NOTES

EFFECT OF SEEDLING GRADE ON GROWTH AND SURVIVAL OF PUNGAM (*PONGAMIA PINNATA*)

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Although afforestation programmes are being carried out through various governmental and non-governmental bodies like the World Bank, SIDA, CIDA, USAID and DANIDA, the total area under forest cover is still declining. This is due not only to deforestation, but also to the failure of afforestation programmes. The amount and distribution of rainfall play a paramount role in deciding the success or failure of an afforestation programme. India receives an average annual precipitation of 1000 mm, of which most is received during the monsoon months of June to October. In some years, a large amount of the total annual rainfall is received in a period with intensive storms followed by prolonged drought spells (Chitale 1994). Besides weather conditions, supply of good quality planting stock material also affects afforestation programmes. A considerable amount of initial cost is involved in the production and supply of quality planting stock.

Seedling morphometric attributes like root collar diameter, seedling height and terminal bud condition have long been used to grade forest tree seedlings into different classes of implied survivability and growth after transplanting in the field. However, reports on morphological grades have been contradictory. Many papers report on optimum performance of tall seedlings (Wakeley 1954, Minko 1974, Lauer 1987, Singh *et al.* 1988, Shiver *et al.* 1990). However, in drought years medium-sized seedlings survive better than small or large seedlings (Venator 1983). The present paper reports on a study carried out to determine the optimal size of seedlings of *Pongamia pinnata* for achieving optimum survival in the field.

Six-month-old seedlings were taken for this study at the Forest College and Research Institute, Mettupalayam, India. Seedlings were graded into four height classes, namely, i) 20–30 cm, ii) 31–40 cm, iii) 41–50 cm, and iv) 51–60 cm. From each class, 6 replications of 16 seedlings each were planted in the campus forest area under dry conditions at a spacing of 2 × 1 m in a randomised block design.

Growth parameters of the seedlings, such as shoot and root lengths, root collar diameter, numbers of leaves and nodes, total leaf area, shoot, root and total dry weights and shoot/root ratio, were recorded initially and after three months on five randomly selected seedlings in each replication. In addition, the survival percentage was recorded by determining the percentage of live seedlings, three months after field planting. Results were analysed and tested for significance ($p = 0.05$) after Panse and Sukhatme (1967).

During the initial evaluation, the tallest seedling class (51–60 cm) recorded the highest shoot length (56.9 cm), total leaf area (123.6 cm^2 $plant^{-1}$), number of nodes (20.2) and total dry weight (9.1 g $plant^{-1}$). The shortest class (20–30 cm) recorded 25.2 cm, 51.8 cm^2 $plant^{-1}$, 12.2 and 3.8 g $plant^{-1}$ respectively (Table 1). All parameters mentioned increased with increasing seedling length; other parameters, viz. root collar diameter, number of leaves, root length and shoot/root ratio, showed no significant differences between height classes.

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Table 1 Initial seedling parameters of different height classes of pungam seedlings

Seedling height class (cm)	Shoot length (cm)	Root collar diameter (mm)	Number of leaves	Total leaf area (cm^2 $plant^{-1}$)	Number of nodes	Root length (cm)	Shoot dry weight (g $plant^{-1}$)	Root dry weight (g $plant^{-1}$)	Total dry weight (g $plant^{-1}$)	Shoot/root ratio
20–30	25.2	4.4	19.2	51.8	12.2	34.9	2.20	1.60	3.81	1.38
31–40	34.2	5.3	17.5	80.0	14.7	33.6	3.49	2.49	5.98	1.40
41–50	46.2	5.5	23.5	112.0	19.5	36.8	4.99	3.42	8.45	1.46
51–60	56.9	5.7	22.0	123.6	20.2	35.9	5.87	3.25	9.13	1.81
SEd	1.16	0.64	3.33	14.62	1.74	4.29	0.547	0.330	0.728	0.209
CD(p=0.05)	2.42	ns	ns	30.49	3.64	ns	1.142	0.689	1.518	ns

SEd = standard error deviation; CD = critical difference; ns = not significant

Table 2 Survival and increment in growth parameters of pungam seedlings three months after planting

Seedling height class(cm)	Survival (%)	Shoot length (cm)	Root collar diameter (mm)	Number of leaves	Total leaf area (cm^2 $plant^{-1}$)	Number of nodes	Root length (cm)	Shoot dry weight (g $plant^{-1}$)	Root dry weight (g $plant^{-1}$)	Total dry weight (g $plant^{-1}$)	Shoot/root ratio
20–30	41.7 (40.2)	5.8	2.4	8.5	48.4	5.3	5.8	1.79	1.39	3.17	-0.05
31–40	75.2 (60.3)	4.4	4.7	12.0	79.4	4.6	5.4	2.23	1.12	3.35	0.18
41–50	84.5(67.0)	2.8	5.8	10.0	77.2	5.0	8.5	2.09	0.73	2.78	0.25
51–60	94.2(76.4)	4.9	6.8	14.8	81.0	7.6	15.6	2.09	1.33	3.42	-0.07
SEd	2.73 (1.89)										
CD (p=0.05)	5.69 (4.03)										

SEd = standard error deviation; CD = critical difference

(Figures in parentheses indicate arc sine values)

The performance of height classes after planting showed that the tallest class was superior to others. The tallest seedlings (51–60 cm) survived better (94.2%) than seedlings of the other height classes, viz. 41–50 cm (84.5%), 31–40 cm, (75.2%) and 20–30 cm (41.2%). The shoot length of the tallest class exceeded that of the shortest class by 99.4%, root collar diameter by 83.8%, number of leaves by 32.9%, total leaf area by 104.2%, number of nodes by 58.9%, root length by 26.5% and total dry weight by 79.8%. The magnitude of increment in respect of the growth parameters after three months of planting showed a close parallel with the seedling height. The increment was generally maximum in the tallest class (Table 2).

The superior performance of the tallest class observed in this study is in agreement with the results of Wakeley (1954), Minko (1974), Lauer (1987) and Shiver *et al.* (1990) for *Pinus* spp., Singh *et al.* (1988) for spruce and Bhagat *et al.* (1990) for silver fir. In all these studies, tall seedlings maintained their dominance over smaller ones. But according to Venator (1983), medium-sized seedlings survived better than smaller or larger seedlings. Grading of nursery stock will be especially worthwhile where early height advantages reduce competition for light and space or protect seedlings from animals (Minko 1974). Minko (1974) also reported that mortality was the greatest in the smallest seedlings and death of the terminal shoot was directly proportional to seedling height which was greater during the first year after planting. It is concluded that selection of tall seedlings for field planting will produce trees capable of optimum survival; these seedlings will also have best resistance to death of the terminal shoot.

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