STUDIES ON THE ESTABLISHMENT OF CULTIVATED GRASSES AND LEGUMES ON BURNED-OVER LAND IN NORTHERN CANADA[1]

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[Received for publication July 9, 1956]

ABSTRACT

The establishment is reported of nine forage species on various soil types. The areas involved had been burned over in September, 1950. Seedings of grasses and legumes were made at two locations late in October, 1950, about six weeks after the burn and at four locations in early April the following spring.

Percentage ground cover was determined for each species in the first and fifth years after seeding. Time of seeding did not influence the establishment of the grasses but the performance of the spring-seeded legumes was superior to that of those seeded in autumn. Creeping red fescue, bromegrass and alfalfa exhibited the greatest adaptability, while crested wheatgrass and red clover proved unsatisfactory for reclaiming burned-over soils in this region. Sweet clover established itself readily and, since the plots were not grazed, reseeding was prevalent. Grasses showed symptoms of nitrogen deficiency except where legumes were present.

INTRODUCTION

Preliminary investigations dealing with the seeding of burned-over lands were commenced on Degraded Black soil in the Peace River region in 1946 (4). This early attempt at re-grassing was highly successful. A more concentrated program was initiated in the late autumn of 1950 following fires which ravaged some 1,000,000 acres of wooded land in this area. Following the fire, charred poplar and coniferous trees, stumps and debris remained, but these were not sufficiently prominent to hinder grazing livestock (Figure 1).

Previous work (2, 3, 4, 5) suggests that satisfactory stands can be established where the ash is deep enough to cover the seed. These investigations have also shown that erosion can be largely prevented if seeding is done immediately following the burn. Workers in British Columbia[4] found that certain forage species established satisfactorily but that the majority of the burned-over glacial soils were suitable only for reforestation.

Satisfactory establishment of sweet clover and alfalfa on burned-over land has been reported by farmers and ranchers in northern Alberta[5]. All workers advised seeding as soon as possible following the fire.

MATERIALS AND METHODS

The following locations representing different soil types were selected:
1. *Westvale, Alberta*—Degraded Black to Black solodized solonetz loam (Valleyview series).

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[4] Cited by Preston, S. G., Supervising District Agriculturalist, British Columbia Department of Agriculture, Prince George, B.C.—*Private communication*, October, 1951.

[5] Cited by Wood, V. A., Director of Lands, Alberta Department of Lands and Mines, Edmonton, Alberta. —*Private communication*, January, 1946.

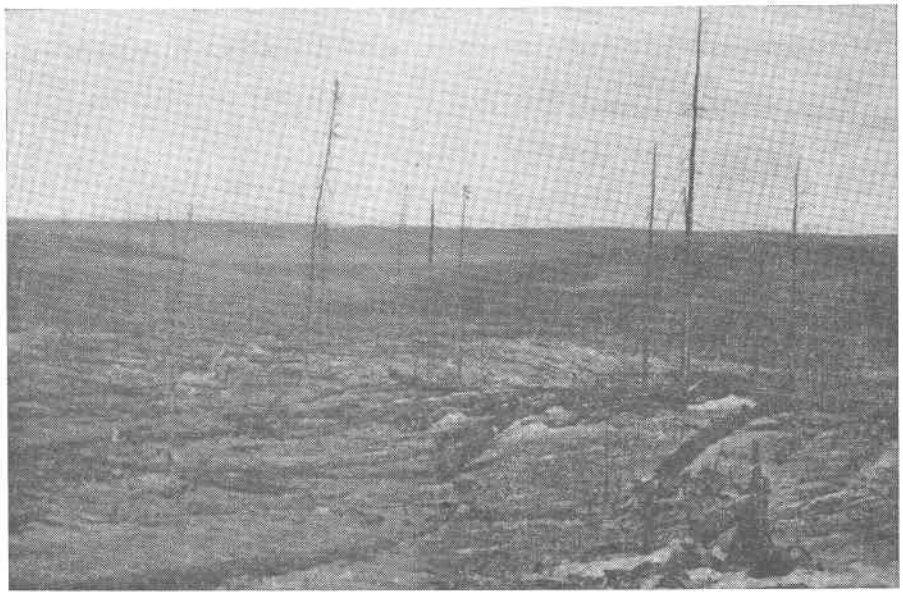

FIGURE 1. This northern British Columbia burn provided conditions suitable for establishment of cultivated grasses and legumes.

2. *Doe River, British Columbia*—Grey Wooded sandy loam.
3. *Mile 22, Alaska Highway, British Columbia*—Grey Wooded sandy loam.
4. *Mile 113, Alaska Highway, British Columbia*—Grey Wooded soil, shallow and stony.

At the first three locations the burned forest cover was composed largely of light to medium stands of willow and poplar with some coniferous growth. At Mile 113 the growth was mainly coniferous.

Much of the organic matter was destroyed by the fires, the depth of ash ranging from 1 to 3 inches.

Autumn seedings were made at Mile 113, and at Westvale in late October, 1950, on 3 to 6 inches of snow. Spring seedings were made at the four locations in early April before all the snow had disappeared and while the frost was in the ground. The seed was broadcast by hand on plots 50 feet square. Plots were in triplicate, arranged in a randomized block design. All legume seed was inoculated, except that used for the autumn seeding at Mile 113, Alaska Highway. The burned soil and debris were disturbed as little as possible.

Forage species seeded and rates in pounds per acre were as follows: Crested wheatgrass (Fairway)—10; creeping red fescue (Olds)—8; bromegrass (Commercial)—12; Kentucky bluegrass (Commercial)—5; timothy (Commercial)—5; alfalfa (Grimm)—10; sweet clover (Arctic)—12; alsike clover (Commercial)—5; red clover (Altaswede)—8.

The establishment of each species was determined by visual observation in August, 1952, and again in August, 1955. Readings for each of the three replicates were averaged and recorded as per cent ground cover (Table 1).

Because of the variable nature of the data, they were analysed statistically by angular transformation as outlined by Hayes and Immer (1).

TABLE 1.—THE ESTABLISHMENT OF SPRING- AND AUTUMN-SEEDED FORAGE PLANTS AT FOUR PEACE RIVER DISTRICT LOCATIONS. DATA AS PER CENT GROUND COVER, AND ARE AVERAGES OF THREE READINGS.

Species	Westvale Spring seeding		Westvale Autumn seeding		Mile 113 Alaska Highway Spring seeding		Mile 113 Alaska Highway[1] Autumn seeding	Mile 22 Alaska Highway Spring seeding		Doe River Spring seeding	
	1952	1955	1952	1955	1952	1955	1952	1952	1955	1952	1955
Sweet clover	62	20	7	20	37	1	1	73	60	72	60
Alfalfa	45	47	3	20	47	40	1	63	40	48	40
Alsike	48	10	2	52	45	63	5	35	28	37	42
Red clover	5	3	1	3	5	3	1	30	18	15	8
Creeping red fescue	68	17	83	30	73	80	73	75	40	72	77
Kentucky bluegrass	43	38	60	15	62	72	48	57	45	55	47
Bromegrass	53	32	78	35	33	27	53	57	60	67	80
Timothy	38	30	53	12	22	7	18	50	22	65	17
Crested wheatgrass	8	0	1	0	0	0	0	20	0	18	2
L.S.D. (P.05)	28	24	10	19	15	13	15	18	20	4	16

[1] Defoliated by black army cutworms in 1952 and test abandoned.

RESULTS AND DISCUSSION

Forage plant establishment was most successful on Grey Wooded sandy loam at Doe River and at Mile 22, Alaska Highway, where the depth of ash averaged 1 to 2 inches. Establishment was less successful but still satisfactory at Westvale on a compacted Degraded Black to Black loam and at Mile 113, on a shallow and stony Grey Wooded soil. At these locations, wind and water removed considerable quantities of ash. As data in Table 1 indicate, grass did not appear to be influenced by time of seeding, but legumes established themselves more readily when spring-sown. Also, as shown by Table 1, autumn-seeded legumes at Westvale remained weak for the first two years, but gradually strengthened as nodular development increased. Native plants invaded all plots where seeded forages did not make full stands. In some instances native grasses and forbs became dominant (Figure 2).

The predominant native forbs and grasses involved were *Epilobium angustifolium* L., *Dracocephalum parviflorum* Nutt., *Geranium* spp., *Aquilegia brevistyla* Hook, *Compositae* spp., *Rosa* spp., *Agrostis stolonifera* Farwell, *Calamagrostis* spp. with associations of *Agropyron* and *Poa* spp. There was some regeneration of *Populus tremuloides* Michx. and *Salix* spp.

At the time of the August, 1955, examination, creeping red fescue, Kentucky bluegrass and bromegrass exhibited the greatest adaptability of the grasses (Figure 3). Timothy established itself satisfactorily where moisture was adequate but stands declined with age. Crested wheatgrass proved unsatisfactory.

There was marked evidence of nitrogen deficiency in the grass stands in the second and subsequent years. This was indicated by yellowing, lack of thriftiness and by a substantial increase in vigour where volunteer legume plants occurred and where grass stands bordered legume plots. Native plants also grew more luxuriantly if associated with seeded legumes.

Sweet clover continued to reseed beneath the previous year's growth (Table 1), but shading of the seedlings limited development. It was demonstrated, however, that unpastured sweet clover will continue to reseed and spread throughout the burned area. Alfalfa and alsike continued to produce good growth and spread throughout the seeded areas. Altaswede red clover was gradually eliminated at most locations.

CONCLUSIONS

Adapted species of grasses and legumes can be satisfactorily established on burned-over areas in the Peace River region. Under favourable conditions, abundant forage is produced and the soil is stabilized against erosion.

In this investigation better results were obtained from seedings made in the early spring following the fire rather than in the late fall, only a few weeks after the burning.

Evidently the establishment of cultivated forage was independent of soil type but a sufficient depth of ash to provide a seedbed was required.

Burned soils are low in organic matter and grasses growing in pure stands showed nitrogen deficiency symptoms. This was corrected where legumes grew in association with the grasses.

FIGURE 2. Fireweed, *Epilobium angustifolium*, growing on burned-over land five years after the burn.

FIGURE 3. Establishment of creeping red fescue on burned-over Grey Wooded sandy loam.

ACKNOWLEDGEMENT

Acknowledgement is made to M. Martinuik, formerly of the Experimental Farm staff and now with Northwest Seeds Limited, Dawson Creek, British Columbia, who initiated the study.

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