Relationship of Seed Weight to Germination of Six Grasses[1]

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Highlight

Heavy seeds of sand bluestem, side-oats grama, blue grama, switchgrass, and yellow indiangrass had a slightly higher percentage germination than light seeds. Heavy switchgrass (A-6606) seeds had a significantly greater percentage germination than did light seeds. Heavy seeds of side-oats grama, blue grama, switchgrass, switchgrass (A-6606), and yellow indiangrass germinated faster than did the light seeds.

Grazing resistance depends on the plant's ability to replace the herbage removed, and upon the plant's ability to reproduce. Cook et al. (1958) reported that the viability of crested wheatgrass (*Agropyron desertorum*) seed decreased as clipping frequency increased, because the seeds from clipped plants were smaller than seeds from unclipped plants. Thus time and frequency of removal affected seed size which influenced reproduction. Kinch and Wiesner (1963) reported that heavy seeds had greater viability than light seeds of green needlegrass (*Stipa viridula*). Whalley et al. (1966) found that germination percentage of hardinggrass (*Phalaris tuberosa* var. *stenoptera*) increased significantly as seed weight increased.

Ellern and Tadmor (1966) noted that the speed of germination may be critical for seedling establishment under semi-arid conditions. Kneebone and Cremer (1955) found that seedlings from large seeds of buffalograss (*Buchloe dactyloides*), yellow indiangrass (*Sorghastrum nutans*), sand bluestem (*Andropogon hallii*), side-oats grama (*Bouteloua curtipendula*), and switchgrass (*Panicum virgatum*) emerged earlier than seedlings from small seeds. Seedlings from large seeds emerged significantly faster than seedlings of small seeds for crested wheatgrass (Rogler, 1954), beardless wheatgrass (*Agropyron inerme*) (Vogel, 1963), hardinggrass, perlagrass (*Phalaris tuberosa* var. *hirtiglumis*), *Phalaris coerulescens*, smilograss (*Oryzopsis miliacea*), and *Schismus arabicus* (Whalley et al., 1966).

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Table 1. Origin and year of harvest for seeds of the six warm season grasses tested. Seeds obtained from Plant Materials Center, U.S. Soil Conservation Service, Los Lunos, New Mexico.

Grasses	Origin of seed	Year of harvest
Sand bluestem	Collected in 1956 from native stand near Elida, New Mexico.	1966
Side-oats grama	Collected in 1935 from native stand at Vaughn, New Mexico.	1964
Blue grama	Field harvested in 1944 near Lovington, New Mexico.	1966
Switchgrass	Collected near Grenville, New Mexico.	1965
Switchgrass (A-6606)	[1]Exact origin of this accession is not known.	1965
Yellow indiangrass	Collected in 1957 from sand plains site, eastern New Mexico.	1965

[1] Collected near old S.C.S. Nursery at Colorado Springs, Colorado about 1937.

Methods and Materials

Seeds of Elida sand bluestem, Vaughn side-oats grama, Lovington blue grama (*Bouteloua gracilis*), switchgrass (A-6606), Grenville switchgrass, and Llano yellow indiangrass were tested in the laboratory to determine the influence of seed weight upon germination percentage and speed of germination (Table 1). The palea and lemma were removed, and only mature, complete caryopsis were tested. After determining the weight range of each variety, the seeds were individually weighed to obtain 200 light and 200 heavy seeds from each variety (Table 2). The light and heavy seeds of each variety were separated into two replicates of 100 seeds each. The germination tests were carried out in covered petri-dishes with a substrate of blotter paper moistened with distilled water. Constant humidity was maintained by continuous cycling of distilled water through the germinator. Temperatures were 30 C for 16 hr and 20 C for 8 hr. Florescent lights were used for a 16-hr photoperiod. Germination was checked daily for 10 days, and only those seeds with shoots exceeding 2 mm were counted and removed.

Results

Germination percentage was greatest for the heavy seeds of all six grass varieties tested (Fig. 1). Germination difference between heavy and light seeds for sand bluestem, side-oats grama, blue grama, Grenville switchgrass, A-6606 switchgrass, and yellow indiangrass were 1, 10, 5, 3, 50, and 24%, respectively. However, an analysis of variance showed the total germination for light and heavy seeds to be significantly different for only switchgrass (A-6606).

Speed of germination was greater for the heavy seeds. An analysis of variance showed heavy seeds of side-oats grama, blue grama, switchgrass, switchgrass (A-6606), and yellow indiangrass germinated faster than light seeds.

Table 2. Range of seed weights.

Species	Light seeds, mg	Heavy seeds, mg
Sand bluestem	35.0 to 43.0	56.0 to 80.0
Side-oats grama	0.5 to 1.0	6.0 to 7.0
Blue grama	0.5 to 1.0	3.0 to 4.0
Switchgrass	8.0 to 14.0	26.0 to 31.0
Switchgrass (A-6606)	3.0 to 8.0	18.0 to 24.0
Yellow indiangrass	16.0 to 20.0	26.0 to 34.0

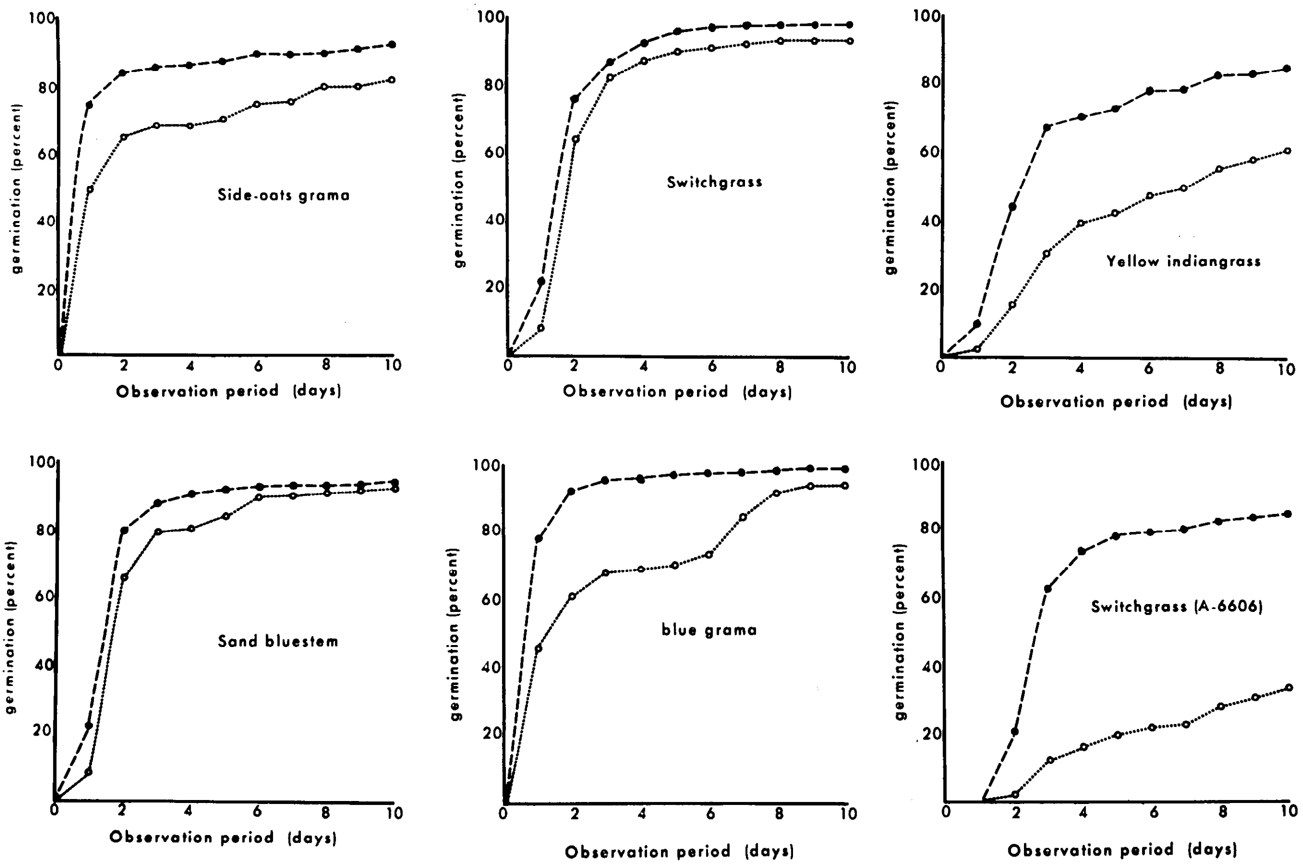

FIG. 1. Daily accumulated germination for heavy seeds (solid circles) and light seeds (open circles) at alternating temperatures of 20 and 30 C for six warm season grasses.

Discussion

The difference in germination percentage and speed of germination observed in the six grasses indicated that the effect of seed weight varied greatly between species and between varieties within a species. For example: Grenville switchgrass had a 3% difference in germination between light and heavy seeds while A-6606 switchgrass had a difference of 50%. The light seeds of Grenville switchgrass had 9% greater germination than even the heavy seeds of A-6606 switchgrass. This difference appeared to be due more to genetic differences than to weight differences.

Seed size effect on speed of germination was significant in side-oats grama, blue grama, Grenville switchgrass, switchgrass (A-6606), and yellow indiangrass. The heavy seeds of all five grasses germinated faster than did the light seeds.

Of particular interest is the thrift and vigor of the seedlings. General observations showed that seedlings of heavy seeds were noticeably larger than seedlings of light seeds. Also, there was a definite decrease in size from the seedlings of the first seeds to germinate to the seedlings of the last seeds to germinate in both heavy and light seeds of all six grasses tested.

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