

Twenty Years of Alfalfa Variety Testing in North Dakota

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The relative forage yield of several alfalfa varieties and blends tested in short-term stands at Fargo and at several branch stations of the North Dakota Agricultural Experiment Station for a 20-year period (1959-1978) are summarized herein. These data indicate that several alfalfa varieties have yielded equal to or slightly greater than 'Vernal', a well-adapted check variety. Winterhardy varieties averaged higher relative forage yields than moderately or very winterhardy varieties, but each alfalfa variety class had varieties equal to or slightly higher yielding than Vernal.

INTRODUCTION

Alfalfa is the most widely grown cultivated forage crop in North Dakota. The North Dakota Crop and Livestock Statistical Reporting Service estimates that 1.98 million acres of alfalfa (includes alfalfa-grass acreage in which alfalfa is the major component) were harvested in 1978. Alfalfa hay acreage has increased substantially during the 1970's as producers recognized alfalfa as a superior forage crop to other traditional hay crops like native hay (Figure 1).

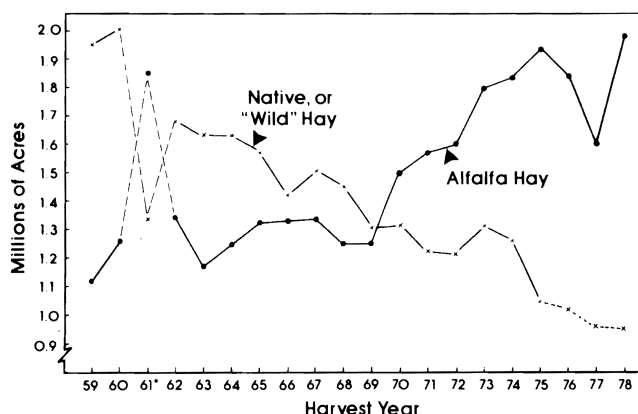


FIGURE 1.

Acreage of Alfalfa and Native Hays harvested in North Dakota during the last 20 years.

* Additional Alfalfa acreage was harvested in 1961 from soil bank land... which was deleted from the trend line.

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Carter (1) reported the results of early alfalfa varietal tests conducted in North Dakota. These tests indicated that 'Vernal' and 'Ladak' were the best adapted varieties for all of North Dakota with Ladak preferred in normal one-cut areas. However, many alfalfa varieties have since been developed by both private and public plant breeders. Many of these varieties are compared in uniform alfalfa varietal tests for forage yield and stand survival and are reported annually in the Central Alfalfa Improvement Conference Report(2). This article summarizes the relative forage yield of several alfalfa varieties and blends tested over the last 20 years (1959-78) at Fargo and several branch stations.

TEST PROCEDURES

A uniform alfalfa varietal trial was established at Fargo each spring for the past 20 years except in 1962, 1974, and 1976. The trials generally were established in randomized complete block designs with three or four replications. Each trial included 11 to 36 entries with experimental alfalfa lines deleted from this summary. All trials were harvested under a 3-cut system when the majority of varieties were at the first flower to early bloom growth stage. However, early maturing, moderately winterhardy varieties tended to be in a more advanced flowering stage than winterhardy varieties, which may skew the forage yield results slightly in favor of the moderately winterhardy varieties. Forage yields were determined by standard methods and expressed in tons oven-dry (dry matter (DM)) forage per acre. The relative forage yield reported herein is the

actual dry matter yield of a variety divided by the dry matter yield of Vernal within the same test. Vernal was selected as the standard variety since it has performed well for many years across North Dakota (1) and in surrounding states. The relative forage yield permits a more valid comparison among varietal trials from different test years. A relative forage yield with a minimum of 5 to 6 test years is considered a fairly reliable estimate of the variety's performance.

Promising varieties from Fargo tests are further evaluated to a limited extent at some of the branch stations. The tests are performed similar to Fargo tests with one to three annual harvests depending upon location and environment.

FARGO RESULTS

The average forage yield of Vernal alfalfa by harvest year for the past 20 years is presented in Table 1. Vernal has averaged 4.27 tons DM/acre in short-term (1 to 3-year-old) stands over the last 20 years at Fargo. The forage yield ranged from 2.73 to 6.07 tons DM/acre for the first productive year and 2.20 to 5.72 tons DM/acre for the third productive year. The forage yield decreased only 0.34 tons DM/acre from the first to third harvest year, but this relationship was shown by Meyer (3) to be biased by differences in annual precipitation among harvest years.

Table 1. Forage yield of Vernal alfalfa by harvest year at Fargo, ND from 1959-1978.

Harvest year	Number of test years	Forage yield in tons/acre	
		Dry matter	12% moisture
Seeding	22	2.09	2.38
First	80	4.45	5.06
Second	58	4.16	4.72
Third	46	4.11	4.67
Fourth	10	4.26	4.84
Fifth	3	4.03	4.58
Sixth	3	3.70	4.20
1st - 3rd			
Average	184	4.27	4.86

The relative yield performance of several alfalfa varieties and blends tested at Fargo, ND during 1959 to 1978 is shown in Table 2. The 10 very winterhardy varieties tested in short-term stands have averaged 93.8% of Vernal's forage yield. Ladak, 'Drylander', 'Norseman', and 'Spredor' have yielded within 2% of Vernal in the years tested. Ladak has a slight yield advantage over Vernal in the longer-term stands (four or more harvest years). The 38 winterhardy alfalfa varieties tested averaged 101.1%

of Vernal's yield (about 0.2 tons DM/acre higher). Ten varieties averaged 5% or more above the yield of Vernal, but only 'Dawson' and 'Scout' have five or more observations. The 30 moderately winterhardy varieties tested in short-term stands averaged 94.4% of Vernal's yield or slightly better than the very winterhardy varieties. Several moderately winterhardy varieties like 'Thor', 'Saranac', and 'Glacier' with several observations have produced yields very similar to Vernal in short-term stands. Other moderately winterhardy varieties like 'Cody', 'DuPuits', 'FD-100', 'G-777', 'Vanguard', 'Stride', and 'PAT 30' apparently lack sufficient winterhardiness for the Fargo environment and produced less than 85% of Vernal's yield in the third harvest year.

BRANCH STATION RESULTS

Average dryland forage yield of Vernal alfalfa in short-term (1 to 3-year-old) stands ranged from 1.48 to 3.30 tons DM/acre annually among the six North Dakota branch stations at which alfalfa variety testing was performed during the last 20 years (Table 3). Yield by harvest year was erratic due to annual precipitation differences. Irrigated forage yield of Vernal alfalfa ranged from 4.66 to 5.68 tons DM/acre in short-term stands. Irrigated forage yields during the second and third harvest years at Carrington, and to a lesser extent at Oakes, were influenced strongly by substantial winter injury and some winterkill. Winter injury and stand loss due to winterkill appears to be less serious under dryland alfalfa production.

The relative forage yield of several alfalfa varieties tested on dryland and under irrigation at the North Dakota branch stations during the past 20 years is presented in Table 4. The very winterhardy varieties averaged 97.0% of Vernal's yield across all dryland stations which is somewhat higher than their performance at Fargo. Ladak, Norseman (a selection from Ladak), and 'Roamer' varieties yielded quite similar to Vernal across the state with a possible yield advantage at western locations. Winterhardy varieties averaged 99.3% of Vernal's yield across all dryland locations which is slightly lower than their performance at Fargo. The highest yielding variety tested has been 'Titan' at 107.3%. 'Anchor', '520', Scout, '123', 'Polar I', '521', and 'Iroquois' have yielded 2% or more above Vernal. Ranger averaged only 95.6% of Vernal's yield across all dryland locations. Moderately winterhardy varieties averaged 94.3% of Vernal's yield across all dryland locations which was quite similar to their performance at Fargo. However, some bacterial wilt resistant, moderately winterhardy varieties like Thor and Saranac have yielded similar to Vernal in short-term stands.

Table 2. Relative forage yield of several alfalfa varieties and blends tested at Fargo during 1959-1978.

Varietal entry	Year of production					Average 1st-3rd	
	Seeding	First	Second	Third	4th-6th		
..... Relative yield - % of vernal							
<u>Very winterhardy</u>							
Drylander	100 (1) ¹	98(1)	103(1)	97(1)	101(9)	99.3(3)	
Kane	103 (1)	88(1)	103(1)	94(1)		95.0(3)	
Ladak	98 (2)	97(16)	99(18)	100(17)		98.7(51)	
Norseman		100(4)	101(4)	95(3)		99.2(11)	
Rambler		79(1)	78(2)	87(2)		82.0(5)	
Ramsey	110 (1)	99(1)	92(1)	95(1)		95.3(3)	
Roamer		91(3)	92(3)	96(3)		93.1(9)	
Spredor	103 (1)	94(1)	102(1)	100(1)		98.7(3)	
Teton		85(3)	96(4)	90(3)		86.9(10)	
Travois		88(8)	88(9)	94(8)		91(5)	90.2(25)
<u>Winterhardy</u>							
Agate	113 (1)	89(1)	95(1)	86(1)	85(3)	88.7(3)	
Anchor	88 (2)	95(2)	107(1)	104(1)		100.3(4)	
ATRA 55		103(1)	105(1)	110(1)		106.0(3)	
Baker	107 (2)	97(2)	89(1)	104(1)		97.0(4)	
BH-22		102(1)	100(1)	109(1)		103.7(3)	
Cayuga		98(3)	84(3)	97(2)		92.4(8)	
Conquest	110 (1)	95(1)	95(1)	99(1)		96.3(3)	
Culver		89(2)	94(3)	84(3)		88.9(8)	
Dawson	104 (4)	101(6)	105(6)	111(5)		105.5(17)	
Dominar	111 (2)	99(2)	111(1)	97(1)		101.5(4)	
Fremont		78(2)	87(2)	104(2)		89.8(6)	
Gladiator	113 (1)	114(1)	97(1)	96(1)		102.3(3)	
Iroquois	101 (2)	92(2)	118(1)	109(1)		103.8(4)	
Klondike	100 (1)	107(1)	107(1)	102(1)		105.3(3)	
<u>Winterhardy</u>							
Klondike Ph	115 (1)	105(1)	109(1)	97(1)		103(3)	103.7(3)
KN-33		93(1)	115(1)	109(1)	105.7(3)		
Ladak 65	91(1)	102(2)	101(1)	105(1)	102.5(4)		
Mark II		109(1)	119(1)	111(1)	113.0(3)		
Naragansett	98 (1)	101(6)	100(7)	101(6)	100.8(19)		
Nugget	109 (3)	94(3)	102(2)	100(2)	98.3(7)		
Phytor	104 (1)	107(1)	102(1)	96(1)	101.7(3)		
Polar I	100 (2)	97(2)	110(1)	102(1)	101.8(4)		
Ranger	86 (2)	95(12)	102(12)	99(11)	99(5)		98.5(35)
Scout		104(2)	115(2)	110(2)	113(1)		110.0(6)
Starcross		104(2)	100(3)	105(3)		102.6(8)	
SX-10	91 (1)	96(1)	92(1)	94(1)		94.0(3)	
Team		95(1)	103(1)	97(1)		98.3(3)	
Titan	101 (1)	102(2)	113(1)	118(1)		108.8(4)	
Trek	101 (1)	93(1)	102(1)	94(1)		96.3(3)	
Valor	100 (1)	91(1)	98(1)	100(1)		96.3(3)	
Victoria		88(1)	112(1)	115(1)	96(3)	105.0(3)	
Weevilchek	81 (1)	91(2)	105(1)	106(1)		98.5(4)	
123	90 (1)	93(2)	94(1)	102(1)	98(1)	95.8(4)	
520	89 (1)	101(2)	112(1)	114(1)		107.0(4)	
521	94 (2)	98(2)	100(1)	97(1)		98.5(4)	
522		121(1)	119(1)	112(1)	107(1)	117.3(3)	
1019		97(3)	97(4)	102(3)		98.3(10)	

Table 2. Continued

Varietal entry	Year of production					Average 1st-3rd
	Seeding	First	Second	Third	4th-6th	
<u>Moderate Winterhardy</u>						
Apex		113(1)	97(1)	107(1)	115(1)	105.7(3)
Appollo	91 (2)	103(2)	91(1)	94(1)		97.8(4)
Arc	110 (1)	94(1)	91(1)	99(1)		94.7(3)
Atlantic		95(6)	100(7)	96(6)	93(3)	97.0(19)
Bonus	109 (1)	105(1)	99(1)	87(1)		97.0(3)
Buffalo		94(6)	92(7)	88(6)	93(3)	91.7(19)
Cardinal		96(2)	95(2)	104(1)		97.4(5)
Citation	108 (1)	97(1)	93(1)	98(1)		96.0(3)
Cody		91(5)	92(6)	73(5)		86.0(16)
DuPuits		95(4)	85(5)	71(4)		83.9(13)
Europa		106(1)	98(1)	103(1)		102.3(3)
FD-100		98(7)	90(8)	84(8)	90(5)	90.1(23)
G-777	109 (1)	109(1)	77(1)	81(1)		89.0(3)
Glacier		97(7)	102(7)	95(6)	97(5)	98.6(20)
Kanza	97 (3)	91(4)	93(4)	98(4)		94.1(12)
Olympic	111 (2)	97(2)	89(1)	97(1)		95.0(4)
Pacer	97 (1)	108(1)	93(1)	92(1)		97.7(3)
PAT 30		120(1)	61(1)	80(1)	91(1)	87.0(3)
Saranac	100 (14)	105(17)	95(17)	96(16)		98.7(50)
Stride		106(1)	56(1)	67(1)	75(1)	76.3(3)
Tempo		95(1)	91(1)	96(1)		94.0(3)
Thor	109 (4)	96(5)	101(4)	104(4)	105(3)	100.3(13)
Tuna		95(2)	101(2)	109(1)		100.6(5)
Unita		96(2)	102(2)	101(1)		99.8(5)
Vangard	104 (1)	95(1)	77(1)	84(1)		85.3(3)
Warrior		102(2)	97(2)	97(1)		99.0(5)
WL-310	112 (1)	98(1)	93(1)	100(1)		97.0(3)
WL-311	115 (1)	98(1)	86(1)	94(1)		92.7(3)
WL-318	109(1)	101(1)	83(1)	90(1)		91.3(3)
919	91 (2)	98(4)	99(4)	96(4)		97.5(12)

.....Tons dry matter/acre to equal 100%.....

Vernal ²	2.09 (22)	4.45(80)	4.16(58)	4.11(46)	4.11(16)	4.27(184)
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¹The number in () is the number of test years or observations on that variety.

²Winterhardy variety.

Table 3. Forage yield of Vernal alfalfa by harvest year at the North Dakota branch stations from 1959-78.

Location	Harvest years (s)				
	First	Second	Third	Fourth + 1st-3rd	
.....tons dry matter/acre.....					
<u>Dryland</u>					
Carrington	4.39(1) ¹	2.40(1)	1.29(1)		2.69(3)
Dickinson	1.67(4)	2.50(4)	2.75(4)	1.49(6)	2.30(12)
Edgeley	1.87(2)	2.70(2)	1.84(2)	2.69(3)	2.13(6)
Langdon	3.33(2)	2.46(2)	3.53(1)	3.00(1)	3.02(5)
Minot	2.85(4)	3.38(5)	3.68(4)	2.81(5)	3.30(13)
Williston	1.31(3)	1.35(3)	1.78(3)	1.84(5)	1.48(9)
<u>Irrigated</u>					
Carrington	5.35(28)	4.47(19)	3.78(18)		4.66(65)
Oaks	6.45(17)	4.82(10)	5.25(10)		5.68(37)
Williston	5.40(1)	5.24(1)	5.52(1)		5.39(3)

¹The number in () is the number of test years or observations.

CONCLUSIONS AND RECOMMENDATIONS

Twenty years (1959-1978) of alfalfa variety testing basically confirms Carter's (1) earlier recommendation of Vernal and Ladak as well adapted varieties for North Dakota with Ladak preferred in normal one-cut areas. However, these data also indicate that several recently released, winterhardy and moderately winterhardy alfalfa varieties may have a 2 to 10% yield advantage compared to Vernal, especially in eastern North Dakota or under irrigation where three annual harvests are normally obtained. Producers should select only certified varieties that have yielded better than or similar to Vernal for short-term stands.

This report has dealt primarily with relative forage yield of various alfalfa varieties, but yield is only one factor to consider in variety selection. Winterhardiness, due to our severe winters, is a prime consideration, especially if long-term (4 years or longer) stands are contemplated. Only winterhardy or very winterhardy varieties should be used in long-term stands. Moderately winterhardy varieties like Thor and Saranac should be used to spread the harvesting workload on large farms. Moderately winterhardy varieties generally flower 1 to several days earlier than winterhardy varieties which should allow a greater percentage of the total hay acreage to be harvested near the optimum first flower to 10% bloom growth stage.

Disease and insect resistance may be a factor in varietal selection. Bacterial wilt, although generally not a serious problem in North Dakota, may be a problem on riverbottom areas or under irrigation

where alfalfa has been grown previously. Producers should select only bacterial wilt resistant varieties since most varieties available are resistant. Phytophthora root rot resistant varieties ('Agate', 'Apollo', 'Phytor', 'WL318', etc.) have shown no yield advantage on well-drained soils and should be considered an important character only on poorly drained or high water table soils. Leaf spotting diseases appear to be the most common alfalfa disease in North Dakota. Varieties like 'Ramsey', 'Europa', '530', Agate, etc. have relative high resistance to common leaf spot. Resistance to several insects has been incorporated into a number of alfalfa varieties, but little if any advantage in yield or persistence in short-term stands has been demonstrated in North Dakota. Varieties with a high level of alfalfa weevil resistance are not available, but partial resistance has been noted in varieties like 'Team', and 'Gladiator'.

Availability of certain varieties may be limited. Several varieties included herein like 'Rambler', 'Teton', 'ATRA 55', Scout, Stride, '522', 'Mark II', 'Naragansett', etc. are no longer in commercial seed production channels. Certified Ladak seed is becoming extremely scarce. Some varieties are not marketed in North Dakota or in nearby states. However, many public and private certified varieties that are equal or superior to Vernal in forage yield, winterhardiness, and disease resistance are available in North Dakota and should be used in preference to blends when establishing new alfalfa stands.

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Table 4. Relative forage yield of several alfalfa varieties tested on dryland and under irrigation at the North Dakota branch stations during 1959-1978.

Varietal entry	Dryland						1	Irrigated			
	Carrington	Dickinson	Edgeley	Langdon	Minot	Williston		All Stations	Carrington	Oaks	Williston
..... Relative yield - % of Vernal.....											
Very winterhardy											
Drylander		98(3) ²			81(3)	101(3)	95.0(12)	100(3)			99.7(3)
Ladak	114 (3)	105(12)	99(6)	95(4)	109(6)	101(7)	100.8(89)	97(8)	98(3)	102(3)	98.1(14)
Norseman	112 (3)	96(6)	88(3)		108(6)	110(2)	101.2(31)	79(3)			79.3(3)
Rambler		104(3)	100(6)	103(4)		86(2)	95.4(20)	99(2)		97(3)	98.0(5)
Roamer		123(3)			94(3)	104(2)	99.8(17)				
Spredor		95(3)			96(3)		96.4(9)	95(3)			95.0(3)
Teton		98(9)	95(6)	94(4)	100(3)	86(2)	93.4(34)	99(2)		94(3)	96.0(5)
Travois		110(6)			95(6)		94.2(37)				
Winterhardy											
Anchor					114(2)		104.9(6)	108(1)	107(1)		107.5(2)
Baker							97.0(4)	97(1)			97.0(1)
Culver		89(3)			100(3)		91.2(14)				
Dawson	88 (3)	90(3)			84(3)	97(2)	99.0(28)	83(3)			83.3(3)
Dominar		93(3)			104(5)	100(3)	100.1(15)	94(1)	108(1)		101.0(2)
Fremont		89(3)					89.5(9)				
Grimm		96(3)	100(3)	92(1)		78(2)	93.1(9)			102(3)	101.7(3)
Iroquois					96(1)		102.2(5)	97(1)	115(1)		106.0(2)
Ladak 65	107 (3)	93(3)			98(8)	101(2)	99.8(20)	90(4)	104(1)		93.2(5)
Naragansett		99(3)	98(3)	124(1)			101.2(26)				
Nugget					99(2)		98.5(9)	100(1)	112(1)		106.0(2)
Polar I					104(2)		102.7(6)	99(1)	111(1)		105.0(2)
Ranger	96 (3)	94(9)	90(6)	92(4)	93(8)	93(7)	95.6(72)	95(7)	101(1)	95(3)	95.5(11)
Rhizoma		94(3)	91(6)	94(4)		82(2)	91.5(15)	107(2)		104(3)	105.6(5)
Scout		96(3)				95(3)	102.9(12)	98(3)			98.3(3)
Titan		105(3)			104(5)	113(3)	107.3(15)	93(4)	102(1)		94.8(5)
Weevlchek		93(3)			106(5)	96(3)	99.5(15)	101(4)	106(1)		102.2(5)
123					108(5)	105(3)	102.9(12)	92(4)	109(1)		95.2(5)
520					99(2)		104.5(6)	95(1)	110(1)		103.0(2)
521					109(2)		102.3(6)	98(1)	111(1)		104.5(2)
Moderately winterhardy											
Apollo							97.8(4)	101(1)			101.0(1)
Cody		84(3)	74(3)	94(3)	94(3)		86.2(28)	92(2)			92.5(2)
DuPuits		89(6)	81(6)	82(4)	106(3)	61(2)	84.8(34)	89(2)		90(3)	89.8(5)
FD-100	69 (3)	86(3)	77(3)	94(3)			87.2(35)	96(3)			96.3(3)
Glacier	78 (3)	97(3)					96.1(26)	94(3)			93.7(3)
Saranac	93 (3)	99(3)			104(3)	102(3)	98.9(62)	102(3)	98(27)		98.0(30)
Thor		94(3)			111(2)		100.5(18)	104(11)	110(1)		104.5(12)
Unita		95(3)			101(3)		99.0(11)				
Warrior		96(3)			100(3)		98.5(11)				
..... Tons dry matter/acre to equal 100%.....											
Vernal ³	2.69 (3)	2.30(12)	2.13(6)	3.02(5)	3.30(13)	1.48(9)		4.66(65)	5.68(37)	5.39(3)	5.04(105)

¹ All stations data includes Fargo data reported in Table 2.

² The number in () is the number of test years of observations on that variety.

³ Winterhardy variety