

Effects of Planting Dates, Seeding Rates, and Row Spacings on Range Seeding Results in Western Colorado¹

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The success of range seeding is highly dependent upon the date of seeding. Early spring and late fall are the planting periods usually recommended for range seeding in western Colorado and adjacent parts of Utah (Hull and Doran, 1950; Doran, Wasser, and Hervey, 1952; Plummer, Hull, Stewart, and Robertson, 1955). In southwestern Colorado, however, August plantings have been suggested (Hull and Johnson, 1955). In a one-year test in northwestern Colorado, highest yields of crested wheatgrass (*Agropyron desertorum*) and intermediate wheatgrass (*A. intermedium*) were reported from late-August plantings. Early-May plantings gave the lowest yields. Yields from October plantings were intermediate. All determinations were made in the third growing season (Hervey, 1958).

In some cases, row width and seeding rate apparently affect yields of herbage from seeded range. At several locations in southern Idaho, yields of crested wheatgrass planted in 6-, 12-, 18-, and 24-inch row spacings did not differ significantly. However, the

6- and 12-inch row spacings gave better control of cheatgrass (*Bromus tectorum*) and brush (Hull, 1948). Near Flagstaff, Arizona, a 6-inch row spacing at a high seeding rate gave highest yields of crested wheatgrass in the second growing season, while an 18-inch spacing with a low seeding rate gave the lowest yields. In the fourth and fifth growing seasons, the 18-inch spacing produced the highest yields while the 6-inch spacing had the lowest. Yields from a 12-inch spacing were intermediate during all years. (Lavin and Springfield, 1955). In northwestern Colorado, crested wheatgrass was planted at 5 and 10 pounds per acre at 6-, 8-, 12-, and 16-inch row spacings. After 9 years there were no significant differences in the yield due to seeding rate or row spacing (Hervey and Noll, 1955). Several of these writers suggested that a 6-to 14-inch spacing would be a suitable compromise when control of erosion and reinvasion of shrubs and weeds as well as maximum yield are considered.

This paper reports studies of the effects of seeding date on stand establishment and of row width and seeding rates on herbage yields in western Colorado.

Methods

The date-of-planting study was begun in September 1948, seven miles southwest of Crawford, Colorado, at an elevation of 7500 feet. The native vegetation prior to plowing for this study was mostly big sagebrush (*Artemisia tridentata*) and scattered juniper

trees (*Juniperus* sp.) Average annual precipitation was estimated to be 12 inches. Distribution ordinarily is rather even throughout the year except in June and early July, when rainfall is only about half that in the other months.

Crested wheatgrass and smooth brome (*Bromus inermis*) were planted in 10-foot rows at the beginning of each month from April through November during the four years of the study. Four replications were used. The plantings were evaluated in 1956 by numerical ratings based on number and distribution of plants (0=no stand; 10=perfect stand).

The seeding rate and row-spacing study was established in October 1949 about 2 miles west of the date-of-planting study. It was in a clearing in the pinyon-juniper that had previously been cleared for farming, but had been abandoned for over 20 years. At the time of plowing for this study, the area was covered by a dense stand of big sagebrush. Elevation and annual precipitation were similar to the other area. Crested wheatgrass was planted at 3, 6, and 9 pounds per acre in 7-inch row spacing, 3 and 6 pounds in 14-inch spacing and 2 and 6 pounds in 21-inch spacing. Intermediate wheatgrass was planted at 4, 8 and 12 pounds per acre in 7-inch row spacing, and 4 and 8 pounds in 14-inch spacing, and 2½ and 8 pounds in 21-inch spacing. The plots are 33 x 132 feet; two replications were planted. Herbage-yield samples were obtained in 1952, 1956, and 1957 by clipping 9.6-square-foot plots.

Results

Dates of Planting

The only planting date that consistently gave satisfactory stands of crested wheatgrass was April 1 (Table 1). Satisfactory stands (rated "5" or better) were obtained at each of the planting dates in at least one of the years.

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Table 1. Average 1956 stand ratings of crested wheatgrass and smooth brome planted in different months 1948 through 1952

	1948	1949	1950	1951	1952
Crested wheatgrass					
April		10.0	10.0	7.8	9.5
May		10.0	8.5	0.5	0.5
June		9.8	8.5	2.0	2.8
July		2.0	7.8	0.2	2.5
August		8.8	10.0	0.0	0.0
September	8.0	9.5	10.0	0.0	0.0
October	9.0	9.8	1.2	9.0	0.0
November	9.5	10.0	0.0	8.8	
Smooth brome					
April		7.0	5.2	5.2	6.8
May		6.2	5.0	4.5	8.0
June		7.8	3.8	3.0	0.5
July		1.5	3.0	4.5	0.8
August		5.8	4.0	6.5	0.2
September	7.8	7.2	3.5	7.5	1.5
October	7.2	1.8	0.2	7.8	6.2
November	8.5	3.2	0.0	1.8	

However, all planting dates except April 1 produced at least one failure or poor stand during the test period. Late-fall plantings were frequently successful. In this test, all failures from October and November plantings resulted from late-fall germination; in the successful late-fall plantings, the seedlings did not emerge until the following April.

The effects of planting date on establishment of smooth brome are not as clear cut as with crested wheatgrass. Stands of smooth brome were generally poorer than those of crested wheatgrass, probably because some of the smooth brome died out. Comparisons with earlier incomplete plot ratings indicate that some of the stands died out prior to 1956. Even so, smooth brome became established at some planting dates when crested wheatgrass did not produce a satisfactory stand. This indicates that smooth brome can become established under a wider range of temperature and moisture conditions than can crested wheatgrass even though it may be less able to persist after establishment. Current studies tend to bear this out.

Attempts were made to correlate stand establishment with

limited and incomplete precipitation records obtained from a rain gage near the plots. No correlation between stand establishment and precipitation at the time of seeding, the period following seeding or time of emergence could be found. No correlation was found between stand establishment and soil moisture at time of planting.

Rate-of-Seeding and Row-Spacing

Because of a heavy invasion of cheatgrass, stand establishment in the rate-of-seeding and row-

spacing study was somewhat erratic, and the yield data were variable. The cheatgrass retarded growth of the seeded grasses in 1950 and 1951. However, by 1952, the successful grass stands were well established and growing vigorously.

Rate-of-seeding was found to have no significant influence on herbage yields of either species at any row spacing. Because of this, the seeding-rate data were combined with the row-spacing data and are not presented separately.

In 1952, the 7-inch row spacing produced higher herbage yields of both species than the 14- and 21-inch spacings, but analysis of variance showed these differences to be not significant (Table 2). In 1956, a dry year, and in 1957, a year of average precipitation, the highest herbage yields were produced by the 21-inch row spacing while the 7-inch spacing produced the least herbage. The 12-inch spacing produced slightly more herbage than the 7-inch spacing but produced significantly less than the 21-inch spacing. Size of the individual plants appeared to be the reason for the differences in yield in 1956 and 1957. In both years plants at the 21-inch spacing were much taller, coarser,

Table 2. Air dry herbage produced during three years by crested wheatgrass and intermediate wheatgrass planted October 1949 at three row spacings

Species and row spacing	1952	1956	1957
Crested wheatgrass	(Pounds per acre)		
7 inches	1033	508	1015
14 inches	902	635	1144
21 inches	910	718	1515
Least significant difference .05	NS	NS	202
Least significant difference .01	NS	NS	307
Intermediate Wheatgrass			
7 inches	798	546	934
14 inches	607	608	1029
21 inches	497	702	1203
Least significant difference .05	NS	63	165
Least significant difference .01	NS	75	NS

and generally more robust than the plants in the narrower row spacings.

In 1951 there was much less cheatgrass in the 7-inch row spacing plots than in those with the 21-inch spacing. Crested wheatgrass seemed much more effective than intermediate wheatgrass in reducing the cheatgrass.

Discussion

Although reports on the effect of date of seeding on stand establishment are limited and in some cases conflicting, from this study it appears that the most reliable seeding date for obtaining satisfactory stands in Western Colorado is April 1. April 1 is usually the earliest date that it would be possible to seed this locality because of snow cover or wet soil. At slightly lower elevations, it might be possible to seed somewhat earlier in the spring, and earlier seeding would probably be advantageous. Because of the short time available for seeding in the spring, it may be necessary to do the plowing or other land preparation the preceding fall. Late fall appears to be the next best date for seeding, but it is not as dependable as early spring.

In general, the results of the row-spacing study agree with reports from other locations. The trend from highest yields with narrow row spacings immediately after establishment to

highest yields with the widest row spacings in later years is in close agreement with results from Arizona. The ability of closer row spacings to control cheatgrass agrees with the results from Idaho. It should be noted that all of these studies are based on a hay harvest. If the herbage had been removed by grazing earlier in the season, the results might well have been different. Also, the closer row spacings produced leafier plants with finer stems. Although there was no erosion hazard on this study area, on other sites better soil stabilization has been observed with the closer row spacing. On steeper land or wherever erosion is a problem, the narrower row spacings should probably be used.

Summary

Although satisfactory stands of crested wheatgrass and smooth brome were obtained by planting during any month from April to November in some years, during 1948-52, April 1 was the only planting dates that gave consistently acceptable stands. All other planting dates resulted in failure or a poor stand in at least one year of the period.

There was no significant difference in yields of crested or intermediate wheatgrasses resulting from the different seeding rates used.

Intermediate and crested wheatgrasses were planted in

rows 7, 14 and 21 inches apart in 1949. In 1956 and 1957, herbage yields were highest for the 21-inch spacing. No significant differences in yields resulting from row spacings were observed in 1952.

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