Initial Stands of Interseeded Alfalfa[1]

M. D. RUMBAUGH and T. THORN

Associate Agronomist and former Instructor, respectively. Department of Agronomy, South Dakota Agricultural Experiment Station, Brookings.

Highlight

Alfalfa was interseeded on range sites in South Dakota, using different implements, seed rates, dates of seeding, and legume strains. A majority of the sixteen trials resulted in the establishment of some legume plants and were considered successful. Most of the failures occurred in one county owing to drought and grasshopper damage in July and August.

The re-introduction of leguminous plants into grasslands where the indigenous legumes have been destroyed may be a profitable management practice. Gomm (1964) observed that mixtures of either sweetclover (*Melilotus officinalis* (L.) Lam.) or Ladak alfalfa (*Medicago sativa* L. x *M. falcata* L.) with Nordan crested wheatgrass (*Agropyron desertorum* (Fisch. ex Link) Schult.) produced more forage than either grass or legumes alone. Furthermore, protein content of grass grown in mixtures with legumes was higher than when grown in pure stand. The leguminous forage itself contributed directly to both the quantity and the quality of feed produced.

In common with other previous works which Gomm reviewed, his studies were conducted on abandoned dryland crop sites where the seedbed was prepared by plowing with a moldboard plow, packing with a culti-packer, and dragging with a float to smooth the soil surface. Many range sites are not topographically suited or do not have soils which permit seedbed preparation of this sort. Other grasslands may not have deteriorated to the point where such an operation is needed or desirable. Interseeding may then be a logical technique for the establishment of alfalfa.

Hervey (1960) cited work in Wyoming where interseeding of 2.2 pounds of crested wheatgrass seed and 0.5 pound of Ladak alfalfa seed per acre resulted in 100 crested wheatgrass and 4 alfalfa seedlings per 100 square feet. Application of nitrogen did not increase the number of seedlings of either of the interseeded species.

At the Archer Field Station east of Cheyenne, Wyoming, interseeding native short-grass sod with crested wheatgrass and alfalfa caused an increase in sheep-days per acre and in pounds of sheep gain per acre. During the third year of grazing, lamb gains per acre were 65% higher on the interseeded than on the untreated native sod.

Charles (1962) reviewed 73 published articles which considered pasture establishment by surface-sowing methods. He pointed out that over 100,000 acres were sod sown by machine in Australia between 1955 and 1957. Little of this acreage, however, was seeded with alfalfa. The report which follows concerns the initial stands of alfalfa obtained following experimental interseeding on several dryland range and pasture locations in South Dakota.

Locations and Test Results

Butte County.—Three different test areas on clayey range sites designated A, B, and C were selected in Butte County in 1961 for interseeding. All are included in the 10 to 14 inch precipitation zone and all were in very poor condition following two years of severe drought. Sites A and B were very similar in soil type and topography and were sparsely covered by Western wheatgrass (*Agropyron smithii* Rydb.), prickly pear cactus (*Opuntia humifusa* Raf.), and several species of undesirable forbs. Site C was more nearly level than either A or B and more densely vegetated with Western wheatgrass, buffalo grass (*Buchloe dactyloides* (Nutt.) Engelm.), blue grama (*Bouteloua gracilis* (HBK.) Lag.), and prickly pear cactus. The soils of these areas were derived from Pierre shale and characteristically exhibit very slow internal drainage.

Site A was planted on only one date whereas the remaining two areas were seeded on three dates in late summer, fall and spring. John Deere and Nisbit grassland drills were used for sowing without prior seedbed preparation. Plots were 8 by 60 feet and were arranged in randomized complete block designs with 3 replications for each date of seeding at each test site.

Two varieties of alfalfa developed for grazing were interseeded. These were the root-proliferating strain, Travois (Rumbaugh, 1964), and the broad crowned rhizomatous type, Teton (Adams and Semeniuk, 1958). Travois was planted in 3 grass mixtures whereas Teton was seeded by itself. The seeding rate was 1 lb./acre of alfalfa. All seedings were grazed to some extent during the experiment.

Drought during 1961 limited germination and much of the seed planted in that year did not grow until the following spring. The nearest weather station (Newell 2NW) was located 11, 16, and 8 miles west of sites A, B, and C, respectively. Table 1

[1] *Published with the approval of the Director as Paper No. 666, Journal Series South Dakota Agricultural Experiment Station.*

Table 1. Total precipitation in inches received during the first week, month, and year after seeding.

Test	Date of seeding	Precip. after seeding one week	one month	one year
Butte County				
1 (Site A)	8/23/61			
2 (Site B)	8/23/61	.00	1.46	22.76
3 (Site C)	8/23/61			
4 (Site B)	10/6/61			
5 (Site C)	10/6/61	.43	.51	22.45
6 (Site B)	4/19/62			
7 (Site C)	4/19/62	.00	5.93	24.28
Shannon Co.				
8	4/25/62	.03	3.07	16.30
9	4/17/63	.66	1.85	14.71
10	10/29/63			
11	10/29/63	.00	.00	17.34
12	10/29/63			
Harding Co.				
13	5/16/63			
14	5/16/63	.00	4.83	16.18
Brookings Co.				
15	4/25/63	1.25	3.75	31.94
16	4/15/64	.88	3.24	.....

presents total precipitation received during the first week, month, and year after seeding at the recording station and is indicative of the amounts at the test areas. The 1 year figures were markedly increased by 8.60 inches of moisture falling in May, 1962. This was a departure of 6.11 inches above the long time average for that month and undoubtedly was beneficial for legume stand establishment.

Table 2 shows the numbers of alfalfa plants surviving to July 14, 1964, in the Butte County trials. Site A, which was seeded only in August, 1961, had an average of 6,368 alfalfa plants per acre. Three to five thousand plants per acre would be an excellent stand at this location. Similarly, the April, 1962, planting at site B was very successful. An average of 9,450 alfalfa plants per acre survived to July, 1964. Tests 2 and 4, seeded in summer and fall at this site, were failures.

All 3 dates of seeding were successful at site C in Butte County although the best stand resulted from the spring planting identified as test 7 in table 2. Averages of 4,510, 5,198 and 6,850 alfalfa plants per acre were obtained for the summer, fall and spring seedings, respectively. At the time they were last observed these alfalfa plants were comparatively small but vigorous, flowering, and in some instances, setting seed. No surface indications of lateral spread by either variety was detected. Variety of legume and seeding implement did not significantly effect the final stand attained.

Shannon County.—Five attempts were made to interseed alfalfa into the range in Shannon County. These trials were placed on clayey and on overflow, 15 to 19 inches precipitation range sites at different times. Soils were unclassified but are included in the White River Badlands Land Type. Various plot sizes, varieties, and species of legumes were used. A single-disk grain drill, a double-disk grassland drill, and a modified flexiplanter were used. The flexiplanter was similar to the unit described by Hervey (1960) except that it was preceded by a single 6 inch sweep. The experiments utilized split-plot, randomized complete-block, and systematic designs. Precipitation data from the nearest recording station 15 miles distant is included in Table 1 for tests 8 through 12.

In these trials, no alfalfa plants survived to one year of age. Germination and early seedling development were excellent in most plots. Visual examination of the young plants indicated that drought conditions during July and August, as well as infestations of grasshoppers contributed to the rapid stand loss. Four varieties of alfalfa and a composite population of biennial sweetclover were seeded on October 29, 1963, as test 10 on an overflow range site with limited competition from Western

Table 2. Alfalfa stands established by interseeding in sixteen tests in South Dakota.

Test	Range site[1] & precip. zone (in.)	Final stand count Date 1964	Alfalfa plants/ acre
Butte County			
1 (Site A)	Cl., 10-14	7/14	6,368
2 (Site B)	Cl., 10-14	7/14	0
3 (Site C)	Cl., 10-14	7/14	4,510
4 (Site B)	Cl., 10-14	7/14	0
5 (Site C)	Cl., 10-14	7/14	5,198
6 (Site B)	Cl., 10-14	7/14	9,450
7 (Site C)	Cl., 10-14	7/14	6,850
Shannon County			
8	Cl., 15-19	9/10	0
9	Ov. 15-19	9/10	0
10	Ov. 15-19	9/10	0
11	Cl., 15-19	9/10	0
12	Cl., 15-19	9/10	0
Harding County			
13	PS, 10-14	9/ 9	2,262
14	Si., 10-14	9/ 9	590
Brookings County			
15	Si., 20-24	8/ 6	13,712
16	Si., 20-24	9/14	53,110

[1] Range site types: Cl=Clayey; Ov=Overflow; PS=PanSpot; Si=Silty.

wheatgrass and green needlegrass (*Stipa viridula* Trin.). Germination the following spring was sufficient to produce good stands by June of that year. At that time the alfalfa plots averaged 24,815 plants per acre. By July 16, 1964, half of these plants had died due to desiccation and by September 10 the remainder had perished. These results are typical of those obtained at this location.

Harding County.—Pan spot and silty sites, designated as tests 13 and 14, were selected in Harding County and interseeded on April 16, 1963. These sites were adjacent and located in an experimental pasture where grazing has been at a low utilization rate for more than 10 years. The climate is semiarid with about 10 of the 14 inches average annual precipitation falling during the growing season. The pan spot test received run off moisture from the surrounding slopes of the silty test. Major native grass species were blue grama, Western wheatgrass, and buffalograss.

Both sites were planted with 6 varieties of alfalfa at a rate of 1 lb./acre seed in contour furrows 36 inches apart. The implement consisted of John Deere flexiplanter units preceded by 6-inch cultivator sweeps to remove strips of existing sod. The sites were not completely protected from grazing and both livestock and antelope had occasional access to the plots.

Alfalfa stands were first determined in April of the seeding year. Averages of 18,364 and 52,972 plants per acre were determined for tests 13 and 14, respectively. Satisfactory numbers of plants were obtained with each of the six strains. Data taken throughout 1963 and 1964 demonstrated a steady decline in alfalfa plant numbers. As shown in Table 2, the pan spot site contained 2,262 plants per acre and the silty site 590 plants per acre in September, 1964. Some legumes survived in all plots and at the time they were last examined appeared to be actively growing, thrifty, and in some instances were flowering and forming seed. At that time there was no surface evidence of root proliferation by either Rambler or Travois.

Brookings County.—A silty 20- to 24-inch South Dakota, site consisting of level sod formed by smooth bromegrass (*Bromus inermis* Leyss.) was chosen for test number 15. Rambler, Semipalatinsk, Teton, Travois, and Vernal alfalfa were interseeded at a rate and by methods identical to those described for the Harding County tests except that livestock was excluded. Despite the extreme degree of competition from the grass, alfalafa seeded on April 25, 1963, averaged 51,319 young plants per acre one month later. Table 1 indicates the favorable precipitation pattern occurring throughout the test period. Vigorous growth was observed by those legumes remaining at the date of the last stand count. At that time, August 6, 1964, an average stand of 13,712 plants per acre was found. Differences among the performances of the five varieties were not statistically significant.

A second silty 20- to 24-inch site designated as test 16 was selected for experimentation in 1964. This pasture was dominated by Kentucky bluegrass (*Poa pratensis* L.). It was interseeded at the rate of 1 lb./acre of seed with Rambler, Semipalatinsk, Teton, and Vernal alfalfa in April, 1964. Moisture conditions after seeding were favorable for germination and seedling development. Table 1 shows that .88 inches were received the first week and 3.24 the first month after planting. An excellent initial stand was obtained despite the fact that the pasture was heavily stocked with dairy cattle throughout the growing season. By June 18 of the seeding year the average population density was equivalent to 93,790 seedlings per acre. Although mortality was high in July and August, on September 14, 1964, the stand still averaged 53,110 alfalfa plants per acre.

Discussion and Summary

A primary objective of the trials in South Dakota was to measure the risk of failure incurred when alfalfa is interseeded into sods in South Dakota. The stands cited for the trials probably are not yet stable. They do, however, indicate the probability of success for the interseeding of alfalfa under these conditions. Results in Brookings County are very favorable even though the oldest stand was seeded in the spring of 1963. The very high population densities observed in the fall of 1964 were in excess of those needed for successful interseeding. These results are believed to be due to the near ideal amounts and distribution of rainfall received during the growing seasons and test soils which permitted rapid infiltration of the precipitation with little lost by run off. Removal of a 6-inch strip of the existing sod appeared to be sufficient for the purposes of these tests. The presence of dairy cattle in the pasture in which trial 16 was located did not appear disadvantageous. The livestock were not observed to graze the test area until the latter part of the summer.

Five of the 7 trials in Butte County were successful. These sites had more than the 5,000 alfalfa plants per acre which had arbitrarily been selected as the goal for the 10- to 14-inch precipitation zone. Two tests at this location were failures, both at site B (Table 2). The causes for the failures are not known. Sites A and B were similar in all re-

spects although located approximately 5 miles from one another. Test 1 at site A was seeded at the same time and under the same conditions as test 2 at site B. The former resulted in an excellent stand of alfalfa whereas the latter did not.

Two additional trials in Harding County were located in the same precipitation zone. Although a considerable number of plants have survived two growing seasons in each trial, the tests are considered to be only partially successful. Final assessment of these trials will be largely influenced by the ability of the remaining plants to propagate by seed or root proliferation. The pan-spot site of test 13 benefited from the additional runoff moisture from the adjacent slopes of test 14. This is believed to be the major cause contributing to the higher stand density on the pan-spot soil.

Five tests in Shannon County, South Dakota, must all be considered failures in that no alfalfa plants were established. Table 1 indicates that moisture conditions following the seeding of tests 8 and 9 were comparable to those during the Butte County tests. However, observations made during the first growing season clearly indicated dessication and grasshopper damage as the causes of the failures in Shannon County. New seeding techniques and possibly grasshopper control will be required for the successful introduction of alfalfa into range environments similar to those of trials 8 through 12. At the other test locations the probability of a successful outcome appears high. These studies are being continued to determine the longevity of the legumes and to obtain data of value to ranchers and others interested in range and pasture research.

LITERATURE CITED

ADAMS, M. W. AND GEORGE SEMENIUK. 1958. Teton Alfalfa. South Dakota Agr. Exp. Sta. Bul. 469. 8 p.

CHARLES, ALLEN H. 1962. Pasture establishment by surface-sowing methods. Herbage Abstr. 32:175-181.

GOMM, F. B. 1964. A comparison of two sweetclover strains and Ladak alfalfa alone and in mixtures with crested wheatgrass for range and dryland seeding. J. Range Manage. 17:19-22.

HERVEY, D. F. 1960. Improving Great Plains rangelands by interseeding. Proc. 8th Intern. Grassl. Congr. p. 216-220.

RUMBAUGH, M. D., COLBURN, J. D., AND G. SEMENIUK. 1964. Registration of Travois alfalfa. Crop Sci. 4:117.