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Sequential Grazing of Cool- and Warm-Season Pastures

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Abstract
Pasture productivity in Iowa often is limited by low productivity of cool-season grasses during summer. This uneven seasonal distribution of forage production could be improved by including species in pasture systems that perform better under higher temperatures. Warm-season grasses produce most of their growth during summer when cool-season grasses are semi-dormant. By using cool-season and warm-season pastures in a sequential system, it should be possible to improve seasonal productivity.

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Introduction

Pasture productivity in Iowa often is limited by low productivity of cool-season grasses during summer. This uneven seasonal distribution of forage production could be improved by including species in pasture systems that perform better under higher temperatures. Warm-season grasses produce most of their growth during summer when cool-season grasses are semi-dormant. By using cool-season and warm-season pastures in a sequential system, it should be possible to improve seasonal productivity.

The overall objective of this project was to evaluate the productivity of sequential grazing systems for beef cattle production in southern Iowa. Specific objectives were to: (1) evaluate the impact of legumes on the productivity of cool-season pastures grazed in the spring and fall, (2) evaluate warm-season grasses for summer grazing, and (3) determine the effects of pasture sequence on the productivity of season-long grazing systems.

Materials and Methods

Eight sequential and four continuous grazing systems were evaluated to determine the impacts of legumes and warm-season grasses on season-long productivity of grazing systems. Pastures were established at the McNay Research Farm near Chariton, Iowa on a Grundy-Haig soil. Smooth bromegrass (*Bromus inermis* Leyss. cv. Bounty) was planted into twelve 3-acre pastures in early spring 1996. At the same time, birdsfoot trefoil (*Lotus corniculatus* L. cv. Norcen), alfalfa (*Medicago sativa* L. cv. Alfagraze), and kura clover (*Trifolium ambiguum* Bieb. cv. Rhizo) each were planted into three of the pastures. All seeding was done into dead sod using a no-till drill. Seeding rates were 12 lb/acre for smooth bromegrass, 5 lb/acre for birdsfoot trefoil, and 8 lb/acre for alfalfa and kura clover. Pastures were blocked by soil characteristics such that each legume treatment and a control (N-fertilized) pasture occurred in each of three blocks. Big bluestem (*Andropogon gerardii* Vitman cv. Roundtree) and switchgrass (*Panicum virgatum* L. cv. Cave-in-Rock) were established into an adjacent set of six 4.5-acre pastures during the summer of 1994, using corn as a companion crop. Big bluestem was seeded at 8.0 lb/acre, and switchgrass was seeded at 5.5 lb/acre—both with corn at a population of 15,000 plants/acre.

The grazing systems were designed on the basis of a fixed seasonal carrying capacity, and pastures were stocked with growing cattle throughout the 1997, 1998, 1999, 2000, and 2001 grazing seasons. Stocking densities for cool-season pastures were 2 animals/acre during spring and fall grazing seasons, and 0.7 animals/acre during the summer. Warm-season pastures were stocked with 1.8 animals/acre. Animals were weighed at approximately 4-week intervals during the grazing period to determine performance for each component of the system. Grazing of cool-season pastures began in May each year, and cattle were rotated to summer pastures based on grazing readiness of warm-season grasses. Two steers remained on cool-season pasture throughout the summer grazing period to serve as a control and for evaluation of the effects of legumes on summer pasture productivity. At the end of the summer grazing period, all cattle were returned to their original pasture for the remainder of the grazing season. Grazing was terminated each year when available forage became limited. Dates of grazing cool- and warm-season pastures are presented in Table 1.

Results and Discussion

During the first year of grazing (1997), species composition of all cool-season pastures was very diverse and did not represent the desired binary grass–legume mixtures. Apparently, by disturbing the soil and suppressing grass competition, a very diverse legume seed bank was activated. All of the cool-season pastures contained large numbers of legume species in addition to the intended one. As a consequence, there were no differences in season-long animal performance due to the cool-season pasture grazed initially in the spring (Table 2). However, by the end of that grazing season and in subsequent years, the sown legume species became more dominant in the pastures and exerted an effect in subsequent years. In 1998, systems containing kura clover and birdsfoot trefoil produced more total gain for systems in which warm-season grasses were included. However, pastures containing alfalfa produced as well as those containing kura clover and birdsfoot trefoil for systems in which cool-season pastures were grazed all season. In 1999, 2000, and 2001, systems containing kura clover produced more gain than those containing any other or no legume.

There were large differences in total gain and seasonal average daily gain due to the summer pasture grazed (tables 1 and 2). In 1997, animals that grazed warm-season pastures during the summer gained less weight than those grazing cool-season pastures for the entire season. Rates of gain for animals grazing warm-season pastures began to level off during the second half of the summer grazing period, while animals grazing cool-season pastures continued to gain weight during this period. These differences continued into the final grazing period, when all cattle were on cool-season pasture. It is unclear why animals grazing warm-season pastures in the summer failed to recover when moved to cool-season pastures. Apparently, there were carryover effects related to adaptation of their digestive system to the relatively low-quality summer pastures. Growing conditions in 1997 were cool and wet and, therefore, very conducive to growth of cool-season species. In 1998, animals grazing big bluestem pastures during summer performed as well or better than those remaining on cool-season pastures at a lower stocking rate. Production from switchgrass pastures was improved in 1999 by removing initial spring growth as hay prior to the summer grazing period. Because of a very dry spring in 2000, cattle were rotated to warm-season pastures almost a month earlier than in previous years. However, moisture conditions improved mid-season, and cattle were returned to cool-season pastures in late July, where they remained until the end of the grazing season. Substantial regrowth of warm-season pastures that could have been used as either pasture or hay occurred during the later part of the season. However, it was decided to allow the growth to stand so that pastures could be burned in the spring of 2001 to help control encroaching weed populations. There was a summer drought in 2001 that substantially reduced the number of grazing days on warm-season pastures. Consequently, warm-season and total season animal gains were lower than in previous years.

One of the more striking results of this experiment is the large impact that year had on performance of the various systems. Most of this variation was due to differences in temperature and precipitation among years. The productivity of the species varied due to weather patterns, with different sequences producing the highest gains during the first three grazing seasons. This suggests that the stability of grazing systems over time might be improved by including a higher diversity of species. However, it has become evident over the last three years that kura clover should be included as a legume species, regardless of the grazing sequence followed.

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Table 1. Dates and number of days cool- and warm-season pastures grazed in 1997, 1998, 1999, 2000, and 2001.

Sequence	1997	1998	1999	2000	2001
Start	13-May	13-May	13-May	11-May	9-May
→WS	10-Jul	24-Jun	8-Jul	5-Jun	5-Jul
→CS	3-Sep	18-Aug	19-Aug	20-Jul	1-Aug
End	1-Oct	18-Sep	23-Sep	26-Sep	29-Aug
Total Days	141	128	133	138	112
CS	86	72	91	93	85
WS	55	56	42	45	27

Table 2. Total, cool-season, and warm-season liveweight gains of cattle grazing various sequences of cool and warm-season pastures.

Initial pasture[1]	Summer pasture[2]	Total gain					Cool-season gain					Warm-season gain				
		1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
		---------- lb / animal ----------														
SB	BB	241	209	194	203	129	139	143	126	106	107	102	66	68	97	23
SB	SG	247	177	222	198	117	167	140	141	140	96	80	37	81	57	21
SB	CS	283	202	227	223	161	204	116	144	151	132	79	86	83	72	29
SB+BT	BB	243	236	191	184	146	161	148	132	110	95	82	88	59	74	51
SB+BT	SG	226	190	195	171	142	147	135	134	109	100	79	55	61	62	42
SB+BT	CS	298	238	208	206	134	192	166	138	125	106	106	72	70	82	28
SB+KC	BB	275	258	215	247	168	179	176	162	171	136	96	82	53	76	32
SB+KC	SG	230	192	257	209	180	147	156	186	167	159	83	36	71	42	21
SB+KC	CS	281	243	256	284	203	169	169	164	186	168	112	74	92	97	36
SB+A	BB	236	192	209	213	115	156	124	163	141	101	80	68	46	72	14
SB+A	SG	241	177	223	206	128	156	112	157	142	105	85	65	66	64	24
SB+A	CS	291	238	226	222	140	183	159	168	133	118	108	79	58	89	22

[1] SB = smooth bromegrass, BT = birdsfoot trefoil, KC = kura clover, A = alfalfa.
[2] BB = big bluestem, SG = switchgrass, CS = cattle remained on cool-season pasture.