

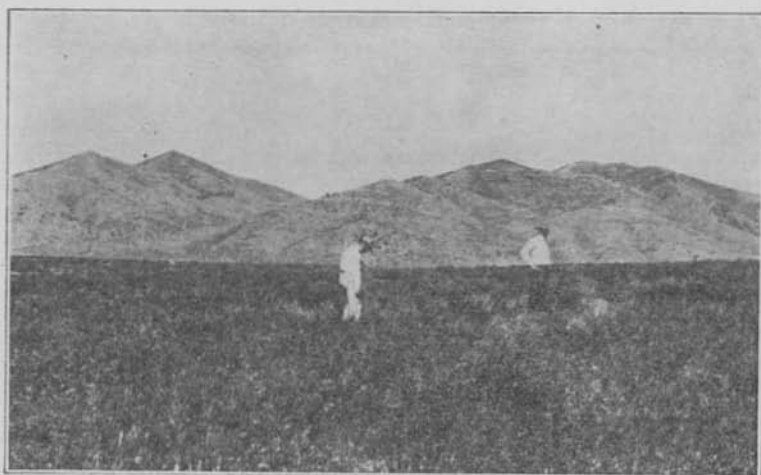
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Adaptability of Alfalfa Strains and Varieties for Idaho

By

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Alfalfa is well adapted to all sections of Idaho.

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VARIETIES of alfalfa have been recognized commercially in the United States only in the last 25 to 30 years. The importation of large quantities of alfalfa seed into this country from various parts of the world led to a study of the adaptability of these numerous strains by various experiment stations and the United States Department of Agriculture. These tests revealed a great variation in yield and hardiness of alfalfa seed produced in the various countries of the world. The information thus secured upon alfalfa was used as the basis for amending the Federal Seed Act in 1926 to include this crop.

In accordance with the terms of this amended act, all imported alfalfa seed must be stained at port of entry. Alfalfa seed of general unadaptation must be stained 10 per cent red; seed of unknown adaptability, 1 per cent green; and adapted seed, 1 per cent violet. This not only serves as a means of identifying imported seed but indicates its probable value for seeding purposes.

The development of the alfalfa seed industry in the United States resulted in the production of a large number of domestic strains of varying adaptability and yielding ability. Most of the seed-producing sections are located in the Western and Northern states. In these areas many strains and varieties have been grown for seed purposes. In the intermountain area hardy alfalfas and numerous common strains have been used for seed production. In the Southwest large quantities of non-hardy Peruvian and Chilean alfalfa seed have been produced. Seed of many of these strains, both adapted and unadapted, find their way to Idaho farms. As a result much winter-killing has taken place causing serious losses to the grower.

Grimm was the first hardy alfalfa to become widely distributed. Since its introduction numerous other varieties and strains of hardy alfalfa have been developed and introduced. Information on the comparative yielding ability of these hardy alfalfa strains and varieties is necessary for the grower to make the proper selection for planting.

Grimm and Common Alfalfa

"Common" alfalfa is the term generally used to include any strain of alfalfa that has purple flowers. Many different strains

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of common alfalfa have been developed in various sections of the world. There is considerable variation in hardiness among these common strains due to the differences in climatic conditions under which they have been developed.

In the United States common alfalfas are often designated by the name of the state where they are grown, such as Idaho-grown, Utah-grown, or Kansas-grown. Oftentimes "dry land alfalfa" is advertised highly. This term usually refers to a common strain grown under dry land conditions.

The value of seed from these various locations and conditions is dependent upon the length of time the seed has been grown in a particular locality. Seed that has been grown for a number of seed generations in a cold section will undoubtedly develop some degree of winter hardiness. To illustrate what is meant by "seed generation", the seed produced from the original seeding is the first seed generation. If this seed is sown and a seed crop produced from it, the second seed generation is secured. After several generations a fairly distinct strain of alfalfa will be produced. Much of the seed produced in important seed sections has come from stock produced in the same area. Therefore, much of the seed labeled with the name of a locality generally is satisfactory for planting under similar climatic conditions. When purchasing the so-called "dry land" or "non-irrigated" seed, a history of the crop should be secured before purchase. Such seed might be only one seed generation removed from an irrigated stock.

Grimm alfalfa represents the variegated group of alfalfas. This group was developed from natural crosses between two distinct species of alfalfa. Whenever the common alfalfa or purple flowered type is grown beside the fine stemmed, decumbent, yellow flowered alfalfa, crosses naturally occur. It is from these crosses that the variegated, hardy strains such as Grimm have been developed. A large proportion of the flowers are purple, but mixed in will be found hues of brown, green, yellow, smoky, and various combinations of shades ranging from yellow to purple in the same flower head.

Most of the alfalfas belonging to the variegated group are very resistant to cold and adverse climatic conditions. This characteristic probably is inherited from the yellow flowered parent. A close study of the hybrid alfalfas will show a great variation in the types and habits of the plants making up the population.

Alfalfa Strain Tests

The first comparison of alfalfa varieties made in Idaho was that of the Grimm and the common. In the spring of 1922, seedlings of these two varieties were made at the University Farm, Moscow, and at Sandpoint, and the following year at Winchester.

The results of these trials for the eight-year period ending in 1930 are shown in *Table I*. The superior yielding ability of the Grimm is shown in the eight-year average. Under Sandpoint conditions during severe winters common alfalfa has killed badly, often making it necessary to break up the stands. At Winchester the decreasing yields of the common alfalfa as the stand became older indicated the greater hardiness and longevity of the Grimm. Winter-killing usually is not a factor in alfalfa production at Moscow. The Grimm strain showed slightly greater yielding ability. These results show definitely the advantage of Grimm alfalfa for Northern Idaho.

TABLE I

Comparative Hay Yields of Grimm and Common Alfalfa in Pounds Per Acre at Moscow, Sandpoint, and Winchester, 1923-30 Inclusive

Year	Moscow		Sandpoint		Winchester	
	Grimm	Common	Grimm	Common	Grimm	Common
1923	6195	6486	5436	7668	-----	-----
1924	2323	1839	5616	5688	1139	1398
1925	4569	4027	7115	6171	2575	2614
1926	3185	2517	8941	8305	4984	3532
1927	4260	3146	6568	6200	4520	3700
1928	*8421	7514	5160	3240	5574	5485
1929	2885	2962	5160	5560	5616	5229
1930	4840	4469	**6120	2680	5465	4355
Ave.	4585	4120	6265	5689	4266	3759

* Yields for 1928-30 inclusive are averages from strain test.

** Yields for 1930 are averages from strain test.

Other Hardy Alfalfa Varieties

In 1924 at Sandpoint, seedings of Cossack and Hardigan were made for comparison with the Grimm variety. *Table II* shows the comparative yield data secured over a five-year period. The difference of approximately a half ton of hay each season on the average shows that hardy alfalfa varieties differ in yielding ability.

TABLE II

Comparative Hay Yields of Alfalfa Strains at Sandpoint, 1925-29 Inclusive

Variety	Yield in pounds per acre					
	1925	1926	1927	1928	1929	Ave.
Grimm	7115	8941	6568	5160	5160	6589
Cossack	4828	7159	6680	4560	4920	5629
Hardigan	5844	7749	5884	4920	6080	6095

A similar test was seeded at Moscow in the spring of 1925. In addition to the hardy sorts, common strains from three sources were included. The two years' data secured before the stands were broken up are shown in *Table III*. Ladak, Cossack,

and Grimm were the higher yielding varieties in the order named. Hardigan, although winter hardy, did not yield any better than the average of common strains. Little difference is shown among the yielding ability of the strains of common.

TABLE III
Comparative Hay Yields of Alfalfa Strains at Moscow,
1926-27 Inclusive

Variety	Yield in pounds per acre			Percentage yield based on Grimm as 100 per cent
	1926	1927	Ave.	
Kansas Common	1578	4748	3168	64.7
Dakota Common	1539	4506	3023	61.8
Cossack	4138	6297	5218	106.7
Grimm	3780	6001	4891	100.0
Common	2662	4821	3742	76.5
Ladak	6834	113.9
Hardigan	1379	5348	3364	48.8

TABLE IV
Sources of Seed of Alfalfa Varieties Grown at Aberdeen,
1928-31 Inclusive

Forage Office Number	Variety	Source of Seed
.....	Grimm	Aberdeen Experiment Sub-Station
14135	Ladak	Seed produced under contract for the Division of Forage Crops and Diseases by C. A. Slingstead, Havre, Montana, from seed of this number produced at Redfield, South Dakota.
14154	Ontario	From Cooperative G. L. F. Exchange, Syracuse, New York.
2005	Spanish	Purchased through the Seed Laboratory from H. W. Doughton Seed Company, New York.
2621	Hardigan	Michigan Farm Bureau Seed Service, Lansing, Michigan.
2668	Dakota No. 12	Alfalfa Seed Growers Association, Rapid City, South Dakota.
2004	Italian	Purchased through the Seed Laboratory from H. W. Doughton Seed Company, New York.
2671	Cossack	From C. W. Kruse, Lemmon, South Dakota.
2674	Turkestan	Purchased through the Federal Seed Laboratory from the Bonahorn Seed Company, Hastings, Nebraska.
2623	Utah Common	Purchased from Peppard Seed Company, Kansas City, Missouri, and said to have been produced in the Uintah Basin, Utah.
14150	Argentine	From Bridger and Company, Buenos Aires, Argentina.
595	Kansas Common	From Peppard Seed Co., Kansas City, Missouri.

In 1928 tests at Aberdeen were begun from seed furnished by H. L. Westover of the United States Department of Agriculture. The sources of this seed are shown in *Table IV*. The seed used in these trials included imported strains as well as hardy varieties and strains of common. The yield data for the four-year period are tabulated in *Table V*. Grimm and Ladak were the high-yielding sorts. Cossack, Hardigan, and Ontario Variegated were somewhat lower in yield than the other hardy types.

Spanish produced the lowest yield of any of the imported strains and is wholly unadapted. None of the foreign strains was as satisfactory as the better domestic common sorts. Dakota No. 12, a common type, produced slightly better yields than the Utah and Kansas Common.

TABLE V
Comparative Hay Yields of Alfalfa Varieties Grown at Aberdeen, 1928-31
Inclusive, 1928 Seedlings. Duplicate Plots

Variety	Forage Office No.	Yields in pounds per acre					Percentage yield based on Grimm as 100 per cent
		1928	1929	1930	1931	Ave.	
Grimm		11920	13840	11960	10000	11930	100.0
Ladak	14135	12720	14000	14160	10360	12810	107.4
Ontario Variegated	14154	10040	12560	12360	10560	11380	95.4
Spanish	2005	8560	9440	9640	8680	9080	76.1
Hardigan	2621	10400	12080	13640	11040	11790	98.9
Dakota No. 12	2668	9360	12160	13720	11440	11670	97.8
Italian	2004	8360	10960	13360	9720	10600	88.9
Cossack	2671	9840	12280	12440	11440	11500	96.4
Turkestan	2674	8280	11480	12640	9600	10500	88.0
Utah Common	2623	10080	11640	11800	8480	10500	88.0
Argentine	14160	10240	11000	11600	7680	10130	84.9
Kansas Common	595	8000	12720	13040	9680	10860	91.0
Average		9786	12013	12530	9890	11063	

Southern- Versus Northern-Grown Strains

A large quantity of alfalfa seed is grown in the Southwestern states. The total production of this area greatly exceeds the supply needed for general use in that section. The surplus seed gradually finds a market in the Northern and Middlewestern states. In some cases this seed is sold as southern seed. Much of it, however, has been marked under the guise of northern-grown common alfalfa. Usually the seed is of high quality, plump, free from weed seeds, and easily sold on its high class appearance. These factors combined with a slightly lower retail price make it a commodity easy to market.

Two of the most common alfalfa varieties grown in the Southwest are Chilean and Hairy Peruvian. Much of the common alfalfa grown in the western states was brought to Chile from Spain. This variety was introduced into California about 1850 after it had been grown in Chile for many years. In the Southwest it is known as Chilean.

Hairy Peruvian alfalfa was first introduced into the United States from Peru in 1899 by the United States Department of Agriculture. Plants of true Peruvian alfalfa may be recognized from other common strains by the pubescence or greater hairiness of the stems and leaves.

Since large quantities of southern-grown Arizona and California seed find their way into Pacific Northwest markets, careful tests were begun at the Idaho Station in 1927 to compare the value of this seed with that available from northern seed producing areas. The sources of the seed used in the test are shown in *Table VI* and represent nearly every important alfalfa seed producing section in the United States.

TABLE VI
Sources of Seed of Various Alfalfa Strains and Varieties Used in the Aberdeen, Moscow, and Sandpoint Trials

Idaho No.	Variety	Source of Seed
9142	Grimm	Grown from certified Grimm at University Farm, Moscow.
9143	Cossack	Grown at Twin Falls, Idaho, by J. W. Thometz.
9144	Chilean	Grown in Sacramento Valley, elevation 800 feet. Secured from C. C. Morse Seed Co., San Francisco.
9145	Common	Grown in Uintah Basin at Cedar View, Utah.
9146	Hairy Peruvian	Grown at Yuma, Arizona. Secured from R. S. Hawkins, Tucson, Arizona.
9147	Chilean	Grown in Modac County, California, elevation 5500 feet. Secured from C. C. Morse Seed Co., San Francisco.
9148	Chilean	Secured from Germain Seed Co., Los Angeles, Calif.
9149	Lebeau	From H. L. Westover, Forage Office, U. S. D. A.
9150	Common	Grown in Riverside County, California, elevation 2000 feet. From C. C. Morse Seed Co., San Francisco, California.
9151	Common	From G. A. Robinson, Agricultural Inspector, Huckley, Utah.
9152	Hairy Peruvian	Grown in Riverside County, California. From J. C. Loomis, Hemet, California.
9153	Hairy Peruvian	From Germain Seed Co., Los Angeles, California.
9161	Grimm	Certified seed grown at Sterling, Idaho, Elevation 4500 feet.
9162	Ladak	From South Dakota.
9163	Ladak	From H. L. Westover, Forage Office, U. S. D. A. Grown at Havre, Montana.
9164	Ontario Variegated	From Eastern States Milling Company, Buffalo, New York.
9165	Common	Utah grown seed from Washburn and Wilson Seed Co., Moscow, Idaho.
2310	Grimm	Certified Canadian from Inland Seed Co., Spokane, Washington.
2311	Grimm	Grown by J. W. Billings, Bonners Ferry, Idaho.

It will be noticed (*Table VI*) that seed from California is grown at elevations varying from 800 to 5500 feet. It might be expected that strains grown at the higher elevations would be better adapted to northern conditions than the others. Actual tests at Idaho Experiment Stations show little difference in the value of these various strains. All of the Chilean and Peruvian types are characterized by rapid growth recovery after cutting. In addition, they usually do not cease growing as cold weather approaches. Because of these characteristics usually they are severely injured by the colder weather of the fall months.

A number of presumably unadapted lots of seed shown in *Table VI* were grown at Aberdeen in 1928 and 1929. Yields were secured in 1930, but their record was not included in the table because of the thin stands and heavy infestation of weeds. All of the strains grown at Aberdeen were comparatively short lived even though the winters during the two-year period were not severe. In the more severe seasons many of them undoubtedly would have winter-killed completely. *Table VII* shows the hay yields secured, together with their percentage of yield in comparison with Grimm, Chilean (9144) and Hairy Peruvian (9153) were border plots and gave higher yields due to a greater plant

TABLE VII
Comparative Hay Yields of Various Alfalfa Strains Grown at Aberdeen,
1928-29 Inclusive

Idaho Number	Variety	Yields in pounds per acre			Percentage yield based on Grimm as 100 per cent
		1928	1929	2-yr. Ave.	
	Grimm	11920	13840	12880	100.0
9144	Chilean	7840	13360	10600	82.3
9145	Common (Utah)	7200	7120	7160	55.6
9146	Hairy Peruvian	8960	9520	9240	71.7
9147	Chilean	7360	10240	8800	68.3
9148	Chilean	8160	6960	7560	58.7
9149	Lebeau	8160	9280	8720	67.7
9150	Common (Calif.)	8480	8720	8600	66.7
9151	Common (Utah)	9680	8000	8840	68.6
9152	Hairy Peruvian	11520	8160	9840	76.4
9153	Hairy Peruvian	13600	8400	11000	85.4

food area and higher moisture conditions. *Table VIII* is a summary of the hay yields shown in *Table VII* together with a comparison of the southern and hardy strains grown in the same seasons. In this table all of the strains of Chilean, Utah Common, and Hairy Peruvian were averaged together to get the yield for each variety. These data show conclusively that only hardy alfalfa varieties are adapted to Aberdeen conditions, even in the less severe seasons. Cossack and Ontario Variegated, although comparatively hardy, did not yield as well as Ladak and Grimm. These data show that care must be exercised in the selection of hardy varieties if maximum hay yields are to be secured.

TABLE VIII
Comparative Yielding Ability of Alfalfa Varieties Grown at Aberdeen,
1928-29 Inclusive

Variety	2-year Average hay yields pounds per acre	Percentage yield based on Grimm as 100 per cent
Grimm	12880	100.0
Ladak	13360	103.7
Ontario Variegated	11300	87.7
Cossack	11060	85.9
Lebeau	8720	67.7
Utah Common	8000	62.1
California Common	8600	66.7
Chilean	8987	69.8
Peruvian	10027	77.8

All of the alfalfa strains shown in *Table VI* were grown at Moscow and Sandpoint. The annual and five-year average yields as well as the percentage yield for each of the varieties in the Moscow trial are shown in *Table IX*. These seedings were made in the spring of 1927 on fall-plowed land, without a nurse crop, at the rate of 10 pounds per acre. The difference in yield between the hardy and non-hardy strains is less than in the Aberdeen trials. For maximum yields however, hardy alfalfa varieties are essential.

Little difficulty usually is experienced in maintaining stands of alfalfa under Moscow conditions. To secure information on the actual numbers of plants per unit area, stand counts were taken in four of the six seasons in which the experiment was conducted.

In order that accurate stand counts could be obtained two square yard areas were staked in each plot. The number of plants actually found in each of these areas was recorded from year to year. The actual stands are shown in *Table X* for each of the seasons. The counts shown in the table are averages of the two areas laid out in each plot. In 1931, at the conclusion of the tests, the plants in each square yard area were dug up and counted to insure the accuracy of the determinations. The 1927 stand counts representing the actual numbers of plants obtained per square yard were taken June 21, six weeks after seeding. In each of the succeeding years the counts were taken immediately following the removal of the first cutting of hay.

Percentages shown in the second part of *Table X* are based upon the actual initial stand of Grimm (9142) as 100 per cent. It will be noted that upon this basis most of the common and southern-grown strains produced much heavier initial stands. In some cases more than two and one-third times as many plants were found in the unadapted strains as in the Grimm. This fact is probably due to the higher hard seed content of the hardy varieties. At the end of the test however, better stands of the Grimm remained than of the common and southern strains.

The third column in *Table X* shows the percentage of stand left each season, taking the 1927 stand of each plot as 100 per cent. These data show the actual loss in stand of each variety from year to year. The total loss in stand on this basis is shown in the last column and ranges from approximately 50 per cent in the hardy types to more than 80 per cent in some of the less hardy sorts. It is apparent from these data that hardy alfalfa strains are essential if one expects to maintain profitable hay stands for a four- or five-year period.

TABLE IX

Comparative Hay Yields of Various Alfalfa Strains Grown at University Farm, Moscow, 1928-32 Inclusive, 1927 Seedlings

Idaho No.	Variety	Yield in pounds per acre					Percentage yield based on Grimm (9142) as 100 per cent.	
		1928	1929	1930	1931	1932		Ave.
9142	Grimm	8334	2856	4888	4027	5885	5198	100.0
9161	Grimm	8508	2914	4792	3494	5924	5126	98.5
9162	Ladak	9853	3707	5953	3814	7163	6098	117.3
9163	Ladak	10125	4472	5808	4356	6844	6321	121.6
9164	Ontario Variegated	9553	3659	5430	4685	5663	5798	111.5
9143	Cossack	9146	2633	4569	3862	6834	5409	104.1
9149	Lebeau	6959	2449	3775	3098	6224	4501	86.6
9145	Common (Utah)	7878	3427	4743	4288	6369	5341	102.8
9151	Common (Utah)	7288	2507	4308	3746	5982	4766	91.6
9165	Common (Utah)	7375	2952	4356	3620	5789	4818	92.7
9150	Common (Calif.)	7173	2856	4646	4162	6553	5078	97.7
9148	Chilean	6475	2584	3727	4714	5566	4613	88.7
9147	Chilean	6832	2662	4937	3746	6921	5020	96.6
9144	Chilean	6947	2372	4375	4172	6660	4905	94.5
9152	Peruvian	6669	2120	4240	3117	6292	4488	86.3
9153	Peruvian	6407	2439	4656	3524	6970	4799	92.3
9146	Peruvian	7007	2226	4308	3233	6515	4658	89.6
	Average	7796	2873	4677	3862	6362	5114	

Table XI was compiled to show the comparison among the different groups of strains. Here the five-year average hay yields may be compared with the percentage yield and total stand loss. In general, as the stand loss increased the average yield decreased. Satisfactory stands are essential for maximum yields and such stands can be maintained only by use of winter-hardy strains even under conditions at Moscow where complete winter-killing rarely occurs in alfalfa.

It was noted also that as the stands thinned out, weeds came in to replace the alfalfa plants. In the alfalfa showing the greatest loss of stand, weeds comprised a large proportion of the total hay yield in the later years of the experiment.

TABLE X
Stand Counts of Various Alfalfa Strains Grown at University Farm,
Moscow, 1928-32 Inclusive, 1927 Seedlings

Idaho Number	Variety	Actual stands				Per cent stand based on 1927 stand of Grimm (9142) as 100 per cent				Per cent stand based on first season's stand as 100 per cent				Actual per cent loss of stand
		1927	1928	1929	1931	1927	1928	1929	1931	1927	1928	1929	1931	
9142	Grimm	187	149	134	95	100.0	79.6	71.6	50.8	100.0	79.6	71.6	50.8	49.2
9161	Grimm	204	179	144	107	108.8	95.7	77.0	57.2	100.0	87.7	70.6	52.4	47.6
9162	Ladak	211	151	109	101	112.8	80.7	58.2	54.1	100.0	71.6	51.7	47.9	52.1
9163	Ladak	186	132	118	100	100.0	70.6	63.1	53.5	100.0	70.9	63.4	53.7	46.3
9164	Ont. Variegated	295	220	158	119	157.7	117.6	84.5	63.6	100.0	75.2	53.5	40.3	59.7
9143	Cossack	111	89	82	58	59.3	47.6	43.9	31.0	100.0	80.2	73.9	52.3	47.7
9149	Lebeau	317	182	99	57	169.6	97.3	52.9	30.5	100.0	57.4	31.2	17.9	82.1
9145	Common (Utah)	308	239	161	76	164.7	127.8	86.1	40.6	100.0	77.6	52.3	24.7	75.3
9151	Common (Utah)	289	238	148	82	154.6	127.2	79.2	43.9	100.0	82.3	51.2	28.4	71.6
9165	Common (Utah)	322	269	170	99	172.2	143.8	90.9	52.9	100.0	83.5	52.8	30.7	69.3
9150	Common (Calif.)	430	272	184	101	229.9	145.5	98.4	54.1	100.0	63.3	42.8	23.5	76.5
9148	Chilean	317	257	148	74	169.6	137.4	79.2	39.6	100.0	81.1	46.7	23.3	76.7
9147	Chilean	244	150	134	56	130.5	80.2	71.6	29.9	100.0	61.5	54.9	22.9	77.1
9144	Chilean	442	252	152	68	236.3	134.7	81.3	36.3	100.0	57.0	34.4	15.4	84.6
9153	Peruvian	296	211	145	66	158.2	112.8	77.6	35.3	100.0	71.3	48.9	22.3	77.7
9152	Peruvian	447	275	158	84	239.0	147.1	84.5	44.9	100.0	51.5	35.3	18.8	81.2
9146	Peruvian	239	161	99	40	127.8	86.0	52.9	30.5	100.0	67.3	41.4	16.7	83.3

TABLE XI

Comparative Yielding Ability and Loss of Stand in Alfalfa Varieties Grown at University Farm, Moscow, 1928-32 Inclusive

Variety	5-year average hay yields in lbs. per acre	Percentage yield based on Grimm as 100 per cent	Total loss of stand for 5-year period, per cent
Grimm	5162	100.0	48.4
Ladak	6210	120.3	49.2
Cossack	5409	104.8	47.7
Ontario Variegated	5798	112.3	59.7
Utah Common	4942	95.7	72.1
California Common	5078	98.4	76.5
Chilean	4846	93.8	79.5
Peruvian	4648	90.0	80.7
Lebeau	4501	87.2	82.1

Two attempts were made to secure yield and hardiness data upon southern alfalfa strains at Sandpoint. The first seeding was made in 1927, but winter-killed so badly that no yields were obtained. Because of the poor stands, the plots were plowed and a new duplicate series begun in the spring of 1928.

Agronomic data secured on the duplicate seeding of alfalfa strains at Sandpoint are tabulated in *Table XII*. This table shows the estimated stands and actual yields for the two-year period. The 1930 yields were obtained even though the alfalfa stands

TABLE XII

Winter-killing Data and Hay Yields of Alfalfa Strains at Sandpoint, Idaho, 1929-30 Inclusive

Idaho No.	Variety	Notes on winter-killing	Hay yields in lbs. per acre		
			1929	1930	Ave.
2310	Grimm	Very good, no loss	9520	6400	7960
2311	Grimm	Very good, no loss	8520	5840	7180
9162	Ladak	Very good, no loss	7600	8200	7900
9164	Ontario Variegated	Very good, no loss	6080	6080	6080
9149	Lebeau	Killing in patches, 50 per cent stand	7680	4040	5860
9145	Common (Utah)	20 per cent left, this remainder weak and recovering below crowns	6680	2560	4620
9151	Common (Utah)	33 per cent stand, killing in patches, slight recovery below crowns	7360	2800	5080
9150	Common (Calif.)	90 per cent killed	7480	2400	4940
9144	Chilean	A few plants left on one end of plot	6000	2120	4060
9148	Chilean	Killed completely	7240	1360	4300
9147	Chilean	A few plants left on one end of plot	6600	1960	4280
9146	Peruvian	Killed completely	6680	1280	3940
9152	Peruvian	Killed completely	7000	1880	4440
9153	Peruvian	Killed completely	7760	1640	4700

were rated as completely killed. In these cases the weight of hay obtained was made up of weeds and volunteer clover which comes in profusely in the cut-over areas. In 1930 the unadapted plots showed such poor stands that the entire experiment was plowed up.

Since both trials with southern seed winter-killed badly, there seemed to be little need for additional seedings. Peruvian and Chilean showed complete lack of winter hardiness. The common strains winter-killed to such an extent that profitable yields could not be obtained the second season after planting. Only hardy alfalfa types are adapted to the cut-over area of northern Idaho. Even in the selection of hardy varieties care should be used, since some of them are lower forage producers than others.

A summary of the Sandpoint data showing the yield and percentage yield of the strain groups is tabulated in *Table XIII*. These data show Grimm and Ladak to be the outstanding varieties so far as yield is concerned.

TABLE XIII
Comparative Hay Yielding Ability of Alfalfa Strains Grown at Sandpoint, 1929-30 Inclusive

Variety	Yields in pounds per acre	Percentage yield based on Grimm as 100 per cent
Grimm	7570	100.0
Ladak	7900	104.4
Ontario Variegated	6080	80.3
Utah Common	4850	64.1
California Common	4940	65.2
Chilean	4213	55.6
Peruvian	4373	57.8
Lebeau	5860	77.4

In 1931 a new group of alfalfa varieties was seeded at Sandpoint. The varieties included in this trial were all of northern

TABLE XIV
Comparative Hay Yields and Percentage Stand of Northern Grown Alfalfa Varieties at Sandpoint, 1932-33 Inclusive

Variety	1933 stands per cent		Yield in lbs. per acre			Percentage yield based on Idaho Grimm as 100 per cent
	May 11	Aug. 8	1932	1933	Ave.	
Idaho Grimm	80	90	7880	9120	8500	100.0
Montana Grimm	75	85	7520	9020	8270	85.5
Cossack	50	85	7280	8640	7960	93.6
Montana Common	25	65	6060	5300	5680	66.8
Utah Common	10	65	5400	4160	4780	56.2
Canadian Variegated	65	85	8360	8820	8590	101.1
Dakota No. 12	25	75	6760	6580	6670	78.5
Ladak	75	90	8380	10560	9470	111.4
Baltic	50	80	7620	8100	7860	92.4
Liscomb	20	65	6300	6000	6150	72.4
French	10	60	6480	3920	5200	61.2
Turkestan	25	70	6060	6160	6110	71.9

origin. The agronomic data secured is shown in *Table XIV* and should suggest the best adapted varieties for the cut-over areas.

A comparison of the stand counts taken on May 11 and August 8, 1933, shows that many of the plants recovered during the summer months. Large numbers of these recovered plants, however, were small and weak even after the removal of the second cutting, and undoubtedly, many of them will be killed before the next crop season. Ladak and Grimm were more winter hardy and consequently produced high hay yields.

It is well known that freezing injury of alfalfa results in the destruction of the central portion of the root below the crown buds. This injury permits entrance of decay organisms, thus promoting decomposition. Steinmetz¹ found that resistance of alfalfa to cold increased as winter began and disappeared with the advent of spring. His investigations also showed that hardy varieties contained more sugar than the less hardy ones. The sugar content assists in protecting the roots against freezing injury.

Ladak Alfalfa

Ladak is a comparatively new variety of alfalfa introduced into this country by the United States Department of Agriculture from the province of Ladak in northern India. In the yield trials conducted at the various Idaho stations, Ladak has yielded slightly better than most of the other hardy alfalfa varieties.

There is a prevailing opinion that Ladak produces a poorer second cutting than other varieties. This idea has become prevalent because the variety does not start growth as quickly after the removal of the first cutting as most commonly grown sorts. An analysis of the first and second cuttings at various stations shows little difference between the actual percentage of the total crop produced by the second cutting. *Table XV* shows the relationship between the two cuttings of Grimm, Ladak, and common for irrigated conditions at Aberdeen. The four-year average yields show that 42.8 per cent of the Grimm yield and 39.2 per

TABLE XV

Comparison of First and Second Cutting of Grimm, Ladak, and Common Alfalfa Grown Under Irrigation at Aberdeen, 1928-31 Inclusive

Variety	Cutting	Total yield in pounds 4-year period	Average annual yield	Percentage of each cutting of total yield
Grimm	First	27280	6820	57.2
	Second	20440	5110	42.8
Ladak	First	31160	7790	60.8
	Second	20080	5020	39.2
Common	First	23240	5810	55.3
	Second	18760	4690	44.7

¹ Steinmetz, Ferdinand H. Winter Hardiness in Alfalfa Varieties. Minn. Tech. Bul. 38, 1926.

cent of the Ladak was produced by the second cutting. Apparently the greater yielding ability of Ladak is due to a larger first cutting, and the second cutting is about equal in weight to that produced by the Grimm.

A similar comparison of the relationship of the first to the second cuttings of Grimm, Ladak, and Common alfalfa for the cut-over area at Sandpoint is shown in *Table XVI*. These data show little difference in the percentages of the total crop produced by the second cuttings of the three varieties. Accurate second cutting comparisons could not be made from the Moscow data, because only one cutting ordinarily is secured from alfalfa in the Palouse area.

TABLE XVI

Comparison of First and Second Cutting of Grimm, Ladak, and Common Alfalfa at Sandpoint, 1929-30 and 1932-33 Inclusive

Variety	Cutting	Total yield in pounds 4-year period	Average annual yield	Percentage of each cutting of total yield
Grimm	First	24140	6035	60.7
	Second	8220	2055	39.3
Ladak	First	25540	6385	59.9
	Second	8480	2120	40.1
Common	First	14140	3535	62.4
	Second	5120	1280	37.6

Bacterial Wilt of Alfalfa¹

During the last ten years bacterial wilt of alfalfa has become an important factor in alfalfa production in certain sections of Idaho. The disease is especially severe along the Snake river from Twin Falls county to the Oregon line.

The bacterial wilt organism gains entrance only through wounds and often causes severe losses by winter injury. The early reports of losses by bacterial wilt were attributed to winter-killing, but soon it was found that the symptoms noted in the diseased plants were not those usually associated with low-temperature injury. The effect of alfalfa wilt varies somewhat, depending upon the conditions under which the alfalfa is growing and though the disease has been given the name "wilt", this term is not entirely descriptive of the disease. Wilting occurs only at certain seasons of the year and under specific temperature and soil conditions. Injury from this disease is usually localized in definite patches and spreads over the field from year to year from the initial infection. The affected plants are usually dwarfed and the entire plant presents a yellowed appearance. Many times a large number of small stems will develop presenting a condition which is known as "witches broom." The leaves are much smaller than normal, curled and crinkled, and the margins of the leaflets often show a yellow or

¹ Information furnished by Dr. C. W. Hungerford, Head, Department of Plant Pathology, Idaho Agricultural Experiment Station.

brown discoloration. The diseased plants soon die and in the spring many such plants may be found in the affected areas of the field with the roots entirely rotted off near the crown.

Plants infected with bacterial wilt exhibit very characteristic symptoms in the roots. If the bark of the root of a healthy alfalfa plant is removed the central portion presents a white appearance. On the contrary the central portion of diseased roots are yellow or light brown in color. The most characteristic symptom and one which may be used for final diagnosis is the occurrence of yellow or brown streaks on the inside of the bark and in the central portion of the root. These streaks are very noticeable when the root is split longitudinally or when the bark is peeled from the root proper. If the infected root is cut in cross sections, scattered dark brown spots will be noted. These spots are particularly numerous around the outer border just inside the bark. They are caused by the causal organisms clogging the water-conducting vessels of the alfalfa.

Although certain cultural practices may help in controlling bacterial wilt the only hope for complete control appears to be by the use of resistant varieties of alfalfa. The Department of Plant Pathology of the Idaho Agricultural Experiment Station has been testing seven varieties of alfalfa for resistance to bacterial wilt during the last four years. Test plots have been located in the Hagerman Valley, near Grandview, and in the Arena Valley near Wilder. The varieties in these test plots include: Idaho Grimm, Idaho Common, French, Cossack, Hardigan, Turkestan, and Ladak. As a result of these tests the seven varieties have resolved themselves into the following groups according to their susceptibility to bacterial wilt: Turkestan has shown considerable evidence of resistance; Cossack, Common, and Ladak while exhibiting some resistance have not survived the attack of the disease nearly so well as the Turkestan variety; the Common variety seemed to resist the disease fairly well until serious freezing injury during the last year allowed the organism to gain entrance and now very little of this variety is left in the plots; Hardigan, French, and Grimm have all proved very susceptible to bacterial wilt.

Considerable work has been done by the United States Department of Agriculture and by the agricultural experiment stations of Kansas and Nebraska in an effort to develop resistant selections. A number of these selections were secured for trial and were planted this year on the Caldwell Substation in order to give them a thorough test under Idaho conditions.

How to Buy Adapted Alfalfa Seed

Farmers intending to seed alfalfa should secure seed of known origin and adaptability. If a hardy variety is to be planted, certified seed should be purchased. Certified seed is produced and marketed by growers' associations under careful field and

threshed-seed supervision. The inspected seed is then marketed in sealed bags under definite standards of purity and quality. Large quantities of certified Grimm alfalfa are marketed in this manner by the Idaho Grimm Growers Association.

Domestic alfalfa seed of definite origin is available through reputable seedsmen. This service, inaugurated in 1927 by the United States Department of Agriculture and known as the Verified Origin Seed Service, is available to seed distributors requesting it. Verified origin seed is marketed in bags bearing government tags stating the locality where the seed was produced. Verified tags furnish no guarantee of purity or germination. However, the service enables prospective purchasers to secure adapted seed for planting purposes. Purity and germination tests on seed may be secured by submitting a sample to the State Seed Laboratory, Nobel Building, Boise, Idaho.

Summary

1. Hardy or variegated alfalfas are best adapted for seeding purposes in Idaho.
2. Hardy alfalfas vary greatly in their hay yielding ability.
3. Grimm and Ladak are the better adapted hardy sorts.
4. Ladak, although slow starting after the first cutting is removed, produces a second cutting equal to that of Grimm or Common.
5. Spanish, Italian, and Argentine alfalfas are wholly unadapted to Idaho conditions.
6. Turkestan is winter hardy but is a lower yielding variety in Idaho; however, it has shown some promise in alfalfa wilt infested areas.
7. Alfalfa seed from the Southwest and California, regardless of the elevation where grown, is entirely unadapted in all sections of Idaho.
8. Many alfalfa plants apparently winter-killed partially recover before the end of the growing season.
9. Alfalfa wilt is responsible for serious losses in certain sections of Idaho.
10. Purchase only seed of known origin, adaptability, and quality for planting purposes.

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