VARIETAL CHARACTERISTICS AND ADAPTATION IN THE LOW DESERT VALLEYS OF THE SOUTHWEST

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Alfalfa is grown as a cash crop in the desert valleys of the southwestern United States. Over 90 percent of the tonnage produced is either harvested in the form of a bale or a cube, with only small quantities going for dehydration, green chop feeding, ensilage, or direct pasture. The climate in the low desert valleys which stretch from southeastern California and Nevada, across the southern parts of Arizona and New Mexico, and into west Texas, is arid or dry desert with very little rainfall. Temperatures are very warm in the summer, normally exceeding 100° F daily maximum, with winter temperatures ranging from 40 to 70° F, with less than 20 days each year of freezing temperatures. Relative humidity is low during the summer ranging from 20 to 50 percent, except for infrequent storms that pass through the area from more moist areas. This type of climate permits alfalfas that are not sensitive to reduced hours of daylightt or low temperatures to continue growing throughout the winter months, although at a reduced rate due to the reduction in temperature and total energy that strikes the leaves from the sun. In addition, the low humidity has favored the development of varieties with little or no resistance to such leaf diseases as common and stemphylium leaf spots, and downy mildew in areas of higher humidity. Traditionally, southwestern alfalfas have not been long lived, having a low tolerance to root diseases and "scald", a lack of oxygen due to excess moisture over a prolonged period of time.

These and many other differences, each varying according to locality, make varietal choice one of the farmer's most perplexing problems. The fact that there are well over 76 varieties that could be grown in the southwestern valleys, each with its own diversity and characteristics, make this choice even more difficult. I have often stated, and I firmly believe, that the proper varietal choice is not simple. It involves a knowledge of all the characteristics of each variety, coupled with a knowledge of the characteristics of the particular piece of land where the individual variety will be planted, then matching these characteristics for the best expected result.

The information contained in this paper is provided as an aid to producers and others interested in understanding factors affecting varietal adaptation. Hopefully it will help define as accurately as possible the characteristics of varieties and brands sold throughout the southwest. Some varieties may not be listed. Their ommission has been inadvertent and not deliberate. This information supplements and updates that published in the Proceedings of the Seventh California Alfalfa Symposium held in Fresno, December 1977.

Variety and Brand Adaptation by Area

Traditionally, alfalfa varieties and brands have been divided into three broad classifications: winter dormant, semi winter dormant, and non winter dormant. This was a useful and simple system when there were relatively few varieties available, and these mostly from breeding programs of the state agricultural experiment stations. Today, with the diversity of germ plasm being used by both public and private breeders this simple system is no longer satisfactory. Breeders have so mixed up the germ plasm among the three types indicated, and have successfully developed varieties with intermediate characteristics, that I am proposing that the alfalfa industry adopt a new, six-part classification as follows:

(1) Winter dormant -- able to withstand extremely cold temperatures for long periods. These are often referred to as "northern" alfalfas. Even under California's mild weather conditions these alfalfas will not grow during the winter months, exhibiting a complete dormancy.

(2) Semidormant -- these alfalfas are referred to as "central" alfalfas, referring to the fact that they are adapted to a wide belt throughout the central part of the United States where the winters are not as severe and where plants can survive that have less and a shorter winter dormancy, and a greater fall and earlier spring growth than winter dormant varieties.

(3) Intermediate dormancy -- this class was created to describe varieties that are really semidormant in midwinter, but which exhibit more rapid regrowth and much later fall growth potential than a truly semidormant variety.

(4) Moderately nondormant -- this group describes varieties that have slightly more winter dormancy than Moapa 69 which is considered the standard for nondormant varieties. Moderately dormant varieties have late fall growth potential, but do become slightly more dormant in the winter than Moapa 69. There are all scales of recovery in this group.

(5) Non winter dormant -- these alfalfas are also referred to as "southern" alfalfas, which will grow during the winter months under temperatures and day lengths which prevail in both the Central Valley and southern California. Certain varieties will recover more rapidly after cutting, and have more winter growth. Others have a slower rate of recovery and have less winter growth.

(6) Very non winter dormant -- varieties and brands in this category show considerably more rapid recovery in the summer and much more winter growth than a nondormant variety such as Moapa 69. They are very frost tender and narrow crowned.

The classification of 76 varieties and brands for winter dormancy, fall regrowth, and principal areas of adaptation are to be found in Table 9.

The usefulness of knowing the winter dormancy classification is being able to know where varieties should be planted. The growth characteristics of winter dormant varieties are slow, the plants are more leafy, and when the winter days become shorter and the temperatures cooler these varieties do not grow to any great extent. In contrast, nonwinter dormant varieties are rapid recovering, with longer internodes between leaves, narrower crowned and less prostrate, and have the capacity to continue growing when the days become shorter and the temperatures reduced. Experiments in Arizona by Feltner and Massengale in 1960 to 1962 (Table 1) illustrate the reduced yield of Lahontan, a strongly semidormant variety, compared to Moapa during the period November 1 through April 30. When cut in the bud and 1/10th bloom stages, Lahontan yielded only 42 percent and 67 percent respectively of Moapa, the latter a winter growing type.

This same experiment illustrates that if slower growing types such as Lahontan can be allowed long periods of time between cuttings during the winter months, they can be as productive, and in this instance 21 percent more than Moapa.

A variety trial conducted by Bob Hagemann in Imperial County, using nondormant and very nondormant varieties, demonstrated that winter growth should not be used as a measure of the ability of a variety to produce hay over a longer period of time. Data in Table 2 indicate that on January 26, 1977 WL 512, the shortest variety, actually was the leading variety in production over a two-year period despite its lower yield on that date.

Alfalfa Characteristics that Influence Varietal Adaptation

There are many factors that influence yield and stand persistence, the two most important considerations to alfalfa producers. The ability of an alfalfa variety to withstand damage from insects, diseases, nematodes, and poor drainage will vary. Alfalfa varieties have differences that are genetically controlled and which are exhibited through resistance or susceptibility to these factors. The most important factors affecting production, except the Egyptian alfalfa weevil, are listed in Table 10. The resistance characteristics of varieties and brands to the EAW were not made since there is no real true resistance present in any variety commercially grown in California. However, certain varieties that are more dormant, leafier, with greater axillary branching, have the ability to continue growing under heavy weevil attack. These characteristics are found mostly in winter dormant and semidormant varieties. Among the varieties and brands listed in Table 10, you will recognize some old timers and a number of new ones. There have been many recent developments in alfalfa breeding that will lead to even better resistance to certain key stand-eliminating factors when these experimental germ plasms are released as varieties. I have been particularly impressed with the great strides made in Phytophthora root rot, root-knot nematode, "scald", and blue alfalfa aphid resistance. There is still a lot of improvement that can be made in factors that are important to southwestern producers including improved resistance to salinity, Egyptian alfalfa weevil, Rhizoctonia root canker, bacterial wilt, southern anthracnose, Stagonospora root rot, and leaf diseases such as common leaf spot and downy mildew. Increased levels of multiple pest resistance is also an important breeding objective for the future so a variety can have a broader range of adaptation over more soil types and different climatic conditions. Increasing levels of resistance to those alfalfa pests where we have a low level of resistance will also assist in increasing productivity and stand life.

Often two or more pests attack at the same time creating synergistic or multiple effects that are difficult to measure. Table 3 summarizes the effect of season-long insect and foliage fungus control at Davis using an insecticide and fungicide on eight varieties of alfalfa. You will note that by spraying every two weeks throughout the season, an additional 1.34 tons of alfalfa hay per acre were obtained over the no spray treatment. The first and second cuttings were affected by a wide variety of pests including the Egyptian alfalfa weevil, pea aphid, blue alfalfa aphid, and common leaf spot, resulting in about 0.4 ton per acre yield reduction in each of the first two cuttings when no insecticide or fungicide was applied.

Even though the first spray was a little late in preventing EAW damage in the first cutting, the results were still spectacular. Little yield increase was obtained from sprays during the summer months, but again in the fall heavy infestations from the pea aphid and alfalfa caterpillar caused significant increase in yield from sprays. This experiment is included merely to demonstrate the serious yield losses that are possible when insect pests and foliage diseases are not controlled genetically or chemically.

Stand Persistence. Stand loss is the sum total of the effects of cultural practices, insects, diseases and nematodes. Stands go out for different reasons in different areas. In general, the more dormant the variety the greater will be its persistence, especially if that dormancy is accompanied by resistance to diseases such as Phytophthora root rot. The fact that non winter growing alfalfas are able to store carbohydrates in their roots through the winter without having them removed by clipping, grazing, etc., adds to the stand life of alfalfa fields. Moapa, a nondormant variety, had a much more rapid stand decline than Lahontan, a semidormant type. Since the introduction of Moapa and other newer varieties, nondormant alfalfas will respond to management manipulations to increase stand persistence. For example, work at Mesa, Arizona has indicated that cutting frequently in the bud stage does not allow for root storage carbohydrates to be accumulated, thus causing a more rapid stand decline through diseases than when cut at the 25 percent bloom stage.

Often stand decline is not readily identified with any single factor. In the Imperial Valley on soils with salty subsoils and a tendency for over-irrigation during the hotter summer months, a situation develops that has been named "summer disease complex", which can be so severe it not only affects production and height of plants but also kills certain varieties. Table 4 illustrates this in the case of UC Salton compared to several older alfalfa varieties.

More recent trials at the Imperial Valley Field Station substantiate that varieties selected for resistance to "scald" or "summer disease complex" have less stunting, more production, greater stand persistence, have more vigor and withstand weed invasions much better. This may be partially due to their resistance to Phytophthora root rot. Table 5 gives the reaction of alfalfa varieties to Phytophthora root rot in a field test at the Imperial Valley Field Station in 1976. Of those listed in this table CUF 101 is shown to have the highest level of plants resistant to Phytophthora root rot, but there are many other varieties, including private varieties, which have equivalent levels of Phytophthora resistance and which would be expected to perform in the same way as CUF 101.

Variety trials conducted for observational purposes in farmers' fields have frequently yielded exceptionally good information on stand persistence. Often the factors that cause the stand decline are not as well identified, but they do give an excellent idea of how varieties persist under different soil situations. A good example occurred in Blythe on the Fisher Ranch where Les Ede planted a trial on a sandy soil that had fairly heavy populations of several species of nematode including root-knot, stubby root, stunt, ring and lesion nematodes, any of which may or may not have been responsible for the stand decline. I am inclined to believe the nematodes are linked since this is the third location in the state where Isom's 71 Polycross has stood out dramatically superior, and all locations had heavy populations of root feeding nematodes. Ratings are given in Table 6. Selections have already been made from this trial and experimentals developed that are under evaluation now for increased resistance to these root damaging nematodes.

Blue Alfalfa Aphid. The desert areas have a greater degree of damage from the blue alfalfa aphid than do other areas of the Southwest where winter temperatures are lower and the BAA doesn't develop as early. In my opinion many people have over-reacted to the seriousness of the blue alfalfa aphid. It certainly can cause yield reductions when it is not controlled or when varieties not resistant are planted. Tests in Imperial Valley by the University of California have indicated that 0.3 to 0.5 ton per acre can be lost in the first two cuttings in the spring when the BAA is not controlled in susceptible varieties. Later in the

Symposium Mr. Raj Sharma will discuss critical levels of BAA necessary before control measures are economically justified. C. G. Summers of the San Joaquin Valley Agricultural Research and Extension Center has shown in large field plots that even higher yield reductions can occur when the BAA is not controlled--up to 1.1 tons per acre of total hay yields with nearly a doubling of the amount of grasses and weeds present in the uncontrolled fields. However, to make a varietal choice based on only BAA resistance is shortsighted in my opinion. To reject a variety with high productivity and stand longevity characteristics in favor of one with resistance to BAA is trading the major investment one has in stand establishment for the cost of several spray applications per year. Fortunately, some of our new varieties have very high levels of resistance to pea aphid and spotted alfalfa aphid and more persistence in the low desert valleys, including higher levels of Phytophthora root rot resistance than previously adapted varieties such as Moapa 69, UC Cargo or Mesa Sirsa (Table 10).

Determinations of yield loss from the BAA so far have been mostly obtained by comparing chemical sprays vs no sprays. This loss has ranged from 0.3 to 1.2 tons per acre. With the release of CUF 101 and WL 514, and the testing of a large number of experimentals from both private and public breeders, resistant varieties can be used to assess the advantage of planting a resistant variety compared to a susceptible one. Table 8 compares CUF 101 with three susceptible varieties, and indicates that in the first cutting in Imperial Valley CUF 101 had a yield increase of 74 percent over Moapa 69, or 47 percent when comparing it to UC Cargo. The difference is not nearly as great when yields are compared on a seasonal basis where CUF 101 had a yield increase of 42 percent over Moapa 69 but only 8 percent over UC Cargo. The greater persisting abilities of Cargo, CUF and Salton are evident when compared against Moapa on a seasonal basis.

Heavy BAA attacks causing fairly severe damage apparently have a carry-over effect in subsequent cuttings from BAA feeding damage. Three trials have been conducted in Imperial Valley from which some conclusions can be made on this carry-over damage. These trials have an average of about 50 percent reduction in yield in the presence of the BAA, and about a 20 percent and a 10 percent reduction, respectively, for the first and second cuttings after the infestation of the BAA. Affected plants seem to be able to restore themselves with no long-term effects. Some trials have had a much shorter residual effect, with damage only in the subsequent cutting. Very few trials have shown no residual carry over from BAA feeding.

Other Pest Problems Affecting Yield and Persistence. In Table 10 are listed 13 factors that have an influence on yield and longevity. Some have been covered in this discussion previously. Others such as Rhizoctonia root canker have had very little breeding for resistance, despite its known effect on stand persistence under the hot summers and saturated soil conditions present in the low desert valleys. Most nondormant varieties are not resistant to common leaf spot and, in fact, are quite susceptible and defoliate easily when this leaf disease is present in cooler weather and high humidity. Programs are underway now to incorporate resistance into new varieties. Bacterial wilt, while a severe stand-depleting disease in many other areas of the United States, is not an important factor in the southwest desert areas. Nevertheless, programs are also underway to develop varieties with at least a moderate level of resistance to improve their usefulness and range of adaptation. The same could be said for southern anthracnose and stem nematode.

Fusarium wilt can be a severe stand-depleting disease, particularly in New Mexico. It occasionally is a factor in stand decline in other areas in the Southwest. Fortunately, most all of the southwest nondormant varieties have at least a moderate level, and in many cases a high level, of resistance to this disease.

Summary

The large number of alfalfa varieties and brands offered to growers in the southwestern states is sometimes confusing. At least it is difficult to maintain an up-to-date knowledge of each of their characteristics. This material is offered to aid in providing information on alfalfa characteristics and where they can be adapted to their best advantage. I believe that the wide choice offered by the great diversity of varieties is good rather than bad. The ever increasing number of new alfalfas made available is creating a much greater choice of types to match a grower's individual needs for dormancy and resistance to specific destructive alfalfa pests. The ever increasing numbers of varieties and brands with multiple pest resistance will continue to grow as alfalfa breeders respond to the need to increase yield and persistence.

I am indebted to many individuals who assisted in providing information that has been included in this paper. The variety and brand characterization of pest resistance was done by a responsible individual from the company who either owns, originated, or distributes the alfalfa in question. In some few instances, public varieties have been characterized by assembling information from different sources. Nearly all of the alfalfa growth characterization and area of adaptation data were done in cooperation with a responsible party from the companies involved. Some few varieties and brands were characterized from information provided by the company. I take the responsibility for those characterizations. If anyone has any questions about a character listed, I would be happy to discuss this with them.

Table 1. Yield of Lahontan as a percent of Moapa during three growth periods in Mesa, Arizona, 1960-62.

Period	Cutting schedule	Lahontan yield as % of Moapa
May 6 - October 31	Bud	93
	1/10 Bloom	97
	Full Bloom	76
November 1 - April 30	Bud	42
	1/10 Bloom	67
	Full Bloom	121
May 1 - November 10	Bud	142
	1/10 Bloom	103
	Full Bloom	102

Table 2. Height and yield of alfalfa during winter period, 1977, and average yield per year for a two-year period. Hagemann and Marble, 1977.

	January 26, 1977		
Varieties	Height - inches	Tons/acre	2-year average tons/acre
WL 512	10.6	0.56	7.74
K206-1	13.4	0.62	7.67
Ardiente	14.2	0.61	7.63
Mesa Sirsa	12.8	0.62	7.61
UC Cargo	13.2	0.63	7.30
UC Salton	13.4	0.60	7.21

Soil type: Holtville silty clay, well drained, low salinity.

Table 3. Season-long insect* and foliage fungus control. Average of eight varieties. V. L. Marble and G. Peterson, UC Davis, 1974.

Treatment	Tons dry matter per acre 4/24	5/27	6/27	7/29	8/30	10/1	Total
Spray	0.70	1.66	1.81	1.79	1.34	0.95	8.25
No spray	0.31	1.23	1.66	1.70	1.30	0.70	6.91
Difference	0.39	0.43	0.15	0.09	0.04	0.25	1.34
LSD .05	0.13	0.12	0.14	0.04	n.s.	n.s.**	0.28

* Benlate® at 2 lb/acre ai and Furadan® at 16 oz/acre ai applied at two-week intervals, March 15 through August 12; monthly, September 13 and October 17.

** Significant at the 8% level.

Table 4. Yield, height, and stand persistence of selected alfalfa cultivars growing in an over-irrigated hay production field at the Imperial Valley Field Station. Lehman, et al., 1973.

Varieties	lbs. green weight per plot 8/4/71	Height in inches 8/4/71	Plants/square foot 10/13/71
UC Salton	13.2	16.3	4.5
Sonora	5.9	9.6	0.0
Moapa	6.9	10.3	0.1
Mesa Sirsa	9.8	11.0	2.8
El Unico	7.7	9.6	0.6

Table 5. Reaction of alfalfa varieties to phytophthora root rot in a field test at the Imperial Valley Field Station, 1976. Lehman, et al., 1978.

Variety	Resistant	Intermediate	Susceptible
	%	%	%
CUF 101	21.5	29.6	49.2
UC Cargo	14.0	31.7	54.4
UC Salton	9.2	24.4	66.4
Mesa Sirsa	8.1	8.6	83.3
Moapa 69	5.5	9.1	85.3
LSD .05	8.0	9.5	11.7

Table 6. Stand ratings taken April 6, 1977 during the third production year. Fisher Ranch, Blythe, Riverside County.

Varieties	Rating
Isom's 71 PX	3.6
UC 76	5.4
Moapa 69	5.6
UC Salton	6.6
Mesa Sirsa	6.8
FM 411	7.2
UC Cargo	7.6
Sonora	8.2
LSD .05	1.3
.01	1.8
CV %	16.1

Visually rated by Marble and Ede; 1 = perfect stand; 9 = no stand remaining.

Table 7. Comparative resistance of 9 alfalfas to 3 species of aphids in greenhouse evaluation tests, Tucson, Arizona. M. Nielson, USDA, 1976.

Entry	Mean % seedling survival*		
	A. kondoi	*A. pisum*	*T. maculata*
CUF 101	70.29 a	70.94 b	87.32 ab
ARS-PA[1]	25.78 b	85.61 a	72.75 cd
Kanza	23.37 b	70.94 b	68.55 d
Dawson	23.37 b	69.51 b	72.00 cd
Washoe	19.86 bc	56.43 c	67.15 d
Lew	19.24 c	46.25 d	80.24 bc
MSTT[2]	11.93 c	23.98 e	93.32 a
Caliverde (ck)	0.0	0.0	8.0

* Means followed by the same letter(s) are not significantly different at the 0.05 level of probability.

[1] Unreleased variety with very high resistance to pea aphid (*A. pisum*).

[2] Unreleased variety with very high resistance to spotted alfalfa aphid (*T. maculata*).

Table 8. Yield of alfalfa varieties grown under normal irrigation conditions. UC Imperial Valley Field Station, El Centro. 1976. W. F. Lehman.

Variety	First cutting 2/20/76*			Seasonal yield as %	
	Yield T/A	Yield as % of UC Cargo	Yield as % of Moapa 69	Moapa 69	UC Cargo
CUF 101	1.49	147	174	142	108
UC Salton	1.19	118	139	117	95
UC Cargo	1.01	100	118	131	100
Moapa 69	0.85	84	100	100	76

* Blue alfalfa aphid damage severe prior to 2/20 cutting. No BAA damage after that date. Planting date October 3, 1975.

Table 9. Alfalfa variety and brand growth characteristics and principal areas of use.

Variety or brand	Winter[1] dormancy	Fall[2] growth	Principal[3] areas of use	Distributor or owner or originator	Information supplied by:
Abunda Verde Brand	VND	7	1	Northrup King	Bill Knipe
Amador	ID	5	2,5,6	" "	" "
Anchor	D	2	8	North American Plant Breeders	Jim Moutray
Apollo	D	3	6,8	" "	" "
Ardiente	ND	6	1,3,4,5	Ferry-Morse	Phil Robnett/Tony Wilson
AS-13	MND	5	2,3,4,5,6	" "	" " " "
AS-13R	ND	6	3,4,5,6	" "	" " " "
AS-49	SD	4	2,3,5,6	" "	" " " "
AS-49R	SD	4	2,3,5,6	" "	" " " "
AS-63	D	2	8	" "	" " " "
Atra 55	D	2	8	Arnold-Thomas Seed Service	Marvin Miller
Aztec	SD	3	6,8	Asgrow Seed	Dick Norton/Ike Kawaguchi
Aztec II	SD	3	6,8	" "	" " " "
Caliente	VND	7	1,4	Ferry-Morse	Phil Robnett/Tony Wilson
Caliverde 65	ID	4	2,3,5,6	Uni. of Calif.	Vern Marble
Condura 73 Brand	ID	4	2,3,5,6	Continental/ Pioneer Intl.	Jim Kautz/Marvin Miller
Converde 95 Brand	VND	7	1,3,4,5	" "	" " " "
CUF 101	VND	8	1,4,5	Uni. of Calif.	Bill Lehman
Dawson	D	2	8	USDA/Uni. of Nebraska	Bill Kehr
DeKalb Brand 123	D	1	8	Ramsey Seed/ Cal/West	Trevor Bower/Don Smith
DeKalb Brand 131	D	3	8	" "	" " " "
DeKalb Brand 167	SD	4	2,3,5,6	" "	" " " "
DeKalb Brand 183	ND	6	4,5,6	" "	" " " "
DeKalb Brand 185	MND	5	4,5,6	" "	" " " "
Diablo Verde Brand	ND	6	3,4,5,6	Asgrow Seed	Dick Norton/Ike Kawaguchi
El Unico	VND	7	1,4	Uni. of Ariz.	Mel Schonhorst
Eureka Brand	SD	3	2,5,6	Security Seed	Bill Rusconi
Gladiator	D	2	8	Northrup King	Bill Knipe
Hayden	VND	7	1,4	Uni. of Ariz.	Mel Schonhorst
Imperial 70 Brand	VND	7	1,4	Security Seed	Bill Rusconi
Joaquin 11	MND	5	2,3,4,5,6	" "	" "
Kodiak	D	2	8	Asgrow Seed	Dick Norton/Ike Kawaguchi
Lahontan	SD	3	2,3,5,6	USDA/Uni. of Nevada	Joe Hunt
Lew	VND	7	1,3	Uni. of Ariz.	Mel Schonhorst
Matador	ND	6	1,4,5	Northrup King	Bill Knipe
Mesa Sirsa	VND	7	1	Uni. of Ariz.	Mel Schonhorst
Mesilla	MND	5	2,4	New Mexico State Uni.	Bill Melton
Moapa 69	ND	6	1,3,4,5,6	USDA/Uni. of Nevada	Joe Hunt
Pacer	D	2	8	Union Seed Co.	Don Brown
Pioneer Brand 540	D	3	7,8	Pioneer Hi-Bred International	Marvin Miller
Pioneer Brand 572	VND	7	1,3,4,5	"	" "
Pioneer Brand 581	ID	4	2,3,5,6	"	" "
Ranger	D	1	8	USDA/Uni. of Nebraska	Vern Marble
Resistador II	ID	4	2,5,6,7,8	Northrup King	Bill Knipe
Rincon	VND	7	1	New Mexico State Uni.	Bill Melton
SD 76 Brand	SD	4	2,5,6,8	Garner Seed	Bob Shotwell
Sonora	VND	7	1	Uni. of Ariz.	Mel Schonhorst
Sonora 70	VND	7	1	" " "	" "
Thor	D	2	8	Northrup King	Bill Knipe
UC Cargo	VND	7	1,4	Uni. of Calif.	Bill Lehman

Table 9. (continued)

Variety or brand	Winter[1] dormancy	Fall[2] growth	Principal[3] areas of use	Distributor or owner or originator	Information supplied by:
UC Salton	VND	7	1,4	Uni. of Calif.	Bill Lehman
WL 215	D	2	8	Germains/ Waterman-Loomis	Ike Kawaguchi
WL 216	D	2	8	" "	" "
WL 219	D	3	8	" "	" "
WL 220	D	2	8	" "	" "
WL 306	SD	3	8	" "	" "
WL 309	SD	3	6,8	" "	" "
WL 310	SD	2	2,8	" "	" "
WL 311	SD	3	2,8	" "	" "
WL 312	SD	3	2,8	" "	" "
WL 318	SD	4	2,5,6,8	" "	" "
WL 450	MND	5	3,5,6	" "	" "
WL 451	MND	5	3,5,6	" "	" "
WL 501R (Eldorado R)	ND	6	4,5,6	" "	" "
WL 508	ND	6	1,3,4,5,6	" "	" "
WL 512	ND	6	1,3,4,5,6	" "	" "
WL 514	ND	6	1,3,4,5,6	" "	" "
WL 600	ND	6	1,4,5	" "	" "
819 Brand	ND	6	1,4,5	Northrup King	Bill Knipe
919 Brand	ID	5	3,4,5,6	" "	" "
1019 Brand	SD	4	2,3,4,5,6	" "	" "
Valor	D	1	8	Union Seed Co.	Don Brown
Vanguard	SD	4	6,8	North American Plant Breeders	Jim Moutray
Vernal	D	1	8	Uni. of Wisc.	Vern Marble
Washoe	SD	3	2,4,5,6,8	USDA/Uni. of Nevada	Joe Hunt

[1]Winter Dormancy

VND = Very non winter dormant
ND = Non winter dormant
MND = Moderately non winter dormant
ID = Intermediate winter dormant
SD = Semi winter dormant
D = Winter dormant

[2]Fall Growth Similarities

1 = Vernal
2 = Thor
3 = Lahontan
4 = Caliverde 65
5 = WL 451
6 = Moapa 69
7 = UC Cargo
8 = CUF 101

[3]Principal Areas of Use

1 = Low desert valleys of southern California, southern Arizona, southern Nevada and southern New Mexico.
2 = High desert valleys of southern California, southern Arizona, southern Nevada, southern New Mexico and west Texas.
3 = Coastal valleys of central and southern California.
4 = Southern San Joaquin Valley.
5 = Northern San Joaquin Valley.
6 = Sacramento Valley.
7 = North coastal valleys.
8 = High elevation mountain valleys of northern California, Nevada, northern Arizona, and northern New Mexico.

Table 10. Alfalfa variety and brand ratings for pest resistance.*

Variety or brand	SAA	PA	BAA	PRR	Sc	Rz	BW	FW	S An	CLS	DM	SN	RKN
Abunda Verde Brand	HR	T	T	T	T	--	S	T	S	--	--	S	--
Amador	R	S	S	R	--	--	S	--	S	--	T	S	T
Anchor	S	R	S	S	S	S	R	S	S	T	R	T	S
Apollo	T	R	S	R	S	S	R	R	R	T	T	S	S
Ardiente	T	T	--	T	T	--	T	--	--	T	T	R	--
AS-13	T	--	--	T	T	--	T	--	S	T	T	T	--
AS-13R	T	--	--	R	R	--	T	--	--	T	T	R	--
AS-49	T	S	--	R	T	--	R	--	S	T	T	R	--
AS-49R	T	--	--	R	T	--	R	--	--	T	T	R	--
AS-63	--	--	--	S	--	--	R	--	S	T	T	--	--
Atra 55	S	S	S	S	S	S	R	--	S	R	T	S	--
Aztec	R	R	S	S	--	--	R	HT	T	T	T	MR	--
Aztec II	R	R	MT	S	--	MT	R	T	T	T	T	MR	--
Caliente	T	T	--	S	S	--	T	--	S	T	T	S	--
Caliverde 65	HR	S	S	MT	--	--	R	--	S	MT	MT	HT	--
Condura 73 Brand	R	T	S	R	S	S	R	--	S	T	T	R	--
Converde 95 Brand	R	R	S	S	S	S	S	--	S	S	R	S	T
CUF 101	HR	R	R	MR	T	--	S	HR	S	S	MT	S	T
Dawson	R	R	S	S	--	--	MR	--	S	MR	S	--	--
DeKalb Brand 123	S	S	--	S	--	--	R	--	S	T	R	S	--
DeKalb Brand 131	R	S	S	S	--	--	MR	--	S	T	R	S	--
DeKalb Brand 167	R	T	S	MR	--	--	T	--	S	T	T	T	--
DeKalb Brand 183	R	S	S	T	--	--	S	--	S	T	T	S	--
DeKalb Brand 185	R	T	S	T	--	--	S	--	S	T	T	S	--
Diablo Verde Brand	R	R	S	S	--	--	T	MR	MT	MT	T	S	--
El Unico	R	S	T	S	S	S	--	--	--	S	T	S	T
Eureka Brand	R	R	S	R	--	--	R	--	--	--	--	R	--
Gladiator	S	T	S	S	--	--	R	--	T	--	R	MT	--
Hayden	R	S	S	S	S	S	--	--	--	S	T	S	T
Imperial 70 Brand	R	--	S	T	--	--	--	--	--	--	--	S	S
Joaquin 11	R	S	S	T	--	--	T	--	S	S	S	T	T
Kodiak	MR	MR	S	S	--	--	R	T	T	T	--	T	--
Lahontan	T	S	S	MR	S	S	R	S	S	S	S	R	S
Lew	R	S	S	S	S	S	--	--	--	S	T	R	--
Matador	HR	S	S	T	--	--	MR	--	S	--	T	S	--
Mesa Sirsa	R	S	S	S	S	S	--	--	--	S	T	T	MT
Mesilla	R	R	S	T	--	--	--	R	--	--	--	T	--
Moapa 69	T	S	S	S	S	S	S	MR	S	S	S	S	T
Pacer	S	R	S	T	S	S	R	--	T	T	--	--	--
Pioneer Brand 540	R	S	S	R	S	S	R	--	S	R	R	S	--
Pioneer Brand 572	R	R	T	T	T	S	S	--	S	S	HR	S	--
Pioneer Brand 581	R	T	T	R	T	S	R	--	S	T	R	R	--
Ranger	S	S	S	S	--	--	T	--	S	MT	HT	S	--
Resistador II	R	MT	S	T	--	--	HT	--	S	T	HT	R	--
Rincon	R	R	S	S	S	--	T	T	--	--	T	--	--
SD 76 Brand	R	R	MT	MR	--	T	R	MR	MR	T	T	HT	--
Sonora	T	S	S	S	S	S	S	--	--	S	T	S	MT
Sonora 70	T	S	S	S	S	S	S	--	--	S	S	S	MT
Thor	S	S	S	S	--	--	HR	--	S	R	R	S	--
UC Cargo	R	T	S	T	T	S	S	HR	S	S	ST	S	--
UC Salton	R	T	S	T	T	S	S	HR	S	S	ST	S	--
WL 215	T	T	S	S	--	--	R	MR	MR	MR	T	S	--
WL 216	MR	R	T	S	S	T	R	T	T	T	T	MR	S
WL 219	MR	HR	S	T	--	T	R	MR	T	T	T	S	--
WL 220	MR	HR	S	MR	--	T	R	MR	MR	T	T	S	--
WL 306	R	R	S	S	--	--	R	HT	T	T	T	MR	--
WL 309	R	R	T	S	--	MT	R	T	T	T	T	MR	--
WL 310	R	R	T	S	--	HT	R	MR	T	S	T	R	--
WL 311	R	HR	HT	T	--	HT	R	MR	MR	MR	T	T	--
WL 312	R	R	MT	R	--	HT	R	MR	MR	MR	T	MR	--
WL 318	R	HR	MT	R	--	T	R	MR	R	T	MR	MR	--
WL 450	R	MR	S	T	S	S	MT	MR	T	T	R	R	T

Table 10. (continued)

Variety or brand	SAA	PA	BAA	PRR	Sc	Rz	BW	FW	S An	CLS	DM	SN	RKN
WL 451	R	T	S	T	S	S	R	HT	T	T	T	T	S
WL 501R (Eldorado R)	R	MR	S	S	S	S	MR	R	T	T	T	S	S
WL 508	HR	R	S	T	S	T	S	MR	MR	T	R	S	HT
WL 512	HR	R	MT	MR	MT	T	MR	R	--	T	MR	R	T
WL 514	R	R	R	T	--	--	MR	MR	--	--	T	T	--
WL 600	R	R	MT	S	S	T	T	MR	T	T	MR	S	--
819 Brand	R	S	S	S	MT	--	S	--	S	--	S	S	MT
919 Brand	R	S	S	T	--	--	S	--	S	--	T	S	T
1019 Brand	R	S	S	T	--	--	HT	--	S	--	HT	R	S
Valor	S	R	S	S	S	S	R	--	MT	MR	--	--	--
Vanguard	T	S	S	S	S	S	R	T	R	T	T	S	S
Vernal	S	S	S	S	--	--	R	--	S	T	HT	S	HT
Washoe	R	MR	S	R	--	--	R	S	S	S	S	R	S

Pests and Diseases

SAA = Spotted alfalfa aphid
PA = Pea aphid
BAA = Blue alfalfa aphid
PRR = Phytophthora root rot
Sc = Scald
Rz = Rhizoctonia stem and root canker
BW = Bacterial wilt
FW = Fusarium wilt
S An = Southern anthracnose
CLS = Common leaf spot
DM = Downy mildew
SN = Stem nematode
RKN = Root knot nematode species

Ratings

HR = Highly resistant
R = Resistant
MR = Moderately resistant
HT = Highly tolerant
T = Tolerant
MT = Moderately tolerant
ST = Slightly tolerant
S = Susceptible
-- = No data available

Definitions

I = Immune. Not subject to attack for a specified pest. Immunity is absolute.
R = Resistant. Ability of plants to restrict the activities of a specified pest.
T = Tolerant. Ability of plants to endure a specified pest or an adverse environmental condition, performing and producing in spite of the disorder.
S = Susceptible. Inability of plants to restrict the activities of a specified pest, or to withstand an adverse environmental condition.

* The author assumes no responsibility for accuracy of the data supplied by the different contributors.