Large Seeds Produce More, Better Alkali Sacaton Plants[1]

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Highlight

Larger seeds of alkali sacaton germinated better and faster than the smaller sizes. Seedlings from larger seeds emerged from deeper depths and had a higher growth rate.

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During the course of previous work I observed considerable variation in seed size of alkali sacaton (*Sporobolus airoides* Torr.). In addition, it appeared that the larger seeds had a higher percentage germination and that they germinated more rapidly than the smaller seeds.

The purposes of this study were to determine seed size classes and the relation of seed size to (1) time required for germination, (2) total germination, and (3) emergence in alkali sacaton.

The larger and/or heavier seeds of grasses have generally been found to produce seedlings of greater vigor than seedlings produced by the smaller seeds. Several workers have found that the heavier and/or larger seeds within certain grass species emerge better and from deeper depths than the smaller and/or lighter seeds (Hunt, 1954; Kittock and Patterson, 1962; Milton, 1935; and Rogler, 1954). A number of workers have reported that larger seeds result in better stands and more vigorous seedlings (Harkness, 1965; Kneebone, 1956; Kneebone and Cremer, 1955; Rogler, 1954; and Tossell, 1960).

Procedures

Six seed size classes were delineated by passing thoroughly cleaned seeds (caryopses free of lemma and palea) through screens with 28 × 28, 30 × 30, 32 × 32, 34 × 34, and 36 × 36 openings per square inch. Seeds held by (that would not pass through) the 28 × 28 screen were designated size 1, those held by the 30 × 30 screen as size 2, etc. Size 6 seeds were those which passed through the smallest (36 × 36) screen. The percentage (weight basis) of seeds in each size class, and the number of seeds per pound, was determined for each of six seed lots.

To determine the effect of seed size on the rate of germination of alkali sacaton, a 30-day germination test was run on four replications of 100 seeds of each of the six seed sizes from the 1966 seed lot. The seeds were germinated on doubled layers of standard blue germination paper in 4-inch petri dishes in a controlled-environment

Table 1. Percentage of seeds (weight basis) per size class and number of seeds per pound in six lots of alkali sacaton.

	Seed lot[1]						
Size class	RP1964	RP1965	RP1966	RP1967	PMNM-184	PMNM-C14	Avg. all lots
1	47	70	42	88	44	42	56
2	19	18	22	8	18	36	20
3	12	7	20	2	22	13	12
4	10	3	7	1	8	7	6
5	5	1	5	1	5	2	3
6	7	1	3	1	3	1	3
Seeds/lb.	2,000,000	1,435,000	1,550,000	1,040,000	2,240,000	1,540,000	1,634,000

[1] Seed lots RP were collected by the author in the Rio Puerco watershed about 60 miles northwest of Albuquerque, New Mexico during October of the indicated year. The other two lots were obtained from the New Mexico Plant Materials Center, Los Lunas, New Mexico.

germination chamber. The chamber was programmed for 8 hours light daily at 90 F and 16 hours darkness at 70 F; relative humidity ranged from 95 to 98 percent. Previous studies have shown that these conditions are adequate for germination of alkali sacaton (Knipe, 1967). A seed was considered as germinated when both radicle and plumule had broken through the seed coat.

The effect of seed size on emergence from different depths of planting was studied by planting seeds of sizes 1 and 3 in a greenhouse in 2-quart pots in sterile sandy loam soil at depths of ½, 1, and 1¾ inches. The pots were subirrigated to saturation at the start of the study; additional waterings were not necessary. This study consisted of 6 replications of 15 seeds per pot. The temperature of the greenhouse ranged from 80 to 90 F, and the relative humidity ranged from 60 to 70 percent. Percent emergence was determined for the 14th day after planting.

To determine the effect of seed size on root and shoot growth, a separate set of pots, identical to those described above but with 8 replications, were seeded with sizes 1 and 3 at a depth of ¼ inch. The seedlings which emerged in these pots were excavated —those in 4 pots 7 days after planting, and those in the other 4 pots 14 days after planting—and the lengths of their roots and shoots determined.

Results of each of the studies were analyzed as a randomized complete block, those from the latter study as unequal subsample numbers because the number of seedlings per pot was not constant. The germination and emergence percentages were transformed to arc sin of square root of percentages prior to analysis.

Results and Discussion

Separating seeds of several lots of alkali sacaton into six size classes revealed a considerable variation in the percentage of seeds per size class among lots (Table 1); the number of seeds per pound also varied among lots, ranging from more than one to more than two million per pound. Over half of the seeds were in size class 1, the largest seeds.

Three days after the start of the germination test the smallest seeds (size 6) had the lowest percentage germination; each successively larger size was significantly better.[2] This relationship continued with one minor exception for all sizes for the duration of the 30-day period (Table 2). The germination percentage of size 1 approached maximum on the third day, whereas the smaller seeds did not approach maximum germination until the seventh day. The larger seeds of alkali sacaton were not only more viable but they also germinated faster.

Seedling emergence in pots with size 1 seed was significantly higher than in pots with size 3 seed at all depths of seeding. Seed size 1 had a higher emergence (%) from the 1-inch planting depth than was obtained with size 3 seeds from the ½-inch depth:

Inches depth	Size 1	Size 3
½	89a[3]	50
1	83a	15b
1¾	22b	0

The growth rate (cm) of seedlings from the large seeds greatly exceeded that of the small seeds, especially with respect to root growth:

	Root length		Shoot length	
Days	Size 1	Size 3	Size 1	Size 3
7	2.3[4]	0.9	2.1	1.4
14	4.5	2.2	2.2	1.8

Conclusions

The results indicate that the larger seeds, by virtue of more rapid germination and development, produce seedlings better adapted to establishment in harsh areas. It is possible that establishment of plants from the larger seeds contributes greatly to natural regeneration of alkali sacaton under natural conditions in arid and semiarid regions. The success of field seedings would probably be enhanced if operations were restricted to the use of large seeds.

[2] All significant differences specified in this paper were at the .05 level.

[3] Any two values followed by the same letter are not significantly different (.05 level, Tukey procedure).

[4] All values between seed size 1 and 3 at a given age are significantly different (.05 level, Tukey procedure).

Table 2. Germination (%) of six sizes of alkali sacaton seed (lot RP1966) after 2, 3, 7, 14, 21, and 30 days.

	Days after start of test					
Seed size	2	3	7	14	21	30
1	6	80	81	83	83	83
2	4a[1]	58	67	68	68	68
3	2a	47	57b	59b	59b	59b
4	3a	42	57b	58b	59b	59b
5	1a	32	47	47	48	48
6	2a	17	25	26	26	26

[1] Any two values in a column not followed by the same letter are significantly different (Tukey procedure .05 level).

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