ADAPTATION OF ALFALFA VARIETIES TO THE DESERT AREAS

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Introduction of Alfalfa to Low Desert Areas of the US

Origin

Alfalfa (Medicago sativa L.) is thought to have originated in the area that is now Iran. It was cultivated long before recorded history. Where man went, alfalfa went with him. Today alfalfa is found growing wild from China to Spain and from Sweden to North Africa. A wild type of alfalfa has been reported growing in Siberia, where temperatures as low as -84°F have been reported. On the other hand, other types have been grown successfully in areas where the temperature exceeds 120°F in the summer. Alfalfa survives and is grown on a large number of soil types with differences in rainfall, elevation and latitude.

Common Alfalfas

Alfalfa was first introduced to the Americas by way of Mexico and Peru by the Portuguese and Spaniards in the 16th century. These alfalfas were types that had been grown in Spain and Portugal. They proved to be well suited to their new environment and thrived. These alfalfas spread from Peru to Chile, Argentina and Uruguay by 1775.

Strains of the alfalfas, originally introduced into Mexico and Peru, were probably brought from Mexico to Texas, Arizona and California by the early missionaries. The introduction from these sources, under the name, "Chilean Clover", to California around 1850 was probably of major importance, however.

These alfalfas were very well adapted to the Southwestern United States and their use soon spread eastward until they were grown to some extent in Montana, Iowa, Missouri and Ohio. Use of these alfalfas was limited because of a lack of winterhardiness, however.

These alfalfas became known as "Common Alfalfas". The different commons were referred to by the state in which the seed was produced, such as California common and Arizona common.

Turkestan Alfalfa

Turkestan alfalfa was introduced into the USA in 1898 from Central Asia. It proved to be an excellent source of resistance to many diseases and insects in the development of varieties. These include resistance to bacterial wilt [Corynebacterium insidiosum (Mc Cull.) H.L. Jens.], stem nematode [Ditylenchus dipsaci (Kühn) Filipjev], spotted alfalfa aphid [Therioaphis maculata (Buckton)], pea aphid [Acyrthosiphon pisum (Harris)], and Phytophthora root rot [Phytophthora megasperma (Drechs)]. It was highly susceptible to foliar diseases, however.

Non-Dormant Alfalfas

Early non-dormant introductions were made from Peru and India. Two later important introductions were Sirsa No. 9 from India in 1956 and African from Egypt as "Hegazi" alfalfa in 1924. Several of these introductions, Hairy Peruvian, African, and Indian, were still in limited production in the US in 1969.

Development of Varieties for the Low Desert Areas of the US

Initially many of the above introductions were grown for forage without concerted breeding work. Adapted types to specific areas evolved by natural selection. Farmers also selected types that did well for them. Later these introductions, along with others such as Grimm, Ladak, and Cossack for Northern areas, served as the germplasm source for the breeding of varieties.

The first varieties were bred by plant breeders at public institutions. Of these, Caliverde and Caliverde 65 trace largely to the commons. The varieties Lahontan and Washoe were selected from Turkestan alfalfa. Moapa and Sonora were selected from African and Mesa Sirsa was selected from Sirsa No. 9.

Private breeding programs were initiated starting in the 1950's. In 1960 privately developed varieties accounted for 11.7% of the California production. In 1969 they accounted for 46.9%. The same trend has occurred in other states, but not of such a high magnitude. With a large number of varieties now available, it is probable that individual varieties will not command the percentage of the market that Lahontan and Moapa did when introduced.

New public and private varieties and brands used in the low desert areas trace mainly to the common, Turkestan and non-dormant sources or combinations of these sources.

Adaptation and Usage

Climate and Soil Considerations

Much of the low desert areas receive less than 10 inches of rainfall. Rainfall occurs mostly in the winter months in Central California and during the spring and summer months in the desert areas of Southern California and Arizona. The quantity and distribution of rainfall, as well as type, duration and frequency of irrigation, affect relative humidity and soil saturation, which, in turn, are related to root and leaf diseases.

Alfalfa is best suited to soils that are near neutral in pH and are well drained. Under favorable soil and moisture conditions, alfalfa roots can penetrate to a depth of more than 30 feet. In compacted or heavy soils, however, root penetration may be limited to one foot. Under conditions of poor water penetration, irrigation frequency must be increased. Also, water stands longer in the field. This often results in scald and/or the development of phytophthora root rot.

Temperatures may exceed 115°F in many of the low desert valleys. These high temperatures, combined with poor water penetration, contribute to scald. Thus, there may be a rapid decline of stand due to conditions that exist during summer months. As one goes up in elevation from the low desert valleys in the Southwest, winter conditions become more of a factor in stand decline.

Semi-dormant varieties show reduction of growth with decreasing day length and lower temperatures even though temperatures are favorable for growth. Non-dormant varieties show less response. Generally, forage yield will be maximized by using a non-dormant variety in the low desert areas, provided stand can be maintained.

Insect Considerations

The spotted alfalfa aphid was first reported in New Mexico in 1954. Lahontan was found to have resistance and Moapa was the first variety specifically bred for resistance. The original biotype was designated ENT-B. A more severe strain, ENT-A, was discovered near El Centro, California in 1958. Since then, four additional biotypes have been detected. The more virulent strain, ENT-F, can completely destroy seedling stands of Moapa. It is important that a variety have sufficient resistance to the biotype in the particular area of use.

The pea aphid can cause damage in the spring and fall and occasionally also in the summer. Biotypes of the aphid have been found. Heavy pea aphid infestations on susceptible varieties reduces yield during infestation, and stunts the plants to the extent that yields of succeeding harvests are also lowered. Heavy pea aphid damage also lowers protien and carotene content of the forage. Pea aphid tolerance in a variety is highly desirable in areas subject to high infestations.

The Egyptian alfalfa weevil [*Hypera brunneipennis* (Boh.)] was found in this country in Arizona's Yuma Valley in the 1930's. From there it spread to the Imperial and Coachella Valleys of California. It also spread to San Diego, San Bernardino and San Luis Obispo counties. Since then it has spread to several counties of the upper Sacramento Valley, Tulare County, and is now spreading in the San Joaquin Valley. New infestations are

reported each year. No adapted resistant varieties are available at present. An integrated program of good crop management, maintenance of predators and parasites, and judicious use of an insecticide when infestation is heavy, is needed for control where the weevil is a problem.

Disease Considerations

Phytophthora is a fungus disease that causes root rot. The great extent of damage caused by this organism in the low desert areas of Arizona and California was not realized until recently. The disease is now known to be a major factor contributing to stand decline. Roots of infected plants rot off below the soil surface. The disease is aggravated by frequent irrigations of excessive length. Although it is particularly severe in poorly drained soils, it has also been found in light well drained soils in Arizona. Semi-dormant alfalfas, with phytophthora resistance, have been used on many heavy soils in the past, where normally a higher yielding non-dormant variety would have been used. An extensive effort is now under way, in both public and private breeding programs, to incorporate phytophthora resistance into non-dormant varieties.

Bacterial wilt is known to be present in most alfalfa growing areas, but has not been shown to be an important factor in the low desert areas. It may cause damage in stands left down over a couple of years in some areas. Many semi-dormant varieties offer a good level of resistance. The first symptom is a stunting of the infected plants. This is accompanied by small leaves and stems and slow recovery after cuttings. As the disease progresses, leaves become yellow and wilting occurs under water stress. There is a yellow-brown discoloration in the woody cylinder of the tap root.

Many other diseases are present and affect plant growth. Publications are available through the Extension Services in each state.

Nematode Considerations

The alfalfa stem nematode, attacks buds and stems of alfalfa plants. Infected stems are greatly shortened and club-like. Crown buds are swollen, distorted and break off easily. The nematode contributes to loss of stand by weakening and eventually killing plants. It has been found in Graham, Pinal and Maricopa Counties of Arizona and Coastal Regions and the Antelope Valley in California. Some resistant varieties, mostly of the semi-dormant type, are available.

The Southern root-knot nematode (Meloidogyne incognita Chitwood) and the Javanese root-knot nematode [M. javanica (treub) Chitwood] are associated with alfalfa in the Southwest. Non-dormant sources, such as African and Indian, are highly resistant to both species. Most non-dormant alfalfas in use would carry a level of resistance. The Northern root-knot nematode (Meloidogyne hapla Chitwood) is found in Northern California and down into the San Joaquin Valley. Little resistance is available.

Variety to Use

California has been divided into major alfalfa zones based on climate (Figure 1.) and Arizona has been divided into major crop adaptation areas based on elevation (Figure 2.). General adaptation of varieties and brands to the different zones or areas is given in Table 1. The best alfalfa to use at a specific location will depend on the disease and insect problems there are and how the crop is to be managed and used. Commercial seedsmen and Extension personnel are sources of information pertaining to disease resistance, insect resistance, and other characteristics of alfalfas listed in Table 1. Specific information can be obtained from the originator of each alfalfa listed in Table 2. In the final analysis, each farmer will determine by personal experience which variety does best for him.

Information supplied in Table 1, on dormancy and adaptation of varieties and brands, was supplied by representatives of Companies and Universities as given in Table 2.

General Reference

Alfalfa Science and Technology, 1972. American Society of Agronomy, Madison, Wisconsin

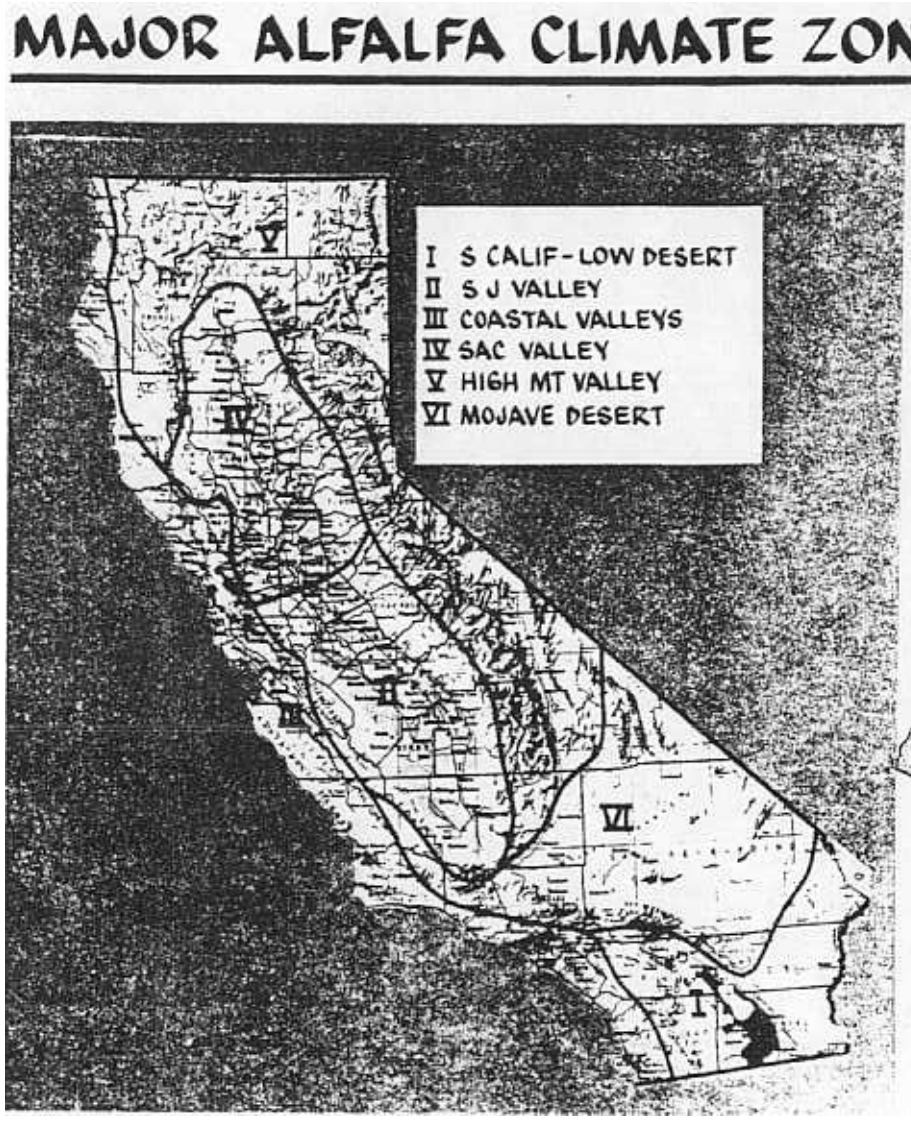

Figure 1.
From Agronomy Notes, University of California, Oct/Nov. 970

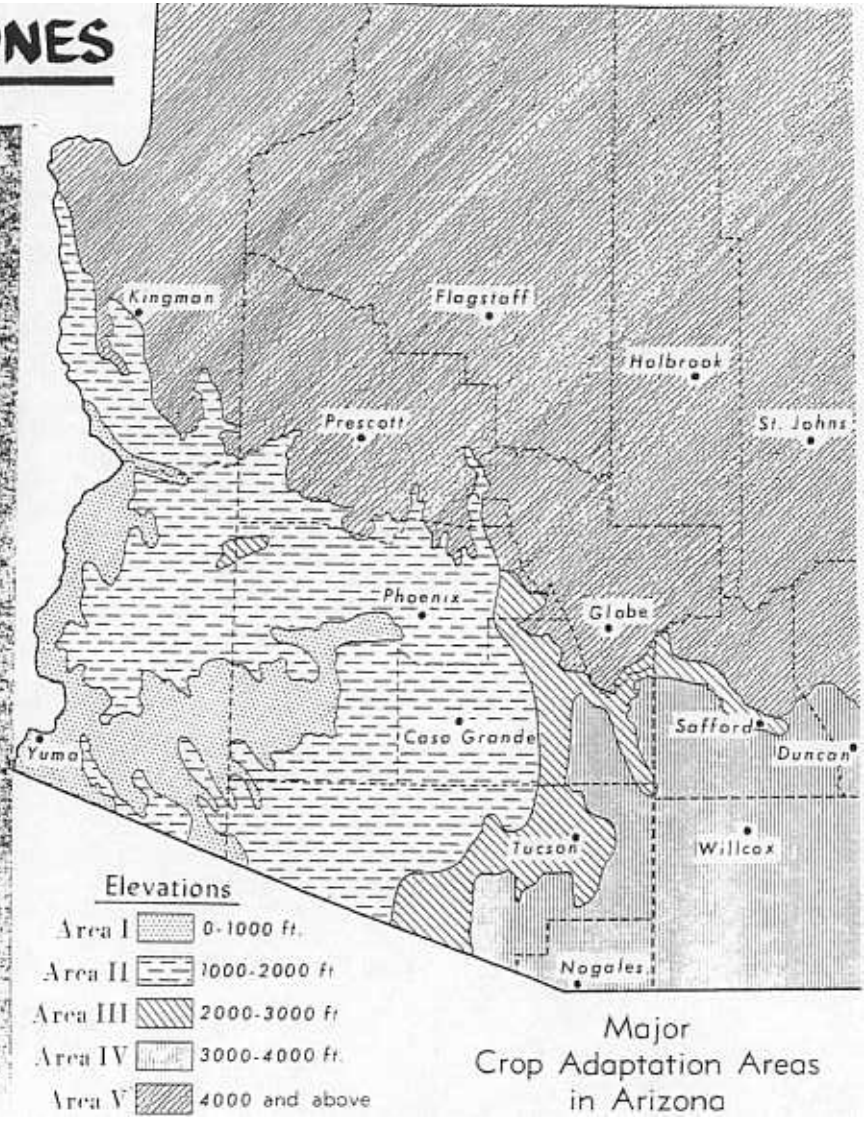

Figure 2.
From Alfalfa for Forage Production in Arizona, University of Arizona, Bull. A-16, 1961

TABLE 1. DORMANCY AND ADAPTATION OF VARIETIES AND BRANDS

VARIETY OR BRAND	DORMANCY 1]	ADAPTED AREAS	
		CALIFORNIA 2]	ARIZONA 3]
Abunda Verde Brand	HND	I, II	I, II, III
AS-13	MND	I, II, III, IV	I, II, III
AS-49	SD	II, III, IV, V, VI	III, IV, V
Caliente	HND	I, II, III, IV	I, II, III
Condura 72 Brand	SD	II, III, IV, V, VI	III, IV, V
Converde 95 Brand	HND	I, II, III, IV	I, II, III
DeKalb 167	SD	II, III, IV, V, VI	III, IV, V
DeKalb 183	ND	I, II, III, IV	I, II, III
DeKalb 185	ND	I, II, III, IV	I, II, III
El Unico	HND	I, II	I, II, III
Eureka	SD	II, IV, V, VI	III, IV, V
Hayden	HND	I, II	I, II, III
Imperial 70	HND	I, II	I, II, III
Joaquin 11	ND	I, II, III, IV, VI	I, II, III
Lahontan	SD	II, III, IV, V, VI	III, IV, V
Mesa Sirsa	HND	I, II	I, II, III
Moapa	ND	I, II, III, IV	I, II, III
Moapa 69	ND	I, II, III, IV	I, II, III
N 71 Brand	HND	I, II, III, IV	I, II, III
N 78 Brand	SD	II, III, IV, V, VI	III, IV, V
Resistador	SD	II, III, IV, V, VI	III, IV, V
Sonora	HND	I, II	I, II, III
Sonora 70	HND	I, II	I, II, III
UC Salton	HND	I, II	I, II, III
Valalfa Brand	HND	I, II, IV, VI	I, II, III
WL 306	SD	IV, V	IV, V
WL 309	SD	IV, V	IV, V
WL 311	SD	IV, V	IV, V
WL 450	MND	II, III, IV, VI	II, III
WL 451	MND	II, III, IV, VI	II, III
WL 501-R	ND	II, IV, VI	I, II, III
WL 504	ND	I, II, IV, VI	I, II, III
WL 508	ND	I, II, IV, VI	I, II, III
WL 600	ND	I, II, IV, VI	I, II, III
819 Brand	ND	I, II, III, IV	I, II, III
919 Brand	ND	I, II, III, IV	I, II, III
1019 Brand	SD	II, III, IV, V, VI	III, IV, V

1] Dormancy
HND = Highly non-dormant
ND = Non-dormant
MND = Moderately non-dormant
SD = Semi-dormant

2] See Figure 1.

3] See Figure 2.

TABLE 2. ORIGINATOR AND SOURCE OF INFORMATION ON VARIETIES AND BRANDS

VARIETY OR BRAND	ORIGINATOR	INFORMATION SUPPLIED BY:
Abunda Verde Brand	Northrup, King & Co.	Bill Knipe
AS-13	Ferry-Morse Seed Company	Ed Beyer
AS-49	Ferry-Morse Seed Company	Ed Beyer
Caliente	Ferry-Morse Seed Company	Ed Beyer
Condura 72 Brand	Continental Grain Company	Eldon Hoffman
Converde 95 Brand	Continental Grain Company	Eldon Hoffman
DeKalb 167	Cal/West Seeds	Iver J. Johnson
DeKalb 183	Cal/West Seeds	Iver J. Johnson
DeKalb 185	Cal/West Seeds	Iver J. Johnson
El Unico	University of Arizona - Tucson	Vern Marble
Eureka	Security Seed Company	Bill Rusconi
Hayden	University of Arizona - Tuscon	Vern Marble
Imperial 70	Security Seed Company	Bill Rusconi
Joaquin 11	Security Seed Company	Bill Rusconi
Lahontan	USDA - Reno, Nevada	Vern Marble
Mesa Sirsa	University of Arizona - Tuscon	Vern Marble
Moapa	USDA - Reno, Nevada	Vern Marble
Moapa 69	USDA - Reno, Nevada	Vern Marble
N 71 Brand	Arnold-Thomas Seed Service	Marvin K. Miller
N 78 Brand	Arnold-Thomas Seed Service	Marvin K. Miller
Resistador	Northrup, King & Co.	Bill Knipe
Sonora	Southwest Alfalfa Group	Vern Marble
Sonora 70	University of Arizona - Tucson	Vern Marble
UC Salton	University of California	Vern Marble
Valalfa Brand	Valley Seed Company	Royce Richardson
WL 306	Waterman-Loomis Co.	Ike I. Kawaguchi
WL 309	Waterman-Loomis Co.	Ike I. Kawaguchi
WL 311	Waterman-Loomis Co.	Ike I. Kawaguchi
WL 450	Waterman-Loomis Co.	Ike I. Kawaguchi
WL 451	Waterman-Loomis Co.	Ike I. Kawaguchi
WL 501-R	Waterman-Loomis Co.	Ike I. Kawaguchi
WL 504	Waterman-Loomis Co.	Ike I. Kawaguchi
WL 508	Waterman-Loomis Co.	Ike I. Kawaguchi
WL 600	Waterman-Loomis Co.	Ike I. Kawaguchi
819 Brand	Northrup, King & Co.	Bill Knipe
919 Brand	Northrup, King & Co.	Bill Knipe
1019 Brand	Northrup, King & Co.	Bill Knipe