

CHANGES IN NORTH DAKOTA HARD RED SPRING WHEAT VARIETIES, 1900-1977

Glenn S. Smith

The past three quarters of a century represents a time of ever intensifying interest and effort in improving wheat varieties available to the grower. The state and federal agricultural experiment stations, private breeders and the milling and baking trade have cooperated in this effort. Since 1916, North Dakota has had a growing and continuing research program in wheat improvement, because about half the farm income in this state comes from wheat. North Dakota growers have benefitted not only from the wheat improvement program of North Dakota, but also from the research of workers in adjoining states and Canada.

The USDA Statistical Reporting Service has conducted nation-wide wheat variety surveys at five-year intervals since 1919, and annual surveys in North Dakota from 1970 to 1975. Some of the earlier USDA Yearbooks also have given information on wheat variety distribution, e.g., 1920 (page 559).

Before 1915, 'Red Fife' and 'Bluestem' were the leading wheat varieties in North Dakota. Although no official estimates are available, historical records of these two varieties permit some estimates of their relative popularity from 1900 to 1914.

Information on the distribution of wheat varieties is very helpful to the growers who use these surveys to adjust their own variety selection plans. Because of wide varietal differences in quality, the milling and baking trade also is greatly concerned with variety distribution.

This paper summarizes the changing pattern of the important hard red spring wheat varieties grown in North Dakota, based upon the USDA surveys. Knowledge of release dates of each variety permits estimates of how long each variety was grown. Smoothing the curves of popularity for each variety permits an estimate of the acreage grown annually between the five-year surveys. Applying the derived annual acreage percentage estimates to USDA Crop

Reporting Service values for annual wheat production gives an estimated production of each variety by years.

Varietal Changes

Table 1 gives the estimated percentage of North Dakota harvested wheat acreage devoted to important hard red spring wheat varieties in all years for which survey data are available, 1914 to 1977. To simplify the analysis, durum wheat varieties are composited, although durum is directly competing with hard red spring and is grown in every county of the state. The table lists all hard red spring varieties which attained at least five per cent of the state wheat acreage. In all years but one (1970), the tabulated varieties account for more than 90 per cent of the harvested acreage.

The durum percentage of total North Dakota wheat acreage has been very erratic, ranging from a low of 12.7 in 1914 to highs of 43.3 in 1921 and 43.0 per cent in 1969. Agricultural census data also show durum percentages above 40 per cent in the non-survey years of 1922 and 1928. Very little durum was grown in 1900, but durum took over an increasing share of the wheat acreage as durum milling facilities and markets became available, and as its resistance to then prevalent stem rust races became recognized. Low acreages in the 1930's probably related to price. Durum acreages decreased in the 1950's because durum varieties were more susceptible than the hard red spring wheats to race 15B of stem rust. Recent high prices and high yielding varieties as well as good export demand have encouraged expansion in durum acreages.

The tendency has been for an increasing number of varieties to be grown as the breeding programs made new varieties available. Before 1924, Red Fife, Bluestem, 'Preston', and 'Marquis' accounted for most of the North Dakota hard red spring wheat acreage. But in recent years, ten or more varieties are being grown.

Table 1. Estimated percentage of North Dakota harvested wheat acreage devoted to important hard red spring wheat varieties and durum. 1914-1977.

Percentage of acreage by years*

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Variety	1914	1916	1917	1918	1919	1920	1921	1924	1929	1934	1939	1944	1949	1954	1959	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Red Fife	21.5	16.0	8.1	6.0	4.3	3.3	3.1	1.6	0.2																				
Bluestem	44.6	14.2	12.1	7.0	5.0	3.9	2.8	0.6	0.2																				
Preston	11.6	12.2	10.1	9.1	8.0	8.1	5.0	2.7	1.4																				
Marquis	5.0	38.5	43.4	47.2	47.5	46.7	41.7	52.9	52.6	39.4	3.0	0.1																	
Kota	.	.	.	.	.	.	.	4.9	0.8	0.4																			
Ceres	.	.	.	.	.	.	.	.	3.0	34.0	20.3	2.7	0.6																
Thatcher	.	.	.	.	.	.	.	.	.	.	41.6	26.4	13.9	10.9	2.0														
Regent	.	.	.	.	.	.	.	.	.	.	.	9.8	2.3	0.6															
Rival	.	.	.	.	.	.	.	.	.	.	.	25.8	10.0	4.3	0.1														
Pilot	.	.	.	.	.	.	.	.	.	.	.	7.0	1.8	0.9	0.2														
Cadet	.	.	.	.	.	.	.	.	.	.	.	.	5.1	2.9	0.1														
Mida	.	.	.	.	.	.	.	.	.	.	.	0.2	31.9	13.9	1.7														
Rushmore	.	.	.	.	.	.	.	.	.	.	.	.	.	10.4	2.0														
Lee	.	.	.	.	.	.	.	.	.	.	.	.	.	31.7	13.0	11.3	10.0	3.4											
Selkirk	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57.1	12.0	9.9	7.0	5.6	3.7	0.8								
Conley	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.8	0.2													
Pembina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8.6	5.0	2.0	1.0	1.0	0.4								
Justin	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	26.8	42.3	51.2	33.1	15.5	7.3	5.7	2.4	2.2	1.4	1.3	1.2		
Chris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.4	23.3	28.0	17.4	12.1	7.1	6.1	4.2	2.7	1.6	1.1	0.8
Fortuna	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.0	6.0	10.7	5.1	2.0	2.0					
Manitou	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.0	8.0	10.9	17.4	5.9	3.7	1.4	1.6	1.3		
Waldron	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	19.2	45.0	36.6	38.0	34.2	30.4	26.3	24.7
WS-1809	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0	7.8	6.5	2.7	1.5	1.2	1.0
Bounty 208	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.1	2.1	4.1	3.9	1.5	0.9	0.7
Lark	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.8	6.5	5.7	0.7		
Era	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8	4.5	4.9	3.6	3.5
Olaf	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.8	11.3	21.6	24.1
Ellar	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3	8.0	9.3
Kitt	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0	3.8
ALL DURUM	12.7	18.6	25.3	29.2	34.6	43.3	36.4	30.1	36.9	22.7	33.8	18.4	29.4	15.7	14.6	32.5	29.0	31.4	28.7	37.1	43.0	27.0	27.7	30.9	28.8	34.3	38.8	31.1	26.5
Total**	95.4	99.5	99.0	98.5	99.4	98.4	95.9	92.8	95.1	96.5	98.7	90.4	95.0	91.3	96.6	91.4	96.2	98.4	99.7	99.3	91.6	86.5	91.2	92.2	92.7	93.7	94.5	91.7	94.4

* Data available for only listed years. (from surveys of Crop Reporting Service, USDA, 1976 and 1977 data from NDSU Extension Service survey).

**Remainder of 100% attributable to minor or unknown varieties.

Figure 1 shows the changes in the leading varieties from 1914 to 1977. Marquis from Ontario, Canada held the longest tenure as a leading variety, 20 years from 1915 to 1934. Experiment Station publications (Stoa, 1945) indicate that Bluestem probably was the leading variety from 1903 to 1914, and Red Fife was in the lead before 1903; but USDA surveys do not give precise estimates. Therefore, Red Fife and Bluestem are not shown on this figure.

Stem rust epidemics in 1904 and 1916 demonstrated the need for rust resistant varieties. 'Ceres' resulted from a North Dakota hybridization program to improve on the rust resistance of Marquis, but Ceres replaced Marquis more because of its drouth tolerance than its rust resistance. Although grown from 1929 to 1949, Ceres was the leading variety only for three years, 1935-1937.

Ceres was very susceptible to stem rust race 56 which prevailed in the epidemic year, 1935, and as soon as the seed supply of resistant 'Thatcher' (Minnesota) could be increased, Thatcher took over the lead for seven years, 1938 to 1944. Meanwhile stem-rust resistant 'Rival' and 'Mida' (North Dakota) offered more leaf rust resistance than Thatcher, and occupied leading positions for three and five years, respectively, from 1945 to 1952. Mida

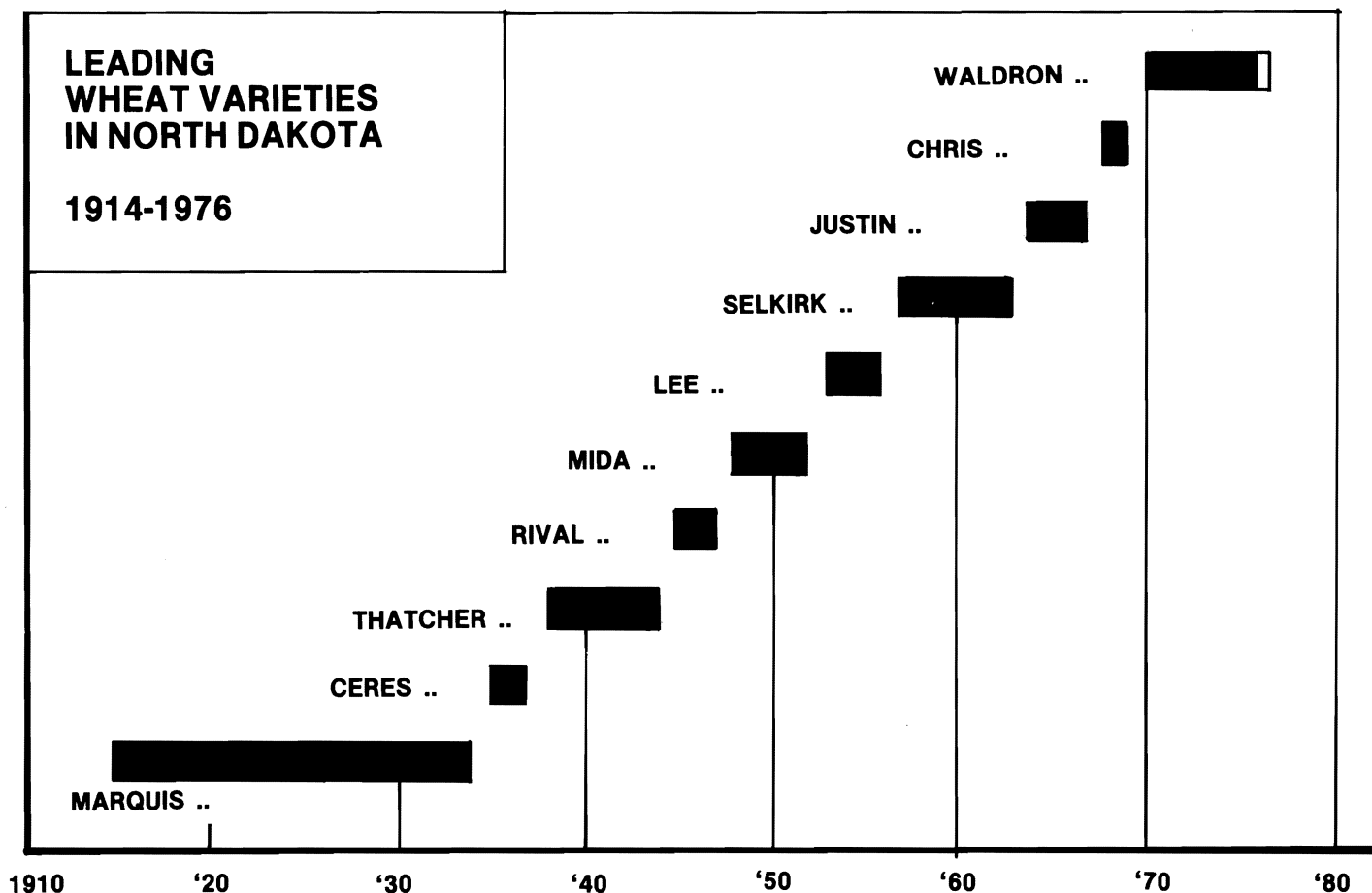
offered strong straw and good seed color, but Mida, along with older varieties was susceptible to the new races of leaf rust which evolved in the late 1940's.

In 1950, and again in 1953 and 1954, a new race of stem rust, 15B became prevalent and destructive. 'Lee' (Minnesota) had more leaf rust resistance as well as considerable tolerance to 15B stem rust, and occupied the lead from 1953 to 1956. The first variety with satisfactory 15B resistance was 'Selkirk' from Manitoba, Canada. Selkirk held the lead for seven years, 1957 to 1963, until it was replaced by 'Justin' from North Dakota. Justin was superior to Selkirk in stem rust resistance, test weight per bushel and milling/baking quality. 'Chris' (Minnesota) was more leaf rust resistant than Justin, and led for two years, 1968-1969.

For the eight years, 1970 to 1977, 'Waldron' (North Dakota) was the leading hard red spring wheat variety, excelling in straw strength and in stem and leaf rust resistance.

Since the early days of Marquis (20 years), only three varieties, Thatcher, Selkirk, and Waldron have retained the lead for as long as seven years. Nearly every major change in the lead has had differential rust reaction overtones, although super-

Figure 1



iority in earliness, straw strength and yielding capacity have been reinforcing factors. North Dakota growers now have escaped serious losses from wheat stem rust for more than two decades. However, an examination of the previous fifty years reveals no basis for complacency.

Wheat Yields and Per Capita Dollar Value

Estimated wheat acreage, yield per acre, production and value per capita in North Dakota, 1900 to 1977 are given in Table 2. Not until 1909 were more than 6 million acres of wheat planted, and it was the post World War I year, 1921, before wheat occupied more than 10 million acres in North Dakota (harvested acres). In only 13 years out of 77 have more than 10 million acres of wheat been harvested.

Yields per acre have fluctuated greatly, but do show trends toward increasing. Figure 2 shows five-year moving average wheat yields in North Dakota, 1900 to 1975. After fluctuating between 8 and 14 bushels per acre, average yields dropped steadily to an all-time low of 6.7 bushels in 1935. These were the dry years. Recovery was rapid, however, and by 1943, the five-year moving average was 17.3 bushels. Then it dropped again to 11.4 in 1952, due partially to 15B stem rust. Since then, average yield has increased steadily to over 25 bushels per acre. These long-time changes are not easily explained. There is no clear-cut cycle of uniform length, but no doubt rainfall and rusts were most influential. Improved varieties are a major influence, as are improved weed control with herbicides, and increasing use of fertilizer. The direction taken by this curve over the next decade will be of major concern.

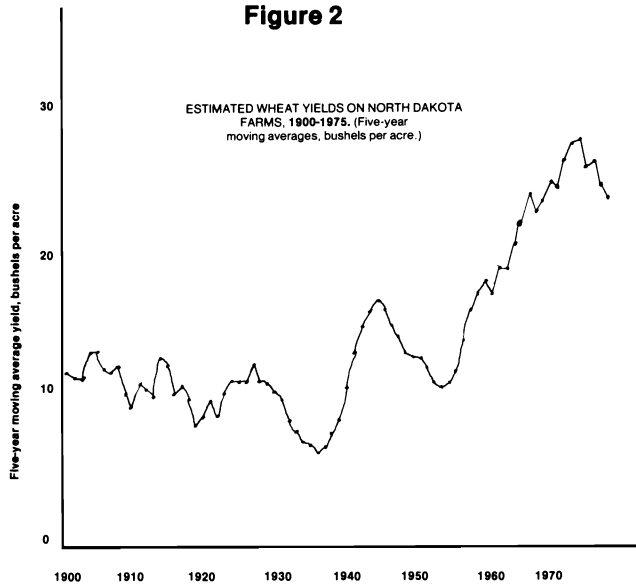
Table 2. Estimated wheat acreage, yield per acre, production and value per capita in North Dakota, 1900-1976.

Year	Acreage 1	Yield per Acre (bu.)	Production 2	Value per capita (\$'s)	Year	Acreage 1	Yield per Acre (bu.)	Production 2	Value per capita (\$'s)
1900	2.69	4.9	13.2	24	1939	7.24	10.5	75.8	82
1901	4.53	13.1	59.3	93	1940	8.03	11.6	92.7	97
1902	3.95	15.9	62.9	98	1941	8.16	17.3	140.7	206
1903	4.35	12.7	55.2	88	1942	7.32	19.6	143.6	240
1904	4.57	11.8	53.9	103	1943	8.33	18.2	151.4	311
1905	5.40	14.0	75.6	116	1944	9.86	15.9	156.3	346
1906	5.99	13.0	77.9	103	1945	9.86	15.7	154.6	363
1907	5.51	10.0	55.1	96	1946	10.19	13.7	139.8	448
1908	5.90	11.6	68.4	119	1947	10.26	14.3	146.4	622
1909	8.19	13.7	116.8	195	1948	9.77	14.4	140.2	456
1910	7.22	5.0	36.1	56	1949	10.56	10.6	112.4	370
1911	9.15	8.0	73.2	112	1950	8.94	13.9	124.0	340
1912	7.99	18.0	143.8	168	1951	10.49	13.9	145.7	495
1913	7.51	10.5	78.8	96	1952	9.85	10.2	100.4	339
1914	7.29	11.2	81.6	136	1953	9.84	9.9	97.3	328
1915	8.35	18.2	152.0	216	1954	7.70	9.0	69.2	231
1916	7.15	5.5	39.3	97	1955	7.21	15.2	109.3	367
1917	7.00	8.0	56.0	179	1956	6.89	17.2	118.8	383
1918	7.77	13.0	101.0	324	1957	6.35	18.8	119.2	380
1919	8.00	6.9	55.2	175	1958	6.37	23.1	147.4	433
1920	7.60	9.0	68.4	234	1959	6.50	15.0	97.5	290
1921	10.73	8.2	87.7	96	1960	6.44	19.8	127.5	367
1922	9.41	13.8	130.3	179	1961	5.73	12.1	69.4	247
1923	8.41	8.2	68.7	90	1962	5.45	28.7	156.4	544
1924	8.67	15.3	132.7	210	1963	5.64	22.3	125.6	392
1925	9.20	12.3	113.5	224	1964	6.36	23.8	151.1	320
1926	9.08	8.6	77.7	136	1965	6.84	26.0	177.9	392
1927	10.34	12.9	133.5	205	1966	6.57	23.4	153.9	397
1928	10.83	14.4	155.5	187	1967	7.96	22.6	180.3	427
1929	10.44	9.6	100.0	145	1968	7.90	26.9	212.8	469
1930	9.90	10.8	107.3	80	1969	6.78	30.3	205.5	443
1931	6.30	6.5	41.0	30	1970	6.49	23.6	152.8	357
1932	10.64	10.4	110.4	59	1971	7.37	32.5	239.6	495
1933	10.10	7.1	71.3	75	1972	7.51	28.9	216.8	650
1934	3.43	6.1	20.9	32	1973	8.77	27.5	241.6	1,727
1935	7.82	7.0	54.7	65	1974	10.32	20.4	210.8	1,639
1936	3.70	5.2	19.2	34	1975	10.21	25.9	264.4	1,777
1937	6.73	8.2	55.0	78	1976	11.66	24.7	287.8	1,307
1938	8.08	9.0	72.7	59	1977	9.66	24.0	231.4	752

¹ Acreage in millions of acres

² Production in millions of bushels.

Figure 2



DATA FOR FIGURE 2

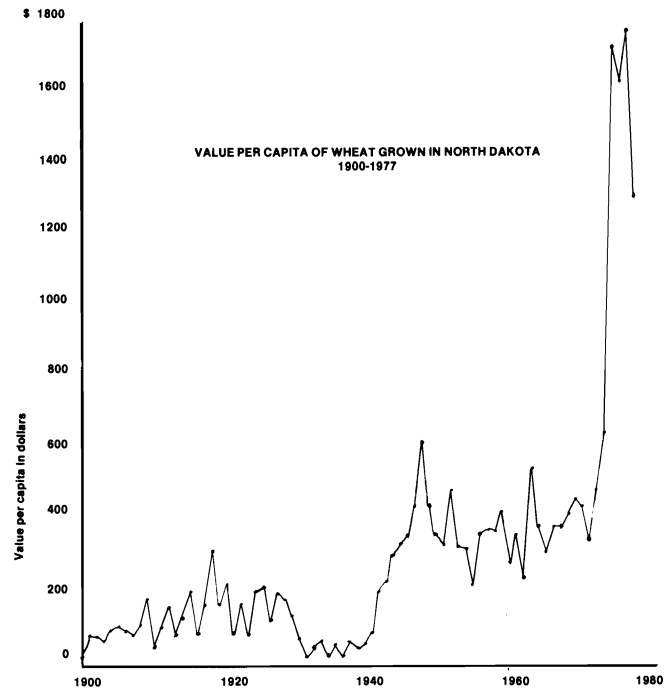
5 year moving ave. yields 1900 to 1977

1900	12.2	1941	15.4
1901	11.9	1942	16.5
1902	11.7	1943	17.3
1903	13.5	1944	16.6
1904	13.5	1945	15.6
1905	12.3	1946	14.8
1906	12.1	1947	13.7
1907	12.5	1948	13.4
1908	10.7	1949	13.4
1909	9.7	1950	12.6
1910	11.3	1951	11.7
1911	11.0	1952	11.4
1912	10.5	1953	11.6
1913	13.2	1954	12.3
1914	12.7	1955	14.0
1915	10.7	1956	16.7
1916	11.2	1957	17.9
1917	10.3	1958	18.8
1918	8.5	1959	17.8
1919	9.0	1960	19.7
1920	10.2	1961	19.6
1921	9.2	1962	21.3
1922	10.9	1963	22.6
1923	11.6	1964	24.8
1924	11.6	1965	23.6
1925	11.5	1966	24.5
1926	12.7	1967	25.8
1927	11.6	1968	25.4
1928	11.3	1969	27.2
1929	10.8	1970	28.4
1930	10.3	1971	28.6
1931	8.9	1972	26.6
1932	8.2	1973	27.0
1933	7.4	1974	25.5
1934	7.2	1975	24.5
1935	6.7		
1936	7.1		
1937	8.0		
1938	8.9		
1939	11.3		
1940	13.6		

(from averages of data (by 5 yr) on Table 2)

The per capita value of wheat in North Dakota exceeded \$300 only once in the first 43 years of this report, in the war year of 1918 (Fig. 3). Then for 30 years the value ranged between \$300 and \$600 per capita. Suddenly, in 1973, the value skyrocketed almost three-fold to over \$1,700, but now in

Figure 3



1977 has fallen back sharply. Four years of high per capita return from wheat have done much for the total economy of North Dakota. The stability and availability of high quality, high yielding hard red spring and durum wheat varieties have contributed heavily to the economic development of the state.

Cumulative Production of Hard Red Spring Wheat Varieties

By applying the estimated acreage percentages to total bushels produced by years, an estimate of the total production of leading varieties may be calculated. Figure 4 gives a summation of cumulative production of leading hard red spring wheat varieties from 1900 to 1977, arranged according to diminishing magnitude. Despite being grown in the early years when yields were low, Marquis is by far the leading variety in total bushels grown in North Dakota, over 900 million bushels. Bluestem was the leading variety for many years, and second in total production as a variety. Waldron leading variety for eight years, ranked third, followed by Thatcher and Selkirk, in the lead for seven years each. Red Fife probably was the leading variety from the days of the earliest settlers (1880's) through about 1903, but ranks lower in this report because of the arbitrary selection of 1900 as the earliest period discussed.

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 docu-

mented 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

**CUMULATIVE PRODUCTION
HRS WHEAT VARIETIES
NO. DAKOTA 1900-77**

VARIETY	PRODUCTION (000,000 BUS.)
MARQUIS	923
BLUESTEM	630
WALDRON	598
THATCHER	546
SELKIRK	475
RED FIFE	449
JUSTIN	334
MIDA	286
LEE	278
RIVAL	255
CHRIS	220
CERES	202
OLAF	150

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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.

Dr. Goetz is Chairman, Botany Department; Conlon is Superintendent, Dickinson Experiment Station; Nyren is Associate Botanist and Williams is Technician, Botany Department, North Dakota State University.

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