The Effects on Growth of Transplanting Germinating Seeds into Containers

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Successful transplantation of seedlings into blank container cavities requires proper timing. Guidelines for determining proper timing for conifers are provided.

For maximum efficiency in production of containerized seedlings, empty cavities must be avoided. The first safeguard is to sow only high-quality seeds that have been thoroughly processed to remove empties. But even the best seedlots contain some seeds that fail or are slow to germinate.

The number of blank cells can be reduced by sowing two or three seeds per cavity and thinning to one seedling after germination is completed or by germinating extra seeds for transplanting to containers where germination has failed. This study examined the second choice and compared the effects of radicle length of transplanted germinating seeds on seedling survival and growth.

Methods

Shortleaf and longleaf pines were used to compare early growth of seedlings from seeds germinated directly in containers with seedlings from seeds transplanted into containers when radicles were 1.5 to 2.0, 3.0 to 3.5, and 4.5 to 5.0 centimeters long.

Containers were size-4 Styroblocks containing 160 cavities in a 10 by 16 pattern. The growing medium was a 1:1 by volume peat-vermiculite mixture. One styroblock was used for a single replication of all treatments with each species. Treatments were fully randomized and replicated four times. Seedlings in outside cavities served as buffers and were not included in the measurements.

Cavities for the control treatment were sown with three seeds each. Seedlings were thinned to one per cavity as soon as most radicles had penetrated the growing medium, about 14 days after sowing. Starting 1 week after sowing the controls, seeds were sown daily for 5 days in closed germination trays to insure a supply of seeds with various radicle lengths. So, age from seed was directly related to length of radicle. A peat-vermiculite mixture was also used for these seeds. Transplanting was done with all precautions both to avoid injury to the tender radicles and to plant them straight in a hole punched with a round, wood stick about 3 millimeters in diameter.

After thinning and transplanting, all seedlings were fertilized equally at frequent intervals. Seedlings were measured 15 weeks after controls were sown. Heights of shortleaf seedlings, root-collar diameters of longleaf seedlings, and total dry weight of all seedlings were determined. Differences between treatments were tested by analysis of variance and Duncan's Multiple-Range Test at the 0.05 level of significance.

Results

No mortality occurred with either species. Therefore, comparisons are based solely on growth and development.

Shortleaf pine. Heights at 15 weeks were directly related to radicle length at transplanting, and control seedlings were tallest (table 1). However, only seedlings originating from seeds with the shortest radicles were significantly smaller than those from all other treatments.

Table 1.—*Effect of radicle length at transplanting on dry weights and heights of shortleaf pine seedlings*

Radicle length	Height	Dry weight
cm	*cm*	*mg*
1.5-2.0	8.61 a[1]	137a
3.0-3.5	9.36b	173b
4.5-5.0	9.48b	188b
Seeded (control)	9.93b	280c

[1] Means in vertical columns followed by the same letter are not significantly different.

Dry weights of seedlings differed more than heights. Control seedlings were heaviest, with average weight double that of seedlings from seeds with short radicles. Seedlings from seeds with long and intermediate radicles weighed about the same, but they were significantly heavier than those originating from seeds with short radicles.

Longleaf pine. Root-collar diameters of longleaf seedlings differed significantly among treatments (table 2), with control seedlings being largest. No difference in caliper existed among transplanted seedlings.

Table 2.—*Effect of radicle length at transplanting on dry weights and root-collar diameters of longleaf pine seedlings*

Radicle length	Root-collar diameter	Dry weight
cm	*mm*	*mg*
1.50-2.0	1.12at	168a
3.0-3.5	1.20a	210b
4.5-5.0	1.28a	237c
Seeded (control)	1.48b	342d

[1] Means in vertical columns followed by the same letter are not significantly different.

Dry weights followed a pattern similar to those found with shortleaf seedlings, with the control seedlings slightly more than twice as heavy as seedlings from seeds with the shortest radicles. All treatments differed significantly from each other, with control seedlings 44 percent heavier than the best of the transplanted seedlings.

Discussion

Seed germination seldom reaches 100 percent. Therefore, containers will have empty cavities after germination is completed. Growers must decide on the best method of increasing stocking. Their decision whether to multiple sow and thin, to single sow and transplant, or to sow and accept initial stocking levels will depend on seed germination and labor costs.

Multiple sowing of cavities is not desirable when seed is of high quality, expensive, or scarce. When the need for transplanting is expected, more seed should be sown at the same time as the containers are planted. This can be done by sowing extra seeds in a small portion of the containers or in special germination trays.

This study clearly showed the importance of careful timing when replacement seedlings are transplanted into empty cavities. Seedlings established by sowing were 1 to 2 weeks older than seedlings established by transplanting. This age difference probably accounted for the larger check seedlings. Also, seedlings from transplants with long radicles were probably older than those from transplants with short radicles. Because smaller seedlings are quickly suppressed at dense stockings, transplanting should be done when an empty cavity becomes evident. If good-quality stratified seeds (except longleaf) are used, this determination is possible in about 10 days. At this time, replacements have short radicles and are easier to transplant without damage than are seeds with long radicles. If transplanting is delayed much beyond this time, seeds with longer radicles should be used.

Research studies are sometimes established by transplanting germinating seeds into containers. Transplants should have either uniform radicles or representative radicles reflecting all lengths in all treatments. Failure to exercise this precaution could bias the experiment.