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Breeding and Management Improve Quality of Switchgrass Pasture

By Bruce Anderson, Ken Vogel, and John Ward

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BETTER CROPS with PLANT FOOD

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Breeding and Management Improve Quality of Switchgrass Pasture

By Bruce Anderson, Ken Vogel, and John Ward

LIVESTOCK PRODUCERS north and east of the central Great Plains rely on cool-season grasses like smooth brome, orchardgrass, tall fescue, and timothy for pasture. Cool-season grasses can be highly productive and nutritious during spring and fall, but during summer they are less productive and low in quality.

Switchgrass is an erect, warm-season perennial grass native to this area. When switchgrass pastures are grazed during summer and cool-season grass pastures are grazed during spring and fall, livestock gains are higher than when cool-season grasses are grazed during the entire grazing season (**Table 1**).

Table 1. Daily gain of heifers during summer following spring grazing of tall fescue at Mt. Vernon, MO.

Grass	ADG
Tall fescue	0.92
Switchgrass	1.21

Matches et al. 1975-78. SWC Res. Rep. UMC

Historically, switchgrass has been difficult to establish because of slow seedling growth and weed competition. Today, switchgrass can be established in one growing season when atrazine herbicide is used to control weed growth (**Table 2**).

Although using switchgrass for midsummer grazing will improve cattle gains, the digestibility of switchgrass is lower than that of cool-season grasses harvested at similar stages of maturity. Digestibility measures the energy value of a grass, and the more digestible grasses usually produce faster rates of gain.

In 1973, a study was initiated in eastern Nebraska to improve switchgrass digestibility by plant breeding. Over 2,000 switchgrass plants that were similar in maturity and origin to 'Pathfinder' switchgrass were established in a selection nursery. Each of these plants had digestibility measured using a test-tube technique called *in vitro* dry matter disappearance (IVDMD). This technique uses rumen fluid collected from cattle to digest a sample of forage. Twenty-five healthy, vigorous plants were identified that had high digestibility. Another 25 vigorous plants with low IVDMD also were identified to help grass breeders estimate the genetic variability of digestibility in switchgrass. After the high and low IVDMD plants were identified, both

Table 2. Stands and forage yields of switchgrass seeded in 1978 at Mead, NE.

	1978	1979	
Atrazine	Forage Yield	Forage Yield	Stand
lb/A	tons/A	tons/A	%
0	0	4.0	65
0 + handweeded	3.9	5.2	90
1	2.7	6.0	97
2	2.4	5.0	94

Martin et al. 1982. Agronomy Journal 74:916-920

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Table 3. Forage yields and digestibility of three switchgrass hays seeded at Mead, NE in 1978.

	Means					
	1978		1979		1980	
Strains	Yield	IVDMD	Yield	IVDMD	Yield	IVDMD
	tons/A	%	tons/A	%	tons/A	%
High IVDMD	3.3	47.2	4.1	55.8	5.6	48.9
Pathfinder	3.2	45.6	4.0	54.0	5.2	43.6
Low IVDMD	3.3	43.3	4.1	52.8	5.6	44.1

Vogel et al. 1984. Crop Science 24:977-980

groups were moved to separate, isolated fields where seed was produced.

In 1978, seed produced from these isolated switchgrass fields and from Pathfinder were seeded in small plots (**Figure 1**). From 1978 through 1980, the IVDMD of the high IVDMD, Pathfinder, and low IVDMD strains averaged 50.6, 47.7, and 46.7%, respectively. The strains did not differ appreciably in forage yield (**Table 3**). Switchgrass responds well to nitrogen fertilizer (**Table 4**) so these high yields were obtained by applying 100 lb of N/A. Soil tests showed no P was needed in that particular study. However, switchgrass does respond to P applied on low P soils (**Table 4**).

On low P soils, switchgrass uses N fertilizer more efficiently when P requirements are met.

Table 4. Annual yield of switchgrass fertilized with N and/or P in Dixon County, NE.

P	N Applied (lb/A)			
Applied	0	40	80	120
lb/A	tons/A			
0	1.58	1.60	1.93	1.90
20	1.33	2.17	3.12	3.46
40	1.35	2.18	2.98	3.63

Rehm, 1981. Soil Sci. Res. Rep. UNL

Figure 1. Switchgrass plots.

(continued on next page)

Replicated one-acre pastures were seeded to these three strains in 1981. To speed establishment, 2 lb active ingredient of atrazine/acre was applied preemerge. In 1982 and 1983, pastures were burned in early spring and 2 lb of atrazine were applied to reduce weed invasion. Each year 100 lb of N as ammonium nitrate/acre was applied in May. Pastures were grazed by three beef yearlings/pasture for 69 and 62 days, respectively, in 1982 and 1983 (**Figure 2**). Heifers were used in 1982 and steers in 1983.

Yearlings grazing the high IVDMD strain gained 0.4 lb/day more than yearlings grazing Pathfinder and produced nearly 80 lb more beef per acre each year (**Table 5**). At 60 cents/lb, this would mean an additional $48 annual profit per acre. Gains during 1983 were much higher than in 1982. In 1982, yearling heifers began grazing when switchgrass was 32 inches tall and were unable to consume it as rapidly as new growth occurred, allowing many seedheads to develop. In 1983, yearling steers began grazing when switchgrass was 12 inches tall and consumed it at nearly the same rate as growth occurred. No seedheads developed during grazing. This illustrates the importance of grazing management practices that provide livestock with less mature, more digestible forage.

Conclusion

These results demonstrate that switchgrass is a highly productive warm-season grass for hay production or summer grazing. A small improvement in IVDMD produced a large increase in livestock gains. The high IVDMD strain has been released as the new cultivar 'Trailblazer', and switchgrass quality might be improved even more with additional breeding and improved forage management. Certified seed should be available for planting in the spring of 1986.

Breeding for improved forage quality in other grasses may also improve gains of livestock grazing these grasses. ■

Table 5. Average forage digestibility and performance of beef yearlings grazing switchgrass strains at Mead, NE.

	1982			1983			1982-83 Avg.	
Strain	IVDMD	ADG	Gain/A	IVDMD	ADG	Gain/A	ADG	Gain/A
	%	lb		%	lb			
High IVDMD	49.4	1.0	210	63.7	2.2	402	1.6	306
Pathfinder	47.2	0.6	128	62.0	1.8	327	1.2	227
Low IVDMD	48.0	0.9	186	61.3	1.7	311	1.3	255

Ward et al. 1984. Journal of Animal Science 59 (Supplement 1):303 (abstract 385).

Figure 2. Beef yearlings grazing.