Short Grass Prairie Grazing Basics and Research Tour

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Precipitation captured by the soil is the limiting factor to forage growth in the water-limited rangelands of western Kansas. Several years of correlating precipitation timing and amount to the end of growing season rangeland yield revealed the time of year that precipitation has the greatest affect on forage production and grazing animal performance. Late fall to early spring is the time period with the greatest need to increase pasture forage availability or quality, and supplementation late in the growing season was examined to determine strategies to keep grazing on low quality forage while maintaining animal gains. For producers who would like to reduce feeding hay or supplement early and late in the season, yet have some early season grazing, this program also looked at data from a five year grazing trial of perennial cool-season grasses that can fill this niche in the mixed and shortgrass prairie region of western Kansas. Information given in this summary is intended to help producers make decisions on stocking during years of average or minimal precipitation, and to show ways in which grazing may be extended and animal performance be maintained without increasing annual inputs.

Precipitation Effects on Shortgrass Range: Forage Production and Steer Gain

Recent drought conditions raised concerns about having enough rangeland forage production to sustain animals for the current grazing season, having sufficient forage for winter stockpiling, animals gaining enough weight during the summer on drought-stressed forage, and producing enough forage the next growing season after the drought to sustain herd size. Available soil water from precipitation is the main limiting factor to total forage production in most regions. Other factors such as prior grazing history (stocking rate) and time of year in which grazing took place also can affect forage production in future growing seasons. To plan for future drought periods, it would be beneficial to know the amount of pasture production that could be expected from decreasing amounts of precipitation so that producers can make informed stocking decisions. Shortgrass rangelands at the Kansas State University Agricultural Research Center–Hays near Hays, KS, have been used for grazing research since the 1940s. For studies with similar stocking rates, rangeland production was compared with annual precipitation or specific monthly combinations of precipitation data for 35 years to find the best relationships between the times of year precipitation is received and end of the growing season forage production. Animal gain data for one of these grazing studies was then correlated to precipitation periods to analyze precipitation effects on steer gain. The time period of precipitation with the greatest relationship to end of growing season forage production was precipitation from October of the previous year (OctPY) through September of the current year (r^2 = 0.61, Fig. 1). Late fall precipitation of the previous year and winter precipitation are important for early spring cool-season grass growth, namely western wheatgrass and annual bromes. The OctPY through September time period also includes precipitation that would fall during the main growing period of the dominant forage in the shortgrass rangeland system, namely warm-season grasses. The two-month period that had the greatest relationship with end-of-season forage production was May and June precipitation (r^2 = 0.56, Fig. 2). This two-month period represents the most rapid growth period of warm-season grasses in western Kansas; therefore, precipitation during this time period is a reasonable predictor of end-of-season forage production.

We found that OctPY to April of the current year precipitation (late fall, winter, and early spring precipitation) had almost no relationship to end-of-year forage production (r^2 = 0.11). Because the dominant warm-season grasses are not growing during this period, precipitation during this time may evaporate or be used by cool-season forages before the warm-season grasses are able to utilize it; furthermore, the lack of precipitation during the winter does not indicate that a lack of forage production will occur, because precipitation in May and June can still produce favorable forage growth. Therefore, precipitation during this late fall, winter, and early spring time period alone had little effect on total forage production during the growing season. Precipitation one and two years prior to the current growing season also had no relationship with current-year forage production (r^2 = 0.07 and 0.00). For drought planning, stocking at a recommended moderate stocking rate for the rangelands being utilized, then adjusting that stocking rate based on condition and vigor of the vegetation entering the winter dormant season, should be the baseline for spring stocking rates, because winter precipitation had almost no relationship to end-of-season forage production. Further refinements of the stocking rate could be based on May precipitation and May and June precipitation combined, because nearly half of the variation in end-of-season forage production can be explained by precipitation that occurs during this time period. However, sequential years of drought may cause grass tiller and plant loss and place rangelands in a state of lower vigor and lower plant density; therefore, beginning season stocking rates may need to be reduced and further adjustments may need to occur during the spring growing season if precipitation is lacking.

Producers are also concerned about animal gain during the grazing season, especially during drought years when producers question forage quality. Thirteen years of stocker studies show that when animals are managed with consistent vaccination, growth implant, stocking rate, and supplement strategies, spring rains have a slight negative relationship with spring animal gain (r^2 = 0.26). As spring precipitation increases, individual animal daily gains decrease over the same time period. Individual animal daily gains during the last half of the growing season, July through September, had almost no relationship with rainfall during the last half of the growing season (r^2 = 0.03); however, when looking at total animal gain during the grazing season, an evident negative relationship with precipitation from OctPY to September of the current year was present (r^2 = 0.50, Fig.3). As precipitation increased, total animal gain decreased. Available plant water is necessary for plant cells to divide, and cell division occurs as plants develop leaves, stems, and seedheads. Plant water allows plants to grow and mature, and as plants mature, forage quality declines. Periods of drought place plants into a position of moisture stress, thus plants do not have the available water to develop and mature as quickly. Therefore, plants in a drought remain in a less mature stage of development for a greater length of time through the growing season and have greater forage quality for a longer period of time.

As long as animals have adequate forage available to meet daily dry matter intake needs during drought, the forage consumed should be of greater quality. Animals that do not perform well during drought periods are likely limited by heat stress or poor water quality that may accompany the drought and reduce performance, are limited by lack of available forage to meet daily dry matter intake needs, or are consuming the prior year's residual forage that remains the following grazing season. In general, grazing animals are likely not limited by forage quality of native rangelands during dry years.

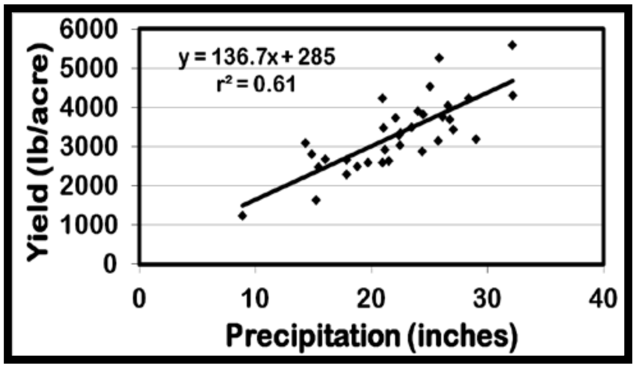

Figure 1. The relationship of 35 years of rangeland yield and annual precipitation from October of the previous year through September of the current year at Hays, KS. The steadily increasing solid line and tightly grouped points indicate that rangeland yield increased steadily and predictably as total water year precipitation increased.

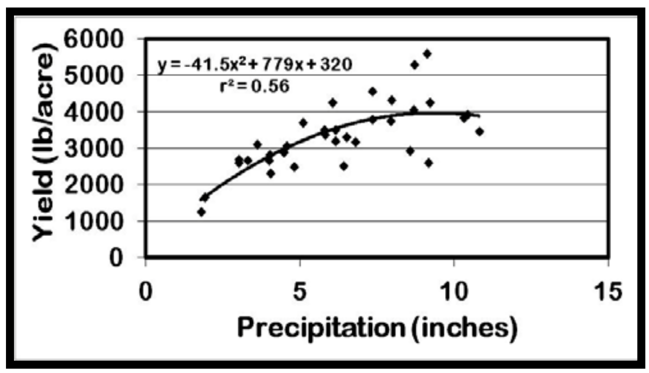

Figure 2. The relationship of 35 years of rangeland yield and total precipitation in May and June at Hays, KS. The increasing solid line and tight grouping at less than 7 inches of precipitation indicates that rangeland yield steadily increased as May and June total precipitation increased up to 7 inches, after which yields became more scattered.

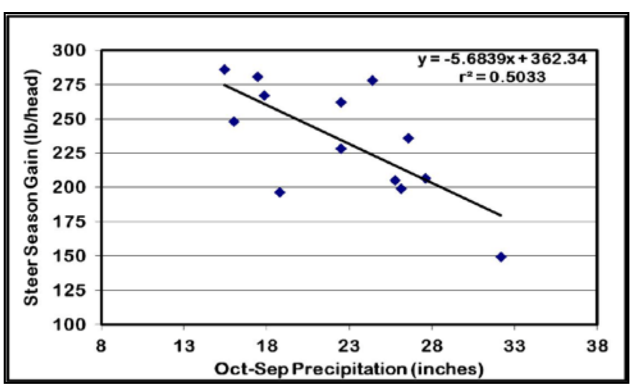

Figure 3. Relationship between stocker steer individual total season animal gain and annual precipitation from October of the previous year through September of the current year in 1999–2012 at Hays, KS. The steadily declining solid line indicates that steer total individual gain steadily declined as seasonal precipitation totals increased.

Using Wet Distillers Grains as a Late Season Supplement for Grazing Steers

Steers grazing on Kansas shortgrass rangelands achieve approximately 55% of their total season gain during the first half of the grazing season and 45% during the last half of the grazing season. In order to try to maintain a higher rate of gain during the last half of the season, protein supplementation may be necessary to improve the digestibility of late season forage. It was hypothesized that wet distillers grains plus solubles (WDGS) could be used as a replacement for a mixture of finely rolled milo and soybean meal supplement as a late season crude protein (CP) source. On Kansas shortgrass rangeland during the 2011 and 2012 growing seasons, steers were stocked continuously season-long at a rate of 3.5 ac/steer, or 0.95 animal unit months (AUM)/ac. Pastures were stocked with ten steers per pasture from the first week of May through the first week of October for a 150 day grazing season. During the last half of the grazing season, animals were supplemented with a finely rolled milo and soybean meal mix in a 1:1 ratio, were supplemented with WDGS as a late season protein supplement, or were fed no supplement. The milo:soybean meal mixture (30% CP) was fed in a bunk at a rate of 1.0 lb dry matter/hd/day. The WDGS (31% CP) was fed in two treatments, either in a bunk or on the ground on shortgrass vegetation, also at a rate of 1.0 lb dry matter/hd/day. Pastures were also sampled for dry matter composition and dry matter yield estimates in mid-July and early October at the start and end of supplement feeding. Gains during the early season in 2011-2012 were statistically similar among the groups before being fed any supplements, gaining between 1.97 and 2.21 lb/hd/day. During the last half of the grazing season, animal gains were greater for the wet distillers supplemented groups fed in the bunk or on the ground compared to no supplement. For the whole grazing season, steers fed a late season supplement gained 27-36 lb/hd more than the unsupplemented group. Total beef produced was greater for the wet distillers supplemented groups compared to the unsupplemented group (87 and 89 lb/acre vs. 78 lb/acre). Animals unsupplemented on pasture gained more in the feedlot than animals fed distillers grains on the ground (521 lb/hd vs. 496 lb/hd). Total dry matter available in the pastures was similar for all supplement treatments in mid-July at the start of the supplement period, averaging 1266 lb/ac, and at the end of the grazing season, averaging 927 lb/ac, so supplement treatment did not affect available forage dry matter in pastures. Wet distillers grains plus solubles can be fed as a late season protein supplement to replace a 1:1 mix of milo:soybean meal. However, close observation shows that a thin layer of WDGS may remain on the soil surface that animals are not able to consume when fed on the ground, and thus lack dry matter and protein that animals of other treatments were able to consume when fed in a bunk. Co-products from the grain processing industry can be used as economical supplements for grazing stocker cattle to replace more expensive supplement resources. Lack of supplement or feeding supplement on the ground may limit animal gains during the late grazing season.

TABLE 1. Individual animal performance of steers on shortgrass rangeland during the early grazing season of May-July, during the late grazing season of July-October while fed protein supplements, total season animal performance, and total animal productivity on a pasture basis in 2011-2012. SBML=milo:soybean meal mixture; WDGS=wet distillers grains plus solubles; ADG=average daily gain.

Supplement		May-Jul Steer ADG	Jul-Oct Steer ADG	May-Oct Steer ADG	May-Jul Total Gain	Jul-Oct Total Gain	May-Oct Total Gain	May-Oct Beef
		---------lb/day-------			---------lb/hd--------			lb/ac
SBML	**Bunk**	2.08	1.55[ab]	1.84[a]	167	117[ab]	284[a]	83[ab]
WDGS	**Bunk**	2.07	1.73[a]	1.92[a]	166	130[a]	296[a]	87[a]
WDGS	**Ground**	2.21	1.59[a]	1.92[a]	177	119[ab]	296[a]	89[a]
Unsupplemented		1.97	1.35[b]	1.67[b]	159	102[b]	257[b]	78[b]

TABLE 2. Individual animal performance and carcass traits of steers after the feedlot finishing phase following late season protein supplementation on shortgrass rangeland July-October from 2011-2012. SBML=milo:soybean meal mixture; WDGS=wet distillers grains plus solubles; ADG=average daily gain.

Supplement		Feedlot Steer Gain	Feedlot Finish Weight	Carcass Weight	Yield Grade	Marbling	Ribeye Area	Backfat
		lb	lb	lb			inches^2	inches
SBML	**Bunk**	514[ab]	1369	884	2.80	6.28	13.70	0.51
WDGS	**Bunk**	513[ab]	1371	884	2.83	6.23	13.52	0.53
WDGS	**Ground**	496[b]	1358	885	2.72	6.17	13.68	0.48
Unsupplemented		521[a]	1342	873	2.80	6.05	13.30	0.50

Values in columns followed with different letters are statistically different.

Wheatgrasses for Complementary Cool-season Forage

Three grazing systems {native range (NR), western wheatgrass/native range (WW/NR), and tall wheatgrass/native range (TW/NR)} were compared for beef cow/calf production in 2007-2011. It was hypothesized that sequential grazing of cool-season complementary forage then warm-season dominated rangeland would increase cow/calf production compared to grazing warm-season dominated rangeland alone. The NR treatment allows 10.6 ac/ hd, while the WW/NR and TW/NR allows 8.2 ac/hd on native rangeland and 2.4 ac/hd on seeded complementary forage, equaling 10.6 ac/hd for all treatments. Cows were weighed, condition scored, and measured with ultrasound for backfat, marbling, and muscle depth prior to grazing and at each transition from grazed forage sources. After five seasons of spring grazing, cows on the seeded WW treatment and the native rangeland treatment had greater April through June cow gain (125 and 131 lb/hd) than the cows on the seeded TW treatment (76 lb/hd). However, calf gain on the three grazing systems was only different between the native rangeland and the TW treatments from April through June, and was 199, 190, and 181 lb/hd for the native rangeland, WW, and TW treatments. Western wheatgrass composition in the native rangeland only pastures ranged from 17-26% western wheatgrass at the end of each growing season from 2007-2011, respectively. These pastures had western wheatgrass composition ranging from 5-24% from 2000 to 2005. Thus, a native cool-season complement was already abundant in the native rangeland only system, so animals would gain as well on this native rangeland as animals on a seeded cool-season complement early in the season. Beginning in July, all animals grazed on native rangeland. For the whole season, April through September, the native rangeland only cows gained more than the WW and TW cows (132 lb/hd, 73 lb/hd, and 62 lb/hd), while the native rangeland only calves also gained more than the WW and TW calves (424 lb/hd, 391 lb/hd, and 386 lb/hd). Thus, the high proportion of native western wheatgrass in the native rangeland only pastures masked any positive effects of utilizing a seeded cool-season complement. Furthermore, deferring grazing of native rangeland until July of the WW and TW treatments likely increased the vigor of the native rangeland, but also allowed the forage to mature and decline in quality before being grazed.