2004

Complementary grazing systems for beef cattle production

Kenneth J. Moore
Iowa State University, kjmoore@iastate.edu

Roger L. Hintz
Iowa State University, rhintz@iastate.edu

Mary H. Wiedenhoeft
Iowa State University, mwiedenh@iastate.edu

E. Charles Brummer
Iowa State University

Stephen K. Barnhart
Iowa State University, sbarnhar@iastate.edu

See next page for additional authors

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Recommended Citation
Moore, Kenneth J.; Hintz, Roger L.; Wiedenhoeft, Mary H.; Brummer, E. Charles; Barnhart, Stephen K.; and Russell, James R., "Complementary grazing systems for beef cattle production" (2004). Leopold Center Completed Grant Reports. 228.
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Complementary grazing systems for beef cattle production

Abstract
Pasture productivity in Iowa often is limited by the low yield of cool-season grasses in the summer. This project considers whether uneven seasonal distribution in pastures could be improved by including species that perform better under higher temperatures.

Keywords
Agronomy, Animal Science, Animal management and forage

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences | Animal Sciences

Lead Investigators
Kenneth J. Moore, Roger L. Hintz, Mary H. Wiedenhoeft, E. Charles Brummer, Stephen K. Barnhart, and James R. Russell

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Competitive Grant Report 00-06

Complementary grazing systems for beef cattle production

Abstract: Pasture productivity in Iowa often is limited by the low yield of cool-season grasses in the summer. This project considers whether uneven seasonal distribution in pastures could be improved by including species that perform better under higher temperatures.

Question & Answer

Q: Does interseeding smooth bromegrass with alfalfa, birdsfoot trefoil, or kura clover improve pasture productivity and 2) Does rotating cattle to summer pastures consisting of with big bluestem or switchgrass improve season-long productivity?

A: The results indicate that interseeding bromegrass pastures with kura clover greatly enhances livestock performance. Kura clover was the only legume that persisted well over the five years the experiment was conducting. Rotating cattle to warm-season grasses in the summer gave inconsistent results depending on the weather.

Approach and methods

A grazing study was conducted to assess the impacts of legumes and warm-season grasses on season-long productivity of complementary grazing systems. Eight complementary and four continuous grazing systems were evaluated. Cool-season pastures used for the study contained smooth bromegrass alone or mixed with birdsfoot trefoil, alfalfa, or kura clover. Warm-season pastures consisted of pure stands of big bluestem or switchgrass.

Background

Warm-season grasses achieve most of their growth during the summer when cool-season grasses are semi-dormant. By using cool-season and warm-season grasses in a sequential system in pastures, it may be possible to improve seasonal productivity and make pasture grazing a more attractive feeding option for Iowa livestock producers.

The overall intent was to evaluate the productivity of complementary grazing systems for beef cattle production on marginal land in southern Iowa. Specific project objectives were to:

• Evaluate the impact of legumes on the productivity and quality of cool-season pastures grazed in the spring and fall,
• Evaluate warm-season grasses for summer grazing, and
• Determine the effects of pasture sequence on the productivity of season-long grazing systems.

Principal Investigator:
K. J. Moore

Co-investigators:
R.L. Hintz
M. J. Wiedenhoeft
E.C. Brummer

S.K. Barnhart
Agronomy

J.R. Russell
Animal Science
Iowa State University

Budget:
$22,143 for year one
$21,805 for year two
$21,237 for year three

Cattle grazing cool-season pasture.
switchgrass. Pastures were established at the McNay Research Farm near Chariton over a two-year period beginning in 1994. Grazing systems were designed on the basis of a fixed seasonal carrying capacity and pastures were stocked accordingly with growing cattle throughout the grazing periods of 1997, 1998, 1999, 2000, and 2001.

Results and discussion
Weather conditions during the growing season varied considerably during the five years the pastures were grazed. The diverse weather conditions allowed investigators to evaluate the performance of the 12 grazing systems under multiple growth environments.

At the start of the project, species composition of all cool-season grasses was highly diverse and did not represent the desired binary grass-legume mixtures. By disturbing the soil and suppressing grass competition, a varied legume seed bank was activated. All cool-season grass pastures contained large numbers of additional legume species. White clover was the most abundant species issuing from the seed bank and was the dominant legume in control pastures.

The proportion of legumes in cool-season pastures declined significantly during the 1997 grazing season. Botanical composition was more stable during 1998, but there were significant declines in legume proportion at the end of the fall and spring grazing season. In 1999, the proportion of legumes followed a similar pattern during the early grazing period, and the legumes did not recover as well by the end of the season. The spring of 2000 was very dry and further depressed the performance of legumes from the previous season.

Forage availability represents the balance between the dry matter produced and that consumed by cattle. Variability in forage availability largely reflects growing conditions during the grazing period, which in this experiment was affected primarily by available soil moisture. The general trend was for forage availability in this project to continue to increase early within a grazing period, reach a peak somewhere near the middle, and to decline thereafter until the stocking rate was reduced or all cattle were removed. This trend was especially apparent in warm-season grass pastures, but was observed to a lesser extent in the cool-season pastures.

Forage quality of all cool-season pastures was relatively high in 1997 due to the large number of legumes present. For warm-season grass pastures, forage digestibility decreased and fiber concentration increased linearly during the summer grazing season. Forage quality did not vary among cool-season pastures in the 1998 grazing season. Protein concentration and digestibility of warm-season grass pastures declined during the summer grazing season and fiber concentration increased. Forage quality of pastures containing kura clover was superior to that of all other cool-season pastures in 1999. Seasonal trends in forage quality of cool- and warm-season pastures during the grazing season were similar to the previous grazing season.

Forage quality during the 2000 grazing season was similar among cool-season pastures containing alfalfa, birdsfoot trefoil, and no legume. Seasonal trends in forage quality for cool-season areas were similar to the previous seasons. Warm-season grass pastures did not differ statistically in digestibility or protein concentration, however, switchgrass digestibility was higher than that of big bluestem. Warm-season pastures were grazed earlier in 2000 so their initial quality was somewhat better. Forage quality of pastures interseeded with kura clover was very high due to relatively high proportions of legume in 2001. Forage quality of warm-season grass pastures was similar to previous seasons.

As a consequence of the unusually high legume proportion in all pastures in 1997, there were no differences in season-long animal performance due to the cool-season pasture grazed initially in the spring. There also were no differences in performance between cattle grazing switchgrass and big bluestem pastures. However, the animals on warm-season grasses during the summer gained less than those that grazed cool-season pastures for the entire season. In 1998, sequences containing kura clover and birdsfoot trefoil produced more total gain than either the control or pastures interseeded with alfalfa. However, a producer who is planning to graze only cool-season pastures all season will find that pastures with alfalfa are as desirable as those with kura clover and birdsfoot trefoil.

Total season live weight gains in 1999 were highest for cattle grazing pasture sequences containing kura clover. In particular, sequences with kura clover pastures grazed for the entire season and those in sequence with
switchgrass produced superior rates of live weight gains. In contrast to previous years, there were no differences in gains between cattle grazing switchgrass pasture in the summer and those that remained on cool-season pasture.

Due to poor forage growth in spring 2000, animals were rotated to warm-season grass several weeks earlier than in previous years. Grazing sequences containing kura clover resulted in the highest total cattle gains. Cattle that remained on cool-season pastures during the summer grew faster than those rotated to warm-season grass pastures (where big bluestem produced the best overall results).

Precipitation in summer 2001 was well below average, so forage growth during this period was relatively low and grazing of warm-season grasses was limited to 27 days. Total season weight gains for 2001 were lower than in previous years due to the summer drought.

The stability of the 12 grazing sequences was evaluated by comparing their variation in total live weight gain over years and mean seasonal performance. The sequences containing kura clover were the most productive and stable over the years of comparison. One of the most striking results was the large impact that yearly variations in temperature and precipitation have on the performance of the various systems, although the differences in legume persistence from year to year also play a role. The results suggest that the long-term stability of grazing systems might be improved by including a higher diversity of species.

Conclusions
Kura clover should be the preferred pasture legume in southern Iowa. It persisted well under five years of grazing and appeared to be more resilient under adverse growing conditions. Because of its superior persistence, pastures interseeded with kura clover maintained a higher quality level than those interseeded with alfalfa or birdsfoot trefoil. This resulted in higher total live weight gains for cattle grazing sequences that included pastures interseeded with kura clover.

In general, rotating cattle to warm-season grass pastures during summer was less advantageous than having them remain on cool-season pastures at a lower stocking rate. The quality of warm-season grass pastures was lower and declined more rapidly than that of cool-season pastures during the summer grazing period. Despite this less impressive performance, sequences with warm-season grass pastures did serve well under some conditions and may be a desirable alternative under some circumstances.

Stocking rates varied between sequences using warm season-grass and cool-season summer pastures, with the latter requiring more land to carry the same number of cattle. Decreasing stocking rates on cool-season pastures during the summer in response to reduced productivity is a common practice. It necessitates the use of more land, but the value of excess spring forage often is conserved as hay or is utilized by other classes of livestock. Having a warm-season grass pasture in the grazing sequence gives the producer more flexibility in pasture management and provides an opportunity to relieve pressure on some cool-season pastures when growth conditions become limiting.

Impact of results
The grazing-type legume cultivars used in the study were only recently developed and had not been evaluated for persistence and productivity in Iowa pastures. The use of complementary grazing systems had been researched previously, but the particular sequences evaluated in this project had not. Critical information was collected about using legumes in cool-season pastures and native warm-season grasses in summer pastures.

The complementary grazing systems evaluated in this experiment are intermediate in capital and management
requirements. They offer an opportunity for farmers with modest resources and limited time for management to enhance the productivity of their pastures, and in some cases may enable others to begin to move toward establishing more intensive controlled grazing systems.

**Education and outreach**

Final collection of project data will determine the extent and nature of outreach efforts. Dr. Barnhart will use information from this project in his forage and extension research activities.

For more information, contact
K.J. Moore, Agronomy, Iowa State University, Ames, Iowa
50011; (515) 294-5482, e-mail kjmoore@iastate.edu