Evaluation of Alfalfa Varieties Interseeded into Grassland

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Two trials conducted at the Dickinson Research Extension Center evaluated the performance of alfalfa varieties for the feasibility of their use as plant material to be interseeded into established grassland plant communities. Trial I started in 1983 and trial II started in 1986.

Procedure

A toolbar-type interseeder was constructed during the winter of 1982-1983 according to published plans (Chisholm et al. circa 1980) for the South Dakota State University pasture interseeder model 1979. Improvements to the interseeding machine were made as indicated from the results of concurrently conducted trials that developed and tested interseeding machine design modifications.

Interseeded alfalfa variety trial I was established on 13 acres located on the S½, SE¼, SW¼, sec. 23, and SW¼, SE¼, sec. 23, T. 140 N., R. 97 W., at the Dickinson Research Extension Center. The 48 X 390 foot plots were arranged in a randomized block design with three replications. The established plant community was mixed grass prairie. Scattered crested wheatgrass plants grew throughout the study site. The soils were Vebar fine sandy loam, Morton silt loam, and Regent silty clay loam. The alfalfa varieties included in the study were Anik, Drylander, Kane, Prowler, Rangelander, Spredor II, Travois, and Vernal. The seed was inoculated with rhizobium bacteria. The alfalfa varieties were interseeded 27 and 28 April 1983 at the seeding rate of 0.50 lbs PLS per row per acre. The unmodified toolbar interseeding machine with four plow shanks set at 3-foot row spacings was used. The furrows were opened with 3-inch twisted chisel plow shovels (Manske 1983).

Interseeded alfalfa variety trial II was established on 0.59 acres located on the SE¼, SW¼, SE¼, sec. 22, T. 143 N., R. 96 W., at the Dickinson Research Extension Center Ranch Headquarters. The 80 X 320 foot plots were arranged in a block design with three replications. The established plant community was mixed grass prairie. The soil was Shambo loam. The alfalfa varieties included in the study were Anik, Drylander, Kane, Mandan A1801, Rangelander, Spredor II, Travois, and Ladak. The seed was inoculated with rhizobium bacteria. The alfalfa varieties were interseeded 22 April 1986 at the seeding rate of 0.50 lbs PLS per row per acre. A modified toolbar interseeding machine with two plow shanks set at 10-foot row spacings was used. The furrows were opened with double straight coulters spaced 3-inches apart, followed by a 3-inch twisted chisel plow shovel that was set at a 3-inch depth and had an alfalfa seed tube and a pack wheel behind the shanks, followed by a 12-inch cultivator sweep that had the point removed and was set to undercut the sod about one inch above the seedbed (Manske 1986).

Alfalfa density was determined by counting plants per meter of row. Plant heights were determined by measuring from soil surface to top of plant. Data were collected monthly during June, July, and August each year for both trial I and trial II, with the growing season of 1989 the termination year for each study.

The plots for trial I were reevaluated during the growing season of 2004, 22 years after the plots had been seeded. All of the alfalfa plants growing within a 48 X 300 foot area of each plot were counted. The plants were separated into three size categories: small--single stem, medium--less than 6-inch diameter crown, and large--greater than 6-inch diameter crown. The color of the flowers was recorded for each plant. Differences between means of alfalfa varieties were analyzed by a standard paired-plot t-test (Mosteller and Rourke 1973).

Results

Six pasture-type alfalfas were evaluated in both trial I and trial II. Each trial had an additional pasture-type alfalfa that was not included in the reciprocal trial. The standard control varieties were Vernal and Ladak for trial I and trial II, respectively.

Seedling densities were high in 1983, during the first growing season of trial I (table 1). Anik, Travois, Drylander, Kane, Spredor II, and Rangelander had the greatest number of seedlings per meter of row. Plant densities decreased greatly

between the first and second growing seasons. During the second year, Travois, Spredor II, Rangelander, Prowler, and Kane had the greatest number of plants per meter of row. Plant densities were generally low, ranging between 0.40 and 1.35 plants per meter of row in trial I from 1985 to 1989, and plant densities were not different among the alfalfa varieties during each growing season from 1985 to 1988 (table 1). A severe drought occurred during 1988, and the plant densities were between 5% and 37% lower during 1989. Travois, Spredor II, and Drylander had the greatest number of plants per meter of row during 1989. Between 1989 and 2004, plant densities decreased slightly for each alfalfa variety except Prowler, which showed a slight increase in density. Spredor II, Prowler, Drylander, and Travois had the greatest number of plants per meter of row, and Vernal had the lowest number of plants per meter of row during 2004 (table 1).

Seedling densities were excellent in 1986, during the first growing season of trial II, and there were no differences in the number of seedlings per meter of row among the alfalfa varieties (table 2). Plant densities decreased between the first and second growing seasons. From 1987 to 1988, plant densities ranged between 2.95 and 6.26 plants per meter of row in trial II. Kane, Travois, Ladak, Spredor II, and Rangelander had high mean plant densities during the 1987 to 1989 growing seasons (table 2). A severe drought occurred during 1988, and plant densities were between 40% and 65% lower during 1989. Plant densities in trial II were greater than densities in trial I even though the younger plants in trial II had greater percent reductions in plant densities as a result of the drought conditions of 1988 than the percent reductions of the older plants in trial I. Anik in trial II increased 5% in plant density following the drought.

Plant heights among the alfalfa varieties were not very different during each growing season for both trial I (table 3) and trial II (table 4). Plant heights in both trials were greater during 1987.

Plant density of the pasture-type alfalfas decreased an average of 42% between 1989 and 2004. The range of decrease was 1% to 67%. The density of only one variety did not decrease: Prowler increased 22% in plants per meter of row. Between 1989 and 2004, plant density of the control variety, Vernal, decreased 88%, the greatest decrease for all of the varieties.

The large plants, those with crowns greater than 6 inches in diameter, had the greatest density (table 5) and formed the highest percentage of the plant population (table 6) for all alfalfa varieties in 2004. For most alfalfa varieties, the densities of the small and medium-sized plants were similar (table 5). For Drylander, Prowler, and Spredor II, plant densities were lower for the small plants than for the medium-sized plants (table 5).

Most of the plants for the varieties Prowler, Rangelander, Spredor II, Travois, Vernal, and Kane had dark or medium shades of purple or blue flowers during the 2004 growing season (table 7). Most of the plants for the varieties Anik and Drylander had yellow flowers in 2004 (table 7).

The species composition of the plant community shifted from a mixed grass prairie with crested wheatgrass plants scattered throughout in 1983 to a community dominated by crested wheatgrass with a few remnant native grasses and forbs growing in scattered locations in 2004.

Discussion

The results from these two trials, with emphasis on the 1987 to 1989 and the 2004 data from trial I and the 1987 to 1989 data from trial II, showed that Travois and Spredor II had superior performances. Drylander and Prowler performed well. Rangelander and Kane performed well in the trials through 1988, but their plant densities decreased greatly between 1989 and 2004. The alfalfa varieties that could be used as plant material to be interseeded into established grassland plant communities were pasture-type (*Medicago falcata*) alfalfas and included Travois, Spredor II, Drylander, Prowler, Rangelander, Kane, and Anik. The varieties with a high percentage of *M. falcata* parentage persist through adverse conditions: these varieties have traits that result in long stand longevity.

Anik generally had lower plant densities, and the plant heights usually ranked in the medium to short categories. In the herbage production trials, Anik was rarely among the high-producing varieties. However, Anik should not be omitted from a list of varieties to be used as plant material to be interseeded into established grassland communities. Anik is 100% *Medicago falcata* and has golden-yellow flowers. Its fine stems seem to maintain their leaves well, and Anik appears to hold its own against the competition from grassland plants. Anik was the only variety in trial II to increase in plant density the first growing season after a drought season.

Vernal had plant densities and plant heights comparable to those of the pasture-type alfalfas during the first seven years of data collection. However, results of the reevaluation of the study plots 22 years after seeding showed that Vernal interseeded into grassland communities did not perform as well over the long term as the pasture-type alfalfas. Stand longevity would be expected to be shorter for Vernal than for *M. falcata* varieties. The alfalfa varieties with a high percentage of *M. sativa* parentage would not be expected to perform well when interseeded into grassland communities.

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Table 1. Plant density per meter of row for trial I.

Alfalfa Variety	1983	1984	1985	1986	1987	1988	1989	2004
Anik	71.34a	0.22c	0.58a	0.40a	0.63a	0.62a	0.54b	0.23b
Drylander	56.70ab	0.38bc	0.62a	0.51a	0.91a	1.01a	0.96ab	0.80a
Kane	47.03b	0.57b	0.65a	0.43a	0.93a	0.64a	0.54b	0.18bc
Prowler	31.86d	0.81ab	0.81a	0.56a	0.89a	0.79a	0.68b	0.83a
Rangelander	37.22b	0.81ab	1.17a	0.64a	0.91a	0.69a	0.46b	0.23b
Spredor II	38.79c	0.88a	0.92a	0.61a	0.96a	1.09a	0.98a	0.97a
Travois	57.39a	2.08a	1.35a	0.81a	1.21a	1.31a	1.01a	0.41a
Vernal	29.28d	0.44bc	0.95a	0.56a	0.98a	1.08a	0.68b	0.08c

Means in the same column and followed by the same letter are not significantly different ($P<0.05$).

Table 2. Plant density per meter of row for trial II.

Alfalfa Variety	1986	1987	1988	1989
Anik	14.09a	3.58d	2.95c	3.11a
Drylander	17.20a	4.47c	2.96c	1.54a
Kane	24.73a	6.22ab	5.31ab	2.53a
Mandan A1801	14.20a	3.38d	5.58a	2.53a
Rangelander	11.84a	4.45c	4.09bc	2.44a
Spredor II	16.55a	5.33abc	4.49b	2.09a
Travois	25.80a	6.26a	4.78b	1.67a
Ladak	16.22a	5.58b	4.49b	1.95a

Means in the same column and followed by the same letter are not significantly different ($P<0.05$).

Table 3. Mean plant height (inches) for trial I.

Alfalfa Variety	1986	1987	1988	1989
Anik	12.46b	17.93b	10.91b	15.15a
Drylander	14.93ab	20.91ab	12.69ab	16.56a
Kane	14.07ab	19.48ab	9.26b	14.51a
Prowler	15.85a	20.48ab	12.22ab	15.28a
Rangelander	14.99ab	18.11b	12.97ab	14.63a
Spredor II	15.73a	20.30ab	12.78a	15.38a
Travois	15.30a	22.41a	13.27ab	15.66a
Vernal	15.93a	22.16a	13.99a	14.53a

Means in the same column and followed by the same letter are not significantly different ($P<0.05$).

Table 4. Mean plant height (inches) for trial II.

Alfalfa Variety	1986	1987	1988	1989
Anik	5.15a	8.22b	7.85a	6.74a
Drylander	4.87a	10.59ab	6.48a	7.10a
Kane	5.12a	11.96a	7.43a	6.90a
Mandan A1801	4.69a	8.36b	7.40a	7.45a
Rangelander	3.91a	11.75a	6.41a	7.74a
Spredor II	5.19a	10.81a	7.98a	7.20a
Travois	5.09a	12.40a	7.38a	8.02a
Ladak	5.30a	12.78a	7.94a	8.10a

Means in the same column and followed by the same letter are not significantly different ($P<0.05$).

Table 5. Density per meter of row of small, medium, and large sized plants for trial I, 22 years after seeding.

Alfalfa Variety	Small single stem	Medium <6 in. diameter	Large >6 in. diameter	Total
Anik	0.04b	0.05b	0.14b	0.23b
Drylander	0.14a	0.18a	0.47a	0.80a
Kane	0.05b	0.04bc	0.10bc	0.18bc
Prowler	0.14a	0.24a	0.46a	0.83a
Rangelander	0.06b	0.08b	0.10b	0.23b
Spredor II	0.24a	0.28a	0.46a	0.97a
Travois	0.05b	0.06b	0.30a	0.41a
Vernal	0.01c	0.02c	0.06c	0.08c

Means in the same column and followed by the same letter are not significantly different ($P<0.05$).

Table 6. Percent of plants in three size categories and the number of plants per acre for trial I, 22 years after seeding.

Alfalfa Variety	Small single stem	Medium <6 in. diameter	Large >6 in. diameter	Plants per acre
Anik	17.09	23.05	59.86	997
Drylander	18.02	22.83	59.15	3525
Kane	24.23	21.15	54.62	786
Prowler	16.44	28.61	54.95	3652
Rangelander	24.31	34.02	41.17	1029
Spredor II	24.23	28.26	47.52	4304
Travois	10.75	15.20	74.06	1801
Vernal	11.57	17.36	71.07	366

Table 7. Percent flower color of alfalfa plants for trial I, 22 years after seeding.

Alfalfa Variety	Purple and Blue Flowers %	Pale Blue Flowers %	White Flowers %	Yellow Flowers %
Anik	7.08	1.11	2.12	89.69
Drylander	14.30	1.74	4.63	79.32
Kane	62.38	21.60	10.06	5.96
Prowler	88.37	0.44	3.49	7.70
Rangelander	81.08	6.27	2.65	10.00
Spredor II	79.69	4.93	1.73	13.66
Travois	63.97	20.38	1.97	13.68
Vernal	63.36	5.79	1.65	29.20
Total Plants	58.08	5.32	3.15	33.45

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