

The Need for Improved Nursery Management Practices and Marketing in the Tree Nurseries of Northern Mindanao

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ABSTRACT

Tree growing is recognized to provide economic and environmental benefits, and this has resulted in tree growing initiatives in Northern Mindanao. However, tree growing is faced with constraints including high field mortality and poor timber stands, with low merchantable height and diameter. This paper seeks to discern the quality differences of seedlings grown in three nursery types in Northern Mindanao, and to investigate the influence of nursery facilities and cultural management practices on seedling quality. Seedling quality was assessed through random sampling of planting materials. Information about nursery facilities and cultural management practices were obtained through interviews with nursery operators and through visual observations. It was found that private, communal and government nurseries have facilities designed for low-cost production of seedlings. The lack of hardening beds and raised benches used for seedling acclimatization explains the inability of seedlings to survive when outplanted. Seedlings were found to be of low quality in all nursery types, with weak stems, unbalanced root-shoot ratio and with J-root formation. It was also found that most nurseries did not apply soil treatment which is one of the basics for growing seedlings. There is an urgent need to improve nursery management practices by employing best management practices including proper hardening techniques using effective but non-expensive hardening beds and soil sterilization to improve seedling quality.

Keywords: Snowball sampling, nursery facilities, sturdiness quotient, root-shoot ratio, hardening beds

INTRODUCTION

The 20 M Filipino people living in the uplands are the potential and effective human resource capable of rehabilitating the nation's denuded forests (Mercado and Piñon 2008). Most of these people are practicing small-scale forestry as a livelihood activity. Intensifying small-scale forestry will not only improve the economic status of people in the uplands but also improve the national economic situation by reducing timber imports. The scaling-up of small-scale forestry in the Philippines is thereby a key to successful rehabilitation efforts. Scaling-up is, however, faced with the

constraints of limited availability of planting materials (Cooper and Denning 1999) and the low quality of planting stock (Gregorio et al. 2004).

This research is based upon the notion that Northern Mindanao is experiencing a shortage of planting materials. The majority of seedlings from nurseries are of low quality as a result of low technical skills and unsuitable nursery facilities, thereby resulting in a low rate of success for tree growing initiatives in this region. Thus, improved nursery facilities and management practices are seen as essential intervention points to improve the quality and supply of timber tree seedlings.

A high quality seedling is best described as a seedling that is physically and genetically superior. Genetically, the seeds must have come from superior mother trees and physically the seedlings must possess all three of the following characteristics: 1) a balanced root-shoot (RS) ratio; 2) sturdy stems and 3) excellent root form. This research assessed the RS ratio, sturdiness and root formation of seedlings in three nursery types (private, communal and government nurseries). Also, nursery facilities and management practices were assessed because this could determine the physical quality of the seedlings being produced.

RESEARCH METHOD

Facilities and Planting Materials Quality Evaluation

The study was conducted in Northern Mindanao (Region 10), the Philippines. The region is mostly classified as 60% forestland (areas in the public domain that have been classified for forest use such as public forest, permanent forest or forest reserves, timberlands, grazing land, game refuge and bird sanctuaries) with continuing reforestation activities while most of the remainder is classified as agricultural land. Composed of five provinces, eight cities and 85 municipalities, Region 10 has a total area of 14,033 km² of which Bukidnon is the largest province (8293.8 km²) and Camiguin the smallest (229.82 km²). The population of the region is 3.95 M; (NSO 2007). Lists of nurseries within the region were obtained from government agencies including the Department of Environment and Natural Resources (DENR, Region 10), the Department of Agriculture (DA, Region 10), and non-government organizations (notably the World Agroforestry Centre). Snowball sampling was also applied whereby nursery operators were questioned about their knowledge of other nurseries within the vicinity with the presumption that the nursery operators being interviewed would know of other local nurseries.

Data on nursery facilities were gathered through personal interviews with nursery operators and through visual observation by the interviewer (the first author). Planting materials were purchased from (and in some cases given without charge by) the nursery operators for quality assessment, which required destructive sampling. Root form was assessed through visual observation after soil removal, while the sturdiness quotient (SQ) was determined by observing seedling height in centimetres and root collar diameter in millimetres and applying the following equation (after Jaenicke, 1999).

$$\text{Sturdiness quotient} = \frac{\text{Seedling height (cm)}}{\text{Root collar diameter (mm)}}$$

The ideal value for this ratio is 6, according to Jaenicke (1999).

The root-shoot ratio (RS ratio) was measured through measuring the dry weight of the roots and shoots and applying the equation developed by Jaenicke (1999):

$$\text{Root - Shoot Ratio} = \frac{\text{Dry root weight (g)}}{\text{Dry shoot weight (g)}}$$

The desirable values range is 1:1 to 2:1, according to Jaenicke (1999).

Data gathered on sturdiness quotient per species, root-shoot ratio and root form were analyzed using descriptive analysis and comparison of means with the use of SPSS 12 statistical software. The quality of seedlings was compared for nursery types and nursery management systems.

RESULTS AND DISCUSSION

Adequacy of Nursery Facilities

The design of nursery facilities including irrigation, fencing, shade, drainage, raised benches, potting media storage and hardening beds has a strong influence on the quality of the seedlings. Most private, communal and government nurseries in Region 10 have fences to prevent the entry of stray animals and discourage pilferage. The majority of nurseries are protected with shade. However, in some cases seedlings were placed under dense tree cover which limited the entry of sunlight. Although this is advantageous when seedlings first germinate, subsequent lack of sunlight will result in etiolated seedlings. In contrast, control over light interception through shading nets allows the shading effect to be reduced gradually over time during the seedling hardening-off process.

The prevalence of nursery facilities by nursery ownership type is reported in Table 1. Most nurseries in all three ownership categories lack potting media storage facilities, which are important to prevent potting media from being washed away during heavy rain or blown away by strong winds. Most nurseries claimed to have excellent drainage, an important feature because in most nurseries seedlings are left on the ground, relatively few nurseries having raised benches for hardening seedlings. Raised benches are important to promote aerial root pruning and prevent roots penetrating the soil.

Table 1. Prevalence of basic nursery facilities, by nursery ownership type

Nursery facilities	Nursery type		
	Private n=36	Communal n=25	Government n=29
Irrigation facilities:			
With irrigation facilities	94	85	86
Without irrigation facilities	6	15	14
Fencing:			
With a fence	75	92	93.1
Without a fence	25	8	6.9
Shade:			
With shade	61.1	60	75.9
Without shade	38.9	40	24.1
Drainage:			
Excellent	63.9	80	75.9
Fair	27.8	20	20.7
Poor	8.3	0	3.44
Raised benches:			
With raised benches	11.1	6.89	4
Without raised benches	88.9	93.1	96
Potting media storage:			
With storage	83.3	100	75.9
Without storage	16.7	0	24.1
Hardening beds:			
With a hardening bed	86.1	0	69
Without a hardening bed	13.9	100	31

Most private and government nurseries have hardening beds but in many of them the seedlings are placed on the ground. The roots penetrate into the soil and seedlings appear healthy because they are able to absorb water and nutrients from the soil. However, these seedlings are not being hardened because of their dependence on soil water and nutrients. When outplanted, these seedlings have difficulty adapting to field conditions, and suffer a high mortality rate.

Nursery Cultural Management

As indicated in Table 2, operators of nurseries of all three nursery types prefer seeds as their planting material, because these are easy to collect and transport. Wildlings are ranked second, and are popular because the seeds have already germinated. However, high mortality and low quality may be encountered due to root

damage upon collection and poor subsequent handling. Cuttings are least preferred because they are more difficult to produce, requiring special training and expertise.

Private as well as government nursery owners mostly prefer to grow indigenous trees, unlike most communal nurseries that prefer to grow both indigenous and exotic species. This determines the availability of seedlings in each type of nursery because their production is dictated by their choice of which species to raise.

Table 2. Attitudes to nursery planting materials

Planting material choice	Nursery type		
	Private n=36	Communal N=25	Government N=29
Preferred germplasm type ^a			
Seeds	4.6	4.4	4.8
Wildlings	3.1	2.7	3.1
Cuttings	1.3	0.6	1.4
Choice of species type ^b			
Indigenous	48.0	24.2	37.9
Exotic	28.0	33.3	31.0
Both	24.0	42.4	31.0

^a Preferences were elicited on a rating scale of 1 to 5, 5 being the most desired.

^b Responses are expressed in percentages.

It was found that only private nurseries carry out grading of seedlings (Table 3). This activity involves the selection of seedlings according to height and thereby facilitates differential pricing and ease of delivery of seedlings. However, sellers consider grading to be laborious and time-consuming and do not see the advantages which would explain why only a few are practicing grading. Since they overlook the advantages of grading seedlings it becomes an arduous task selecting seedlings during selling especially when buyers prefer particular sizes or height of seedlings in mass quantities. While seedling grading is an important part of every nursery's day to day activities, communal nurseries do not undertake this activity. Surprisingly, most government nurseries also do not grade seedlings.

Soil treatment including soil sterilization and application of fungicides and insecticides is not practiced in most nursery types. Sterilizing of potting media is important to eliminate microorganisms that may damage seeds and seedlings during seedling emergence, and also to render the weed seeds not viable thereby minimizing weed infestation. This process in turn proves to be cost-effective because it results in less seedling damage brought about by soil borne pathogens and seedling disturbance as a result of taking out weeds from germination boxes.

Table 3. Some important nursery management activities^a

Nursery management activity	Nursery type		
	Private N=36	Communal N=25	Government N=29
Grading of seedlings			
Grading practiced	93.9	32.0	24.1
Grading not practiced	6.1	68.0	75.9
Soil sterilization			
Sterilization through heating	8.3	8.0	20.7
Chemical application	2.7	0	0
None	88.9	92.0	93.1

a. Responses expressed in percentage adoption.

Seedling Quality Assessment

Table 4 reports the sturdiness quotients of seedlings from the three nursery types in Northern Mindanao. The majority of the seedlings from private nurseries have a sturdiness quotient greater than 6.0. This indicates that the seedlings raised have great height relative to stem diameter, and are weak and lanky and thus undesirable. The majority of the seedlings sampled also have an unbalanced root-shoot ratio, i.e. not in the range 1 to 2. Further, seedling testing revealed that nearly half of the sampled seedlings had an undesirable J-root formation. This impedes the uptake of water and nutrients and also makes the plant vulnerable to windthrow (Carter 1987, as cited by Gregorio and Herbohn 2007). These results suggest that seedlings raised in all nursery types were mostly of low quality and would be unable to survive under the environmental conditions of the planting sites.

Table 4. Physical quality of seedling samples from each nursery type

Nursery type	Unsturdy seedlings (%) ^a	Unbalanced root-shoot ratio (%) ^b	Presence of J-rooting (%)
Private	74	80	41
Communal	68	86	54
Government	70	73	32

a. Seedlings having a sturdiness quotient of greater than 6.

b. Seedlings having a root:shoot ratio outside the range 1.0 to 2.0.

Seedling Marketing

Almost all nursery operators interviewed indicated that seedling demand dictates their production, and lack of demand is a persistent problem. Nursery operators argued that seedling demand is erratic and even when there is a demand they are forced to sell seedlings at very low prices due to competition pressure from other nurseries, the nursery industry being characterised by the 'ease of entry' of new operators. This

situation results in the seedling nurseries foregoing production quality control measures because buyers are more concerned about low seedling prices which often mean unsuitable quality.

There is a need to educate seedling buyers and tree growers about the advantages of using high quality planting materials. Buyers do not seem to understand the concept that success in tree planting must start from planting materials that are healthy, sturdy and coming from superior mother trees. There is a need to make buyers recognize that a healthy seedling in most cases performs better than a sickly, lanky or etiolated seedling and is more able to survive under adverse field conditions. When superior quality planting materials become the preferred option for buyers, production of low quality seedlings can be expected to decline.

CONCLUSION

Most forestry seedling nurseries in Northern Mindanao have the basic facilities required by a nursery, and some attention is given to nursery management practices. However, these facilities and management practices are in general designed for low-cost production of low quality planting materials. Facilities such as raised benches and hardening beds are necessary to prevent root penetration into the soil, reduce the weeding requirement and to control water uptake. Interviews with nursery operators reveal that some of the generally recommended nursery management practices necessary to produce high quality seedlings are not widely adopted, including soil sterilization and the grading and hardening of seedlings. These management practices support improved growth of seedlings. On the part of operators, lack of necessary skills and lack of training in desirable nursery management practices are an apparent constraint. Although many of the nursery operators claimed to have undergone training, their nursery practices do not affirm this.

Seedling demand dictates the supply of seedlings by the nurseries of Northern Mindanao. The demand, however, is erratic over time as claimed by most nursery operators and thus seedling production has been limited which in turn constrains implementation of seedling quantity control. The fact that buyers prefer the lowest priced seedlings has been a persistent problem because it encourages seedling growers to produce low priced and low quality seedlings. These seedlings are likely to perform poorly with high mortality after outplanting.

Improved forest seedling nursery management facilities and practices are required to improve the quality of seedlings raised in Northern Mindanao. There is also a need to educate buyers to buy high quality seedlings in order to put an end to the market for low quality planting materials.

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