II. DEFOLIATION EFFECTS ON NUTRITIVE VALUE

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Protein and energy are highly variable in crested wheatgrass forage and can become low enough to prevent economical weight gain by livestock. Crested wheatgrass is often grazed heavily during the spring to prevent development of "wolf" plants which are of poor quality. This management scheme does not necessarily provide the livestock operator with an optimum harvest by the grazing animal.

The first paper of this series points out that cattle must be on the pasture during a specific time period to remove flowering stems. This program of grazing management has direct and significant impacts on forage quality at specific dates. Proper grazing can promote leafy regrowth which will be of higher quality than stemmy growth.

PROCEDURES

Plants clipped according to procedures in Part I were air dried and ground in a Wiley mill. Ground tissues were analyzed for dry matter, organic matter, and percent ash. Subsequent analysis for crude protein by macro-kjeldahl and organic matter *in vitro* digestibility were carried out.

RESULTS AND DISCUSSION

The rapid loss of digestible energy and crude protein through the growing season has been well documented previously and similar results were obtained in this case (Table 1). It is readily apparent that simple deferral of grazing will result in lower quality forage. In this instance, deferral of clipping until after June 20 resulted in crude protein levels of 4.9 percent which are below maintenance even for mature cattle. Initiation of grazing early in May when adequate forage is present is clearly desirable to provide livestock with adequate protein.

Similarly, digestible organic matter was decreased by delayed clipping (Table 1). Digestible organic matter in low protein forages is roughly equivalent to total digestible nutrients (TDN). Nutrient requirements for beef cattle nursing calves are 52 to 55 percent TDN. These data indicate that for mature cattle energy was not below requirements for lactation until August although performance would be lower at that time. Bred heifer and steer performance would have been severely limited after July 1 by both protein and energy deficiencies in previously ungrazed plants. Plants which had been clipped early in the season would provide higher quality forage (Table 2) and would not limit livestock performance.

Table 1. Protein content and digestibility of crested wheatgrass during the growing season

Sampling date	Crude protein	Digestible organic matter
	%	
4-26-83	14.7	77
5-10-83	13.6	80
5-24-83	11.0	73
6-7-83	7.8	71
6-20-83	6.4	72
7-5-83	4.9	65
7-18-83	3.6	61
8-2-83	3.3	58
8-16-83	3.1	53

Table 2. Crude protein and digestibility of crested wheatgrass regrowth on August 16, 1983, after different initial clipping dates

Date[1]	Crude protein	Digestible organic matter
	%	
4-12-83	3.3	58
4-26-83	3.4	59
5-10-83	3.4	58
5-24-83	5.4	63
6-7-83	7.8	62
6-20-83	9.1	58
7-5-83	8.9	58
7-18-83	no regrowth	no regrowth
8-2-83	no regrowth	no regrowth
8-16-83	no regrowth	no regrowth

[1] Date refers to initial clipping. Regrowth was obtained between the initial clipping date and August 16.

These declining forage quality curves point out a major problem which can arise with deferred and rotational grazing systems. Under a hypothetical four pasture rotation program, the cattle would be entering progressively lower quality pastures. In this study, by July 5 yearling cattle would be rotating into a pasture comprised primarily of forage with protein and energy levels which were at or below maintenance. Additionally, forage quality would rapidly decrease as highest quality plant parts were grazed and stemmy, more mature plants were left.

The problem then is, how do we devise a grazing scheme which will not lose the early quality forage but which also is best for the grass?

Paper I discussed the one-crop/two-crop technique and the effects of management on regrowth potential and total forage production. Here we look at the directly associated quality factors. Crested wheatgrass can be manipulated to provide high quality forage in August (Table 2). The actual pounds of nutrients produced in August by various management schemes of course is predicated on the amount of precipitation received. These data were obtained during an above average precipitation period and will show above average forage production. It is likely that regrowth quality would remain high in drier years although regrowth amounts would decline. In a drought we would not expect any regrowth except from those plants clipped very early.

Clipping the plant at any time before elongation of the flowering stem resulted in significantly lower crude protein in regrowth forage in August than plants clipped after initiation of stem elongation. This results from removal of leaf material on primary tillers and subsequent elongation of the flowering culm. Regrowth forage in August was thus comprised mainly of stemmy regrowth which was mature and similar to those plants which had not been clipped before August.

From mid-May to mid-June, when flower stalks were actively growing, defoliation significantly increased forage quality in August. Although August is normally a time of poor quality for crested wheatgrass, in this study plants clipped after flower elongation but before anthesis had crude protein contents as high as 9 percent. August energy levels as indicated by digestibility were significantly increased by late May and early June clipping treatments.

After mid-June, depleted soil moisture and seasonal effects limited regrowth, and resulted in no clear quality improvement. By mid-July, there was no potential for regrowth. From that point on, yield and quality began to decrease at an accelerated rate. From these data it is apparent that regrowth from plants clipped in late May and early June had the highest quality in August. The peak quality in regrowth protein occurred in mid June while regrowth digestibility peaked in mid May. Late growing season effects likely resulted in elevated fiber content in regrowth of plants clipped after May.

CONCLUSIONS

Range managers can promote high quality late season forage in crested wheatgrass. This regrowth can contain 9 percent crude protein and have concommitant digestibility of 58 percent. As a practical matter, it is likely that the optimum clipping date for regrowth in this study was May 24. Protein levels were only 5.4 percent in August after clipping May 24.

However, the total pounds of regrowth were much greater (see Paper I, Figure 2) and forage digestibility was greatest (63 percent). In this particular year, we had nearly 500 pounds per acre of regrowth after clipping May 24 when the plants were entering the period of flower elongation. That regrowth had 2.3 percent greater protein and 10 percent greater digesbility than plants left unclipped until August.

These data indicate that a rotational grazing program which provides improved quality forage in early fall will have to be timed such that pastures for fall use will be grazed to the proper level within a 2- to 4-week "window". Grazing which ends before that will result in low quality regrowth. Grazing which ends after that time will not provide sufficient biomass to allow fall grazing. It becomes apparent that a rotational grazing plan using several pastures will have to be coordinated with other pastures in some way. This is needed because of the observed decreased potential for regrowth as the season progresses.