Summer Grazing System using only Domesticated Cool-Season Grass Pastures

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Crested wheatgrass is a domesticated cool-season grass that is physiologically ready for grazing in early May, after the three and a half new leaf stage, four to five weeks earlier than native cool-season grasses that reach the three and a half new leaf stage in early June. The ability to start grazing a month ahead of grazing on native rangeland is the primary biological advantage of crested wheatgrass pastures and their priority use should be grazing during May as spring complementary pastures in conjunction with summer native rangeland rotation systems. Even though this is a fact long-known, a large portion of beef production operations have greater land area planted with crested wheatgrass than can be used during May as spring complementary pastures and many of these beef operations are in need of additional summer grazingland.

The crested wheatgrass acreage in excess of May complementary pastures can be used in a summer grazing system by implementation of twice-over grazing technology (Manske 1999a, 2007). There are two biological problems that need resolution in order for summer grazing of crested wheatgrass pastures to work and to be sustainable as a long-term practice. First, the high stocking rate used on the spring grazing treatment during May cannot be the stocking rate used during summer grazing of crested wheatgrass, and second, crested wheatgrass lead tiller forage drops below 9.6% crude protein during the third week in June and livestock lose weight shortly after.

The stocking rate used during summer grazing of crested wheatgrass should be the same rate as properly stocked native rangeland on identical soil types used during the summer. The total net primary production of crested wheatgrass herbage biomass during an entire growing season is about the same as that produced on native rangeland. Crested wheatgrass monocultures appear to produce greater herbage than native rangeland because ungrazed crested wheatgrass has one major growth period with most of the lead tillers growing together at a similar time and at a similar rate resulting in a high peak herbage biomass early in the growing season with little new growth occurring after mid to late June. Native rangeland, on the other hand, is a mixture of numerous cool-season and warm-season species with several growth periods not occurring together but spread throughout the growing season resulting in a lower peak herbage biomass extended over a longer period of time, and producing about the same quantity of total new growth material as crested wheatgrass in a year.

The stocking rate for grazing crested wheatgrass during May can be relatively heavy because of the similar lead tiller rapid growth during the early portion of the growing season. A high stocking rate can be repeated annually on spring complementary crested wheatgrass pastures when the grazing occurs during the period that the quantity of herbage biomass is increasing towards the peak level and if the stubble left after grazing at the end of May is about three inches tall and the pasture is not used again until the next spring. Crested wheatgrass plants used heavy one time during May require the remainder of the growing season to recover biologically.

Double heavy use of crested wheatgrass does not work biologically. Nevertheless, many crested wheatgrass pastures have two heavy uses per growing season with intense grazing occurring during the spring and fall. Some crested wheatgrass pastures are grazed in the spring and hayed during the summer, and other pastures are hayed during the summer and grazed in the fall. Crested wheatgrass plants are hardy but they do not fully recover from two heavy uses during one growing season. Numerous biological problems develop in crested wheatgrass plants that are used heavy two times each year. Double heavy use decreases plant health with the accompanying decreases in herbage production and plant density. Repeated double heavy use results in a depauperated stand that can have greater than 50% bare ground, while a properly managed healthy stand located in the Northern Plains would have no more than about 6% to 12% bare ground. Heavy grazing at the high spring stocking rate on summer crested wheatgrass pastures would be expected to produce negative effects on plant health similar to that of double heavy use. However, stocking summer grazed crested wheatgrass pastures at the same rate as summer grazed native rangeland pastures should be perpetually sustainable.

Traditionally managed crested wheatgrass pastures provide adequate crude protein for lactating cows until the third week in June. The nutritional quality of crested wheatgrass lead tiller forage drops below 9.6% crude protein soon after the flowering stage when the seeds are being filled (figure 1) (Manske 1999b). Stimulation of vegetative secondary tillers that have a crude protein content greater than 9.6% would be able to extend the length of time for an additional two to two and a half months, until late August, that the forage quality on crested wheatgrass summer pastures would meet the dietary requirements of lactating cows.

The physiological processes for stimulation of vegetative reproduction of secondary tillers from axillary buds in crested wheatgrass is the same as in native range grasses. Secondary tiller development from axillary buds is regulated by lead tillers, through a process called lead tiller dominance. The lead tillers produce an inhibitory hormone that prevents the growth hormone from activating growth within axillary buds. Grazing that removes a small amount (25% to 33%) of young leaf tissue from the aboveground portion of lead tillers after the three and a half new leaf stage and before the flowering stage reduces the amount of the inhibitory hormone in the plant. With that inhibitory hormone reduced, the growth hormones stimulate vegetative reproduction, and secondary tillers develop from the previous year's axillary buds (Manske 2007). If no defoliation occurs before the flowering stage, the lead tiller inhibits vegetative tiller development until the inhibitory hormone production naturally declines during the flowering stage. This hormone reduction permits one axillary bud to grow and develop into a secondary tiller, which in turn produces inhibitory hormones that prevent growth of the other axillary buds. Single tiller development after the flowering stage on crested wheatgrass plants is, by default, primarily as crown tillers producing bunches, while multiple tiller development following biologically effective stimulation by grazing is mainly as rhizome tillers producing dense sod.

The period of stimulation of vegetative development of multiple secondary tillers in crested wheatgrass is between the three and a half new leaf stage and the flowering stage. Crested wheatgrass has three and a half new leaves around 22 April in western North Dakota (table 1) (Manske 1999b). The leaf weight, however, is not great enough to start grazing during late April and it is important to wait until 1 May when the herbage biomass quantity is sufficient for grazing. The first stalks of crested wheatgrass with flowers occurs around 28 May (table 1) (Manske 1999b). Because of some variance with their growth stages, there is a period of about 10 to 14 days in which the population of lead tiller stems reach the flowering stage. Stimulation of secondary tillers should occur during the period between 1 May and 7 or 11 June. The degree of secondary tiller stimulation from grazing late flowering lead tillers of crested wheatgrass is not known and adjustments to the end of the stimulation period may be required. If 10 June is selected, there would be 40 days for the stimulation period which would also be the duration of the first grazing period. The second grazing period is double the number of days of the first period and would be 80 days in duration. A summer grazing system on crested wheatgrass pastures would be from 1 May until 29 August, with a duration of 120 days.

Each pasture in a crested wheatgrass summer grazing system with four similar sized pastures would be grazed for 10 days in succession during the first grazing period between 1 May and 10 June. Then, during the second grazing period, each pasture would be grazed again for double the number of days it was grazed during the first grazing period. The second period would occur between 10 June and 29 August and each of the four similar sized pastures would be grazed for 20 days in the same sequence. The first pasture grazed in the sequence was the last pasture grazed the previous year.

If the pastures were of different sizes, the number of days grazed during the first period is equal to the same percentage of 40 days, or the number of days in the adjusted stimulation period, as the pastures' percent contribution of forage to the total pasture system. If four different sized pastures contributed 20%, 22%, 30%, and 28% of the total pasture forage, the number of days grazed during the first period would be 8, 9, 12, and 11 days, respectively, and the number of days grazed during the second grazing period would be 16, 18, 24, and 22 days, respectively.

The number of days grazed are not counted by calendar dates; days grazed are counted by the number of 24 hour periods grazed from the date and time the cattle are turned into a pasture. If cattle are turned into pasture A at 9:00 am on 1 May, seven days of grazing occurs at 9:00 am on 8 May, not on 7 May.

The quantity of forage removal during the first grazing period should be between 25% and 33% of the standing herbage biomass weight in order to remove sufficient quantities of the inhibitory hormone to activate cell growth in the axillary buds. If 50% or a greater portion of the standing herbage is removed during the first period, the quantity of secondary tillers that grow and develop is greatly reduced because of the reduction in the quantities of synthesized material available for new growth that results from the lower photosynthetic activity of the smaller leaf area remaining with the lead tillers than when 25% to 33% of the leaf material is removed. During the second grazing period, the secondary tillers will have developed at least three leaves and 50% of the standing herbage biomass weight can be removed without harmful effects to the plants. However, the crested wheatgrass plants would not be able to recover adequately, after late August, if the plants were grazed heavy by removing greater than 50% of the aboveground herbage weight during the second grazing period. Leaving about 50% of the aboveground herbage biomass standing at the end of the grazing period is important for biological recovery of the plants, reducing carbohydrate respiration rates during winter dormancy, and providing sufficient old growth vegetation for the following grazing season.

Mature lactating cows can develop milk fever or grass tetany while grazing lush spring crested wheatgrass vegetation. Milk fever is caused by a deficiency of calcium (Ca) and grass tetany is caused by a deficiency of magnesium (Mg). Crested wheatgrass herbage, however, is rarely deficient in calcium or magnesium during the growing season. Absorption of most minerals is by passive diffusion across the intestinal wall; some calcium is transported with a protein carrier. Only about half of the ingested minerals are absorbed into the cows body under normal conditions. During the early spring, the rate of forage passage through the cows digestive tract is accelerated when lush vegetation high in water and crude protein is consumed; greatly reducing the absorption of dietary minerals and potentially causing deficiencies of calcium or magnesium. Cattle grazing crested wheatgrass pastures containing sufficient carryover residual vegetation can maintain a normal rate of forage passage and a normal rate of mineral absorption; which, in effect, prevents the occurrence of milk fever and grass tetany.

The grazing management recommendations included in this report are based on known grass plant biological processes and their responses to defoliation at specific phenological growth stages. These recommendations have not been verified from a specific grazing trial consisting of summer grazed crested wheatgrass pastures. However, the only information that remains to be determined from a research project is the specific date for the end of the stimulation period, which may possibly change by a few days, and the determination of the pounds of calf weight per acre that would be expected to be produced on a summer grazed crested wheatgrass system. This report has been written to provide biological guidelines for the development of summer grazing systems on crested wheatgrass pastures by beef producers before a field grazing study was performed because it is very unlikely that such a grazing study with summer grazed crested wheatgrass pastures will be conducted any time soon and, if such a grazing study were to be started, the collected data would not be available for several years.

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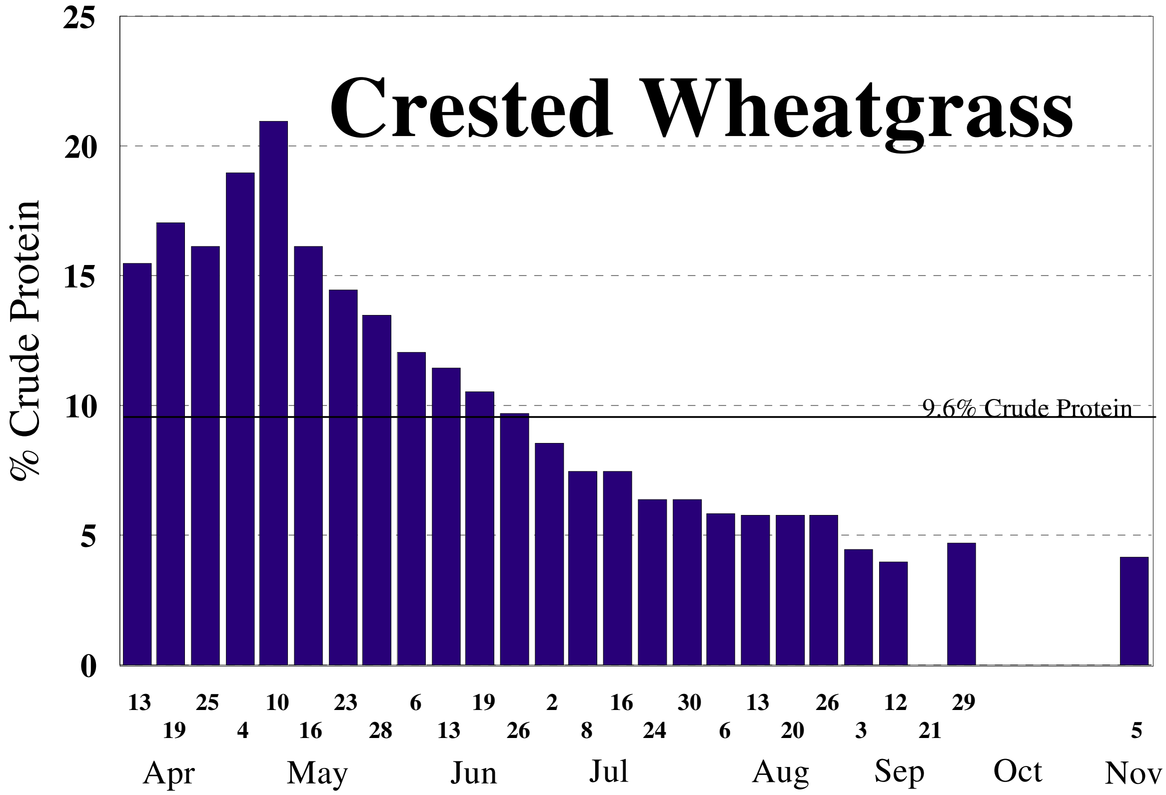

Fig 1. Mean percent crude protein of ungrazed crested wheatgrass in western North Dakota, data from Whitman et al. 1951.

Table 1. Crested wheatgrass weekly percent crude protein and phenological growth stages of ungrazed lead tillers.

Sample Date	Percent Crude Protein	Phenological Growth Stages
Apr 1		
13	15.5	Early leaf greenup
19	17.1	
25	16.2	Three and a half new leaves
May 4	19.0	Active leaf growth
10	21.0	
16	16.2	Flower stalk developing
23	14.5	
28	13.5	Flowering (anthesis)
Jun 6	12.1	
13	11.5	Seed developing
19	10.6	
26	9.7	
Jul 2	8.6	Seed maturing
8	7.5	
16	7.5	Seed mature
24	6.4	
30	6.4	Tiller drying
Aug 6	5.9	
13	5.8	
20	5.8	
26	5.8	
Sep 3	4.5	

Data from Whitman et al. 1951

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