A Comparison of Techniques for Interseeding Native Mixed Grass Prairie in Western North Dakota

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A study conducted at the Dickinson Branch Experiment Station evaluated chemical and mechanical sod control for interseeding grasses and alfalfa into native mixed grass prairie. The use of a cultivator sweep for mechanical sod control gave excellent results, while applying the recommended rates of Paraquat and Glyphosate in bands over the seeded row did not control the native sod. Yield data from the Travois alfalfa (*Medicago sativa*) interseeded range showed alfalfa yields comprised up to 20% of the total forage production 1 year after seeding. Both a low and high rate of nitrogen plus phosphorous fertilizer significantly decreased the number of alfalfa seedlings the first year and the high rate decreased the yield of alfalfa the second year. Seeding native grasses into good to excellent condition range did not increase forage production with any of the species studied. Russian wildrye (*Elymus junceus*) could not be successfully interseeded at any of the sod control widths studied.

Interseeding research has been conducted by the Botany Department and Dickinson Experiment Station since 1969. These studies have included stand counts and/or production data from eight species interseeded into native mixed grass prairie with three different machines using eight types of sod control. Also included in these studies were two seeding dates and three fertility levels.

A small plot trial seeded in the fall of 1969 has shown that interseeding alfalfa into native mixed grass prairie can increase production as much as 32 per cent (Nyren, et al. 1978). These plots were seeded with a machine which used lister type blades to cut and remove the native sod from a 36 cm strip. While this machine achieved excellent sod control it left the soil surface very rough. Ten years after the seeding operation it is still difficult to drive or walk across the treated area. In an effort to overcome the rough destructive appearance of the lister type interseeder, a John Deere 1500 Powr-till seeder was purchased and equipped with a sprayer attachment. In the spring of 1976 two pastures were seeded, one to Russian wildrye (*Elymus junceus*) and one to Travois alfalfa (*Medicago sativa*). The sod control strips were 30 cm wide and treated with .7 Kg AI/ha of Glyphosate. Due to the lack of soil moisture, and lack of growth of the native sod, almost no control was achieved with the herbicide even on areas where much higher rates were applied.

In an effort to overcome this dependence on the height and growth of the vegetation at the time of seeding, a Melroe 701 drill was acquired and modified for interseeding. Since the drill was not available until May, 1977, there was no time to develop the best modification for interseeding. The drill was modified by moving the double disk furrow openers to the rear and placing a shank, with a 30 cm cultivator sweep attached, between the single coulter and the double disk furrow openers. A pack wheel was mounted behind the furrow openers to firm the seedbed. The pastures were again seeded with this machine in May, 1977. The results were excellent sod control but an uneven stand due to lack of control on seeding depth. The interseeded pastures have been grazed every year since they were seeded. In 1977 the seeded pastures were grazed during July by 10 heifers, in 1978 and 1979 by 10 cow-calf pairs. Included in the study with the interseeded Russian wildrye and Travois alfalfa is a fertilized pasture given yearly applications of 56 kg/ha N, and a pasture treated with the Melroe drill but not seeded, and an untreated check.

Although the alfalfa stand was uneven to begin with, it has spread and filled in to the point where a good stand has developed (figure 1). The Russian wildrye stand has remained poor throughout the entire 15 acre pasture. Data from the five pastures show that the alfalfa interseeded pasture has produced more kg/ha of beef than the fertilized pasture.

The precipitation during the course of the study is shown in table 1. Rainfall during the 1977 season was above the 88 year average in March, May and June. The total rainfall for 1977 was 18.4 cm above normal. The above normal precipitation in the spring and summer as well as the total precipitation had a very profound positive effect on the seedings done in the spring of 1977. While the 1978 spring and summer precipitation was more nearly normal, the total for the year was 4.4 cm above normal. The year 1979 was below normal dur-

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Figure 1. A view of the pasture interseeded to Travois alfalfa in May of 1979, using the Melroe drill equipped with modification number 4. This photo was taken in the fall of 1979.

Table 1. Monthly precipitation at the Dickinson Experiment Station.

	Year				88
Month	1977	1978	1979	1980	yr. avg.
January	.44	.25	.27	.51	.43
February	.36	.39	.98	.71	.41
March	1.31	.09	.23	.34	.72
April	.13	1.81	1.28	.03	1.44
May	2.60	3.99	.91	.12	2.37
June	5.38	2.10	3.06	2.67	3.57
July	1.08	2.41	2.22	1.43	2.16
August	1.52	2.01	2.21	3.31	1.73
September	5.78	2.56	1.27	.76	1.30
October	2.16	.29	.17	2.41	.84
November	1.09	1.34	.11	.37	.52
December	1.28	.39	.10	.42	.41
	23.13	17.63	12.81	14.51	15.90

ing the spring and summer months and 7.8 cm below normal for the year. The precipitation for the fall-winter of 1979 and the winter-spring of 1980 was one of the lowest on record. The October through May precipitation for 1979-80 was 5.3 cm compared to 18.1 cm for the 88 year average. This low precipitation had an adverse effect on the plots seeded in the spring of 1979 and on the 1980 yields.

Chemical Sod Control:

For this phase of the study a John Deere 1500 Powr-till drill equipped with a sprayer attachment was used. Plots were seeded with this machine in early June 1977 to study the effect of two herbicides applied at six band widths on plots seeded to two grasses and one variety of alfalfa. Plots were seeded with this machine in early June 1977 to study the effect of two herbicides applied at six band widths on plots seeded to two grasses and one variety of alfalfa. Plots seeded to Russian wildrye (*Elymus junceus*) and green needlegrass (*Stipa viridula*) were sprayed with Glyphosate at 2.2 kg AI/ha or Paraquat at .56 kg AI/ha on three band widths of 15, 20 and 30 cm over rows 46 cm apart. The plots seeded to Travois alfalfa (*Medicago sativa*) were treated with the same herbicide rates on 23, 32 and 36 cm bands over 61 cm row spacings.

The study was located on a silty range site which had been grazed annually as part of a large pasture. The trial utilized a complete randomized block design replicated three times.

Data on the amount of sod control were collected by using the point contact method. Seventy five point frames containing 10 points each were placed across the treated row. The degree of control was determined by recording a hit when the point came into contact with the base of a plant. If the leaves and stem of the plant were dead the plant was recorded as being controlled by the herbicide.

Analysis of the point data from the first phase of the trial indicated no control from either herbicide regardless of the width of the control strilp. Seedling counts done on the grass plots after one growing season showed no significant differences between any of the treatments. Seedling counts on Travois plots showed significantly more seedlings on the 23 cm Glyphosate treated plots than on any other treatment (table 2). The next best stand was on the 23 cm Paraquat treatment but this was not significantly higher than any other treatment except the 36 cm Paraquat. while the number of seedlings was adequate in the fall following seeding, many of the plants were small. Visual observations of the plots at the end of the second growing season showed little increase in size of the remaining alfalfa plants. In the fall of 1979, at the end of the third growing season, a plant count was again made (table 2). These data show that while the stands had decreased markedly the 23 cm Glyphosate plots still had significantly more seedlings per meter of row.

Table 2. Seedlings per meter of row on Travois seeded plots.

		Travois	
Treatment	Band width (cm)	1977	1979
Paraquat	23	14.6 ab[1]	2.6 ab
Paraquat	32	8.9 bc	3.6 ab
Paraquat	36	6.1 c	3.2 ab
Glyphosate	23	21.6 a	4.8 a
Glyphosate	32	13.3 bc	2.3 b
Glyphosate	36	12.6 bc	3.6 ab
Check	0	10.8 bc	2.5 ab

[1]Values followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

The poor control from the herbicide treatments on this and other trials conducted on native range, coupled with the high cost of these chemicals, forced a re-evaluation of our sod control methods. It was felt that mechanical sod control had more practical application in work on native range than chemical.

Mechanical Sod Control:

In the spring of 1977 a Melroe 701 drill was acquired and modified for interseeding. Because of the time

frame of the study, four modifications were designed and tested at the same time to determine which was the most effective. Modification number 1 consisted of removing the single coulter, which is standard equipment on the Melroe drill, and replacing it with two coulters set side by side 6 cm apart. This was then followed by a shank with a 30 cm cultivator sweep attached. The double disk seeding assembly was removed and a new seeding unit was constructed. The new seeding assembly utilized a seeding shoe from a Planet Jr. grass seeder to form the seedbed (figure 2). This was

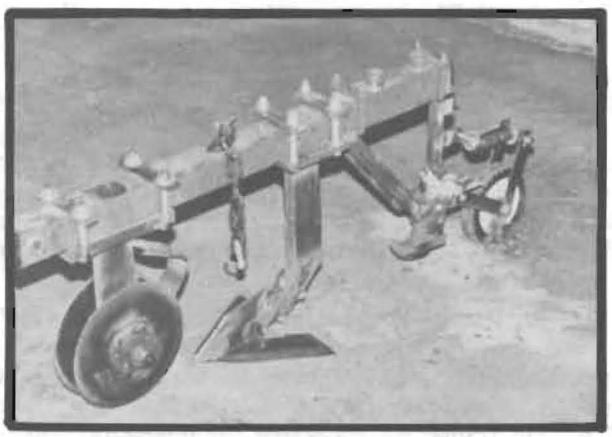

Figure 2. Modification number 1, showing the straight coulters side by side at 2¼" spacing, 12" cultivator sweep, and Planet Jr. seeding assembly with pack wheel.

followed by a packwheel to firm the seedbed. The second modification retained the stock single coulter followed by the seeding assembly described for modification number 1. Sod control was achieved by the use of two half sweeps, one mounted on each side of the seeded row. Since the support shanks for these sweeps were not mounted in line with the seeding assembly they achieved the same sod control without disturbance to the seeded row (figure 3).

Figure 3. Modification number 2, showing the single coulters in front of half sweeps. These two units were mounted on either side of the seeding assembly (background) which consisted of a straight coulter in front of the seeding assembly.

In the third modification the single coulter was removed and replaced with one of the double disk seeding assemblies. The double disk assembly cut and spread the sod to form a notch in which the shank and 30 cm cultivator sweep ran. These were then followed by a Planet Jr. seed assembly to which two side fins had been added to further spread the sod, leaving an open furrow. A packwheel followed in the furrow to firm the seedbed (figure 4).

Figure 4. Modification number 3, showing the double disk furrow operators mounted in front of a 12" sweep followed by the seeding assembly with fins and pack wheel attached.

The fourth modification was the same as the one used to seed the pastures in the spring of 1977, and used the stock single coulter followed by a shank and 30 cm cultivator sweep with the stock double disk seeding assembly. This was then followed by a pack wheel to firm the seedbed (figure 5).

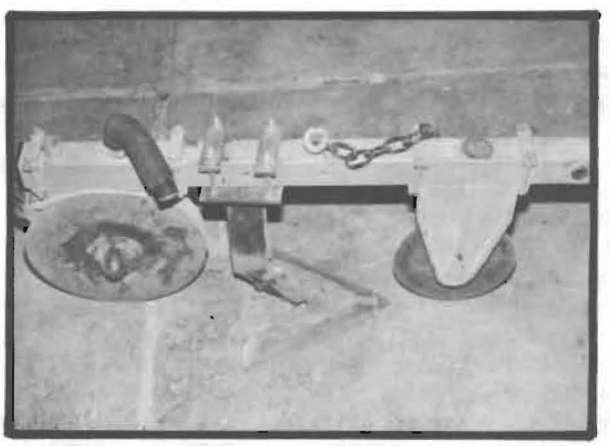

Figure 5. Modification number 4, showing the single coulter moved forward to make room for the 12" sweep, followed by the standard double disk furrow openers and pack wheel. The pack wheel assembly is not shown in this photo.

These four modifications plus the stock seeding unit were used in October of 1977 to seed crested wheatgrass (*Agropyron desertorum*) into native range. Three replications were seeded with each of the five units. Visual comparisons of the five units indicated that the

best seedbed was made by modifications 1 and 2. These plots were seeded again in May of 1978 to compare not only the five units but also the date of seeding.

Results from this phase of the study confirmed our visual observations that modification numbers 1 and 2 prepared the best seedbed. Table 3 shows the results of seedling counts done in the fall of 1978.

Table 3. Crested wheatgrass seedlings per M of row by seeding date.

Modification	October	May	Average
1[3]	49.3 a[1]	17.0 a[2]	33.3 a[1]
2	21.7 b	5.8 b	14.0 b
3	8.3 c	5.0 b	6.7 c
4	4.3 c	0.0 c	2.2 cd
5 (Stock unit)	2.3 c	0.4 c	1.4 d

[1]Values in the same column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.
[2]Values in the same column followed by the same letter are not significantly different at the 10% level according to Duncan's multiple range test.
[3]See text for further explanation of modifications.

Modifications 1 and 2 both had significantly more seedlings than any of the other treatments. In comparing the October vs. May seeding the fall seeding had a significantly (5% level) better stand on all treatments except modification number 3.

In the spring of 1978 another small plot study was undertaken to determine the amount of sod control necessary to establish Travois alfalfa, green needlegrass and Russion wildrye in native mixed prairie. Three rates of fertilizer were also evaluated to determine the value of adding nitrogen (N) and phosphorus (P).

Plots were set up to test three sod control widths; 0, 6 and 30 cm and three fertility rates; ON[5]OP, 56 kg/ha N[5]22 kg/ha P and 100 kg/ha N[5]45 kg/ha P. These plots were seeded on June 19 and 20, 1978. Seedling counts in the fall of 1978 showed no significant differences between any of the treatments on the green needlegrass plots (table 4). The Russian wildrye showed significantly better stands on the plots treated with the 6 cm sweep and those treated with the 30 cm sweep and given either the low or high rate of fertilizer. The addition of N and P fertilizer to the Travois seeded plots significantly decreased stands over the no sod control and 6 cm sod control treatments, however, height measurements show a significant (5% level) relationship between the addition of N and P fertilizer and increased height of the alfalfa seedlings (table 4).

Yield data was taken on the alfalfa seeded plots in August of 1978 and 1979 (table 5). Forage production was determined by clipping the vegetation in three 30*102 cm frames placed across the interseeded rows. The alfalfa was placed in separate bags, oven dried and weighed.

Table 4. Seedlings per meter of row and alfalfa seedling heights for grasses and alfalfa seeded into native mixed grass prairie.

Sod control (cm)	Fertility level (kg/ha)	Seedlings/M of row		1978	1979	Travois alfalfa
		Green needlegrass	Russian wildrye	Travois alfalfa	Travois alfalfa	seedling height (cm)
0	0	1.3 a[1]	1.0 b	35.8 a	9.7 a	10.1 c
6	0	1.9 a	7.6 a	31.2 ab	9.1 ab	12.3 b
30	0	2.1 a	3.0 b	21.3 bc	7.3 bc	12.7 b
30	56N + 22P	2.2 a	7.5 a	13.0 c	5.6 cd	20.8 a
30	100N + 45P	4.7 a	4.5 ab	9.6 c	4.0 d	22.3 a

[1]Values in the same column followed by the same letter are not significantly differnt at the 5% level according to Duncan's multiple range test.

Table 5. Yield of native mixed prairie interseeded to Travois alfalfa in June 1980.

Sod control (cm)	Fertility level (kg/ha)	Total 1978	Yields kg/ha 1979			1980		
			Grass	Alfalfa	Total	Grass	Alfalfa	Total
0	0	2919b[1]	1700a	259ab	1960a	896ab	78a	975ab
6	0	3199b	2182a	238abc	2420a	931ab	95a	1025ab
30	0	2338b	1765a	438a	2202a	746b	85a	831b
30	56N + 22P	3162b	2078a	321ab	2399a	1161a	128a	1288a
30	100N + 45P	3049b	2304a	177bc	2480a	1283a	102a	1385a
Check	0	4032a	2156a	0c	2156a	1177a	0a	1177ab

[1]Values in the same column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

Production was significantly decreased by all interseeding treatments during the 1978 growing season. The following year, however, there was no significant difference in total production among any of the treatments.

Alfalfa yields on the interseeded plots were highest on the unfertilized 30 cm sod control plot but was not significantly different from the other unfertilized treatments and the low fertility plots. It would appear that the poor stands resulting from the addition of N and P had a detrimental effect on the subsequent years production.

Forage yields in 1980 were well below 1978 and 1979 due to the dry conditions. Analysis of these data showed significantly less grass production on the unfertilized plots where the 30 cm sod control was used. Alfalfa yields were well below the previous year with no significant difference from any of the treatments. Total forage yields were the highest on the two fertility treatments and lowest on the unfertilized 30 cm control plots.

Conclusions:

Results of this and other work (Nyren et al., 1977) at the Dickinson Experiment Station showed that the application of Glyphosate or Paraquat on native mixed prairie for the purpose of sod control for spring seeding is unreliable. While some alfalfa plants became established on the herbicide plots the abnormally high rainfall during the establishment year may have had a more positive effect than the herbicide application.

This unreliability, coupled with the high cost, renders these chemicals undesirable for work on native range.

Interseeding native grasses into good to excellent condition native range has been shown to be of little value in improving overall production. A six year study (Nyren et al., 1978) at the Dickinson Experiment Station showed no increase in production from interseeding green needle grass into excellent condition range. Any increases in production were attributed to the mechanical interseeding treatment rather than production of the interseeded species.

The failure of Russian wildrye to become established is also consistent with research at Dickinson (Nyren et al., 1978) and Swiftcurrent, Saskatchewan, Canada (Dr. Tom Laurence, personal communications). russian wildrye seemed unable to compete with the native sod in any of the control widths studied.

Forage production on the mechanically interseeded plots was significantly reduced by all interseeding treatments during the first growing season. Pasture interseeding trials at Dickinson (Nyren et al., 1977) have shown that grazing the first year does not harm the newly seeded alfalfa plants. It has been observed, however, that grazing during the first season with yearling heifers was less detrimental to the newly seeded alfalfa than when cow-calf pairs were used. The calves seemed to use the control strips as walk-ways and in so doing caused more trampling damage.

The unfertilized 30 cm sod control plot produced 438 kg/ha of alfalfa in 1979, 20 per cent of the total production. While this is not a large increase in the total forage production, other work at Dickinson (Nyren et al., 1979) seems to indicate that an increase in beef production can be obtained with 10 to 20 per cent of the total forage production being comprised of interseeded alfalfa.

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Due to the mild, dry calving season in 1981, scour problems have been minimal. In the future the antidiarrheal preparation may be made available to a limited number of veterinarians or ranchers who would record and report results from using the compound. It is hoped that continued studies will verify these preliminary field trials.