forest management note

Note No. 41 Northern Forestry Centre Edmonton, Alberta

EVALUATION OF POSTBURN SEEDING OF JACK PINE IN CENTRAL SASKATCHEWAN

In the continuing effort to develop successful silvicultural techniques for regenerating jack pine (*Pinus banksiana* Lamb.) after harvest cutting, several experimental seeding tests were conducted following four operational burns (Chrosciewicz 1978). The burns were located at latitudes 53°53′–53°55′N and longitudes 104°57′–104°58′W, about 31–36 km by road northeast of Candle Lake, Saskatchewan. The predominant soil moisture regimes (Hills 1955) were 2 (fresh) on two areas and 2 to 3 (moderately moist) on the other two areas. The mineral soil materials were loamy glacial tills, varying in texture from sandy loam to sandy clay loam, with about 8-25 cm of silty sand in the upper horizons; they contained 1–35% stones by volume. The fires consumed logging slash, aerial parts of vegetation, surface moss and litter, and varying quantities of duff underneath the moss and litter (Chrosciewicz 1978). The resulting seedbeds consisted of 6–37% exposed mineral soil and 63–94% partially burned duff, with the duff materials averaging 0.9–5.0 cm in their postburn depth (Table 1).

METHODS

Twenty-four 0.04-ha plots were used in the tests. They were randomly located in groups of four plots per site within each of the four clear-cut areas designated for burning. The plots were 20 by 20 m, each containing five uniformly spaced transects, which in turn were subdivided into 4-m^2 sample quadrats. This arrangement allowed 50% sampling of each plot. Initially, the 0.04-ha plots were used for assessing, by site, the fuel and seedbed conditions before and after burning on each of the four areas, but because the seeds contained in cones of the original pine slash were destroyed with the burning slash, the same plots were later used for testing the postburn seeding treatments as outlined in this paper.

All four operational burns were carried out in midsummer of 1971, and their detailed descriptions, including the results, were already published (Chrosciewicz 1978). The burned 0.04-ha plots were broadcast seeded to jack pine in two different seasons: fall 1971 (October 14) and spring 1972 (June 11). Each time, two different amounts of seeds were sown; 0.49 kg/ha in single seeding and 0.98 kg/ha in double seeding were replicated by the individual plots four times on sites with soil moisture regime 2 and two times on sites with soil moisture regime 3. The seeds were of local origin and had a germinating capacity of 68–70%. They were sown in small controlled lots; each lot was thoroughly mixed with a standard quantity of vermiculite. A Cyclone seeder was used to spread the mixture evenly over the well-defined plot area at the desired rate.

Jack pine regeneration was surveyed on the plots during the second half of August 1975, nearly four full growing seasons after seeding. Individual pine seedlings were counted on all 4-m^2 sample quadrats, and the height of the dominant seedling was measured on each stocked quadrat. Seedbed conditions under each pine seedling were identified and recorded as being either exposed mineral soil or partially burned duff.

The t-statistics derived from one-way analyses of variance (Snedecor and Cochran 1980) were used in testing the significance of differences between sample means of both jack pine stocking and jack pine seedlings per hectare for the various seeding treatments and site combinations (Table 2). Preliminary comparisons of the means by the individual sites failed to show significant

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Table 1. Jack pine regeneration four growing seasons after postburn seeding treatments

Plot no.	Soil moisture regime[a]	Postburn seedbeds[b] Exposed mineral soil (%)	Partially burned duff (%)	Mean duff depth (cm)	Postburn broadcast seeding[c] Fall 1971 (kg/ha)	Spring 1972 (kg/ha)	1975 jack pine regeneration[d] 4-m² quadrats sampled (n)	4-m² quadrats stocked[e] (%)	Total living seedlings (n/ha)
36	2	21	79	2.0	0.49	—	50	8	198
39	2	15	85	3.3	0.49	—	50	14	346
43	2	22	78	2.3	0.49	—	50	6	148
47	2	19	81	2.9	0.49	—	50	6	148
34	3	7	93	2.2	0.49	—	50	4	99
49	3	8	92	3.9	0.49	—	50	20	544
31	2	26	74	2.1	—	0.49	50	28	1 087
41	2	21	79	2.9	—	0.49	50	32	1 038
45	2	16	84	2.6	—	0.49	50	30	1 483
53	2	16	84	2.6	—	0.49	50	44	2 224
32	3	11	89	1.8	—	0.49	50	64	2 471
51	3	10	90	4.4	—	0.49	50	80	7 018
37	2	21	79	0.9	0.98	—	50	22	544
40	2	25	75	2.6	0.98	—	50	4	99
44	2	11	89	2.4	0.98	—	50	8	741
48	2	17	83	1.8	0.98	—	50	16	544
35	3	14	86	1.6	0.98	—	50	2	49
50	3	15	85	1.9	0.98	—	50	32	1 038
38	2	7	93	2.9	—	0.98	50	28	1 038
42	2	34	66	2.3	—	0.98	50	54	1 829
46	2	14	86	3.1	—	0.98	50	58	2 817
54	2	37	63	1.7	—	0.98	50	92	6 029
33	3	6	94	2.6	—	0.98	50	48	1 631
52	3	7	93	5.0	—	0.98	50	94	13 245

[a] According to Hills' (1955) system of classification.
[b] All plots burned-over in summer of 1971.
[c] Broadcast seeding classified in Table 2 as single (0.49 kg/ha) and double (0.98 kg/ha), depending on the amount of seeds sown.
[d] Regeneration surveyed in mid-August of 1975, using 50% sampling of the 0.04-ha plot areas by 4-m² quadrats.
[e] Quadrats stocked with one or more seedlings per quadrat.

Table 2. Comparisons of 1975 jack pine regeneration by postburn seeding treatments

Broadcast seeding		0.04-ha plots	Mean jack pine stocking[b]	Mean jack pine seedlings[b]
Season	Type[a]	(n)	(%)	(n/ha)
Fall 1971	Single (0.49 kg/ha)	6	10 (± 6)	247 (± 168)
			NS	NS
Fall 1971	Double (0.98 kg/ha)	6	** 14 (± 12)	* 502 (± 378)
			**	*
Spring 1972	Single (0.49 kg/ha)	6	46 (± 21)	2 554 (± 2 265)
			NS	NS
Spring 1972	Double (0.98 kg/ha)	6	62 (± 26)	4 432 (± 4 668)

[a] Combinations of seeded plots on fresh and moderately moist sites (soil moisture regimes 2 and 3) from Table 1.

[b] Differences between means (with ± standard deviations) significant at $P \leq 0.01$ (**) or $P \leq 0.05$ (*); the not significant (NS) designations indicate $P > 0.05$.

differences at $P \leq 0.05$, and further tests were done for site combinations.

RESULTS

Nearly four full growing seasons after the seeding treatments, jack pine regeneration was highly variable. Fall 1971 single broadcast seeding (0.49 kg/ha) resulted in 4–20% pine stocking with 99–544 seedlings/ha, whereas fall 1971 double broadcast seeding (0.98 kg/ha) resulted in 2–32% pine stocking with 49–1 038 seedlings/ha (Table 1). Similarly, spring 1972 single broadcast seeding (0.49 kg/ha) resulted in 28–80% pine stocking with 1 038–7 018 seedlings/ha, whereas spring 1972 double broadcast seeding (0.98 kg/ha) resulted in 28–94% pine stocking with 1 038–13 245 seedlings/ha (Table 1). For both the fall and the spring treatments, the mean pine stocking values and the mean pine seedlings per hectare were not significantly different ($P > 0.05$) between the single and the double rates of broadcast seeding (Table 2). The differences between the fall and the spring treatments, however, were highly significant ($P \leq 0.01$) in terms of the mean pine stocking values and significant ($P \leq 0.05$) in terms of the mean pine seedlings per hectare for both the single and the double rates of broadcast seeding (Table 2).

The overall average frequency distribution of pine seedlings was 74% on partially burned duff and 26% on exposed mineral soil. After nearly four full growing seasons, the plot mean heights of the dominant pine seedlings varied from 0.03 to 0.27 m, and averaged 0.18 m for all 24 plots.

CONCLUSIONS

The tests clearly demonstrated that, for the two rates of seeding used, 0.49 kg/ha and 0.98 kg/ha, spring seeding produced significantly better jack pine regeneration than did fall seeding. Doubling the amount of seeds sown, although beneficial on the average in both the fall and the spring seeding, showed less conclusive results because of excessive variations in terms of pine regeneration between the treated plots. The choice of the amount of seeds to be sown in future postburn seeding operations must therefore be left to managerial discretion. In any case, spring seeding is definitely recommended.

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