FALL AND SPRING TRANSPLANTINGS OF CONIFERS IN THE PLAINS REGION

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Several years' tests in a northern Great Plains nursery indicate spring transplanting of 2-0 seedlings is superior to fall transplanting. Considerable year-to-year variation in results existed, however.

Fall plantings of conifers have proven successful in some regions of North America to extend the planting season and to reduce conflicts with spring nursery activities. For example, Winjum (3) reported an average survival of 90 percent for 2-0 seedlings of Douglas and noble fir when planted from October to April in the coastal region of Oregon. On the other hand, Mullin reported survivals of only 31 to 50 percent for fall plantings of 2-0 white and red pine in southern Ontario (2). This article reports results of five nursery tests for fall and spring transplantings from 1961 to 1966 at the Indian Head Tree Nursery for 2-0 seedlings of white spruce (*Picea glauca* (Moench) Voss), Colorado or blue spruce (*P. pungens* Engelm), and Scots pine (*Pinus sylvestris* L.).

Materials and Methods

Plants from the same seedbed and of the same seed source were used for each comparative fall and spring planting test. The required number of plants were loosened by undercutting part of each seedbed to a depth of 5 inches with a U-plow. Seedlings were then pulled by hand and sorted to a uniform size and quality by discarding all small (1-0) and damaged plants. These seedlings were placed in tubs with the roots in water and transplanted on the same day as lifted into nursery transplant plots by a modified, self-propelled five-row Holland transplanter. Plants were spaced 3 inches apart in the rows, with rows 11 inches apart in each five-row block. All plantings were irrigated immediately and subsequently as required by an overhead Skinner system.

The first test in 1961-62 involved 10,000 seedbed plants of each of the three species. These plants were lifted and transplanted on August 25, 1961, and again on May 23, 1962, in an adjacent plot, after completion of the spring tree packing operations. Similar quantities of seedlings in the second test in 1962-63 were transplanted on August 17, 1962, and May 16, 1963, in adjacent plots. The number of plants which survived and made new terminal growth was recorded in the fall after one and two seasons for the four transplanting dates, and are summarized in table 1 as percentages of the original plantings.

The third and fourth tests in 1963-64 and 1964-65 each in-

Table 1.—*Survivals[1] for 1961-62 and 1962-63 fall and spring transplantings of three conifer species after one and two seasons of growth*

Seasons of growth and species	Fall and spring transplanting dates and survivals			
	8/25/61	5/23/62	8/17/62	5/16/63
	(%)	*(%)*	*(%)*	*(%)*
First Season				
White spruce	74	90	78	84
Colorado spruce	92	96	77	71
Scots pine	91	97	75	69
Means	86	94	77	75
Second season				
White spruce	51	74	70	76
Colorado spruce	70	80	70	62
Scots pine	62	74	71	53
Means	61	76	70	63

[1]Survivals as a percentage of the original 10,000 seedlings planted.

volved two fall transplanting dates and one spring planting of 5,000 seedlings for each of the three species. For the 1963-64 test, seedlings were transplanted on August 15 and August 29, 1963, and on May 13, 1964. For the 1964-65 test the planting dates were August 17 and 28, 1964, and May 13, 1965. Survivals after one and two seasons of growth were recorded and are listed in table 2.

The fifth test in 1965-66 included four fall transplanting dates, namely, August 12, 17, 24, and 31, 1965, and one comparative spring planting on May 17, 1966, in the same transplant plot. For all plantings, two outside rows in each five-row block were planted to Colorado spruce seedlings, the other two outside rows to white spruce, and the center row to Scots pine seedlings. Only 150 seedlings were transplanted in each row for each date of planting. Survival records for plants in the central three rows of all five planting dates after two seasons of growth are reported in table 3.

Table 2.—*Survivals[1] for two fall transplating dates in 1963 and 1964 and for spring transplantings in 1964 and 1965 of three conifer species after one and two seasons of growth*

Seasons of growth and species	Transplanting dates and survivals					
	Fall 1963		Fall 1964		Spring	
	8/15/63	8/29/63	8/17/64	8/28/64	5/13/64	5/13/65
	(%)	*(%)*	*(%)*	*(%)*	*(%)*	*(%)*
First season						
White spruce	55	15	82	87	90	92
Colorado spruce	39	28	58	88	82	89
Scots pine	36	32	46	54	88	99
Means	43	25	61	78	86	93
Second season						
White spruce	48	15	68	84	89	86
Colorado spruce	38	27	56	84	75	86
Scots pine	35	31	41	53	87	99
Means	40	24	55	75	83	90

[1]Survivals as a percentage of the original 5,000 seedlings planted.

Results

Survival of 2-0 seedling transplants in the five tests differed not only for fall and spring plantings, but also for species and years. No doubt the results were influenced by adverse weather factors during the 1961 to 1966 period, because annual precipitation ranged from an all-time low of 7.2 inches in 1961 to 18.9 inches in 1963; the frost-free season varied from May 28 to September 4 for 100 days in 1965 to 150 days in 1963; and the date of fall freeze-up ranged from October 31 in 1961, 1962, and 1963 to November 10 in 1965 and 1966 .

Conflicting results were manifested by the fall and spring transplantings of 1961-62 and 1962-63 (table 1). Survival of seedlings was greater for the spring 1962 transplantings of all three conifer species than for the fall 1961 plantings, averaging 76 and 61 percent, respectively, after two seasons of growth. On the other hand, mean survival for the 1962 fall transplants was 70 percent and for the 1963 spring plantings only 63 percent. The lower survival of 1963 spring transplantings was attributed to excessive precipitation (2.5 inches) from April 28 to May, 14, which prevented efficient

Table 3.—*Survivals*[1] *for four fall transplanting dates in 1965 and for one spring transplanting date in 1966 of three conifer species after one and two seasons of growth*

Seasons of growth and species	Transplanting dates and survivals				
	8/12/65	8/17/65	8/24/65	8/31/65	5/17/66
	(%)	*(%)*	*(%)*	*(%)*	*(%)*
First season					
White spruce	49	4	17	23	91
Colorado spruce	63	19	17	28	92
Scots pine	24	3	1	1	89
Means	45	9	11	17	91
Second season					
White spruce	49	4	14	23	89
Colorado spruce	60	19	16	27	87
Scots pine	23	2	1	1	88
Means	44	9	10	17	88

[1]Survivals as a percentage of the original 150 seedlings planted.

operations of the mechanical transplanter on May 16.

Results for the 1963-64 and 1964-65 tests demonstrated superiority of spring transplantings (table 2), but showed marked differences between years for the two dates of fall plantings. Survivals of the 1964 spring plantings were consistently greater than the 1963 fall plantings for all species, averaging 83 percent as opposed to 40 and 24 percent, respectively, for the August 15 and 29 plantings. Survivals of the 1965 spring plantings averaged 90 percent compared to 55 and 75 percent for the respective August 17 and 28 plantings of 1964. Nevertheless, results for the August 28 fall plantings of white and Colorado spruce approached those for the May 13 spring plantings (84 to 86 percent), which suggests that survival of fall plantings may increase with maturity of the 2-0 spruce seedlings or with more favorable climatic conditions.

Survivals of the 1963 and 1964 fall plantings after one season of growth were apparently affected by the amount of protective snowfall the previous winter. Survivals for the two 1963 plantings averaged 25 and 43 percent when the snowfall recorded for November and December was only 5 inches, whereas those for the two 1964 fall transplanting dates averaged 61 and 78 percent, after 12 inches of snowfall during November and December 1964. Evidently, seedlings transplanted in fall 1963 were exposed to more severe winter desiccation, which was reported by Lindquist, Grover, and Cram (1) to reduce survivals for 2-1 conifers in the plains region. On the other hand, all fall plantings of Scots pine in 1963 and 1964 with survivals of 31 to 54 percent were essentially failures, while those spring plantings for 1964 and 1965 with survivals of 87 and 99 percent proved highly successful. Similar results were reported by Mullin (2) for fall and spring plantings of white and red pine in Ontario. Thus, only spring transplanting of Scots pine seedlings is recommended for the plains region.

Results for the 1-965-66 planting test (table 3) clearly demonstrated the superiority of spring conifer transplanting and the failure of fall transplants due to adverse climatic conditions.

Survivals after two seasons of growth were disappointing for all four fall plantings in 1965; and although those for the August 12 planting averaged 44 percent, those for the later August 17 to 31 plantings were only 9 to 17 percent. Conversely, survivals for the May 17, 1966, plantings were consistently excellent (88 percent) for all three species. Seedling losses for fall 1965 transplantings were primarily the result of a frost-heaving action in late November 1965. Following 4 inches of snowfall, temperatures during November gradually rose to 71° F. As the snow melted, icy surfaces developed along the seedling rows during the night. With subsequent daytime temperatures, these icy layers lifted seedlings from the soil. Higher survivals for the early August 12 transplants suggested that some of the seedlings had developed adequate root systems to become established prior to freeze-up on November 10. The relatively high survival of Colorado spruce seedlings in the August 12 planting (60 percent) demonstrated this species was more tolerant to the adverse winter conditions than white spruce or Scots pine.

Conclusions based on the above results for five 1961 to 1966 fall and spring transplanting tests are as follows:

1. Fall transplantings of 2-0 Scots pine and white and Colorado spruce seedlings are not recommended in the plains region.
2. Spring transplanting of 2-0 conifers provides the most efficient method of producing 2-2 plants.
3. Nursery practices, such as cold storage of 2-0 seedlings, must be developed to increase production of 2-2 conifers.

Literature Cited

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