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Original Research Paper

Root growth potentials of selected hardwood tree Species in the Philippines

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ABSTRACT

The effect of different root pruning lengths on the number of new root developed and length of tap root extension were determined. The overall response of root growth (RG) as exhibited by the number of new roots and length of tap root extension was found to be significantly affected (P= 0.05) by different pruning lengths. A positive response was observed: RG increased with root pruning (that is treatments with root pruning produces more new roots and developed more tap root length extension compared to those of control treatment with no root pruning. The result of the study shows that root pruning before transplanting had positive impact on the seedlings in term of producing new roots and extension of tap roots.

Key words: Root growth **(**RG), root pruning, new roots, root length extension**.**

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INTRODUCTION

The inability to recognize seedling quality as a measure of planting performance has led to the failure of many reforestation and plantation projects in the Philippines. This impact was clearly pinpointed in the Master Plan for Forestry in the Philippines (1990). Accordingly, there is a need to carefully consider the production of seedlings with consistently high establishment and growth potential to ensure high percentage of survival. Strategies in assessing quality of planting stocks need to be away from using the traditional approach of looking only into the sound morphological characteristics of seedlings to be planted (Grossnickle, et.al., 1991). However, this often fails to detect difference in seedling's physiology. Hence, holistic assessment of stock quality requires the integration of both morphological and physiological attributes of seedlings. Indeed, consideration of both factors provides an effective appraisal of the fitness of seedlings for field planting purposes.

Conceptually, a target seedling should possess those morphological and physiological traits that could be quantitatively linked to successful reforestation (Rose et.al., 1990). This concept put emphasis on the interaction of both traits that contributes to the overall make-up of a planting stock. In the Philippines, many studies on seedling attributes dealt with morphological traits. However, only a few studies have been found to report to investigated root growth in relation to field planting performance. Methods of measuring RG have already been standardized in many temperate countries but this has not been carried out in the tropics including Philippines (Gazal, 1998) Thus, the potential of using RG as an indicator of seedling quality and performance of four selected tropical hardwood tree species in the Philippines needed to be explored. This study attempted to provide a basis for interpreting root growth potential (RGP) as a seedling performance that attributed to four selected tree seedlings (e.g. Narra, Supa, Dao, and Thailand shower) as affected by different root pruning length from the tip of the tap root.

The relationship between root system development of planted forest tree species and its survival, stability and growth have attracted considerable research interests (Van Eerden and Kinghorn, 1978; Somerville, 1979; Coutts and Lewis, 1983). Seedlings established naturally have been found to have a stable root configuration with well-developed tap roots and evenly distributed lateral roots, nonetheless, bare root transplants were reported to be less stable and having irregularly distributed root systems (Grene, 1977; Chavasse, 1978; Burdett, 1979). Several nursery procedures, such as undercutting and transplanting, are to increase the root: shoot ratio and produce sturdy plants with well branched,

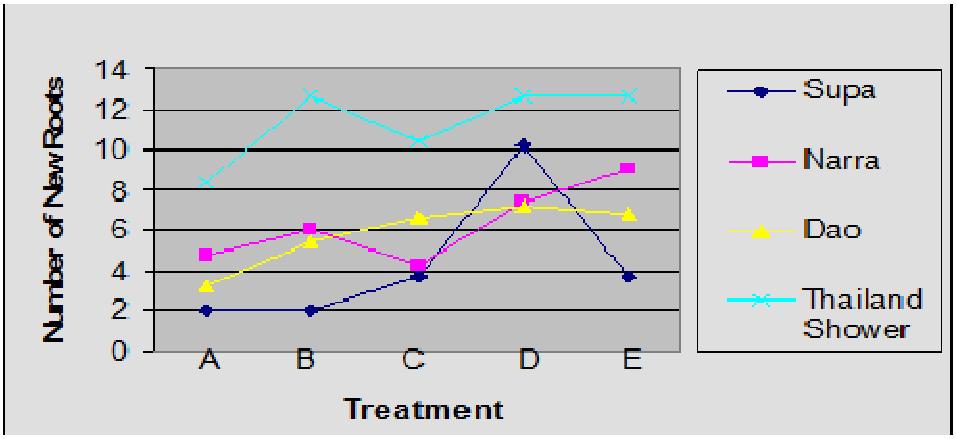

Figure 1.Number of new roots developed by species.

fibrous root systems to aid their rapid establishment in the field (Aldhous, 1972). These nursery treatments have improved the root growth capacity of plants and planting stock with a high root growth capacity. It has been reported to have improved field establishment and growth rates by several workers (Stone and Jenkinson, 1970; Burdett, 1979b; Sutton, 1980; Burdett, et.al., 1983and Burdett et.al., 1984).Root pruning is particularly applied when transplanting bare rooted seedlings is allowed the root system to produce more fibrous roots responsible in up-taking nutrients from the soil.In the present study however, four different seedling species were tested for the ability to respond to root pruning treatment under nursery condition in a potted soil.

METHODOLOGY

A one-month old seedlings of Narra (*Pterocarpusindicus*), Thailand Shower (*Cassia siamea* Lam.), Supa (*Sindorasupa*Merr), and Dao (*Dracontomelondao*) were transplanted in September 10, 2004 from seed box to a 5" x 8" polyethylene bags filled with ordinary garden soil mixed with rice bran. Before transplanting, different seedlings were cleaned of soil particles by drenching water from a faucet and then root pruned at different length from the tip as treatments. The seedlings were watered twice a week and no further nutrients were supplied to the developing plants.

Twenty-five (25) seedlings of each species of the above were used in the study with a total of 100 seedlings for the total study. The study was laid out in a CRD experiment and was replicated for four (4) times. The potted seedlings were placed in the green house of the Department of Silviculture and Forest Influences, UPLB, College, Laguna. Observation of the RGP was done after 21 days. The root growth of the different species were compared under four root pruning lengths: a). Control (no root pruning); b). 1cm root- pruning; c). 2cm root-pruning; d). 3cm root-pruning; and e).4cm root-pruning. All were measured from the tip of the primary root.

Results of the four runs were pooled and Statistical analysis was done by the one-way analysis of variance using (SAS version 5) computer programme. When P values were <0.05, there is significant differences between species group and was established through Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Figure 1 shows that Thailand shower produces more roots than the corresponding species as affected by the length of tap root pruning. One centimeter pruning for Thailand shower is significantly higher in terms of developing new roots followed by Supa at 3cm tap root pruning. Three centimeter tap root pruning for Supa and 4cm for Narra were significantly higher (P = 0.000) in terms of developing new roots compared to those of other treatments. Root growth potential (RGP) of different species responded differently on the treatment applied. However, most of the species were responded positively to root pruning. In terms of the extension of the tap root system, it was observed that Dao has showed the longest mean length of extension measured (3.16cm). The longest was observed in 1cm tap root pruning which is significantly different (P= 0.001) with other root pruning lengths (Figure 2).

The same with the previous result, responses of the different species varies in terms of tap root extension. All the species have responded positively to root pruning in terms of tap root extension. Two centimeter root pruning of Narra was significantly higher (P =0.05) compared to those of other treatments while 3cm root pruning for Supa was observed effective in developing tap root extension.

Correlation analysis of the two methods of measuring

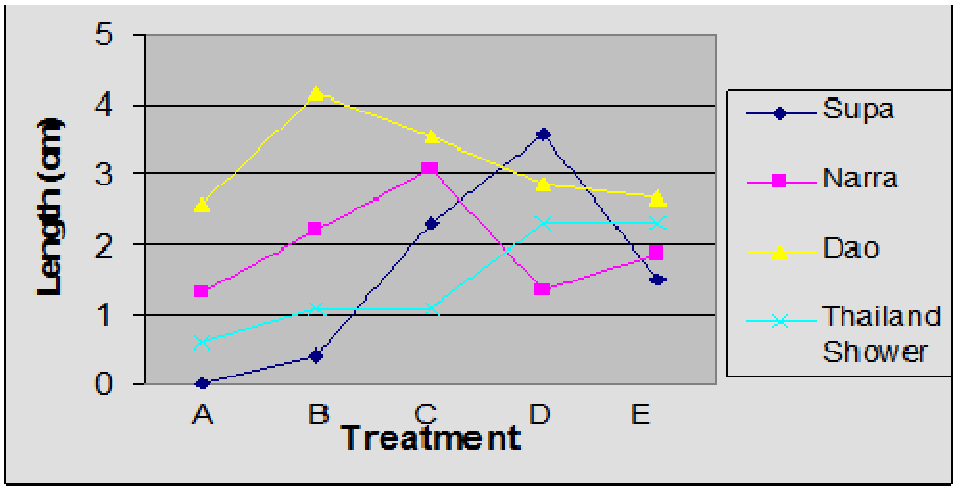

Figure 2. Length of tap root extension by species.

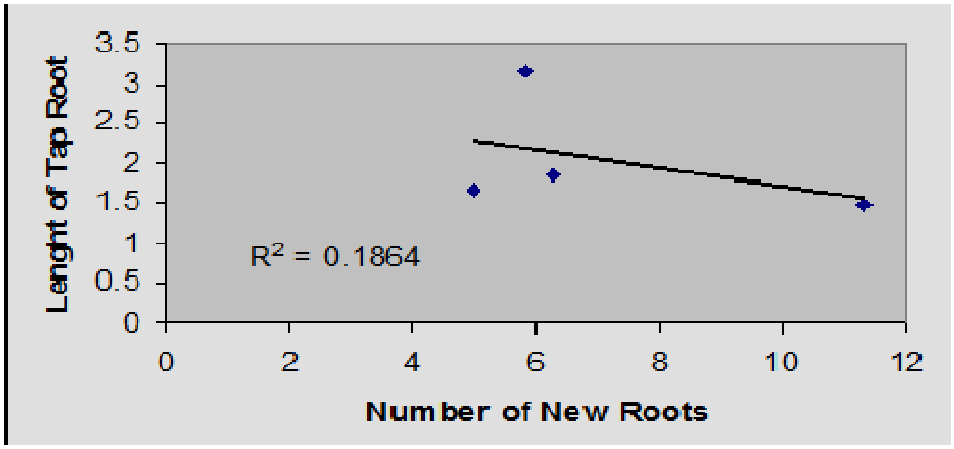

Figure 3. Scatter plot of the number of new roots developed with the length of the tap root extension.

RGP such as counting the number of new roots developed and measuring the length of tap root extension revealed no significant relationship. The number of the new roots developed is negatively related (R^2 = 0.1864) with the measured tap root extension length (Figure 3). This implies that number of developed new roots was not found to be affected by the tap root extension within 21 days.

Conclusion

Effects of the different root pruning lengths on the number of new root developed and length of tap root extension were determined. To determine significant effects, the trait was subjected to Analysis of variance (ANOVA). The number of new roots and length of tap root extension were also correlated to determine the degree and extent of relationship between them.

The overall response of RGP as exhibited by the number of new roots and length of tap root extension was found to be significantly affected by the different pruning lengths. A positive response was observed in RGP that was found to be increasing with root pruning (i.e. treatments with root pruning produces more new roots and developed more tap root length extension compared to the control treatment with no root pruning).

The result of the study that root pruning before transplanting has a positive impact on the seedlings in term of producing new roots and extension of tap roots. By counting the number of new roots developed and measuring the length of tap root extension would not be substantial parameters to conclude that one treatment is better than the other, much more that some of the species responded insignificantly.

The root system of the plants are good indicator of

survivality as what Mexal and Landis 1990 cited “seedling with good root mass consistently survived better than those with poor root mass”. Nevertheless, RGP is considered as a good standard of the ability of a seedling to produce new roots when growing in an ideal environment (Ritchie 1985). Furthermore, it is a direct measure of the physiological condition of the seedling which is important in evaluating seedling stock quality and predicting outplanting performance (Ritchie and Tanaka, 1990, Burdett, 1987; Flanagan and Owens 1985).

Recommendations

From the above, it is recommended that similar study may be carried out to look into responses of the same and other species on new root formation and tap root extension. It should include other parameters that are necessary to determine seedling quality index to draw reliable recommendations at field levels. Since, results of the present study under greenhouse condition may be extrapolated only with reservation at field condition so that the findings could be recommended as nursery cultural techniques. Accuracy of other methods of measuring RGP such as volume of new roots, weight, and site condition should be investigated. Future studies may focus on heights, diameter, biomass, root: shoot ratio, and other morphological characteristics should also be included in the parameters to be measured to widen the scope and make a sound interpretation and conclusion of the study results.

REFERENCES

Abod SA, Simon (1983). Effect of restricted water and its combination with root pruning on root growth capacity, water status and food reserves of pinuscaribean var. hondurensis seedlings. Plant and Soiul., (71): 123 -129.

Aldhous JR(1972). Transplanting and undercutting. In: Nursery Practice, Forestry Commission Bulletin No. 43 HMSO pp.184

Burdett AN (1979). New methods of measuring root growth capacity: their value in assessing Lodgepole stock quality, Canadian Journal of Forest research. 9: 63: 67.

Burdett, A.N. 1987. Understanding root growth capacity, theoretical considerations in assessing planting stock quality by means of root growth tests. Canadian Journal of Forest research. 17: 768 – 775.

Burdett AN, Herring LJ, Thompson CF (1984). Early growth of planted spruce. Can. J. For. Res. 14:644--651.

Burdett AN, Simpson DG, Thompson CF (1983). Root development and plantation establishment success. Plant Soil 7 1: 103-110.

Chavasse CGR (1978). The root form and stability of planted trees with special reference pp. 54-64. In Van Eerden, E and J. Kinghorn (eds). Proc. Root form of planted trees symp. Brit. Columbia Min. Forest/Can. For Serv. Joint Rept. 8:354.

Coutts , Lewis, (1983). When is the structural root system determine in sitka spruce? Plant Soil 71: 155-160.

DENR (1990) Philippine Master Plan for Forestry - 1990. FMB, DENR, Quezon City.

Domingo IL (1963). Quality, survival and growth of planting stock as affected by underground root pruning. Technical Bulletin No. 1, UPLB, College, Laguna.

Donald DGM (1988b). The effect of season on the root growth capacity of one year old pinus radiate seedlings, South African Forestry Journal 147: 6-8.

ERDB (1995). Research Information Series on the Ecosystem, DENR

Feret DD, Kreb RE (1985). Seedling root growth potential as an indicator of loblolly pine field performance. Forest Science 31 (4): 1005-1011.

Flanagan AM, Owens JN (1985). Root growth and root growth capacity of white spruce (Piceaglauca) seedlings. Canadian Journal of Forest Research. 5 (4): 625 – 630.

Ford ED, Deans JD (1977). Growth of a Sitka spruce plantation: spatial distribution and seasonal fluctuations of lengths, weights and carbohydrate concentrations of fine roots. Plant Soil 47:463-485.

Grossnickle SC, Arnott JT, Major JE, Tschaplinski TJ (1991). Influence of dormancy induction treatments on western hemlock seedlings. I. Seedling development and stock quality assessment. Can. J. For. Res. 21:164-174.

Gazal RN (1998). Effect of Soil moisture and root growth potential of Narra (PterocarpusindicusWilld) transplants. Unpublished M.S Thesis, UPLB, College, Laguna.

Ritchie GA (1985). Root growth potential principles, procedures and predictive ability. In: Duryea, M.L (ed) Evaluating seedling quality: principle, procedures and predictive abilities of major tests. 93-104. Corvallis, Oregon, October 16-18, 1984. College of Forestry, Oregon State University, Corvallis, Oregon.

Ritchie GA, Tanaka Y (1990). Root growth potential and the target seedling. In: Rose, R.; Campbell, S. J.; Landis, T. D.; eds. Gen. Tech. Rep. RM-200. Target seedling symposium: proceedings: combined meeting of the Western Forest Nursery Associations; August 13–17, 1990; Roseburg, OR; Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station: 37–42.

Rose R, Atkinson M, Gleason J Sabin T (1990). Root volume as a grading criterion to improve field performance of Douglas fir seedlings. New Forest Species.195-209.

Somerville A (1979). Root anchorage and root morphology of pinus radiate on range of ripping treatments. N.Z.J. For. Sci. 9:294-315.

Stone EC, Jenkinson JL (1970). Influence of soil water on root growth capacity of ponderosa pine transplants. For. Sci. 16:230-239.

Sutton RF (1980). Planting stock quality, root growth capacity, and field performance of three boreal conifers. N. Z. J. For. Res. 10:54-71.

Van Eerden E, Kinghorn JM (1978). Proc. Symp. Root form of planted trees, BC Min. Forests/ Can. Forest Serv. Rep. 8. Prov. British Columbia,Min. Forests. Victoria BC. p.357.