DEPTH OF SEED COVERING INFLUENCES GERMINATION OF CONTAINER-GROWN PONDEROSA PINE

Deep covering of granite grit and vermiculite increased germination about one third.

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Granite grit No. 2 is favored as a seed covering for container-grown conifer seedlings because it creates a suitable microclimate for germination, aids in radicle orientation, and protects against seed loss (*1*). Recommendations call for seed coverings of No. 2 granite grit at a depth of 0.3 to 0.6 cm, depending on seed size (*1*). However, recent greenhouse work suggests that a greater depth of grit might prove beneficial in increasing germination of ponderosa pine (*Pinus ponderosa*). Thus, a study was designed to compare germination of container-grown ponderosa pine under shallow (0.4 cm) and deep (1.5 cm) coverings of grit and three alternative coverings — peat, perlite, and vermiculite.

Methods

This study was aimed at increasing germination rates in Champion Timberlands greenhouses in Bonner, Mont. The techniques of container filling and sowing for this project were based upon Champion's normally used manual procedures. Eight No. 2A styroblocks with 240 cavities each were used; each styroblock was divided into two groups of 100 holes each, leaving a separation zone of 40 unused cavities, for a total of 16 groups of 100 holes each. Each of these holes was filled with a wetted peat-vermiculite mixture. The growth medium was compressed within the cavities to an approximate depth of 1.5 centimeters. Ponderosa pine seeds from a single stand, which had been in cold storage for 2-½ years, were separated by both air column and screening methods to obtain seeds of uniform size and weight. These seeds were soaked in water overnight and then sown one seed per cavity. The 16 test groups were covered at random by one of the four materials-grit, peat, vermiculite, and perlite, and at one of two depths—approximately 0.4 and 1.5 centimeters. A shallow covering (approximately 0.4 cm) of the material was sprinkled over the holes until the top of the seed was only partially visible. For a deep covering (approximately 1.5 cm), the holes were filled to the top of the container. These 16 test groups produced 200 seeds for each of the four treatments of covering material and the two depths of covering.

The styroblocks were placed in the University of Montana forestry greenhouse. They were rotated clockwise twice weekly, to minimize possible microclimatic influences. The containers were lightly watered daily. Emergent seedling counts were recorded every other day after the appearance of the first seedling. Seeds with a shallow covering were counted as soon as the hypocotyl began to lift from the soil medium. Those seeds under deep coverings were counted as soon as any part of the seedling became visible. Five weeks after the sowing date the test coverings were disturbed to examine all seeds or seedlings. The criterion for final germination count was defined as a radicle elongation of 0.1 centimeter.

Results

Collected data were divided into two categories: The number of emergents visible before disturbance, and the number of germinants recorded after disturbance of the seed coverings (table 1). The deep grit exhibited the best emergence and the best germination. Shallow grit showed significantly lower germination than deep grit. Comparison of the covering material rankings before and after disturbance showed what was suspected: With deep peat, deep perlite, and deep vermiculite a large number of seeds had germinated but had not become visible. However, deep grit produced both strong emergence during the test period and a large number of germinants which had not broken through the covering.

Differences among treatments were found to be significant at the 95 percent confidence level. The normally used shallow grit covering resulted in significantly

Table 1.—*Total emergents and germinants for two depths of four seed coverings*

Covering	Total visible out of 200 (number)	Ranking	Total germinants out of 200 (number)	Ranking	Increase of germination, compared to shallow grit (percent)
Grit					
Shallow	65	4	81	7	—
Deep	86	1	111	1	38
Vermiculite					
Shallow	75	2	97	3	19
Deep	65	4	104	2	28
Perlite					
Shallow	72	3	89	5	10
Deep	53	7	82	6	1
Peat					
Shallow	59	6	78	8	-4
Deep	51	8	94	4	16

lower germination than the other seed covering treatments, including the deep grit.

Conclusions

Ponderosa pine seed germination was increased approximately 38 percent by using a deep covering of 1.5 centimeters of granite grit rather than a shallow covering of 0.4 centimeters (table 1).

This increased germination represents a potential savings in seed, reseeding, and transplating costs for containerized greenhouse operations. The deep vermiculite covering exhibited a 28 percent increase in germination. The comparatively lower cost of vermiculite may make it an acceptable alternative. A deep covering of grit or vermiculate may enhance germination by maintaining higher humidity, reducing temperature fluctuation at seed level, and allowing air circulation to facilitate gas exchange. Further testing of both grit and vermiculite is needed to determine the covering material and depth that will maximize germination while minimizing cost.

Literature Cited

1. Van Eerden, E.
1974. Growing season production of western conifers. *In* Proceedings of the North American containerized forest tree seedling symposium. R.W. Tinus, W.I. Stein, and W.E. Balmer eds. Great Plains Agric. Counc. Publ. No. 68.