Blue Grama Has Potential For Drought-Resistant Turf

Additional breeding will improve the cultivar's athletic turf qualities

By Leo Schleicher and Shane M. Andersen

Renewed interest in blue grama (*Bouteloua gracilis [H.B.K.] Lag. Ex Steud.*), particularly as a drought-tolerant species, has stimulated renewed research efforts in recent years.

Blue grama is valued for its ability to survive severe environmental stress, particularly drought. Although blue grama demonstrates potential as an acceptable turfgrass managed at intermediate intensity, little information is available and considerable genetic improvement is needed.

Blue grama is a perennial, warm-season grass species with excellent drought, heat, and cold tolerance. Native to the North American Great Plains and Southwest, blue grama has traditionally been used as a forage or range grass, particularly in the mixed and short grass prairies of the High Plains. Blue grama was planted during the severe drought of the 1930s to control erosion.

Although several blue grama varieties have been released, such as Bad River, Hachita and Lovington, no true turf-type cultivars are currently commercially available.

Blue grama is a sod-forming grass, spreading from basal tillers or short, scaly rhizomes. Its deep and extensive root system allows it to survive long periods of drought. It tolerates frequent, relatively short mowing and has low fertility requirements. Although blue grama has historically been used as a low- or reduced-input turfgrass, the genetic potential for improvement is high. The species is highly outcrossing with considerable ecotypic variation in morphology. Ecotypes within the Great Plains are tetraploid.

Desirable turfgrasses — in terms of growth habit and spread, density, mowing and traffic tolerance, genetic color and leaf texture — are those able to produce a perennial, sod-forming turf. Development of blue grama as a quality turfgrass will require improvement in several of these characteristics through selection, traditional breeding and genetic engineering.

Blue grama germplasm

At South Dakota State University, we have evaluated blue grama as a turfgrass for several years. Polymorphic molecular markers (SSRs) identified in related grass species were screened for amplification in blue grama, and selected markers are currently being screened on plants collected from wild South Dakota populations. These markers will be useful to blue grama breeding programs and future linkage and mapping studies. Additionally, native germplasm from northern Great Plains grasslands is being collected to increase diversity for research.

Preliminary data from our South Dakota collection have been gathered. For example, leaf width variability among 66 accessions was investigated using samples from greenhouse pots of 2-year-old blue grama stands mowed at 7.6 centimeters. Longitudinal sections of leaf blades were excised from second-oldest, fully developed leaves at 25.4 millimeters apical to the leaf collar. Leaf width values were derived from spatial-calibration software using scanner-generated imagery. Leaf widths ranged from 0.93 to 2.22 mm, with a mean of 1.65 ±0.31 mm.

The bluish-gray to grayish-green color of blue grama is often considered undesirable in quality turf compared to the darker green color of traditional cool-season turfgrasses. Data from our Highmore, S.D., location in 2006 indicated that the average

QUICK TIP

Nematodes can be beneficial or parasitic to plants. Parasitic species that feed on plants pose concern for turf managers. These microscopic worms attack all parts of the plant above and below the surface, but they are most detrimental to the plant when the root system is attacked. Once infected, plants are highly susceptible to other potential problems. Discussions about the prevention of nematode occurrence begin with the importance of having a healthy plant. Proper fertilization and the reduction of stress will result in healthier plants that can sustain some damage from these parasites. Conduct proper soil and tissue testing to monitor your turf's specific nutritional needs.

TABLE 1

Phytotoxicity of postemergence herbicides applied to blue grama seedling turf in 2005 and 2006.

Herbicide Treatment	Formulation	Rate (kg of a.i. per hectare)*	Labeled for blue grama turf†	Visual injury‡ Early	Visual injury‡ Late	Coverage reduction§
MSMA	1.6SC	2.43	No	Yes	No	No
quinclorac	75DF	0.84	No	Yes	Yes	No
imazapic	2L	0.07	Yes	Yes	Yes	Yes
mesotrione	4L	0.27	No	Yes	Yes	Yes
fluroxypyr	1.5L	0.28	No	No	No	No
carfentrazone-ethyl	1.9L	0.03	No	Yes	No	No
2,4-D amine	3.8L	1.12	No	No	No	slight
triclopyr	4L	1.12	No	No	No	No
clopyralid	3L	0.55	No	No	No	No
dicamba	4L	1.12	No	Yes	Yes	Yes
fenoxaprop-ethyl	0.57L	0.10	No	No	No	No
simazine	4FL	1.12	No	No	No	No
2,4-D+mecoprop+dicamba	0.73L	1.12	No	Slight	Slight	Slight
metsulfuron-methyl	60D	0.04	No	No	No	No
halosulfuron-methyl	75D	0.07	No	No	No	No
carfentrazone-ethyl + quinclorac	1.9 L + 75DF	0.02+0.84	No	Yes	Yes	No
isoxaflutole	4L	0.16	No	Yes	Yes	Yes

† *Source: www.state.sd.us/doa/* ‡ *Early, 3 to 10 DAT; Late, 14 to 28 DAT* § *3 DAT to 28 DAT;* **Kilograms of active ingredient per hectare.*

genetic color in our collection was unacceptable, but highly variable. Mean genetic color was 3.4 ± 1.0 on a 1 to 9 scale, where 9 is excellent. Fewer than 8 percent of rated accessions had acceptable color (equal to or better than 5.0).

Blue grama establishment

Recommendations regarding blue grama establishment for erosion control and range sites are available; however, additional research is needed to establish blue grama as turf. Recommended seeding rates for non-turf sites can range from 1.3 kilograms per hectare to 56 kilograms per hectare depending on the source. Seeding rates are highly dependent on method of seeding (such as broadcast or drill) and whether the seed is cleaned or processed.

Available water near the soil surface is critical for an extended period between germination and adventitious root development due to an elongated subcoleoptile internode that pushes the crown near the soil surface.

Acceptable turf stands are possible in a relatively short period when seeding at 146 kilograms per hectare PLS (Pure Live Seed — the percent by weight of desirable turfgrass seed in a bag that can be expected to germinate), particularly with favorable soil temperatures and light, frequent watering. For example, Bad River ecotype emerged from soil within 48 hours after planting at our Brookings, S.D., site in mid-July for three consecutive years. Soil temperatures at 5-cm depth during planting were 22.4, 19.6, and 21.3 degrees Centigrade in 2005, 2006 and 2007, respectively.

Germination of summer annual weeds seriously interferes with late spring and summer establishment. Light watering that is required for early blue grama survival also enhances weed germination and growth. Although mowing is effective in controlling taller growing weed species, weeds with a prostrate or decumbent growth habit can create problems.

No pre-emergence herbicides are labeled for weed control in blue grama turf, and imazapic is the only labeled post-emergence herbicide.

Herbicide screening studies for phytotoxicity in blue grama seedling turf were recently conducted over a two-

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TABLE 2

Phytotoxicity of pre-emergence herbicides applied at blue grama seeding in 2006 and 2007.

Herbicide treatment	Formulation	Rate (kg of a.i. per hectare)*	Labeled for blue grama turf†	Visual injury	Coverage reduction‡
siduron	50WP	6.72	No	Slight	Slight
mesotrione	4L	0.27	No	Yes	Yes
pendimethalin	3.8ECL	1.68	No	Yes	Yes
isoxaflutole	4L	0.16	No	Yes	Yes
quinclorac	75DF	0.84	No	Slight	Slight
dithiopyr	40WSP	0.28	No	Yes	Yes
imazapic	2L	0.03	No	Slight	Slight
simazine	4FL	1.12	No	Yes	Yes
metsulfuron-methyl	60D	0.04	No	Slight	Slight

*† Source: www.state.sd.us/doa/ ‡ 3 DAT to 28 DAT *Kilograms of active ingredient per hectare.*

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year period at Brookings, S.D., (Tables 1 and 2 for post-emergent and pre-emergent herbicides).

Results indicated that several post herbicides were safe at listed rates on blue grama seedling turf. However, all pre-emergent herbicides applied at seeding caused slight to severe injury.

Leo C. Schleicher is professor of turfgrass science in the Department of Horticulture, Forestry, Landscape and Parks at South Dakota State University. He received his graduate degrees from Purdue University and the University of Nebraska-Lincoln. Shane M. Andersen is turfgrass research/extension associate in the same department. He has a M.S. from South Dakota State University.

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