Maximizing establishment of Cimarron little bluestem

With proper planting and management, Cimarron little bluestem can be a viable option for golf course rough.

Victor L. Maddox, Ph.D.
J. Michael Goatley Jr., Ph.D.
H. Wayne Philley, Ph.D.
Barry Stewart, Ph.D.
D. Wayne Wells, Ph.D.

Native grasses have been used in secondary roughs and natural areas because they offer desirable characteristics in terms of size, shape and color; they are adapted to a wide range of soils and climates; require minimal to no maintenance; and can provide habitat for many forms of wildlife (1,9). However, germination and subsequent establishment are still a major problem, and stand failures are common for a number of reasons, including weed invasion, improper variety selection and inadequate seeding rate (8).

Variety selection

Cimarron little bluestem (*Schizachyrium scoparium* [Michx.] Nash) was chosen for this study based on its previous performance (3,4) and adaptation (10).

Weed management

Little is known about the management of weeds in native grasses within the golfing environment. Experience with native grasses within forages indicates that early establishment of native grasses on golf courses could be vulnerable to weeds, especially warm-season annual weeds (7).

Because some degree of playability is necessary after establishment, open voids are important in the canopy of clump-forming native grasses. However, these open voids may serve as invasion areas for weeds.

Seeding rates

Recommended seeding rates for little bluestem are highly variable. USDA recommendations (10) were based on the number of seeds per square foot, but most seed companies currently recommend rates based on pounds of pure live seed (PLS) per acre. Little information is available on seeding rates, and recommendations on Web sites range from 6.7 pounds/acre (7.5 kilograms/hectare) (Sharp Brothers Seed Co., personal communications, 2006; Linda Conway Deuver, personal communications, 2006) to 28 pounds/acre (31.4 kilograms/hectare) (James C. Grimes, personal communications, 2006).

The objective of this study was to evaluate the influence of seeding rate and weeds on the establishment of Cimarron little bluestem for golf course secondary roughs.

Establishment studies

Establishment studies were conducted at the Mississippi State University Plant Sciences Research Center, Starkville. The soil was a Marietta fine loam. Soil samples were taken in July 2000 and 2002 and analyzed. Because little bluestem was native to the area, research plots were fumigated with methyl bromide at 653 pounds/acre (731.9 kilograms/hectare) before planting to prevent germination of any pre-existing little bluestem or weed seed. Irrigation was supplied as needed during germination. No irrigation was provided during the second year of either trial.

The first study was planted Aug. 2, 2000. Cimarron little bluestem seed was obtained from Hamilton Seed Co. Seed germination was 86%, purity was 70%, and weed seed was 0.05%; no dormant seed were reported.

The second study was initiated Aug. 9, 2002. Cimarron seed was obtained from Bamert Seed

Co. and featured 88% germination, 44.4% purity, 1.1% weed seed and no dormant Cimarron seed. Both lots were planted within six months of seed testing.

In each study, seed was planted at five rates: 12.7, 25.4, 38.1, 51 and 63.4 pounds PLS/acre. The lowest rate of 12.7 pounds/acre (14.2 kilograms/hectare) was based on the 1992 recommendation of Stock Seed Farms, which now suggests a rate of 14.5 pounds PLS/acre (16.3 kilograms/hectare).

Because of broadleaf weed pressure, the first establishment study was treated with 2,4-D at 1.19 pounds a.e./acre (1.3 kilograms a.e./hectare) (Weedone LV4 3.8EC; Rhone-Poulenc Ag Co.) three weeks after planting. Weed cover ratings were determined visually and recorded during the second establishment study followed by mowing at 2.5 inches (6.4 centimeters) to control weeds. Little bluestem foliage was cut only slightly during mowing.

The experimental design was a randomized complete block with repeated measurements. There were three replications of experimental plots of 36 square feet each. Percent cover was determined visually and recorded each month after planting during two growing seasons of each trial.

Study 1: 2000—2001

At one month after planting, there were significant differences among treatments, except for the two highest seeding rates of 51 and 63.4 pounds/acre (57.2 and 71.1 kilograms/hectare) (Figure 1). Cimarron little bluestem had only 5% cover when seeded at 12.7 pounds/acre (14.2 kilograms/hectare), but 46.7% cover when seeded at 63.4 pounds/acre (71.1 kilograms/hectare). At two months after planting and the end of the first season, there were significant differences among treatments, except for the 38.1- and 51-pound/acre (42.7- and 57.2-kilogram/hectare) seeding rates.

After ratings resumed in April 2001 (nine months after planting), the 12.7-pound/acre (14.2-kilogram/hectare) rate had significantly lower coverage ratings than the other seeding rates. Plot coverage progressed through 11 months after planting, though there was no significant difference between seeding rates 25.4 pounds/acre (28.5 kilograms/hectare) or greater (Figure 1). At 12 months after planting, disease had reduced coverage ratings. Nonetheless, the trend in coverage remained the same with no significant difference among the three highest planting rates, which had significantly more cov-

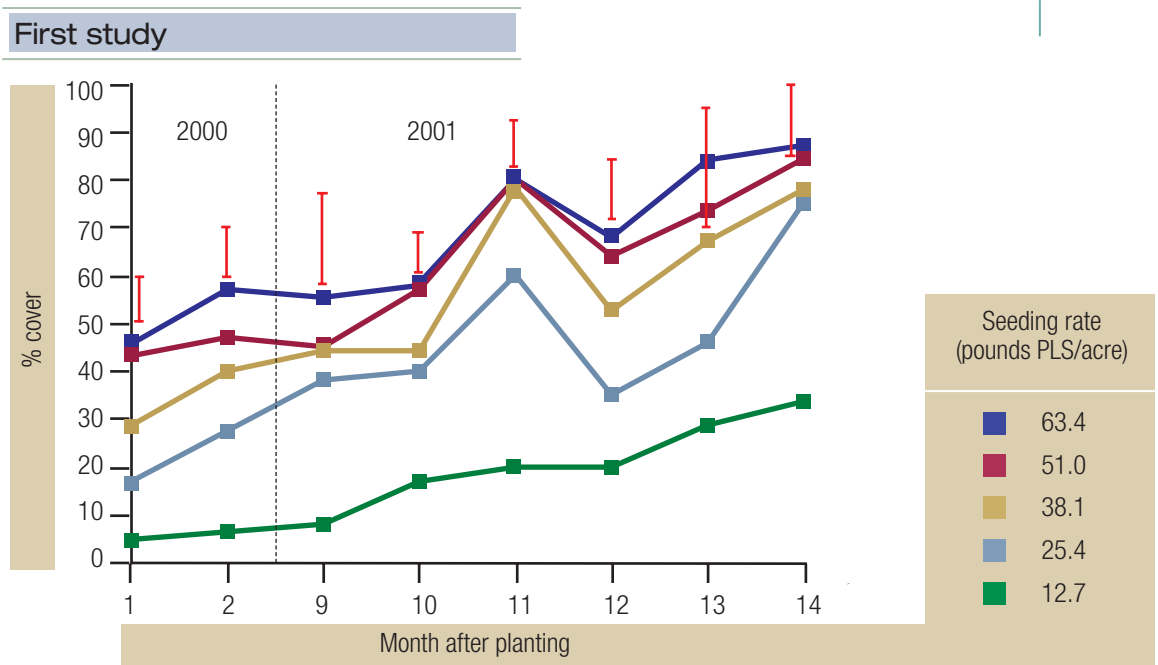

Figure 1. Influence of five seeding rates on establishment of Cimarron little bluestem in 2000 and 2001 with least significant difference bars for each month in red. Study planted Aug. 2, 2000. No ratings were taken during winter months from three through eight months after planting (vertical dotted line).

2000-2001 establishments

Photos courtesy of V. Maddox

The 2000 and 2001 establishment study of Cimarron little bluestem. **Top:** Two months after planting. **Middle:** 10 months after planting. **Bottom:** 13 months after planting.

erage than either the 12.7- or the 25.4-pound/acre (14.2- or 28.5-kilogram/hectare) seeding rate.

By 14 months after planting, there were no significant differences in coverage between seeding rates of 25.4 pounds/acre (28.5 kilograms/hectare) or more, with coverage ranging from 73% to 87%. Maturation and flowering was observed in all treatments, and plants were forming clumps, which may have prevented plots from reaching near 100% cover.

Because other researchers have observed 72% cover with Aldous little bluestem as long as nine years after establishment (2), it may not be possible to achieve 100% cover with Cimarron little bluestem. However, the influence of intensive management on little bluestem cover has not been fully explored.

Study 2: 2002—2003

At one month after planting in 2002, all seeding rates of 25.4 pounds/acre (28.5 kilograms/hectare) or more had similar establishment ratings, and the only significant differences were between the 12.7-pound/acre (14.2-kilogram/hectare) and the 51- or 63.4-pound/acre (57.2- or 71.1-kilogram/hectare) rates (Figure 2). The 12.7-pound/acre (14.2-kilogram/hectare) rate had only 2% cover compared to 15.7% cover for the 63.4-pound/acre (71.1-kilogram/hectare) rate. At two months after planting at the end of the first growing season, there was a similar trend, but there were no significant differences between treatments with percent cover ranging from 4% for the 12.7-pound/acre (14.2-kilogram/hectare) rate to 38.3%

The 2000 and 2001 establishment study of Cimarron little bluestem showing voids (lower right-hand corner) between maturing plants at 13 months after planting.

for the 63.4-pound/acre (71.1-kilogram/hectare) rate treatment.

Cover ratings resumed in April 2003 (nine months after planting), and seeding rates of 51 or 63.4 pounds/acre (57.2 or 71.1 kilograms/hectare) had significantly higher cover than the 12.7-pound/acre (14.2-kilogram/hectare) rate. At this rating date, no treatments were significantly different from the 25.4- and 38.1-pound/acre (28.5- and 42.7-kilogram/hectare) rates. Plot coverage improved through 10 months after planting, after which, coverage remained relatively constant. Although coverage for the 12.7-pound/acre (14.2-kilogram/hectare) rate remained low compared to other treatments, it showed significantly less cover only at 12 months after planting.

At 14 months after planting, all plots showed some level of flowering, percent cover ranged from 68.3% to 78.3% for seeding rates of 25.4 pounds/acre (28.5 kilograms/hectare), and plants were maturing and forming clumps, which may have prevented plots from reaching cover near 100%.

Effect of seeding rate and weeds on establishment

In both studies, higher seeding rates resulted in higher percent cover and the lowest seeding rate of 12.7 pounds/acre (14.2 kilograms/hectare) showed poor performance.

Although percent cover showed a significant correlation with seeding rate in study 1, the correlation was not as apparent in study 2. Reduced weed competition during establishment may account for the difference because weeds had to be chemically treated shortly after planting in study 1.

Weeds were not eradicated in the second study so we could analyze the relationship between early weed coverage and little bluestem density. The seed label for little bluestem indicated 1.12% weed seed, which was much higher than the 0.05% weed seed in the first study. On Aug. 26, 2002, two months after planting, redroot pigweed (*Amaranthus retroflexus* L.) cover ranged from 5% to 90% across the plots. There was a positive correlation between percent redroot pigweed and little bluestem seeding rate. Because the plots had been fumigated before planting, this correlation indicates that redroot pigweed seed was a component of the planted seed. Although weeds were mowed following cover ratings, it is possible that some residual influence was manifested throughout the study.

Weeds often limit stand establishment of perennial warm-season grasses and can cause complete stand failure (5,6). The relatively slow

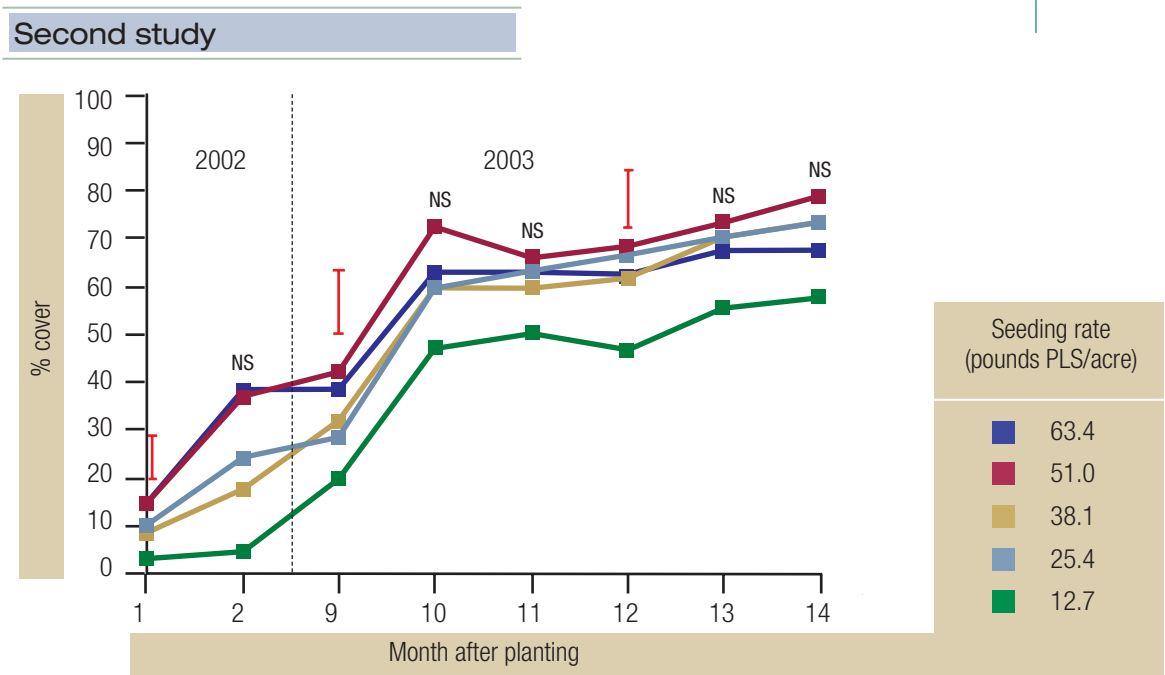

Figure 2. Influence of five seeding rates on establishment of Cimarron little bluestem in 2002 and 2003 with least significant difference bars for each month in red when significant. Study planted Aug. 9, 2002. No ratings were taken during winter from three through eight months after planting (vertical dotted line). NS, not significant.

2002-2003 establishments

The 2002 and 2003 establishment study of Cimarron little bluestem. **Top:** Two months after planting with weeds. **Middle:** 10 months after planting. **Bottom:** 13 months after planting.

establishment of little bluestem, its clumping growth habit and the likelihood of weed seed in the bag indicate that a weed control program may be necessary in order to gain the desired establishment.

The seeding rate response in study 1 (Figure 1) indicates that a higher seeding rate results in better initial coverage, but monthly means indicated no significant differences between seeding rates of 25.4 pounds/acre (28.5 kilograms/hectare) or more by the end of the study at 14 months after planting. Study 2 indicates a similar pattern, but no significant differences (Figure 2) were observed by the end of the study.

Conclusions

A seeding rate of 12.7 pounds PLS/acre (14.2 kilograms/hectare) for Cimarron little bluestem may not provide acceptable coverage for secondary golf course rough. Percent cover for this rate was unacceptable in both studies at two months after planting. Rainfall during early establishment can be a problem, particularly on slopes, and poor coverage would most likely result in establishment failure. Poor coverage combined with weed competition also would not produce the aesthetic appeal required on a golf course.

Because weeds were not controlled in the second study, weed competition may have contributed to the lack of significant differences among seeding rates.

In addition to higher seeding rates, high-quality seed and/or weed control may be necessary for acceptable establishment. If weed seed are present in the little bluestem seed, increasing planting rates likely will increase weed competition because little bluestem has slow establishment rates and a clumpy growth habit. An early response to weed competition may be the key to successful establishment.

This study indicates that establishment will require a minimum of two years. By the end of each study, there were no significant differences in cover among seeding rates of 25.4 pounds PLS/acre (28.5 kilograms/hectare) or greater. The significant differences found early in each study tended to fade by the end of the studies. Therefore, higher seeding rates may be beneficial only during the first year of establishment, particularly where rainfall is a problem. Where rainfall is not a problem, higher seeding rates may not be worth the additional costs over a two-year establishment period.

The highest cover obtained in any plot in either study was 86.7%. Obtaining 100% cover may not be a reasonable goal with little bluestem. This was apparent by the end of each study, when plants began to clump, leaving voids between plants. However, some voids may be beneficial in secondary roughs because voids make it easier for golfers to locate balls while still providing some level of penalty. Additional research is needed to determine the effect of little bluestem management practices such as mowing on the level of penalty.

Acknowledgments

Thanks to Wayne Langford, department of plant and soil sciences, Mississippi State University, for assistance with field research.

This research was initially published online as "Maximizing Cimarron little bluestem establishment as secondary rough for a golf course" by V.L. Maddox, J.M. Goatley Jr., G. Philley, B. Stewart and D.W. Wells in *Applied Turfgrass Science* doi:10.1094/ATS-2007-0802-01-RS. Aug. 2, 2007. (www.plantmanagementnetwork.org).

Literature cited

1. Dodson, R.G. 2000. Landscaping for wildlife. p. 55-73. *In:* Managing wildlife habitat on golf courses. Ann Arbor Press, Chelsea, Mich.
2. Jung, G.A., J.A. Shaffer, W.L. Stout and M.T. Panciera. 1990. Warm-season grass diversity in yield, plant morphology, and nitrogen concentration and removal in Northeastern USA. *Agronomy Journal* 82:21-26.
3. Maddox, V.L., J.M. Goatley Jr., H.W. Philley, J.V. Krans et al. 2003. Evaluation of native grass cultivars for Mississippi golf course natural areas under variable management: Part 1, soil pH of 5.2. Mississippi Agriculture and Forestry Experiment Station Bulletin 1132. Mississippi State University.
4. Maddox, V.L., J.M. Goatley Jr., H.W. Philley, J.V. Krans et al. 2004. Evaluation of native grass cultivars for Mississippi golf course natural areas under variable management: Part 1, soil pH of 6.5. Mississippi Agriculture and Forestry Experiment Station Bulletin 1137. Mississippi State University.
5. Martin, A.R., R.S. Moomaw and K.P. Vogel. 1982. Warm-season grass establishment with atrazine. *Agronomy Journal* 74:916-920.
6. Masters, R.A. 1995. Establishment of big bluestem and sand bluestem cultivars with metolachlor and atrazine. *Agronomy Journal* 87:592-596.
7. Mitchell, R.B., and C.M. Britton. 2000. Managing weeds to establish and maintain warm-season grasses. p. 159-176. *In:* K.J. Moore and B.E. Anderson, eds. Native warm-season grasses: Research trends and issues. CSSA and ASA, Madison, Wis.
8. Moser, L.E. 2000. Morphology of germinating and emerging warm-season grass seedlings. p. 35-47. *In:* K.J. Moore and B.E. Anderson, eds. Native warm-season grasses: Research trends and issues. CSSA and ASA, Madison, Wis.
9. Tietge, R.M. 1992. Wildlife and golf courses. p. 441-478. *In:* J.C. Balogh and W.J. Walker, eds. Golf course management and construction: environmental issues. Lewis Publishing, Chelsea, Mich.
10. USDA. 1991. Native perennial warm season grasses for forage in the Southeastern United States (except South Florida). USDA-SCS Ecological Science and Planning Staff, Fort Worth, Texas.

GCM

Victor L. Maddox (vmaddox@pss.msstate.edu) is a postdoctoral associate in the GeoResources Institute, Mississippi State University, Mississippi State. J. Michael Goatley Jr. is a turfgrass specialist and associate professor in the crop and soil environmental sciences department at Virginia Tech, Blacksburg. H. Wayne Philley is a research associate, Barry Stewart is an associate professor and D. Wayne Wells is an assistant Extension professor in the department of plant and soil sciences, Mississippi State University, Mississippi State.

The research says

- In two-year studies on Cimarron little bluestem for secondary roughs in golf courses, seed was planted at five rates.
- The recommended seeding rate of 12.7 pounds PLS/acre may not be acceptable, because poor coverage at two months after planting would probably cause establishment failure during rainfall.
- Based on this study, rates at or above 25.4 pounds PLS/acre would be recommended to improve establishment.
- However, 100% cover is still unlikely, and establishment will require a minimum of two years.
- Early management response to weed competition may be a key component for successful establishment of Cimarron little bluestem in golf course secondary roughs.