Increased Range Forage Production by Reseeding and the Chemical Control of Knapweed

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Highlight: *Diffuse knapweed and spotted knapweed on the lower ranges of the interior of British Columbia can be controlled by 8 oz/acre of picloram (4 amino-3,5,6, trichloropicolinic acid). Crested wheatgrass was not seriously affected by the chemical. Crested wheatgrass significantly increased forage production over the check areas when protected from grazing by domestic animals.*

A rapid spread of knapweeds (*Centaurea*) (Moore, 1954) has occurred on the rangeland of the British Columbia interior in the last 20 years. The species diffuse knapweed (*Centaurea diffusa* Lam.) and spotted knapweed (*Centaurea maculosa* Lam.) are the most prevalent. Although Russian knapweed (*Centaurea repens* Lam.) is well established in the southern part of the province, it has not encroached on the central interior ranges. All species are adaptable to a wide range of soil

and climatic environments and are easily spread by vehicles and livestock.

Despite the variation in geographic distribution of the different species, over half a million acres of rangeland have been invaded in the Kamloops-Okanagan area and an undetermined acreage in the west and central Kootenay regions. This widespread invasion accompanied by the vigorous knapweed plant growth has drastically reduced the growth and forage yield of native grasses. In turn, this has lowered the annual carrying capacity of the ranges.

Varying levels of chemical control of knapweed have been reported from plant spraying with 2,4-D (2,4-dichlorophenoxy acetic acid). Turner and Fertig (1965) obtained complete control of spotted knapweed with 2,4-D at 24 ounces actual acid per acre. Renney and Hughes (1969) obtained temporary control of diffuse knapweed with 2,4-D, but seedling establishment was not prevented. Limited reports are available on the use of picloram (4 amino-3,5,6 trichloropicolinic acid) as a chemical control for knapweed.

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Manuscript received August 7, 1974.

Materials and Methods

To obtain information on the increase of range forage from reseeding and chemical control of knapweed with picloram, one site was selected at Cache Creek, 54 miles west of Kamloops, and the other at Pritchard, 25 miles east. Vegetation at both locations was badly depleted due to many years of overgrazing by cattle. The vegetation at the Cache Creek site, which receives less than 9 inches of total moisture yearly, had been reduced to needleandthread (*Stipa comata* Trin. & Rupr.), sand dropseed (*Sporobolus cryptandrus* (Torr.) A. Gray), and a dense stand of diffuse knapweed. At the Pritchard site, which receives an estimated 12 to 14 inches of annual precipitation, overgrazing had reduced the native cover to almost a solid stand of Kentucky bluegrass (*Poa pratensis* L.) with a recent invasion of knapweed.

Plots, 30 X 10 ft, with four treatments and four replications in a randomized block design, were established in September, 1967, at Cache Creek and in 1969 at Pritchard. The treatments were: (1) 4 oz picloram active ingredient (AI) per acre and reseeding; (2) 8 oz picloram AI per acre and reseeding; (3) reseeding; and (4) check, no seeding and no chemical applied. All seedings were made with the rangeland drill using crested wheatgrass (*Agropyron cristatum* E. Gaerth) at 8 lb per acre. The plot area was subsequently fenced at Cache Creek to evaluate the effects of no grazing and the contribution from reseeding and the chemical control of knapweed.

Each fall during the 4-year period (1968-1971), three square meter areas were harvested from each plot at Cache Creek and in 1970 and 1971 at Pritchard. Forage samples were dried in a forced air oven at 65°C for dry matter determinations. All yield data were analyzed for variance and significance determined by Duncan's Multiple Range Test (1955).

Results and Discussion

When 4 oz/acre of picloram AI were applied to the plots at Cache Creek prior to seeding, good knapweed kill was obtained. Seeding with the rangeland drill under suitable field conditions was followed by an excellent establishment of crested wheatgrass as indicated by the progressive increase in dry matter yield of native vegetation plus crested wheatgrass from 1968 to 1971. A yield increase of 32% over that of the check treatment was obtained the first year as compared to an 82% increase in the fourth and final test year. This indicates a long term advantage in forage production from this treatment (No. 1) over reseeding without picloram (No. 3). Use of picloram in other forage studies has not been as successful. Arnold and Santelmann (1966) showed that field forage yields of grasses and forbs were significantly reduced by all rates of picloram when stands were treated at early stages of plant growth. In greenhouse trials, however, picloram applications of 1.5 lb/acre or less did not reduce production of the top growth once the grass seedlings had reached the true four-leaf stage of growth.

The mean yield of reseeding alone from the 4-year test period was only slightly lower than reseeding plus 4 oz of picloram AI. The absence of grazing animals brought about favorable conditions for the crested wheatgrass establishment and competition over the native range species.

Yield data from the Cache Creek plots indicate that picloram AI at 8 oz per acre, had a toxic effect on the crested wheatgrass and the native vegetation, but after 4 years, forage

Table 1. Dry matter yield (lb/acre) on fenced lower grassland areas as affected by applications of picloram and reseeding to crested wheatgrass.

Treatment	Cache Creek				Pritchard	
	1968	1969	1970	1971	1970	1971
4 oz picloram, seeded	102a*	304a	399a	460a	495ab	505a
8 oz picloram, seeded	61b	127c	193b	350ab	497a	520a
No picloram, seeded	66b	384ab	377a	352b	538a	560a
Check	77ab	221bc	234ab	252c	380b	420b

*Treatment means within a column at a given location with the same letter are not significantly different.

yields were equal to plots seeded to crested wheatgrass but not treated with picloram. No measurements were made of the effect of picloram on germination or emergence of crested wheatgrass seeds. However, in germination studies with buffalo-grass (*Buchloe dactyloides* (Nutt.) Engelm.) side-oats grama (*Bouteloua curtipendula* (Michx.) Torr.) and switchgrass (*Panicum virgatum* L.), Scifres and Halifax (1972) found that concentrations of picloram up to 1000 ppb did not reduce the number of caryopses germinated. Effects of herbicidal treatment were observed in the early development of seedling organs of these range grasses.

At the Pritchard site, because of the dense sod of Kentucky bluegrass, difficulty in soil penetration was encountered with the rangeland drill. Recent modifications of the rangeland drill by Asher and Eckert (1973) would probably overcome this problem.

Very little increase in forage production was obtained on the Pritchard plots with picloram and/or seeded to crested wheatgrass. Kentucky bluegrass was not affected by the relatively low rates of picloram, and the establishment of crested wheatgrass was difficult. Van Born (1965) used picloram to effectively remove smooth brome grass (*Bromus inermis* Leyss) and quackgrass (*Agropyron repens* (L.) Beav.) from Kentucky bluegrass sod, indicating that Kentucky bluegrass is very tolerant of picloram at rates up to 3 lb AI/acre. The data indicates that picloram could be more beneficial for knapweed control under drier conditions, such as existed at Cache Creek.

The herbicide picloram resulted in good control of diffuse and spotted knapweed, but restricted grazing must be used if dryland ranges are to be rejuvenated and forage production increased. Reseeding with ground equipment using crested wheatgrass because of its drought tolerance can be invaluable in meeting this objective.

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