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The Effect of Time and Height of Cutting on the Yield, Crude Protein Content and Vegetative Composition of a Native Flood Meadow in Eastern Oregon[1]

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SYNOPSIS

Four years of differential cutting treatments had no effect upon fifth year yield. Yield declines were associted with loss in soil fertility. No significant changes in vegetative composition. Crude protein content decreased with maturity and increased with cutting height.

DURING recent years the ranchers producing hay on native flood-meadows in eastern Oregon have expressed the belief that yields are declining. If this is true, it seems likely that the trend is due to loss in soil fertility since haying practices were initiated, or to earlier cutting because the advent of tractor-drawn mowers has allowed more rapid harvest.

Information in this paper is the result of an experiment initiated in 1951 to determine the effects of time and height of cutting upon hay yields, crude protein content, and vegetative composition. Simultaneous fertility trials have revealed the importance of nitrogen upon hay yields and phosphorus upon hay composition and quality (3, 4).

MATERIALS AND METHODS

The experiment was conducted on a meadow of the rush-sedge-grass type (3), which is typical of the major portion of Oregon's 350,000 acres of native meadowlands. These lands are flooded each spring by runoff from surrounding watersheds for periods ranging from 6 to 12 weeks. In most cases meadowlands are in inland valleys without drainage outlet, and the removal of flood water is largely dependent upon evaporation and transpiration.

Soils of meadow areas generally range in texture from a silt to clay loam. The surface soils are mildly calcareous and slightly to moderately alkaline. The subsoils are moderately calcareous and somewhat less alkaline.

Under the conditions of continuous flooding and lack of drainage, the ecological aspect throughout the years has become one of wetland species with rushes (*Juncus* spp.) and sedges (*Carex* spp.) predominating in association with grasses, native legumes, and forbs. The dominant rush species is baltic rush *(Juncus balticus)*, and the dominant sedge species is rusty sedge *(Carex subjunca)*.

The vegetative complex consists of as many as 85 species which form a dense compact sod with root penetration seldom exceeding 14 inches. Vegetative growth is short and dense.

The growing season of these species is concurrent with the flooding period. At the end of the flooding period, usually about July 1, hay harvest is begun. Regrowth is negligible and is grazed with the aftermath of the hay harvest in the fall by cattle returning from the range.

Permanent plots were cut in 1951, 1952, 1953, and 1954 at 5 stages of maturity and at 3 cutting heights. The vegetative development of Nevada bluegrass *(Poa nevadensis)* was used to indicate cutting date. The five stages of development were: *(1)* full bloom, *(2)* soft dough, *(3)* hard dough, *(4)* green color one-half gone and *(5)* green color all gone. In 1952, 1953, and 1954, meadows were still flooded at the full bloom stage of maturity and cutting was slightly delayed. Cutting heights were 2, 4, and 6 inches and were used to allow stubble to remain for translocation of food reserves to roots. In the fall of each treatment year, all plots were recut to 2 inches, and the aftermath was removed. In 1955, all plots were cut to 2 inches when at the soft dough stage.

The experiment was conducted as a complete factorial in a randomized block design of four replicates. Plot size was one-eightieth of an acre.

Yield samples were taken by harvesting complete plots. Cutting heights were regulated by attaching skids under the sickle bar of the plot mower. During harvest, samples were taken from each plot shock for moisture and crude protein determinations. Yields are expressed in tons per acre at 10% moisture.

Two random 3.2 square-foot samples of herbage were taken per plot prior to harvesting in 1955. These samples were frozen and later hand separated into four vegetative groups: *(1)* rushes, *(2)* sedges, *(3)* grasses and *(4)* forbs, to determine percentage composition by weight.

EXPERIMENTAL RESULTS

In 1955, the yields of hay cut at a common date and at a uniform height were equal among treatments. Therefore, the 4 years of differential cutting treatments did not affect hay yields in an accumulative or permanent manner. Temporary effects due to time and height of cutting were apparent during the 4 years 1951–54 inclusive. Years, height of cutting, and the interaction of years by height of cutting were all significant sources of variation (table 1).

The variation among years was due to the low yields in 1954, in which year the amount of flooding was considerably below normal.

Raising the cutter bar from 2 to 4 to 6 inches materially reduced yields. The difference between yields of hay cut at 2 and at 4 inches was 0.62 ton per acre. In other words, the amount of forage between 2 and 4 inches was 40% of the total herbage above 2 inches.

The interaction of years by height of cutting is due to variation of yields of hay cut at 6 inches. In 1951 and 1952 there was considerable lodging of vegetation from wind. This caused mechanical error because some of the herbage,

Table 1.—Yields of hay in tons per acre as influenced by years and cutting height.

Cutting height	Years				Average
	1951	1952	1953	1954	
2 inches	1.69	1.75	1.59	1.21	1.56
4 inches	1.01	1.06	1.07	.60	.94
6 inches	.30	.34	.53	.14	.33
Average	1.00	1.05	1.06	0.65	

L.S.D. (P0.05) for comparing height averages 0.39
for comparing year averages 0.44

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which would normally have been cut at the 6-inch cutting height, slid under the cutting bar. In 1954, growth was so short that mechanical error also occurred from vegetation sliding under the cutter bar at the 6-inch cutting height.

The crude protein content of hay cut at various cutting dates and heights is given in table 2. The decrease in crude protein content with advancing maturity is of common occurence (1, 2, 5). The crude protein contents of portions of herbage lying between 2 and 4 inches, 4 and 6 inches, and above 6 inches were 5.7, 6.3 and 6.7% respectively. These values appear to be directly related to the larger proportion of leaves and seeds occurring in herbage from the higher cuts.

There were no significant differences among cutting treatments in species composition by weight, although a visual increase in beardless wild-rye *(Elymus triticoides)* occurred on late-cut plots when this species was present. The average percentage composition of rushes, sedges, grasses, and forbs was 52, 40, 7 and 1% respectively; however, the rush component varied from 4 to 94%, sedges from 6 to 76%, grasses from 0 to 28% and forbs from 0 to 16%.

DISCUSSION AND CONCLUSIONS

It is concluded that time of cutting is not the primary factor in the yield decline of flood meadows. Apparently, translocation of carbohydrate reserves to roots normally occurs prior to the termination of flooding and the opportunity for hay harvest.

In concurrent fertility trials it was found that meadows respond to nitrogen fertilization (3, 4). It has also been shown that the yield of annual white-tip clover *(Trifolium variegatum)* can be increased by phosphorus fertilization and delayed cutting (3). On areas in which this clover is indigenous, any practice resulting in a decrease in its occurrence and growth should indirectly affect associated species in terms of nitrogen nutrition. In view of this data, it appears that the decline in meadow production is primarily due to a loss in soil fertility from continuous cropping, a decrease in clover composition, or both.

Meadows are usually flooded until Nevada bluegrass is in or past full bloom and hay can seldom be cut before this stage of maturity. Since yield data have shown no increase in quantity after Nevada bluegrass has reached full bloom, hay should be cut at this stage or as soon thereafter as moisture conditions permit in order to obtain highest quality. An exception in optimum harvest-time may be made on areas where it is possible to increase annual clover composition through delayed harvesting.

Because of the dense, low-growing characteristics of this vegetation, mower blades should be set as low as possible to obtain maximum quantity of hay.

Table 2.—Average crude protein values of hay cut at five stages of maturity and three cutting heights in 1951, 1952, 1953, and 1954.

Stage of maturity of Nevada bluegrass	Height of cutting			Average
	2 in.	4 in.	6 in.	
	%	%	%	%
Full bloom	6.94	7.36	7.45	7.25
Soft dough	6.82	7.10	7.55	7.16
Hard dough	6.42	6.73	6.96	6.70
Green color ½ gone	5.69	5.89	6.07	5.88
Green color all gone	4.88	5.23	5.39	5.17
Average	6.15	6.46	6.68	

L.S.D. (P0.05) for comparing stage of maturity 0.17
for comparing height averages 0.13

SUMMARY

Permanent plots on a native flood-meadow were cut at 5 stages of maturity and 3 cutting heights during each of the 4 years 1951 through 1954. Yield and crude protein content were measured each year. In 1955 the vegetative composition was measured, and hay yields were taken on a common date with a uniform cutting height of 2 inches.

Four years of differential cutting treatment had no effect upon yields in the fifth year.

Crude protein content of hays decreased with advancing maturity and increased with cutting heights. The portion of the plants occurring above 6 inches contained 1% more crude protein than the portion occurring between 2 and 4 inches.

There were no significant changes in vegetative composition as a result of cutting treatment, although a visual increase in beardless wild-rye *(Elymus triticoides)* occurred on late-cut plots on which this species was present.

It is concluded that early cutting practices have not decreased yields. Rather, yield declines are associated with a loss in soil fertility.

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