

Seed Yield and Caryopsis Weight of Side-Oats Grama as Influenced by Cultural Practices¹

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Highlight

Insect control, row spacing, and nitrogen fertilization were studied. Insect control increased seed set and seed yields of side-oats grama. Seed set and seed yields per acre were higher but caryopsis weight was lower from plantings in solid stands than from spaced rows. Nitrogen fertilizer maintained seed quality and increased seed set and yields of cleaned seed. Cultural practices to obtain maximum development of caryopses, as well as large yields, should be utilized because of the great importance of seed quality in stand establishment.

Side-oats grama (*Bouteloua curtipendula* (Michx.) Torr.) occurs in association with other grasses on native ranges and meadows. The role of side-oats grama in the recovery of grassland following drought years has been described (Weaver and Albertson, 1944). It was one of the few grasses that invaded in great abundance, covering areas bared by loss of other grasses

and becoming a species of first rank. In periods of favorable moisture it occurs less frequently in pure stands.

Improved varieties of side-oats grama have been developed for seed production and revegetation use in the Great Plains (Harlan, 1962; Keim and Newell, 1962). Varieties are recommended, where adapted, for planting in mixtures of warm-season grasses. The use of side-oats grama in such mixtures insures continuity of stands.

Seed production of most warm-season prairie grasses has been in spaced rows (Atkins & Smith, 1967). This practice provides for the use of machinery for cultivation and weed control, and facilitates irrigations required for optimum seed set and uniform seed maturity. Suitable irrigation and fertilization practices for seed production of side-oats grama in 40-inch rows have been determined (Smika and Newell, 1965). Chemical and mechanical weed control practices in seed production fields have been compared (McCarty et al., 1967).

Some grasses are difficult to contain in rows because of their vigorous vegetative spread. With proper cultural practices, solid stands of certain cool-season grasses will produce large yields of good quality seed. The importance of the timely availability of soil nitrogen to the plant has been shown in brome grass (Newell, 1951) and in western wheatgrass (Smika and Newell, 1966). Weed control in seed fields of these heavy sod-forming grasses is not a serious problem after establishment.

Side-oats grama is not a vigorous sod-forming grass and can be maintained in rows. However, side-oats grama planted in rows for seed production will, in time, form solid stands by vegetative spread unless certain cultural practices are followed. It is there-

fore of interest to determine if initial plantings in solid stands might produce seed of quality and quantity comparable to seed produced in rows.

The use of adapted, high-quality grass seed has been found to be very important in the establishment of new grass stands (Schumacher and Atkins, 1965). Seed quality (caryopsis weight) of side-oats grama, has been shown to be influenced by fertilization and irrigation management practices (Newell and Smika, 1965) and by degree of insect control, primarily thrip damage to the flower (U.S. Dep. Agr., 1962). The objectives of this study were to determine caryopsis weight and seed yield of side-oats grama as affected by (1) insect control practices, (2) solid vs. row planting, and (3) nitrogen fertilization.

Experimental Procedure

Two varieties of side-oats grama, Butte and Trailway (Newell and Conard, 1963) were seeded in a factorial design with 3 replications in 1961. Plots with rows were 16 $\frac{3}{4}$ ft wide (five 40-inch rows) by 40 ft long. Solid stand plots were 16 \times 40 ft. All plots were irrigated in early spring and at heading in 1964 and 1965. Earlier work (Smika and Newell, 1965) had shown this to be the best irrigation regime. Nitrogen fertilizer was applied in late April of 1964 and 1965 at rates of 0 and 80 lb/acre. Insects were controlled by spraying dieldrin at 0.25 lb/acre at weekly intervals during the flowering period of the grass. This practice involved 6 sprayings in 1964 and 5 in 1965.

Seed yields were determined by hand harvesting 20 ft of the center row of each row plot and an area 3 \times 20 ft in solid stand plots in late August of 1964 and 1965. Seed was harvested

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Table 1. Seed set¹ of side-oats grama as affected by cultural practice. North Platte, Nebraska, 1964–1965 average.

Variety	Cultural practice						Variety average
	Planting method		Fertilization		Insect control		
	Solid	Rows	0–N	80–N	None	Spray	
Butte	24.4	21.3	20.4	25.8	21.1	25.1	23.1
Trailway	19.0	13.8	16.4	16.4	13.8	19.0	16.4
Cultural practice							
Average	21.7	17.8	18.4	21.1	17.4	22.0	—

¹ Ratio of caryopses weight to weight of spikes expressed as percent. Significant difference between varieties, level of insect control, planting method, and N fertility level averages at 5% level or less.

when the caryopses were in the dough stage as judged in the fertilized plots. Spikes were stripped from the racemes and processed through a small seed cleaner. Yields were measured in weights of spikes, the commercial unit of "seed" in side-oats grama. Seed set and caryopsis weight were determined for each treatment from spikes of 10 culms taken from each of three locations not included in the area harvested for yield.

Results and Discussion

Seed set.—Caryopses purity contributes to total spike weight (seed yield) and is measured as the ratio of the weight of caryopses to the weight of spikes (Table 1). Seed set was significantly higher for Butte than for Trailway. Increases in purity were obtained from the solid planting when compared with those from the row planting. Nitrogen fertilization had no effect on seed set of Trailway but 80 lb/acre of N significantly increased seed set of Butte. Both varieties of grass had significantly higher seed set as a result of insect control.

Seed yields.—Per acre of seed yields of both grass varieties were significantly influenced by planting method and nitrogen fertilizer (Table 2). Solid stands gave an average of 130 lb/acre more seed than row plantings. Larger seed yields from solid stands might be expected because of more seed-bearing culms per unit area from the relatively young stands and because seed set was higher in solid stands than in rows in this instance. However, even larger differences were produced between levels of nitrogen fertility than between planting methods. Fertilizer (80 lb N/acre) increased seed yields 160 lb/acre over unfertilized plots. Two pounds of seed per acre per pound of fertilizer N were thus real-

ized. Insect control also increased cleaned seed yields of both varieties, but these increases were not statistically significant at the 0.05 level in this experiment.

Caryopsis weight.—This is expressed as milligram weight per thousand caryopses (Table 3). At North Platte, Butte had significantly higher caryopsis weight than Trailway. Highly significant increases in caryopsis weight of both varieties were obtained from row planting as compared with planting in solid stands. Nitrogen fertilizer tended to increase caryopsis weight of the grass in solid stands but did not raise it to the weight level of that in rows. Insect control had no influence on caryopsis weight.

Results from this experiment suggest the possible advantage of solid-planted over row-planted side-oats

grama because of the increased yield of spikes obtained from the relatively young stands. The higher yields in these initial harvests are attributed to a larger number of seed-producing stems per unit of area in the solid stand planting. Sufficient nitrogen was available for seed head formation in the solid stands but nitrogen became a limiting factor in the development of the caryopses.

Disadvantages associated with solid stands include increased cost of seed for planting and difficulties with weed control and irrigation. Increase of stand by natural reseeding should be prevented by cultivation or roguing. Seedlings from parent rows, when producing seed, will disqualify a field for seed certification if a limited number of generations are specified for the variety (Newell and Conard, 1963). This provision for cross-pollinated grasses maintains the genetic potential of the seed for superior characteristics claimed. Also, seedlings from parent rows produce plants of different age and differing maturity which cause problems of harvesting good-quality seed.

Summary and Conclusions

The importance of effective insect control in seed production of side-oats grama was demonstrated by the increased seed set and seed yields resulting from spray treatment. How-

Table 2. Cleaned seed yields (lb/acre)¹ of side-oats grama as influenced by cultural practice. North Platte, Nebraska, 1964–1965 average.

Planting method	Variety		Fertilization		Insect control		Average
	Butte	Trailway	0–N	80–N	None	Spray	
Solid	420	380	270	510	380	400	390
Rows	270	250	220	300	240	270	260
Average	345	315	245	405	310	335	

¹ Whole spikes processed through a seed cleaner. Significant difference between planting method and N fertility level averages at 5% level or less.

Table 3. Caryopsis weight¹ of side-oats grama as affected by cultural practice. North Platte, Nebraska, 1964–1965 average.

Planting method	Variety		Fertilization		Average
	Butte	Trailway	0–N	80–N	
Solid	813	598	670	741	706
Rows	889	761	836	813	825
Average	851	680	753	777	

¹ Milligram weight of one thousand caryopses. Significant difference between varieties and planting method averages at 1% level.

ever, the untreated plots were not severely damaged in this experiment.

Both planting method and N fertilization affected the timely availability of soil nitrogen to the plant which is an important factor controlling seed production. The availability of nitrogen affects grass seed-head formation, seed set, and seed quality (Smika and Newell, 1965, 1966).

Cultural practices are necessary for seed production of side-oats grama and should include planting in rows approximately 40 inches apart, supplemented by suitable irrigation, fertilization, and insect control. Harvesting seed from solid stands and stands of side-oats grama not receiving cultural practices should be discouraged because of the poorer quality seed harvested from these stands.

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