Published in Proc. West. Sec. Am. Soc. An. Sci., Vol. 15. 1964.

Digestibility of Native Flood Meadow Hay at Different Stages of Growth

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Livestock production in eastern Oregon, and much of the western range area, is dependent on hay production from native flood meadows. This hay is comprised of rushes, sedges, some clover, and grasses with composition determined by the amount of flooding and other environmental factors. One-half to two-thirds of this hay is a rush-sedge combination; with deep flooding as much as 90% of this combination can be rush and 10% sedge while with limited moisture conditions the reverse in percentages of rush and sedge may occur (Rumburg and Cooper, 1961). The quality of this hay is such that livestock performance is generally limited if fed without supplementation. Average crude protein values are from 7 - 9% while gross energy values approximate that of better quality roughage.

Fertilizer will generally increase yield with no significant increase in quality of the forage. The most effective means of increasing quality is harvesting at a time when nutrients are at their optimum for livestock production. Rumburg et al. (1964), found that crude protein and dry matter from the forage reaches maximum yield at approximately the same time. Research workers have long recognized that the conventional proximate analysis procedure is inadequate for measuring the changes that take place in maturing plants and their effect on animal performance (Kamstra, et al., 1958; Moxon and Bentley, 1953, and Crampton et al., 1960). The purpose of the present study was to determine the date at which native meadow hay would provide maximum production in terms of livestock utilization as measured by digestion trials.

PROCEDURE

Native flood meadow hay was harvested at four dates, June 9, June 28, July 17, and August 4 of 1961 and at eight weekly intervals starting with June 21 and ending with August 9 of 1962. The hay harvested at the four dates in 1961 was subjected to digestion trials with wether sheep in a 4 x 4 latin square design. The hay harvested in 1962 was fed in digestion trials to three wether sheep in a randomized block design.

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2/ Jointly operated by the Oregon Agricultural Experiment Station and the Crops Research Division, Agricultural Research Service, USDA.

Technical Paper No. 1824, Oregon Agricultural Experiment Station.

In both trials the sheep were caged in digestion crates with open mesh floors to allow for the collection of the excreta. A constant amount of intake was established for each sheep and intake of hay from each date of cutting was maintained constant. The hay was chopped in about one-inch lengths and the daily ration was fed in equal amounts four times daily. Total excreta were kept refrigerated and mixed and sampled at the completion of each trial. Aliquot samples were taken daily of the hay.

A seven-day preliminary and five-day collection period were used in both trials. The sheep exhibited a preference for the earlier cut hay by the manner in which they cleaned up their daily ration. When early cut hay was fed it was usually eaten in a very short time whereas it took most of the day for the sheep to consume the later cut hay.

Digestibility values were determined for nitrogen, dry matter, cellulose, and energy for each date of harvest and were subjected to statistical analysis.

RESULTS AND DISCUSSION

Apparent digestibility values for hay harvested in 1961 and 1962 appear in tables 1 and 2, respectively. Nitrogen digestibility ranged downward from 63.0 to 35.2% from the earliest to the latest harvest date in 1961. This decrease was significant with each later date of harvest. The digestibility of nitrogen in hay harvested in 1962 ranged from a high of 64.5 to a low of 39.5%. There was no significant difference in nitrogen digestibility of the hay harvested on June 21, June 28, and July 5, but later harvest resulted in a significant decrease in digestibility with each week of delay.

Table 1. Apparent digestibility of nitrogen, dry matter, cellulose, and gross energy from hay harvested at different dates in 1961.

Date of harvest	Digestibility values 1/			
	Nitrogen	Dry matter	Cellulose	Gross energy
	%	%	%	%
June 9	63.0	61.8	68.0	60.3
June 28	60.2	56.6	59.8	55.8
July 17	48.4	51.7[a]	55.1[b]	50.5
August 4	35.2	49.2[a]	54.0[b]	47.8

1/ Values with the same superscript are not significantly different ($P < 0.05$).

Dry matter digestibility of the forage harvested in 1961 ranged from 61.8 to 49.2%. The decreases between June 9, June 28, and July 17 were significant. However, the difference in digestibility of the hay for the July 17 and August 4 harvests was not significant. The digestibility of

dry matter for the first 3 dates of harvest in 1962 were not significantly different. The average digestibility for these dates was 65.4%. Dry matter digestibility values of the hay harvested on the 4th, 5th, and 6th week were significantly lower than of the first 3 weeks but were not significantly different from each other. There was a significant decrease in dry matter digestibility with each date of harvest after the sixth week.

Table 2. Apparent digestibility of nitrogen, dry matter, cellulose, and gross energy from hay harvested at different dates in 1962.

Date of harvest	Digestibility values 1/			
	Nitrogen	Dry matter	Cellulose	Gross energy
	%	%	%	%
June 21	64.1[a]	65.2[b]	71.8[d]	64.0[f]
June 28	64.5[a]	65.2[b]	73.4[d]	64.5[f]
July 5	64.2[a]	65.7[b]	71.7[d]	64.8[f]
July 12	61.0	60.3[c]	66.0[e]	59.7[g]
July 19	58.2	61.1[c]	65.5[e]	60.1[g]
July 26	53.1	58.7[c]	65.4[e]	57.9[g]
August 2	46.7	55.3	63.0	53.3
August 9	39.5	51.4	60.4	49.9

1/ Values with the same superscript are not significantly different ($P < 0.05$).

Cellulose digestibility followed the same pattern as dry matter for each year of harvest with ranges from 68.0 to 54.0% and 71.8 to 60.4% for the 1961 and 1962 harvest dates, respectively. This is in agreement with work reported by Wallace et al. (1961) on in vitro cellulose digestion with this same type of hay.

There was a significant decrease in the digestibility of the gross energy with each later date of harvest during 1961 with a range from 60.3 to 47.8%. Hay harvested in 1962 followed the same pattern with respect to the digestibility of the gross energy as dry matter and cellulose. The range in digestibility of energy was from 64.0 to 49.9%.

Data from this trial are in general agreement with that noted by Lloyd et al. (1961), Schneider et al. (1953), Reid et al. (1959), Weir et al. (1960), Meyer et al. (1957), and Kamstra et al. (1958), who reported a progressive decline in the utilization of nutrients measured in this study with increasing maturity. However from the standpoint of production it appears as though the per acre yield of available nutrients for livestock reaches a maximum at the same time as dry matter, i.e. early July (Rumburg et al. 1964).

The nitrogen, cellulose, and gross energy content of the hay for each date of harvest are shown in table 3. The difference between years is greater in some cases than between dates of harvest for these data. The length of time of flooding, depth of flooding and other environmental factors contribute to the quality of this forage. These factors change the ecological balance of species which in turn contribute to nutrient quality of forage in relation to date of growth.

Table 3. Nitrogen, cellulose, and gross energy content of the hay at each harvest date during 1961 and 1962.

Date of harvest	Composition		
	Nitrogen	Cellulose	Gross energy
	%	%	cal/g
1961			
June 9	1.62	31.57	4062
June 28	1.31	32.91	4068
July 17	0.93	33.84	4034
August 4	0.75	34.64	4075
1962			
June 21	1.58	31.44	3950
June 28	1.52	32.25	3841
July 5	1.43	31.47	3915
July 12	1.38	31.72	3909
July 19	1.29	30.97	3904
July 26	1.18	32.93	3904
August 2	1.08	33.22	3857
August 9	1.01	33.66	3869

SUMMARY

Native flood meadow hay harvested at four dates, June 9, June 28, July 27, and August 4 of 1961 and at eight weekly intervals starting with June 21 and ending with August 9 of 1962 was subjected to digestion trials with wether sheep.

Nitrogen and gross energy digestibility significantly decreased with each later date of harvest in 1961. Nitrogen digestibility ranged from 63.0 to 35.2% and gross energy digestibility rangedfrom 60.3 to 47.8%.

Dry matter digestibility values significantly decreased with each date for the first three harvest dates but digestibility from the fourth date of harvest was not significantly lower than the third during 1961. Cellulose digestibility for the 1961 hay followed the same pattern as that of dry matter.

Digestibility values were not significantly different for the first three dates of harvest in 1962 for any of the nutrients determined. After the third harvest date nitrogen digestibility significantly decreased with each later date of harvest.

Dry matter, cellulose, and gross energy digestibility decreased the fourth week and then leveled off for two weeks before decreasing with each later date of harvest during 1962.

There was considerable yearly variation in the chemical composition and digestibility at different harvest dates due to changes in species composition and changes in maturity dates of the hay as influenced by yearly moisture and other environmental differences.

These data indicate that native flood meadow hay in this area should be harvested in early July to attain maximum livestock production per acre.

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