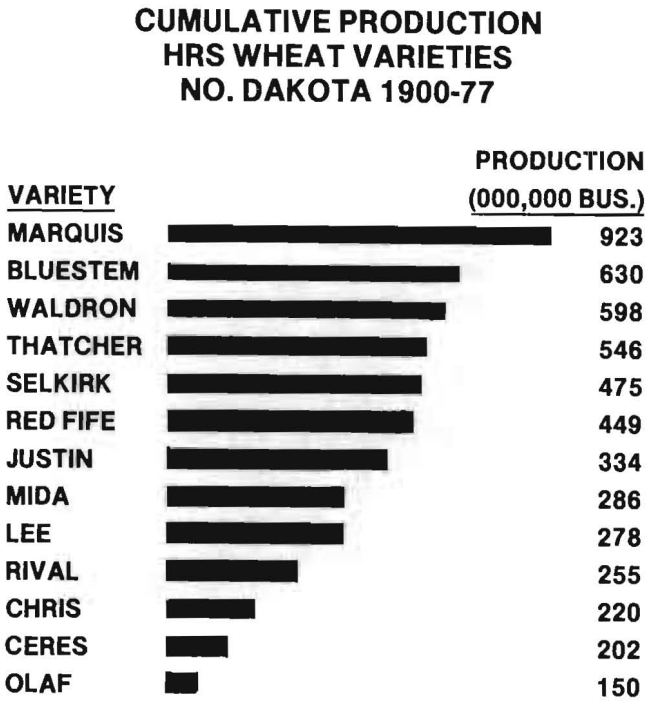
Annual monitoring of the acreages of leading wheat varieties expedites grower acceptance of a new superior variety, and hurries the dropping of those of dubious value. Such information also is helpful to the breeder who can relate the documented grower preferences to known varietal characteristics. The milling/baking trade also benefits from these surveys because they enable the buyer more quickly to locate areas growing varieties with desired quality characteristics.

Figure 4



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ALFALFA MANAGEMENT IN WESTERN NORTH DAKOTA

Harold Goetz, Thomas Conlon, Paul Nyren and Dean Williams

ABSTRACT

Alfalfa is considered to be the single most important forage crop for hay in North Dakota. Proper management for optimizing maximum yields and stand maintenance must consider the time of cutting, frequency, rainfall, and stage of bloom. This study showed the best performance in terms of yield to be a near mid June and early August harvest. An additional later harvest did not add substantially to the yields. A full bloom harvest first cutting followed by an October second harvest resulted in high yields, but quality of forage was greatly reduced. Overall performance of the alfalfa is highly dependent upon amounts and timing of rainfall.

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Alfalfa is considered to be the most important forage crop harvested for hay in North Dakota. In the 21 counties west of the eastern boundary of Sioux, Morton, Oliver, McLean, Ward and Renville Counties, approximately 735,900 acres of alfalfa are annually harvested as hay with a yield of 1,329,700 tons for an average of 1.81 tons/acre (3). Although of major importance throughout the state and region in terms of acres planted and tons of hay harvested, proper management has not always been understood or applied to ensure continued stand maintenance, maximum sustained yields, and forage quality. Management of alfalfa, used primarily for hay, requires a knowledge of plant performance with different cutting dates and the ability of the harvested plant to recover to produce another crop of hay the same or following season (1). Cutting height of the alfalfa may also be an important factor to consider along with the already mentioned variables. A study in eastern North Dakota, employing a 1, 3, and 5-inch stubble height, indicated a higher forage quality when the stubble height and harvest frequency were increased although total forage production was greatest in the 1-inch stubble height when harvested either one or two times during the growing season. Winter kill was also observed in some of the lower stubble and higher frequency cuttings in this study (2).

This study was designed to observe the response of Ladak alfalfa to cutting as to varying dates, frequency, stages of bloom, and possible winter kill. The study was carried out over a 4-year period (1969-1972). Additional observations on stand maintenance were made in the period between 1973 to 1975 although detailed information was not collected following the 1972 growing season.

METHODS AND MATERIALS

The experimental area was situated on a well-drained Morton Silt Loam soil at the Dickinson Experiment Station. The experimental design was a random block with four replications with 13 plots within each replication. The 13 treatments included combinations of a single cutting when plants were in full bloom, two cuttings consisting of full bloom and a second cutting in mid-September, early October, or mid-October, two cuttings including mid-June and early August, two cuttings including late June and late August, and an additional cutting applied to the two-cutting date sequence at successively later intervals. In addition to the different cutting-date treatments, a single 46 lbs P/acre treatment was included in 1971 and 1972 for harvesting at the full bloom stage of maturity. Cutting dates were selected in a manner which included various stages of maturity, regrowth, and flowering. All cutting treatments were at the 1-inch stubble height. The data were statistically analyzed employing the Duncans Multiple Range Test.

RESULTS AND DISCUSSION

The yield data for each year of the study are presented in Table 1. The 4-year average data showed the highest combined average yield to be 8,534 lbs/acre from the June 20-August 10-October 1 cutting treatment, followed by the June 20-August 10-September 15 plots at 7,736 lbs/acre and the June 20-August 10-October 15 plots at 7,661 lbs/acre. The latter two treatments are separated by only 75 lbs/A.

The lowest average total yields observed over the study period was from the full bloom cutting (July 15) and the phosphorus treatment, yielding 5,271 and 4,899 lbs/acre, respectively. The full bloom first cutting treatments followed by another harvest in either mid-September, early or mid-October, resulted in yields nearly as high as those treatments harvested three times beginning in mid-June. The quality of the forage, however, is greatly reduced under this management system.

The highest yielding treatments all included an early June and early August harvest date. The September and October cuttings were generally low yielding and did not add an appreciable amount of forage to the total yield when compared with the earlier harvest. Late June and late August harvests (Treatments 5, 6, 7, and 8) showed approximately similar first cutting yields as those observed in the early June harvest treatments (Treatments 1, 2, 3, and 4), although the second harvests were considerably less due to the delayed initial cutting dates of 10 days. The later cutting dates for those treatments did not produce enough regrowth for a third harvest any years of the study period.

The first harvest of the alfalfa resulted in the highest yield regardless of the treatments (Table 1). Second cuttings generally yielded one-third to one-half less than those in the first harvest. The differences in yield between the first and second harvest dates generally became appreciably greater as the date for the initial harvest was delayed. The greatest difference observed between two harvests was the full bloom stage and the October 15 harvest date (3,596 lbs). Plots harvested for a third time generally yielded less than one fifth that of the second cutting treatments.

The progressive reduction in yields associated with plots harvested more than at a single date during the growing season may be at least partially compensated for in higher forage quality as evidenced by a more leafy and less stemmy nature of the harvested forage. Alfalfa harvested initially at an advanced stage of maturity results in much lowered quality of forage with an associated reduction in total hay yield. Fertilization of alfalfa with phosphorus has not resulted in an increase in production in this trial and may actually have inhibited plant growth based on production performance. From the data obtained it appears that the best

Table 1. Average yield and response to cutting of Ladak alfalfa at varying dates, frequency, and stages of bloom — 1969-1972 seasons.

Treatments (cutting dates)		Dry-weight yield lbs/acre/alf. 1969	1970	1971	1972	Average yield/4 yr	Average total yield
6-20	(1)	2334	3729	4508	5254	3956	
8-10		3670	2461	3429	2376	2984	6940
6-20		2848	4107	4996	4816	4192	
8-10	(2)	3803	2685	3108	2062	2915	7736
9-15		1403	233	*	880	629	
6-20		3000	3994	5120	5052	4292	
8-10	(3)	4462	2964	3484	2178	3272	8534
10-1		1997	382	535	966	970	
6-20		2427	4260	4558	5135	4095	
8-10	(4)	3678	2770	3206	2224	2970	7661
10-15		1555	*	*	827	596	
6-30		2165	5531	4587	5433	4429	
8-30	(5)	3117	2587	1715	1863	2321	6750
6-30		1920	5638	3927	5021	4127	
8-30	(6)	2928	2318	1877	1860	2246	6373
9-15		*	*	*	*	*	
6-30		1963	5387	4733	4806	4222	
8-30	(7)	3664	2528	1772	2010	2494	6716
10-1		*	*	*	*	*	
6-30		2561	5441	4335	5043	4345	
8-30	(8)	3322	2433	2672	2283	2678	7023
10-15		*	*	*	*	*	
Full bloom (7-15)	(9)	2845	5521	6442	6276	5271	5271
Full bloom	(10)	3179	5831	5943	5933	5222	7135
9-15		3281	1443	1602	1324	1913	
Full bloom		2265	5300	5833	5892	4823	
10-1	(11)	3092	1538	1442	1359	1858	6681
Full bloom		2134	6217	6980	6669	5500	
10-15	(12)	3299	1384	1692	1238	1903	7403
46 lb/P 1/	(13)	—	—	5031	4766	4899	4899

( ) = treatments.
* = No regrowth.
1/2-year average (1971-72)
Treatments 9 and 13 yielded significantly less than the others.
Treatment 3 is significantly higher than 6, 9, and 13.

yield performance is realized from the June 20-August 10-October 1 cutting treatment.

The yield performance of dryland alfalfa is greatly dependent upon amount and distribution of rainfall in western North Dakota (Table 2). Fluctuations in annual yield, as well as the number of potential harvests, is dependent upon the timing of precipitation. Late fall or early spring moisture is necessary for a high yielding first harvest, as is continued spring and summer rainfall for production following the initial cutting. This study has indicated that first and second cuttings may readily be possible from alfalfa when properly managed. When adequate rainfall is available following a second cutting, a third harvest may be feasible in years when early frost does not occur. Factors to consider, other than total forage yield and quality, are stand deterioration and possible winter kill due to too frequent harvesting or harvesting too late in the

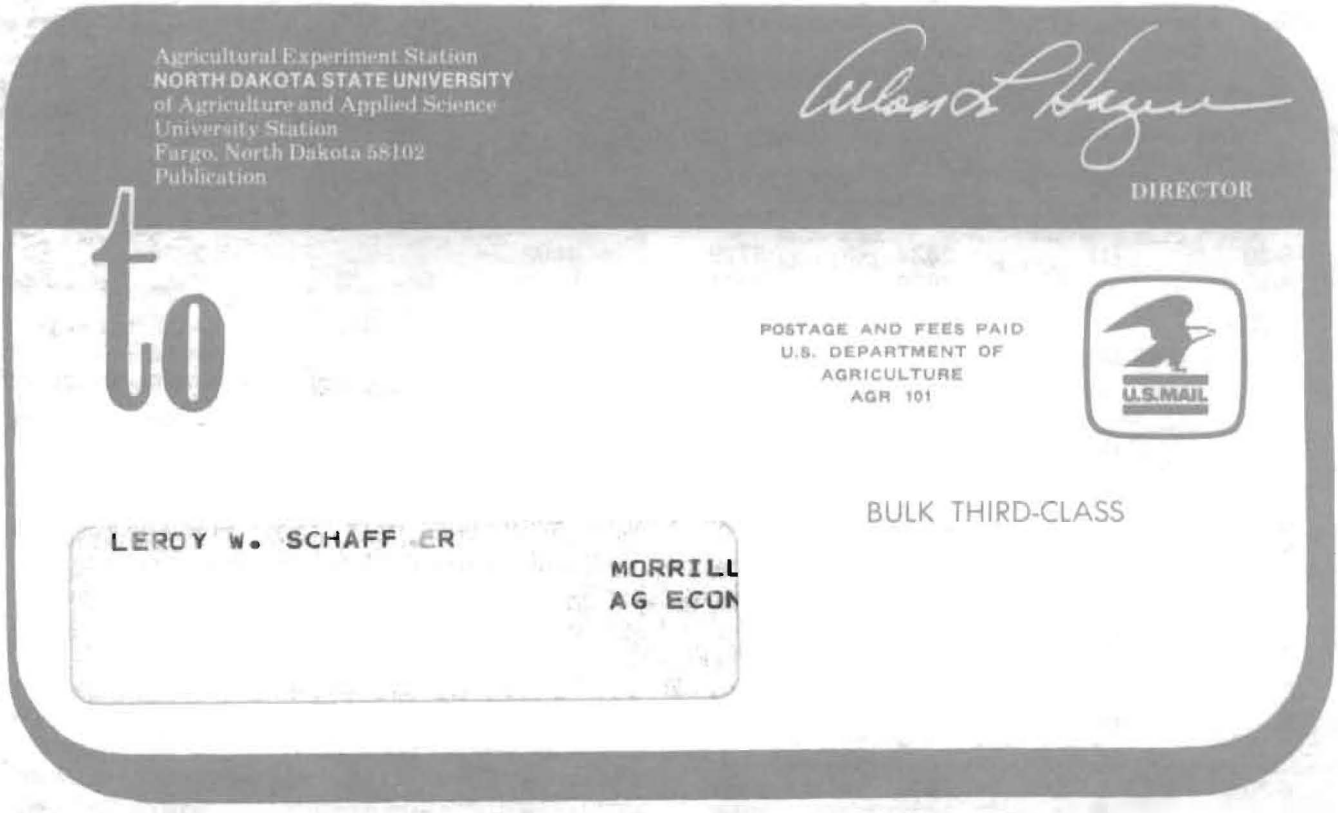

Table 2. Monthly precipitation totals recorded at the Dickinson Agricultural Experiment Station during the period 1969-1972.

	1969	1970	1971	1972	4-year average	81-year average
January	0.66	0.67	0.26	0.50	0.52	0.44
February	0.36	0.04	0.50	0.21	0.28	0.42
March	0.25	0.55	0.68	0.69	0.54	0.72
April	0.72	3.53	2.99	1.27	2.13	1.38
May	1.32	6.53	0.87	5.09	3.45	2.36
June	6.13	1.98	7.54	4.29	4.99	3.59
July	4.40	3.86	0.25	2.72	2.81	2.23
August	0.52	0.29	0.24	2.90	0.99	1.78
September	0.31	1.49	3.59	0.74	1.53	1.23
October	0.86	0.40	3.18	1.56	1.50	0.84
November	T	0.84	0.50	0.04	0.35	0.51
December	0.84	0.16	0.37	0.75	0.53	0.40
TOTAL	16.37	20.34	20.97	20.76	19.62	15.90

season. In this study only a very minor amount of stand deterioration was observed, although conditions normally associated with winter kill elsewhere may not have been present in the study area. The study has demonstrated the type of alfalfa management which may be the optimum for hay yields in the western portion of North Dakota.

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