; the first dose to begin one month after the date of sapling planting.
11	Weeding and cleaning	30cm radius ground around the base of each	First weeding -	First weeding -

Sl. #	Item of work	Specification	Cut-off date for implementation	
			High land (not submerged)	Haor/Beel (swamps)
		planted sapling shall be kept clean of all weeds by uprooting, and the soil is hoed and kept loose for aeration and water percolation.	15-20 days after sapling planting; thereafter as & when needed but invariably before fertilizer application .	15-20 days after sapling planting ; thereafter as & when needed but invariably before fertilizer application till the plantation site is submerged by flood water.
12	Creepers & climber cutting	Creepers/climbers slashed to the ground and chopped; plant base is cleaned off the Creepers/climbers root & stem.	Whenever creepers/climbers attack occurs.	Whenever creepers/climbers attack occurs.
13	Thinning	Weak plants removed by cutting to make room for healthier plants to grow thick & tall.	5 th year of the plantation	5 th year of the plantation
14	Pest and disease control	Pest and disease incidences shall be constantly observed, carefully assessed, and quickly located if disease breaks out	Insecticides / Fungicides sprayed whenever pest and disease attack observed. MACH, HRS/ local agricultural specialists should be consulted for quick remedial measures.	Insecticides / Fungicides sprayed whenever pest and disease attack observed. MACH, HRS/ local agricultural specialists should be consulted for quick remedial measures

Schedule - B

Work Estimate and Expenditure Schedule for Plantation Activities

[Plantation watcher (invariably) and daily laborer (when conveniently available) shall be recruited from the RMO/RUG general committee members.]

Sl. #	Item of work	Laborer requirement	Labor wage per unit
1	Plantation activities in hilly terrain and highland situations (i.,e., other than swampy land) : a). Excavation of pit for seedling plantation: Pit size-30cm x 30 cm x 30 cm	1 (one) daily laborer (DL) per 60 (sixty) pit	Labor wages to be fixed by Site price fixation committee consisting of SC as convener & SE and FC as member.
	b). Pulverizing soil, cleaning grass/plant roots/stony materials from dugout soil, mixing manure & refilling pits with manure-mixed soil	1(one) DL per 60 (sixty) pit	-Do-
	c). Planting seedling in soil-worked pit & fixation of stake alongside the planted sapling.	1(one) DL per 50 (fifty) pit	-Do-
2	(i). Tree Plantation activities in Haor/Beel /Swampy locations (wet ground/soft clay): (a). Cleaning of plantation area by cutting Dolkolmi and other jungles for clearing the ground and making it fit for planting	1 (one) DL Per 100 (one hundred) pit space	- Do-
	b). Making planting holes, application of fertilizer in the planting holes and planting seedling, fixation of stakes	1 (one) DL per 50 (fifty) pit	-Do-
	ii. Tree Plantation activities in Haor/Beel situations - Dry soil and hard ground	Same scale as for item 1 above	-Do-
3	Weeding, cleaning and application of fertilizer by side dressing.	Works will be done by the plantation watchers maintained according to the scale specified under item number 4 below; or by hired laborer.	50 (Fifty) Paisa per month for each surviving plant. <u>Note:</u> If a plantation watcher having satisfactorily done his/her primary job of plantation watching can cope up with weeding –cleaning job, he/she will do it. Other wise hired laborers would be engaged and paid for according to the above fixed scale.
4	Daylong watching of plantation (sun rise to sun set) against damages, general maintenance of plants and stakes, and their replacement when needed, watering plants (when needed) during drought period.	a) For roadsides, embankment slopes, river/stream/canal bank etc: linear type plantations – One watcher engaged per kilometer length of plantation.	Taka 1,000 (one thousand) only per watcher per month in T-B and K-M Sites, Taka 1,200 (One thousand two hundred) per watcher per month in Hail Haor site.

Sl. #	Item of work	Laborer requirement	Labor wage per unit
		b). For block plantations- One watcher engaged per 3,000 (Three thousand) number of plants	Taka 1,000 (one thousand) only per watcher per month in T-B and K-M Sites, Taka 1,200 (one thousand two hundred) per watcher per month in Hail Haor site.
5	Stake	Specifications : Mentioned against item # 8 of Schedule "A" above.	-Do-
6	Twine for tying planted seedlings with side stakes	Twine made of polymer compound like polyethylene or other twines	-Do-
7	Organic manure	Decomposed animal dung	-Do-

MACH Project Plantation Scheme Feasibility Survey Proforma

Date of Survey :

01. Name of the plantation :
Scheme (indicating starting and editing point)

2. Scheme Location
Village :
Union Parishad : Upazila: Zila

3. Type of Scheme : Road/ Embankment/Canal bank/Beel or haor periphery /Patch forest /Institution compound/Others (specify)

4. Name of the land owner :

5. If road/embankment, indicate matrix: Top width Slope width # Plant rows possible
(average) (average) (average)

6. Total length/area of scheme :

7. Soil type in the scheme site :

8. Inundation status: Not inundated/Inundated occasionally /water stagnates seasonally in rains

9. Estimated # total saplings needed for afforestation:

10. Suitable species for planting with :
Species wise number

11. Is there existing :
RMO/Plantation committee

12. If yes, indicate name of :
RMO/Plantation committee

13. If no RMO/Committee exists, has action :
been taken to form such committee

14. Comments by survey team about scheme selection :

Signatures of survey team members

15. Signature of site committee members :
approving the scheme