Effect of Time of Fertilizer Application on the Seed and Forage Yield of Russian Wild Ryegrass

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Several workers have pointed out that the application of nitrogen fertilizers and use of wide row spacings increased seed yields of Russian wild ryegrass, Stelfox et al. (1941), Stitt (1954), Heinrichs and Lawrence (1956), and Lawrence (1963). Others have reported on the influence of fertilizer and row spacing on the forage production of this grass, Kilcher (1958 and 1961), Lorenz and Rogler (1959), and Smika et al. (1960). Both nitrogen fertilizer and wide row spacings were found to give increased forage yields.

Very little work has been reported on the influence of time of fertilizer application on the production of the Russian wild ryegrass. Stitt (1954), on the basis of limited observations, indicated that early spring was probably the best time to apply fertilizer for increased seed yields. The present study was undertaken to determine the influence of time of fertilizer applications on the seed and forage yields of Russian wild ryegrass.

Experimental Methods

Russian wild ryegrass was seeded in 1951 in rows two feet apart on an irrigated clay soil at Swift Current, Saskatchewan. The experimental design was a split-plot with six replications in which fertilizers constituted the main plots and time of fertilizer application the sub-plots. Ammonium nitrate, 33.5-0-0, and ammonium phosphate-sulphate, 16-20-0, fertilizers at rates supplying 50 pounds of N per acre were applied at four times of the year, in July (mid-summer) immediately after seed harvest, on September 15 (early fall), on October 15 (late fall), and in April (spring). Fertilizers were applied as a seeded band 6 inches to the side of each grass row and 1 to 1.5 inches deep. The grass was irrigated three or four times during the growing season to apply approximately 10 inches of water to supplement the seasonal rainfall of 6.6 to 10.4 inches during the 5 year period.

Heading was sparse in 1952 and no yields were taken. In 1953, 1954, and 1955 seed yields and forage yields were obtained by harvesting the grass for seed with a hand sickle and cutting the aftermath for forage.

Results

Seed Production.—In the first two crop years Russian wild ryegrass fertilized immediately after seed harvest produced about three times as much seed as when it was fertilized at other times (Table 1). However, in the third year, fertilization in the spring resulted in seed yields as great as those obtained from other application times. The

Table 1. Seed yields in pounds per acre of Russian wild ryegrass as influenced by time of fertilizer application.

Fertilizer and time of application	Year 1953	1954	1955	Mean
33.5-0-0				
After seed harvest (July)	196	172	60	143
September 15	76	62	16	49
October 15	76	20	9	35
Spring (April)	77	62	66	68
Mean	106	79	38	74
D[1]	21	14	20	22
16-20-0				
After seed harvest (July)	234	122	26	127
September 15	60	51	25	45
October 15	82	36	15	44
Spring (April)	66	51	76	64
Mean	110	65	36	70
D	21	14	20	22

[1]D is the difference required for significance at P = .05, as outlined by Snedecor (1961).

lowest average seed yields were from stands which had been fertilized at either of the two fall dates.

The source of N had no apparent bearing on seed yield and thus the use of a fertilizer containing phosphorus was not warranted.

Forage Production.—Except in the first crop year, 1953, dry matter yields were greatest from stands fertilized in the spring (Table 2). Yield increases attributable to spring applications of fertilizer ranged from 22 to 120 percent when compared to other dates of application.

Here again the source of N was unimportant except that N in the form of 16-20-0 is more expensive than N in the form of 33.5-0-0.

Table 2. Dry matter yields in tons per acre of Russian wild ryegrass as influenced by time of fertilizer application.

Fertilizer and time of appplication	Year 1953	1954	1955	Mean
33.5-0-0				
After seed harvest (July)	1.67	.91	.92	1.17
September 15	1.41	1.07	.99	1.16
October 15	1.46	1.14	1.01	1.20
Spring (April)	1.54	1.95	1.48	1.66
Mean	1.52	1.27	1.10	1.30
D[1]	.15	.40	.20	.16
16-20-0				
After seed harvest (July)	1.75	.87	.77	1.13
September 15	1.35	1.14	1.04	1.18
October 15	1.58	1.04	.91	1.18
Spring (April)	1.12	1.86	1.27	1.42
Mean	1.45	1.23	1.00	1.23
D	.15	.40	.20	.16

[1]D is the difference required for significance at P = .05, as outlined by Snedecor (1961).

Discussion

The marked increase in seed yields attributable to after-harvest applications of fertilizer in this study may seem to be at variance with the results obtained by Stitt (1954). However, Stitt's fertilizer treatments were made as late as September so that subsequent seed yields were not the result of after-harvest treatment as much as they were the result of fall applications. Fall applications, even in the present study, resulted in seed yields that were generally smaller than those from spring applications.

The decline in seed yield in 1955 agrees with earlier reports, Lawrence (1963), and Lawrence and Ashford (1964), who noted decreasing yield with increasing age of stand. As in the present study they reported yield decreases even when fertilizer was applied.

The high vegetative response to spring applications of fertilizer, and the high seed yield response to after-harvest applications, suggest that the best use of a Russian wild ryegrass stand might be achieved by split applications of fertilizer. This type of fertilizer management might be especially important where the herbage aftermath will be intensively grazed during the fall season. The necessity of aftermath grazing for maintaining seed yields has been pointed out by Lawrence and Ashford (1964). Studies are being conducted to determine the influence and soundness of split applications of fertilizer on the overall production of Russian wild ryegrass.

Summary

In two of the three years Russian wild ryegrass fertilized immediately after seed harvest in July produced significantly more seed than when it was fertilized as other times of the year. Russian wild ryegrass fertilized in the spring (April) produced higher dry matter yields than that fertilized at other times of the year. No differences in seed or dry matter yields could be attributed to the source from which N fertilizer was obtained. Both seed and dry matter yields tended to decrease with increasing age of the stand.

Literature Cited

HEINRICHS, D. H. AND T. LAWRENCE. 1956. Russian wild ryegrass. Can. Dept. Agr. Publ. 991.

KILCHER, M. R. 1958. Fertilizer effects on hay production of three cultivated grasses in Southern Saskatchewan. Jour. Range Mangt. 11: 231-234.

KILCHER, M. R. 1961. Row spacing affects yields of forage grasses in the brown soil zone of Saskatchewan. Can. Dept. Agr. Publ. 1100.

LAWRENCE, T. 1963. Seed yield of Russian wild ryegrass grown on an irrigated clay soil in Southwestern Saskatchewan. Jour. Range Mangt. 16: 311-312.

LAWRENCE, T., AND R. ASHFORD. 1964. Seed yield and morphological development of Russian wild ryegrass as influenced by grazing. Can. J. Plant Sci. In Press.

LORENZ, R. J., AND G. A. ROGLER. 1959. Effect of row spacing and nitrogen fertilizer on production of irrigated Russian wildrye (*Elymus junceus* Fisch.): I Forage yields. Agron. Jour. 51: 286-288.

SMIKA, D. E., H. J. HAAS, AND G. A. ROGLER. 1960. Yield, quality, and fertilizer recovery of crested wheatgrass, bromegrass, and Russian wildrye as influenced by fertilization. Jour. Range Mangt. 13: 243-246.

SNEDECOR, G. W. 1961. Statistical Methods. Iowa State University Press. Ames, Iowa.

STELFOX, H. B., D. H. HEINRICHS, AND R. P. KNOWLES. 1954. Seed production studies with Russian wildrye. Can. J. Agr. Sci. 34: 28-35.

STITT, R. E. 1954. Seed production of Russian wildrye. Agron. Jour. 46: 171-175.