Germination, Forage Yield, and Seed Production of American Sloughgrass (*Beckmannia syzigachne*)

A. BOE AND R. WYNIA

Abstract

Germination, forage yield, and seed production characteristics were studied in American sloughgrass (*Beckmannia syzigachne* (Beck.) Steud.,) a valuable wetland forage species in the northeastern and northcentral states. Germination of field-collected caryopses from northeastern Montana, stored at 7°C for 60 days post-harvest, was significantly (*P<0.05*) higher under alternating temperatures (7°C for 15 h and 21°C for 9 h in each 24-h period) than at constant 21°C. Germination percentages greater than 60% were found for freshly harvested greenhouse-produced spikelets and caryopses after 14 days in complete darkness, and no significant differences were detected between complete darkness and 15 h dark/9 h light treatments under alternating temperatures. Greenhouse-produced caryopses were significantly heavier and exhibited significantly higher germination than caryopses from field collections. A Montana field collection and a seed increase of that collection significantly (*P<0.05*) outyielded a local South Dakota collection for both forage and seed at Brookings, South Dakota. Overall mean dry matter forage and mature seed yields were 2,700 and 540 kg/ha, respectively. Forage yields at early-head of the seed increase population planted at 15, 18, and 21 kg/ha were not significantly different and had an overall mean of 5,090 kg/ha.

These preliminary data indicate that the potential of *B. syzigachne* as a cultivated forage for cropland depressions in the Northern Great Plains does not appear to be limited by complex germination requirements, low forage yield, or weak seed production.

American sloughgrass (*Beckmannia syzigachne* (Beck.) Steud.,) is the North American native of a bipscies genus that is widespread in the cooler parts of Eurasia and North America. *B. syzigachne* is present in marshes and along ditches throughout the northeast and northcentral states and is occasional in the northeast (Gould and Shaw 1983). It frequently colonizes denuded wetland forage species in the northwestern and northcentral states. Germination of field-collected caryopses from northeastern Montana, stored at 7°C for 60 days post-harvest, was significantly (*P<0.05*) higher under alternating temperatures (7°C for 15 h and 21°C for 9 h in each 24-h period) than at constant 21°C. Germination percentages greater than 60% were found for freshly harvested greenhouse-produced spikelets and caryopses after 14 days in complete darkness, and no significant differences were detected between complete darkness and 15 h dark/9 h light treatments under alternating temperatures. Greenhouse-produced caryopses were significantly heavier and exhibited significantly higher germination than caryopses from field collections. A Montana field collection and a seed increase of that collection significantly (*P<0.05*) outyielded a local South Dakota collection for both forage and seed at Brookings, South Dakota. Overall mean dry matter forage and mature seed yields were 2,700 and 540 kg/ha, respectively. Forage yields at early-head of the seed increase population planted at 15, 18, and 21 kg/ha were not significantly different and had an overall mean of 5,090 kg/ha.

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Germination Studies

Experiment 1: Greenhouse-produced spikelets and caryopses previously stored at room temperature for 45 days post-harvest, when subjected to alternating temperatures and complete darkness, exhibited mean germination percentages comparable to those in uncovered trays (Table 1), indicating darkness did not severely inhibit germination.

Experiment 2: Caryopses subjected to the alternating temperature regime achieved significantly higher \((P<0.05)\) germination percentages than those maintained at 21°C (Table 1). Within each of the 2 temperature treatments, no difference was detected between trays kept in the dark and those exposed to ambient April light from 0800 to 1700 hours each day. Alternating temperatures have been shown to enhance germination of numerous range grasses (Toole 1940). However, McElgunn (1974) reported that 10 grass species averaged higher germination at constant 21°C than at 7°C for 12 hours and 18°C for 12 hours.

Experiment 3: The highest germination percentages were found for the greenhouse-produced lots (Table 1). After 14 days, the 1980 and 1981 greenhouse-produced lots exhibited mean germination percentages of 96 and 91%, respectively. Greenhouse-produced caryopses were significantly \((P<0.05)\) heavier than caryopses from field collections. Mean 50-caryopse weights were 16.8 and 13.2 mg for greenhouse-produced and field-collected lots, respectively. Higher germination percentages and faster germination rates for large compared to small seed have been reported for numerous range (Green and Hansen 1969) and pasture (Kneebone 1972) grasses.

Results and Discussion

Forage Yield, Seed Production, and Field Germination Studies

In November 1981 the initial forage yield trial (Trial 1) was planted on a Lamoure silt loam clay loam, nearly level [fine-silty, mixed (Calcic), frigid Cumulic Haplaquolls] soil approximately 2.0 km north of Brookings. Three different seeding rates (13, 18, and 23 kg/ha) of the 1982 seed increase material (SD82). Planting method and plot size for Trials 2 and 3 were as described for Trial 1. Trials 2 and 3 were hand-weeded once during June 1983. On 11 July 1983, six 60-cm² plots were randomly selected within each plot at harvest time for later calculation of dry matter yields. Panicles were disarticulated by hand and fertile spikelets were separated from inert material with a South Dakota Seed Blower. Seed yields were determined based on total weight of fertile spikelets from each plot.

In October 1983, six 60-cm² plots were randomly selected within the 2 middle border rows of Trial 3. The border rows had not been harvested for seed, and mature spikelets produced in those rows had disarticulated from the rachis in August. Within each of these plots, which were excavated to a depth of 2.0 cm, numbers of fully germinated seedlings and nongerminated spikelets were determined after the soil had been carefully removed in the laboratory by rinsing on a fine-mesh screen.

 tens were found among seed sources for both forage and seed yields. Seed sources of Montana origin significantly \((P<0.05)\) outyielded the local field collection for both forage and seed. Mean forage.
yields ranged from 3,250 to 1,990 kg/ha for the 1982 seed increase of material collected in Montana in 1981 and the local collection, respectively. In Trial 3, no significant differences were detected among the 3 planting rates. Although initial emergence appeared to be positively associated with planting rate in Trial 3, failure to detect differences in forage yield among planting rates may be due to this species' high tillering capacity. Overall dry matter yield means were 3,240 (forage plus seed) and 5,000 kg/ha for Trials 2 and 3, respectively. Differences in harvest time may partially explain these yield differences, since Trial 3 was harvested at early-head while Trial 2 was harvested at seed maturity when general vegetative deterioration was quite evident. Also, the highest yielding in Trial 2 (SD 82) was the seed source for the planting rate study (Trial 3).

Numbers of seedlings and nongerminated spikelets obtained in October 1983 from 6 sample plots within the border rows of the 1982 Trial 3 averaged 54,399.8 ± 6,248.0, and 65,985.4 ± 17,688.8/m², respectively. Percent germination of spikelets (calculated as total number of seedlings/total number of seedlings + total number of nongerminated spikelets obtained from the 6 plots)) was 45%. This percentage was determined from spikelet numbers and was not adjusted to represent only those spikelets that contained caryopses. Since 100% caryopses set in field-grown spikelets seems unlikely, field germination percentage calculated for caryopses may be expected to be somewhat higher. However, Boe and Evans (1981) reported 100% self-fertility and caryopses set in inflorescences of greenhouse-grown plants.

Conclusions

The potential forage values of many native species are unrealized. However, several factors that may limit the number of natives that can be profitably incorporated into cultivated forage systems are: (1) complex germination requirements that inhibit rapid and uniform germination, (2) low forage yield potential, and (3) poor seed production. This preliminary research was aimed at determining if any of these factors were characteristic of B. syzigachne, a native species recognized as a valuable component of wetland forage.

We observed 45% germination in the field in October for spikelets that had matured and disarticulated in the summer, and up to 96% germination for freshly harvested caryopses under alternating temperatures in the laboratory. These data indicated a lack of complex seed dormancy characteristics in the germplasm studied. Nonrestrictive germination requirements and prolific seed production capabilities may be important characteristics associated with this species' ability to rapidly colonize exposed mudflats and disturbed wetlands. Dix and Smeins (1967) reported that B. syzigachne was commonly found in cropland depressions in eastern North Dakota. The seed unit that disarticulates from the rachis at maturity is a firm, glabrous, free-flowing spikelet that presents no difficulties for conventional planting equipment.

Forage and seed yields under dryland conditions at 2 locations were similar to long-term averages for smooth brome grass (Bromus inermis Leyss) in the same area (Ross and Krueger 1976). This indicated that high yielding stands of B. syzigachne could be successfully established from dormant plantings made after freez-up.

In the Northern Great Plains, there is a need for more efficient utilization of seasonal wetlands where cropping with cereal or row crops is unpredictable due to high spring-time moisture levels, and where dense sod-forming perennial grasses, such as reed canary-grass (Phalaris arundinacea L.) and creeping foxtail (Alopecurus arundinaceus Poir.), are not desired. These data indicate that B. syzigachne's potential for utilization as a pasture or hay crop does not appear to be limited by complex germination requirements, low forage yield potential, or poor seed production. At this point, more extensive ecotype collection and evaluation for forage yield and quality and adaptability to short-term forage production in seasonal wetlands seems warranted.

References


