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Effect of Season of Use and Grazing Systems on Nutritional Value of Forage[1/]

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"Nutritional value" and "forage quality" are rather nebulous terms and quite difficult to equate without further qualification. From the standpoint of livestock production this must be defined as the ability of the forage to provide for a specific type of livestock production. Several factors contribute toward nutritional value, such as chemical composition, availability of the nutrients to the animal for useful purposes, balance or imbalance of nutrients and finally acceptibility by the grazing animal, which is often called palatability.

The range forage evaluation work at the Squaw Butte Experiment Station has been concerned with the summer grazing season from mid April to September. Methods used for evaluation have been chemical, in vitro and in vivo. The nutrients we have been most concerned with are protein and energy. From the standpoint of deficiencys and economics these are probably the most important to the livestock producer. It is quite well established that salt and a good source of phosphorus should be made available to all range animals. Minerals and vitamins while important are generally secondary with regard to economics and requirement. The supplementation of minerals and vitamins in a ration which is deficient in protein and/or energy will not substantially improve performance, however, if it is a deficiency area then these minerals should be supplied.

Chemical Analyses

Individual species of range forage have been collected, at the Squaw Butte Experiment Station, over several years at various stages of plant development and calendar dates. In addition fistulated animals have been used as samplers of the mixed forage actually consumed by the grazing animal. There is variation in chemical composition due to year sampled, method of sampling, and to range area sampled. Due to moisture, temperatures, or

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other climatic conditions forage quality may hold up longer some years than others. Intensity of grazing and type of animals grazing may cause a variation in the quality of forage on seemingly "alike" ranges.

One can not hope to have a "picture" for each individual situation, therefore, the general trend of forage quality throughout the grazing season is presented. In general these trends are the same in any of the range areas of the west and may vary only with early or lateness of the spring season which can extend or shorten the time at which nutrients become deficient for livestock production. Climate, elevation, and availability of browse species can also effect quality. If browse is available and acceptable to livestock the protein content and quality will hold up longer so energy may be the first limiting factor for livestock production. During dry years when quantity is short the quality of forage is generally higher.

The crude protein, digestible protein, cellulose, and total digestible nutrients at various dates during the grazing season are given in table 1. This is an average as determined on all major species individually, and on the combination of species as taken by the grazing animal during the grazing season. Data on crested wheatgrass is presented separately since it should generally be grazed separately. Table 2 shows the stage of development of each of the common grass species at specific dates during 1959 and 1960. This also serves to show variation between years and species.

This data show A. spicatum (bluebunch wheatgrass), S. hyrtrix (squirrel tail), F. idahoensis (Idaho fescue), and A. desertorum (crested wheatgrass) have their crude protein content reduced to 7 to 8% by July 1 which is a marginal level for the production that should be expected from the type of animals on the range at this time. S. thurberiana (thurbers needlegrass) and K. cristata (Junegrass) hold their protein content above this level for a few weeks longer. TDN follows this same pattern but generally becomes deficient for animal production about 2 - 3 weeks later than does protein content of the forage.

Livestock Production

If we could harvest range forage as we can a field of meadow hay the optimum time for harvest would be about the latter part of June or early July, since this is when we would get the maximum pounds of major nutrients required for livestock production. However, since this is not feasible we need to consider how to get the most sustained livestock production along with sustained range forage production. Actually these two terms are synonymous since obviously one compliments the others.

Forage evaluation studies at this station over the past several years have provided the data to calulate the amounts of crude protein, digestible protein, and TDN that certain classes of livestock should take from a crested wheatgrass or native range pasture during the grazing season, providing adequate grass is available. The data reported here is for cattle on crested wheatgrass pasture. The same general trends are present with native pasture except variation between years and pastures is greater due to variation in balance of species. Figures 1 and 2 show the pounds of crude and digestible protein taken from crested wheatgrass pasture by yearlings and mature cows with nursing calves, respectively. Also plotted on these figures is the protein requirement of yearlings for maintenance and two pounds daily gain and of mature cows with nursing calves. Figures 3 and 4 show the TDN requirement for these animals and the amount of TDN each class of animal should get from the forage. According to these data, protein becomes deficient in the forage for this type of animal performance by about the middle of June and TDN becomes deficient 2 - 3 weeks later in the fore part of July.

Our animal productinn records bear this out. Yearling cattle on both native and crested wheatgrass range will generally gain 2.0 pounds plus during the month of May and June, 1.5 pounds or less during July and less than 1.0 pounds thereafter. The same situation is true for the suckling calves on these pastures. Calves gain 1.75 plus pounds during May and June 1.0 - 1.5 pounds in July, less than a pound in August and relatively no gain if left on the cows after the first of September.

Management factor effecting forage quality.

We have presented a rather grim picture. What can we do about it? There are several factors worth consideration to the livestock operator, such as supplementing yearling cattle, creep-feeding calves, early weaning of calves, and removal of all saleable classes of livestock after economic production stops. This will leave the remaining forage for maintenance of the breeding herd. Other avenues are development of high quality late summer-early fall pastures and the use of grazing or management systems that will provide for better quality late season forage. Any system should be flexible enough to permit deviation to take care of year to year variation.

A two-crop system of grazing probably has the potential of providing more high quality late season forage than other systems. To accomplish this second crop, the grass needs to be grazed early and at a rate sufficient to clip the grass fairly close by the time seed heads are in the boot. This is about May 20 on our Station on average years. This stops further growth of seed stalks and, if soil moisture is adequate, regrowth will be of the vegetative type. This second crop is of considerably higher quality in late summer than a one-crop stand of grass would be at that time. This system has been demonstrated with crested wheatgrass and with favorable moisture conditions, is advanta-

geous with regard to both yield and quality. This system also gives good control of "wolf plants" in crested wheatgrass.

Other systems of grazing do little for actual quality of forage. About the only way quality improvement is made is by ecological changes as a result of the grazing system. These, at best, are generally very slow. A grazing management system where areas, containing a high proportion of slower maturing grass species or browse species, are grazed later will give higher quality late season forage. However, animals will generally graze the species with higher protein content harder, and this makes grazing management more difficult.

Probably the brightest future for high quality late season forage is in the development and establishment of grass species that provide a balance of nutrients for the animal and that can be managed as single specie stands. Currently recommended grass species for semi-arid ranges provide little, or no, advantage, quality-wise, over native range grasses during late season. Therefore, possibilities for supplemental pastures of introduced grasses and legumes should be further investigated. Grazing systems as an aid to improving quality can have a real place in the management of introduced grasses, but will contribute very little toward improving late season quality of native range forage.

Table 1. Nitrogen, cellulose, *in vitro* cellulose digestibility and TDN of crested wheatgrass and native range forage at various dates.

Species Date	Nitrogen	Cellulose	Cellulose digestibility	TDN [1]
	%	%	%	%
A. desertorum				
4-30-59	2.82	22.2	76.3	70.0
5-11-60	3.07	19.9	74.0	68.0
5-18-59	1.90	25.5	68.3	66.0
5-23-60	2.64	21.8	69.7	65.0
6-2-59	1.70	24.8	68.3	65.0
6-2-60	2.21	26.2	73.3	66.0
6-16-59	1.74	26.6	72.2	61.0
6-16-60	2.21	25.5	65.0	63.0
7-1-59	1.36	26.8	53.0	53.0
7-15-59	1.01	28.7	48.0	50.0
8-5-60	0.74	32.9	48.1	50.0
Native forage [2]				
4-30-59	3.11	24.6	70.7	68.0
5-11-60	2.40	25.8	70.4	66.0
5-18-59	2.42	25.9	67.7	65.0
5-23-60	2.16	27.4	67.6	65.0
6-2-59	1.94	26.5	65.0	64.0
6-2-60	1.94	27.2	70.4	64.0
6-16-69	1.57	29.3	57.1	58.0
6-16-60	1.49	29.8	53.3	52.0
7-1-59	1.21	29.7	50.8	52.5
7-15-59	1.09	31.0	49.9	50.0
8-5-60	0.92	29.9	50.0	50.0

1/ Some of these values are calculated from digestibility trials and others are estimated from the chemical composition.

2/ Values were taken from analysis of individual species and weighted with regard to percent each species contributed to total.

Table 2. Stage of development of different species at specific calendar dates during 1959 and 1960.

Date	SPECIES					
	Bluebunch wheatgrass	Squirrel tail	Idaho fescue	Thurber's needlegrass	Junegrass	Crested wheatgrass
	(stage of growth)					
4-30-59	pre-boot	pre-boot	pre-boot	pre-boot	pre-boot	pre-boot
5-11-60	pre-boot	pre-boot	pre-boot	early boot	early boot	pre-boot
5-18-59	boot	late boot	late boot	early boot	early head	boot
5-23-60	pre-boot	boot	early head	late boot	early head	boot
6-2-59	head	early head	headed	early head	headed	early head
6-2-60	boot	late boot	head	early head	head	late boot
6-16-59	early flower	flower	flower	early flower	flower	head
6-16-60	head	early flower	flower	flower	flower	head
7-1-59	early seed	early seed	late dough	early seed	seed stage	seed stage
7-15-59	mature	mature	mature	mature	mature	mature
8-5-60	dry & mature	dry & mature	dry & mature	dry & mature	dry & mature	dry & mature

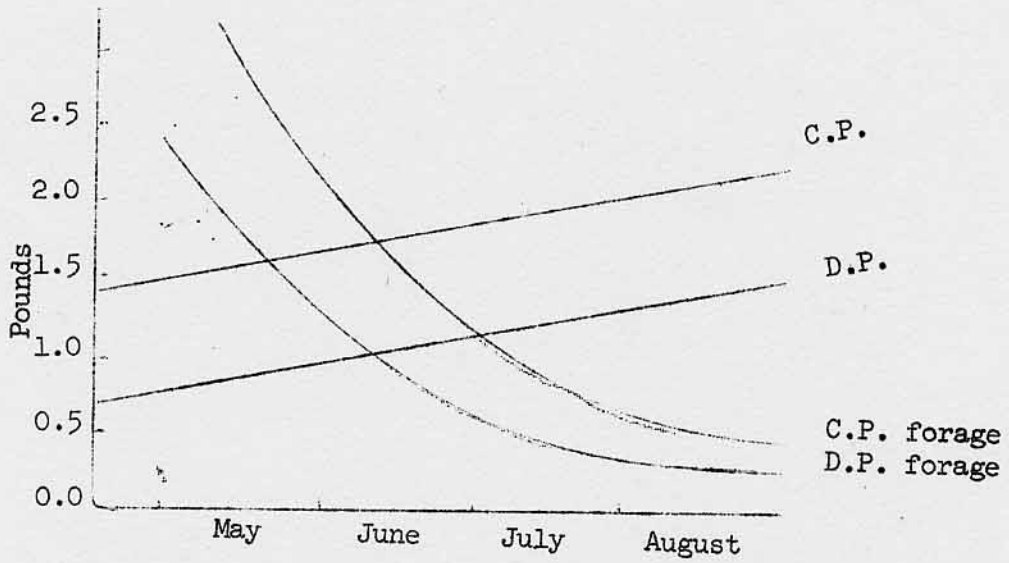

Figure 1. Pounds of crude and digestible protein required for maintenance and 2 pounds daily gain of yearling steers and the amount they will get from range forage.

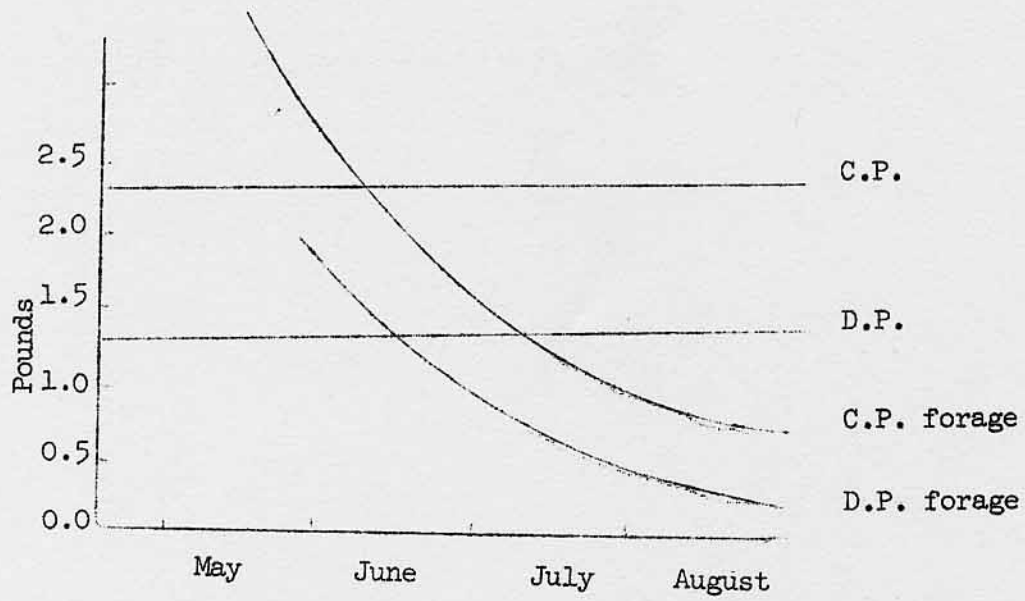

Figure 2. Pounds of crude and digestible protein required by a mature cow nursing a calf and the amount she will get from range forage.

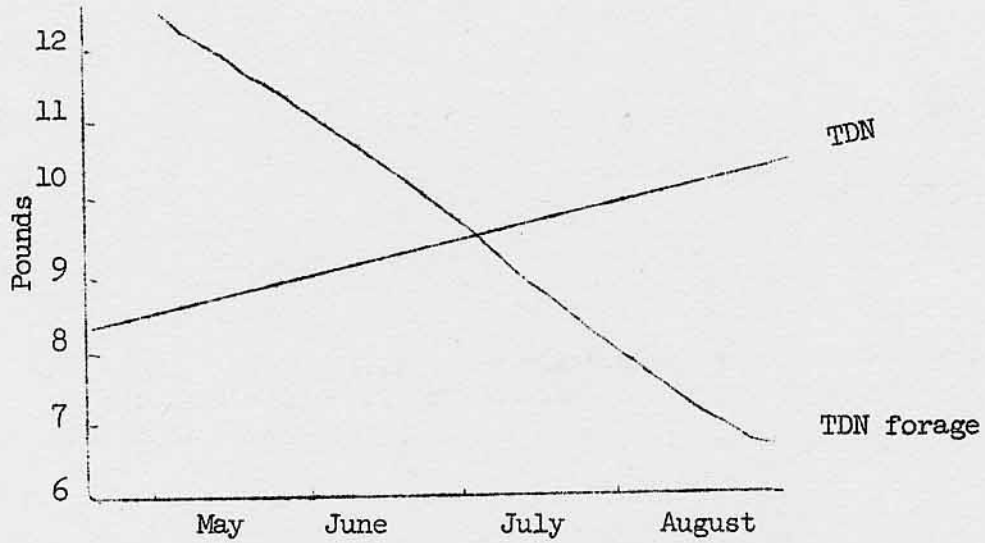

Figure 3. Pounds of TDN required for maintenance and 2 pounds daily gain of yearling steers and the amount they will get from the range forage.

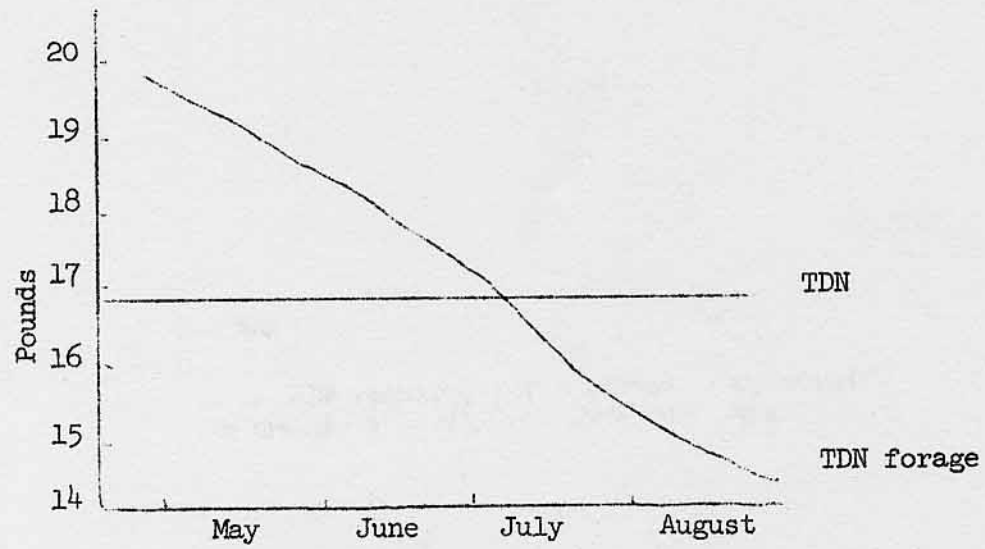

Figure 4. Pounds of TDN required for a mature cow, nursing a calf, and the amount she will get from the range forage.