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Improving Aspen Poplar Populus-Tremuloides and Prickly Rose Rosa-Acicularis Covered Rangeland With Herbicides and Fertilizer

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IMPROVING ASPEN POPLAR AND PRICKLY ROSE-COVERED RANGELAND WITH HERBICIDES AND FERTILIZER

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The improvement of brush-covered rangeland seeded to tame forage species following the application of three herbicide mixtures, with and without fertilizer, was documented. The area was located 193 km northeast of Regina, Saskatchewan, on a Waitville loam in the Grey (Podzol) soil association. The highest forage yields were reported on areas that received either a combination of 2,4-D + 2,4,5-T, 2,4-D + dicamba or 2,4-D + picloram and a yearly fertilizer treatment. The forage yields on the three previously mentioned treatments ranged from 109 to 139 g/m^2 and from 394 to 424 g/m^2 during the first and second years, respectively, of the experiment, respectively.

L'article étudie l'amélioration des parcours broussailleux ensemencés d'espèces fourragères cultivées après l'application de trois mélanges herbicides avec et sans fumure. La région retenue se situe à 193 km au nord-est de Regina (Saskatchewan) sur un loam Waitville dans l'association des sols gris (podzols). Les plus forts rendements proviennent des superficies ayant reçu une combinaison de 2,4-D + 2,4,5-T, 2,4-D + dicamba ou 2,4-D + picloram et une fumure annuelle. Les rendements ont varié de 109 à 139 g/m^2 et de 394 à 424 g/m^2 respectivement au cours de la première et seconde année d'expérience.

During the past 30 years, producers have attempted to increase the amount of forage in the aspen parkland of Saskatchewan by removing native woody and herbaceous species and establishing tame forage species. The natural vegetation in the area is dominated by aspen poplar (*Populus tremuloides* Michx.) which varies from nearly solid stands in the northern part of its range to groves on the moister southern sites. (The botanical nomenclature follows that of the Canada Weed Committee (1969).) Prickly rose (*Rosa acicularis* Lindl.) is often found growing in the aspen parkland on the dryer sites. The typical method of upgrading the rangeland is to bulldoze, pile and burn the woody species and then to disk several times before bromegrass (*Bromus inermis* Leyss.) and alfalfa (*Medicago sativa* L.) are seeded. A satisfactory seedbed for the successful establishment of tame forage species can be prepared with one to three passes of a heavy-duty disk. This will not kill all the rhizomes of prickly rose or the roots of aspen poplar (Pringle et al. 1973). This leads to a pasture with a woody regrowth problem and is the start of secondary succession with aspen poplar as the low-yielding climax vegetation.

To control the regrowth of aspen poplar, 2,4-D [(2,4-dichlorophenoxy) acetic acid] can be used alone or in a mixture with 2,4,5-T [(2,4,5-trichlorophenoxy) acetic acid], (on 15 Apr. 1980, the use of 2,4,5-T was banned in Saskatchewan) when prickly rose is present (Bowes 1975). Also, picloram (4-amino-3,5,6-trichloropicolinic acid) and dicamba (3,6-dichloro-0-anisic acid) have controlled woody regrowth (Bowes 1976; Friesen 1964). The need for an effective rangeland improvement program that combines optimum forage yields and

good control of woody regrowth provided the incentive for this research project.

The specific objective of the experiment was to determine the benefits of using fertilizer and herbicides to improve newly seeded rangeland covered with aspen poplar and prickly rose growth.

MATERIALS AND METHODS

The experiment was located 193 km (51°22'N and 103°16'W) northeast of Regina, Saskatchewan on an area that was cleared of aspen poplar by bulldozing in 1964 and then seeded to bromegrass and alfalfa in 1965. The selected area was dominated by aspen poplar regrowth, 2-m tall. The soil texture was a loam within the Waitville association (Mitchell et al. 1944). Annual precipitation during 1974, 1975 and 1976 was 504, 470 and 396 mm, respectively, compared to the Canadian normals (Anonymous 1972) of 435 mm for the 1940–1971 period.

The experimental design was a completely randomized block with split-plots. It was replicated four times with an individual plot size of 408 m^2. The main plots received the herbicides and the subplots the fertilizer treatments. An untreated check plot was included with the following treatments: iso-octyl ester of 2,4-D + 2,4,5-T, iso-octyl ester of 2,4-D + dimethylamine salt of dicamba and iso-octyl ester of 2,4-D + K salt of picloram applied at 1.5 + 0.7, 2.2 + 1.1 and 2.2 + 0.6 kg/ha, respectively. Herbicides were applied on 25 June 1974 in 168 L/ha of water with a contourmatic sprayer as described by Meyer et al. (1967). Soil samples were collected on 14 May 1974 and were analyzed for nitrogen and phosphate at the Saskatchewan Soil Test Laboratory, Saskatoon, Saskatchewan. Supply of both nutrients was low. One-half of each plot received a yearly application of 45 kg/ha of both nitrogen and P_2O_5. Fertilizer was hand-sprinkled over the plots on 14 May 1974, 7 May 1975, and 26 Apr. 1976.

The control of aspen poplar and prickly rose was estimated by measuring the leaf canopy which was observed to intercept a 30-m line transect. The total canopy width of each species that intercepted the line transect was expressed as a percentage of the total length of the line. Measurements were recorded on 26 June 1974, 20 Aug. 1974, 13 Aug. 1975, and 13 Aug. 1976. Since the area was lightly grazed during the duration of the experiment, all forage samples were obtained from under wire mesh cages which were installed at the beginning of each growing season. The forage yields were estimated by obtaining samples from four 0.5 m^2 areas per plot on 11 July 1974, 9 July 1975, and 28 June 1976. All samples were clipped at the ground surface, placed in plastic bags and frozen. Later the samples were separated into grasses, legumes and forbs. All samples were oven-dried at 100°C for 48 h before weighing.

RESULTS

The aspen poplar canopy cover was relatively uniform over the selected test site at the beginning of the experiment (Fig. 1). From August of the treatment year until end of the experiment, the aspen poplar canopy cover was lower on the herbicide-treated than on the check plots. Usually the areas that received a treatment of 2,4-D + picloram had the lowest canopy cover. Yearly fertilizer treatments did not change the size of the aspen poplar canopy cover when compared to the unfertilized areas.

Prickly rose canopy cover varied between 2 and 4% at the start of the experiment (Fig. 1). By August of the treatment year, all herbicide applications greatly reduced the size of the canopy cover, which remained lower than the check during the following 2 yr. Annual applications of fertilizer did not influence the size of the prickly rose canopy cover when compared to the unfertilized areas.

In 1974, grass yields on areas that had received a fertilizer treatment were approximately twice that on the unfertilized areas (Fig. 2). The grass yields were not affected by the herbicide treatments that year. In the following 2 yr, a combination of annual fertilizer treatment and an application of any of the herbicide mixtures provided the greatest grass yields. Where a herbicide or fertilizer treatment was used alone, grass yields were generally 50% less than those obtained where a combination of the two treatments was used. Grasses represented approximately 95% of the total forage yield (Fig. 2). Alfalfa was eliminated following the use of a combination of fertilizer and

herbicides. The yield of forbs varied with the herbicide mixture and ranged from low to high as follows: 2,4-D + picloram < 2,4-D + dicamba < 2,4-D + 2,4,5-T < check. The largest total forage yields were found on areas that received a combination of herbicide and fertilizer treatments during 1974 and annual fertilizer treatments during 1975 and 1976.

DISCUSSION

Cattle producers who want to improve areas covered with aspen poplar and prickly rose should consider a combination of fertilizer and herbicide treatments. The highest forage yields were found on any area that received a combination of yearly fertilizer treatments and any of the herbicide mixtures. Fertilizer was applied before spring growth commenced and was available during the spring growing period. All herbicides were applied at the full expanded-leaf stage of aspen poplar and did not kill the trees until after the maximum growing period of the forage species. By the following spring, many aspen poplar trees were dead, which

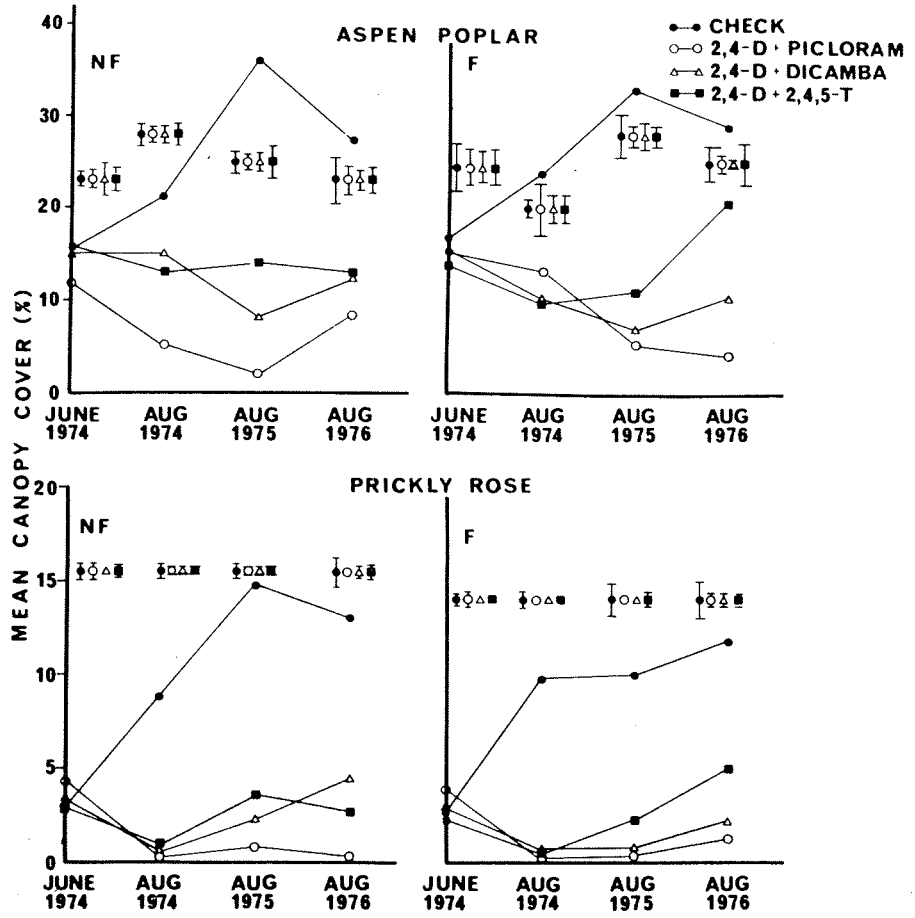

Fig. 1. Mean percentage canopy cover of aspen poplar and prickly rose following the application of herbicides and yearly fertilizer treatments ($\chi \pm S\chi, n = 4$). (Canopy cover was calculated as the canopy width for each species that intercepts a line transect expressed as a percentage of the total length of the line.) F = fertilized plots; NF = unfertilized plots.

removed the competitive effect on the forage species. The total yields recorded for these areas ranged from 394 to 437 g/m^2 (Fig. 2) which is close to the 446 g/m^2 reported for a well-managed pasture in a similar area (Anonymous 1974). Of the various species that contributed to the total yield, grasses increased the most on any area that received a fertilizer and herbicide treatment. This was desirable because grasses comprise the main portion of the cattle diet.

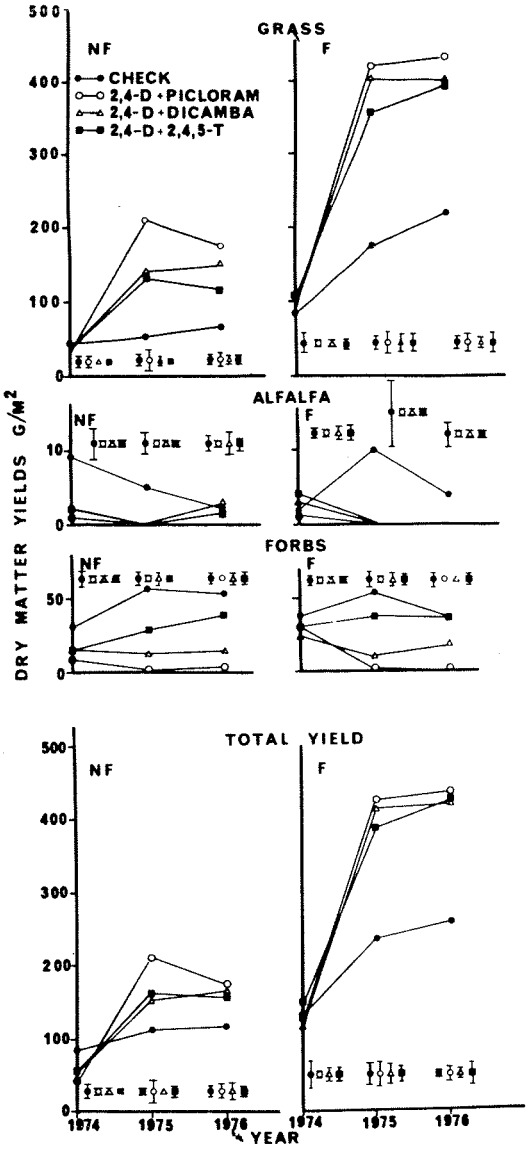

Fig. 2. Grass, alfalfa, forb and total forage yield following the application of herbicides and yearly fertilizer treatments ($\chi \pm S\chi$, $n = 4$). F = fertilized plots. NF = unfertilized plots.

It was difficult to select the best herbicide treatment in a rangeland improvement program when based on yield response, yield composition and control of regrowth (Figs. 1 and 2). The most important yield component was grass, which produced a similar amount of forage when treated with any of the herbicide mixtures and fertilizer. Areas receiving the 2,4-D + picloram mixture contained a lower ratio of forbs to grass than areas treated with 2,4-D + 2,4,5-T. The mixture 2,4-D + dicamba was intermediate between the two previously mentioned treatments. Generally, the lowest canopy cover for both woody species occurred in areas treated with 2,4-D + picloram, but the trend was not consistent. Additional research is required to determine if control is consistently superior following the use of a mixture containing 2,4-D + picloram.

The main disadvantage when using a combination of herbicides and fertilizer to improve rangeland was the elimination of alfalfa from the stand (Fig. 2). There was a continuous decrease in the amount of alfalfa on the unfertilized check from 1974 to 1976 but the legume was not eliminated. However, the increase in grass following the fertilizer and herbicide treatments greatly exceeded the contribution made by alfalfa.

The similar canopy cover of aspen poplar and prickly rose on areas receiving the same herbicide treatment either with or without the addition of fertilizer indicated that the woody species were not responding to yearly fertilizer treatments (Fig. 2).

Picloram and 2,4-D applied at 2.2 + 0.5 kg/ha effectively controlled aspen poplar and prickly rose regrowth on a 9-yr-old and a 2-yr-old pasture (Fig. 1, Bowes 1976). This suggests that a mixture of picloram plus

2,4-D can be used to effectively control new and established aspen poplar regrowth up to 2 m tall.

It was concluded that the highest forage yields were obtained on areas which were improved by using fertilizer and herbicide combinations. Forage yields increased over a 2-yr period after the initial application. Yield increases were attributed to fertilizer the first year and to herbicides the second year.

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