



Effect of Seedling Height and Diameter of Nursery Stock of Ban Oak on Out Planting Survival

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ABSTRACT

Key Words:

Ban Oak, collar diameter, field performance, height, morphological parameters, naked root, survival

A study was conducted to determine the effect of seedling height and diameter of polybag and bare root nursery stock of Ban Oak on survival after out planting. The graded nursery stock of Ban Oak based on morphological parameters (height and collar diameter) was out planted during 2008 and 2009 rainy season in the field. Ban Oak stock raised in polybags performed better in lower limits/elevation of occurrence of this species as compared to bare root stock. However, bare root stock performed equally well in upper limits of occurrence of this species. In good sites, stock height >9" was found to be good indicator of field performance of Ban Oak nursery stock. In stress sites, stock height >18" was found as better parameter related to survival of the seedlings

INTRODUCTION

Quality planting stock is considered as an indicator of better field performance. The quality refers to superiority, vitality, genuineness and disease free stock. The quality stock supposed to enhance the productivity of the forest as full genetic potential of stock under normal field conditions will be expressed. Higher cost of production of quality planting stock is fully compensated when we are sure of its better survival and faster growth in the field. It is well known fact that the good planting sites have been already exhausted under various plantation programmes during last 2-3 decades. Leftover sites are available to increase forest cover with refractory conditions and very less soil depth. Situation in Himalayan regions is more difficult owing to more impact of global warming, less snowfall in winter months and

frequent drought like conditions during summer. To overcome all these challenges, production and utilization of quality planting stock of forestry species is now a day's becoming essential in all plantation programmes being carried out in Himalayan states.

Quality of nursery stock is now recognized as key factor for the success of any plantation programme. Less survival percent in various plantation programmes in India may be attributed to poor quality of nursery stock. The productivity of Indian forest still remains low as compared to world average. The key factor for all these issues is nursery stock quality. However, the quality parameters both morphological and physiological have not been fixed in general for most of the Himalayan tree species planted on large scale in the field. It is mandated that to bring 2/3rd of total

geographical area of the hill states under tree cover, millions of saplings are required to accomplish the job in coming decades. The source of planting material i.e. seed or vegetative part is utmost important as it determines the genetic quality of the nursery stock, but morphological and physiological quality are equally important for better survival in the field. These parameters can be controlled in the nursery to a great extent by manipulation of nursery practices.

Accordingly, Himalayan Forest Research Institute, Shimla has initiated the work on finalizing morphological parameters of quality for assessing Ban Oak nursery stock for getting higher survival in the field. Ban oak is gregarious in habitat and is frequently found associated with conifers- Deodar and Kail at higher elevations and Chir pine towards the lower limits and with other broad leaved species such as *Rhododendron arboreum*, *Acer caesium*, *Pyrus pashia*, *Myrica esculenta* etc. The tree can attain girth of 120-180cm and height of about 20m. Ban oak acorns are edible and can be dried, ground and used to thicken stews or to make breads (in mixture with cereal flour). Seed is produced in fair quantities almost every year. Under natural conditions, reproduction is through seed and coppice. Drought is probably the most adverse factor causing mortality in the seedlings. They grow well in grass and in moderate weed growth, but develop best in clear hoed ground (Troup 1921).

Nursery raised seedlings grow somewhat faster, ordinarily attaining a height of one to one and a half feet in 3 to four years (Negi and Naithani 1995). Comparatively, the growth of seedlings is slow under natural conditions. The rainy season has been found to be the best season for transplanting nursery raised seedlings in the forest. On dry hot slopes, transplanting ensures more survival. Air layering is found to be successful and the application of auxins encourages rooting (Khosla et. al. 1979). Singh (1982) described the nursery technique of Ban Oak. He advocated sowing in the nursery beds in February-March. Seeds are sown in lines spaced

about 25 cm with a spacing of about 5cm between the seeds. The depth of sowing is about 2cm as deep sowing delays germination and reduces the germination percentage. Seedlings of about 15-20 cm height become fit for planting out. Similarly, Luna (1996) also described the nursery technique for raising nursery stock of Ban Oak and advocated to transplant Ban Oak seedlings into large polythene bags. The growth of seedlings in the nursery is comparatively faster, and they become 50-60 cm tall in two years. Lal et al. (1999) indicated that for the production of maximum healthy seedlings of *Quercus leucotrichophora* dibbling method of sowing and irrigation twice a day proved to be the best combination. Panwar and Bhardwaj 2000; Sharma (1998) and many other authors also stressed the importance of quality seedlings for better field performance.

The Ban Oak is potential species for maintaining hydrological functions of Himalayas and valuable species for improving the green fodder availability in the region. In the present study, the Ban Oak stock raised in nursery as polybag and bare root stock, graded into different height and collar diameter classes and out planted in the field to fix optimum values of these parameters to determine the quality of nursery stock based on these morphological parameters.

MATERIALS AND METHODS

Ban Oak stock was raised at Shilly nursery, Solan. It is located 3 km. away from Solan town on Solan- Jaunaji road at 77° 54.4 24' E longitude, 30° 07.5 51' N latitude and 1550 m above msl in lower temperate region. The area experiences little snowfall during December to March in winter. The total area of the nursery is approximately 2.0 ha and is surrounded by Ban Oak forest with 20-25 % slope. The texture of the soil is loamy.

For determining morphological seedling quality parameters of Ban Oak based on out-planting, the nursery stock of the species was produced in different seedling production systems and graded based on seedling height & root collar

diameter and out planted accordingly for assessing survival as done by various workers (Bronson and Long 1994; Menzies 1988 and Manson and Trewin 1987). Out planting experiments were laid out during 2008 and 2009 rains in Randomized Block Design (RBD) with five morphological grades each based on height & root collar diameter with four replications. Old abandoned plantation sites were selected for conducting out planting experiments in Solan (1550 m amsl) and Shimla Wildlife divisions (2100m amsl). The graded nursery stock of Ban Oak based on morphological parameters were out planted during 2008 (both naked root and polybag raised) and 2009 (only naked root) in the field.

Ban Oak nursery stock raised as bare root stock as well as containerized stock in polybag of size 15 cm x 23cm were graded on the basis of height into five classes (T1: <9"; T2: 9" -12"; T3: 12"-15"; T4 15"-18" and T5: >18") with four replications. The plantation was raised at 3x3 m spacing.

To determine root collar diameter as quality parameter, Ban Oak nursery stock raised as bare root stock as well as containerized stock in polybag of size 15x 23cm were graded on the basis of root collar diameter (T1: <4mm; T2: 4-5mm; T3: 5-6mm; T4 6-7mm and T5: >7mm with four replications. The plantation was raised at 3x3 m spacing.

Surviving plants in each treatment were counted at the time of recording growth attributes of the out planted Ban Oak plants in all the experiments. The experiments were laid out as per statistical design and the out coming data were analysed following the procedure described by Gomez and Gomez (1984).

RESULTS

Determination of seedling height as quality parameter at lower limit of Ban Oak:

Survival percent of Ban oak seedling raised in nursery in polybags and as bare root stock graded to various height classes and planted in Shilly Solan is presented in Table 1. The survival percent was significantly different among various treatments for nursery stock raised in poly bags. The highest survival per cent (30.52%) after two years of out-planting was found in treatment T5 *i.e.* >18" height class of polybag stock but on par with T4 *i.e.* 15"-18" height class (24.97%) and T3 *i.e.* 12"-15" (22.22%) treatments and significantly better than other treatments. The lowest survival (13.89%) was recorded in treatments T1 *i.e.* <9" height class of poly bags raised Ban oak stock. However, the survival per cent of bare root stock after two year of planting in the field was found to be non significant among various treatments.

Table 1. Effect of seedling height of polybag and naked root Ban Oak nursery stock on survival after two years of out planting at Shilly Forest, Solan.

Treatment	Height Class (inches)	Survival (%) (Polybag)	Survival (%) (Naked root)
T ₁	<9"	13.89	5.55
T ₂	9"- 12"	19.44	11.11
T ₃	12"- 15"	22.22	13.89
T ₄	15"- 18"	24.97	13.89
T ₅	>18"	30.52	16.67
	CD 5%	8.59	NS
	Max. Value	30.52	16.67
	Min. Value	13.89	5.55

Determination of seedling root collar diameter as quality parameter at lower limit of Ban Oak

Out planting survival percent after two years of plantation of Ban Oak nursery stock raised in polybags as well as bare root stock graded to various diameter classes and planted in Shilly Solan is given in Table 2. The survival per cent was significantly different among various treatments for nursery stock raised in polybags after two years of out planting. The highest survival percent

(30.55%) was recorded in treatment T5 i.e. > 7 mm diameter class of polybag stock followed by T4 i.e. 6-7 mm diameter class (27.77) and were at par with each other and significantly better than other treatments. The lowest survival (16.67%) was recorded in treatment T1 i.e. < 4mm diameter class. However, the survival per cent of bare root stock after two years of planting in the field was found to be non-significant among various treatments.

Table 2. Effect of root collar diameter of polybag and naked root Ban Oak nursery stock on survival after two years of out planting at Shilly Forest, Solan.

Treatment	Collar Diameter Class (mm)	Survival (%) (Polybag)	Survival (%) (Naked root)
T ₁	< 4	16.67	5.55
T ₂	4 – 5	19.44	8.33
T ₃	5 - 6	19.44	13.86
T ₄	6 - 7	27.77	16.67
T ₅	> 7	30.55	13.86
	CD 5%	10.01	NS
	Max. Value	30.55	16.67
	Min. Value	16.67	5.55

Determination of seedling height as quality parameter at upper limit of Ban Oak

Similarly, survival percent of Ban oak seedling raised in nursery in polybags and as bare root stock graded to various height classes and planted in Potter Hills site near Shimla is presented in Table 3. The survival per cent was significantly different among various treatments for nursery stock raised in polybag as well as bare root stock. In case of poly bag stock, the highest survival (83.33%) after two years of planting was

found in treatment T5 i.e. > 18" height class and was at par with T4 (15"-18" high class) and T3 (12"-15" height class) but significantly better than other treatments. The lowest survival (69.45%) was found in treatment T1 <9" height class. Similarly, in case of bare root stock, the highest survival (66.67%) was recorded in treatment T4 i.e. 15"-18" height class and was found to be on par with treatments T5, T3 & T2 but significantly better than T1. The lowest survival (50.00%) was recorded in treatment T1 i.e. < 9" height class for bare root stock of Ban oak.

Table 3. Effect of seedling height of polybag and naked root Ban Oak nursery stock on survival after two years of out planting at Potter Hills, Shimla

Treatment	Height Class (inches)	Survival (%) (Polybag)	Survival (%) (Naked root)
T ₁	<9"	69.45	50.00
T ₂	9"- 12"	72.22	61.11
T ₃	12"- 15"	77.78	63.89
T ₄	15"- 18"	80.56	66.67
T ₅	>18"	83.33	63.89
	CD 5%	8.98	8.98
	Max. Value	83.33	66.67
	Min. Value	69.45	50.00

Determination of seedling root collar diameter as quality parameter at upper limit of Ban Oak

Similarly out planting survival percent after two years of plantation of Ban Oak nursery stock raised in polybags as well as bare root stock graded to various diameter classes and planted in Potter Hills, Shimla is given in Table 4. The survival per cent of polybags raised stock of Ban Oak was found to be non significant among various

treatments. However, the survival was significantly different among various treatments for bare root stock after two years of out planting in the field. The highest survival (72.22%) was found in treatment T1 i.e. <4mm diameter class and was significantly better than all other treatments. The lowest survival (47.22%) was found in treatment T5 i.e. > 7 mm diameter class.

Table 4. Effect of collar diameter of polybag and naked root Ban Oak nursery stock on survival after two years of out planting at Potter Hills, Shimla

Treatment	Collar Diameter Class (mm)	Survival (%) (Polybag)	Survival (%) (Naked root)
T ₁	<4	75.00	72.22
T ₂	4 – 5	86.11	61.11
T ₃	5 – 6	80.55	52.78
T ₄	6 – 7	80.55	55.56
T ₅	>7	80.55	47.22
	CD 5%	NS	9.24
	Max. Value	87.50	72.22
	Min. Value	75.00	47.22

DISCUSSION

Ban Oak nursery raised in polybags and as bare root stock graded into different height and diameter classes and out planted in the field at two sites during rainy seasons. At Shilly site near Solan survival percent for polybag and naked root stock of Ban Oak was found low for all height and diameter classes as depicted in Table 1 and 2. The higher survival was found in case of larger height and diameter classes. The low survival for both polybags and bare root stock was attributed to drought like conditions prevailed during 2008 and 2009 at that plantation site. In similar study, South et. al (1993) found that planting date had a dramatic effect on field performance and that planting into dry soil can reduce survival and growth. Thus differing seedling characteristics on the various planting dates may explain why planting period had a large impact on survival but the effect of conditions at time of planting need to be considered as well. Even Bayley and Kietzka (1996) reported that survival of *Pinus patula* could be significantly improved by identifying the best time of years and conditions for planting as well as improving stock quality.

Similar experiments also conducted at Potter Hills site near Shimla at upper limit of species occurrence having better site conditions and with similar height and diameter classes of poly bags raised and bare root stock of Ban Oak. The survival per cent after two years of out planting at that site was found to be encouraging both for polybag as well as bare root nursery stock as depicted in Table 3 and 4. The survival per cent of Ban Oak seedlings having height classes above 15" raised as polybag stock was >80% and for bare root stock it was >60% for all height classes >9". The survival percent of Ban Oak seedlings raised in polybags was >80% for all diameter classes >4mm and for bare root stock it was maximum (72.22%) for <4mm diameter class. Khanal et al. (2018) reported the combined influence of initial seedling quality and microsite quality on survival of first year seedling and observed that average first year survival increased with increase in

seedling and microsite quality distribution. Sharma (2017) also reported 15"-18" height and 5 – 6 mm root collar diameter of polybag raised stock as well as naked root stock of Deodar was found best for enhancing survival in the field under normal rainfall/ snowfall conditions. In stress sites, Deodar nursery stock height >15" was found as better parameter related to survival. Similarly, it can be inferred from the present study that height class >9" is good enough for better survival both in case of polybags as well as bare root stock in good site conditions or upper limit of species occurrence in Himalaya. In case of collar diameter class, maximum survival was found in 4-5 mm class for poly bag stock and for naked root stock, maximum survival was observed in case of diameter class <4mm in good site conditions or upper limit of species occurrence in Himalaya.

CONCLUSION

It was found in the present study that polybag raised stock of Ban Oak survived better in the field as compared with bare root stock. Ban Oak stock raised in polybags performed better in lower limits/ elevation of occurrence of this species as compared to bare root stock. However, bare root stock performed comparably well in upper limits of occurrence of this species viz. a viz. Polybag raised stock. In good sites, stock height >9" was found to be good indicator of field performance. In stress sites, stock height >18" of nursery stock was found as better parameter related to field survival.

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