ALFALFA PRODUCTION IN THE HIGH DESERT

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The high desert alfalfa production region of California is located from the Mojave Desert which includes portions of Los Angeles, San Bernardino, and Kern Counties, north to Inyo and Mono Counties. Alfalfa fields in the high desert are clustered in isolated valleys with long stretches of desert between them. These valleys are so isolated and dispersed that the climate, growing conditions, soil types, and even the production practices and problems can vary considerably between production areas. The main alfalfa production areas and their characteristics are presented in table 1.

Many people mistakenly believe that "desert" is "desert", and lump the high desert with the low desert. However, those that are familiar with both areas realize there are very distinct differences. The climate in the high desert is unique, but has similarities with both the low desert and the colder northern parts of the state. The high desert climate is characterized by large swings in temperature, both from day to night and from summer to winter. Winter low temperatures between zero to ten degrees (negative 10 to 20 in the northern mountain valleys) have been recorded (particularly this last year), while summer temperatures exceeding 110 degrees commonly occur. A drop in temperature of 40 to 50 degrees between day and night is not uncommon. Spring frosts as late as April (and even June in northern high-elevation areas) are routine, and slow alfalfa growth. Winds are a common denominator throughout all of the high-desert valleys. Most areas have a prevailing "breeze" of 10 to 20 miles per hour during the day. Winds can be especially fierce during the spring months. Rainfall is rare, and much of the high desert receives less than five inches annually. Isolated thunderstorms can occur in the summer, especially in the eastern portion of the Mojave desert. The thunderstorms are localized, but significant precipitation can occur. Growers comment on the astonishing ability of these storms to search out and rain on cut alfalfa fields. High temperatures, low precipitation, winds, and a high number of sunny days combine to create an extremely arid environment.

Soils in the high desert vary considerably depending on the valley, and the location within each valley. However, in general, coarse textured soils predominate (i.e. sandy loams and loamy sands). Loam or clay loam soils are rare, but do occur (such as the Lucerne Valley area). Most areas have alluvial soils giving rise to distinct layers which in some cases can cause infiltration and drainage problems and affect root development. Soils are basic, with pH's averaging between 7 and 8. Salinity problems can occur, but are manageable provided the water quality is good.

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There are a total of approximately 35,000 acres of alfalfa in the high desert. In contrast to many alfalfa production areas in the state, the average size farm in the high desert is relatively small, approximately 300 acres. Many of the farms are even less than 100 acres, and the grower usually has another source of income. Nearly all the farms are managed and farmed by the owner/operator.

One of the unique features of the high desert is the lack of rotational crops. Alfalfa is THE primary crop. A typical stand life is from six to nine years, and growers joke about the "good ole days" when alfalfa stands were "old enough to vote". Grains, usually oats or hooded barley, are grown for hay during the year (to a maximum of two years) between alfalfa crops. Occasionally, sudan grass is double-cropped with grain during the year between alfalfa crops. These rotational crops are not usually profitable, and therefore, in some instances, alfalfa will be planted "back to back" without switching to an alternative crop. However, this is not considered to be a wise agronomic practice, and therefore, is not usually done.

A range of dormancy groups are produced in the high desert. The dormancy group selected depends on the climate of the different high desert valleys and the number of cuttings usually obtained. Semidormant and moderately nondormant varieties predominate, with some nondormant varieties being grown in the Daggett/Newberry Springs area. Some very nondormant public varieties are occasionally selected by growers bent on purchasing inexpensive seed, but these varieties do not have the winter hardiness needed for the cold winters and stand persistence is reduced considerably. The number of cuttings and yield obviously varies with the production area and variety (table 1). Four cuttings are most common in the Bishop area, six to seven cuttings in the Daggett/Newberry Springs area, and five to occasionally six cuttings for the remaining areas which comprise the majority of the high desert. The first cutting is harvested in late-April to May, and the last cutting in late-October to mid-November. Late cuttings are possible because the arid environment still permits haymaking. Total annual production varies, with six to seven tons being common in the Bishop area, and eight to nine tons in the more southern areas of the high desert. Ten ton per acre yields are attained on fields with good soil and proper management.

Most fields are harvested by the owner/operator and his employees rather than by custom harvesters. Curing conditions in the high desert are usually exceptional due to the arid environment. During the summer months, hay is often baled three to four days after cutting, and this has been reduced to as short as two days by some growers in Newberry Springs. A distinctive aspect of harvesting in the high desert is that the hay is not raked in most areas (except for the Bishop area), and is baled directly out of the swath. Because of the exceptional curing conditions, raking is usually not needed. Also, the fluffy windrows that are formed after raking are especially vulnerable to wind. The wind can scatter windrows, and has even been observed to blow the hay completely out of the field.

Agricultural water is pumped from underground basins, with the exception of a few fields in the West Antelope Valley and some fields in the Owens Valley. The standing water level ranges from as shallow as 50 feet to depths of 300 feet or more. Hence, the cost of pumping water varies dramatically. Adding to the variability in water costs is the number of electric rate schedules now available. The cost per kilowatt hour depends on whether the grower is using one of the Time of Use (TOU) rates and/or an interruptable rate or a standard agricultural rate. Consequently, the pumping costs range from approximately $20 to over $70 per acre foot.

Water use in the high desert is higher than in other areas with comparable yields because of the arid environment. In the Owens Valley approximately five acre feet per season is sufficient. Six to six and a half acre feet is required in most of the high desert areas that obtain five cuttings. However, slightly over seven acre feet per year are needed for maximum yields in the lower elevation production areas of the high desert (i.e. Inyokern, Barstow, Daggett, and Newberry Springs).

Sprinkler irrigation is the primary irrigation system employed in the high desert. Wheel lines are probably the most common, with center pivot systems a close second. Center pivots require the least amount of labor and are very well suited to soils with high intake rates. They are widely used in the hottest areas of the high desert with gravelly soils (i.e. Inyokern, Daggett, Newberry Springs, and Sandy Valley). The introduction of center pivots has increased production tremendously in these areas because they make possible the frequent irrigations that are required on soils with a low water holding capacity. Border strip flood irrigation, the main irrigation system used on most alfalfa fields in the rest of the state, is used on few fields, primarily the finer textured fields in the Lucerne and Antelope Valleys.

Another unique aspect of alfalfa production in the high desert is the target market. In Inyo and Mono Counties, alfalfa is sold to the dairy, beef, and horse market. Owens Valley, Tri-Valleys, and Fish Lake Valley hay goes primarily to the Southern California dairy market, while most of the other areas sell or feed locally to beef and horses. However, in the remainder of the high desert, most of the alfalfa produced is sold to retail feed stores catering to the horse market. Some growers sell first, and sometimes last, cuttings to dairies (these cuttings have the highest TDN and protein and are hardest to cure), while other growers opt to sell all of their hay to the horse market. At any rate, the bulk of the hay produced in the high desert goes to the horse market.

The climatic conditions in the high desert lend themselves to producing top-quality horse hay. As previously mentioned, hay cures rapidly so problems with mold (horses are especially sensitive to mold) are practically nonexistent. Also, the low humidity and rapid curing conditions result in a remarkable bright green color that is unsurpassed in the state. Most growers have very effective weed control programs that leave their fields practically weed-free. Growers allow the hay to become more mature before cutting, approximately 25 to 50% bloom. A 35 to 45 day cutting schedule is typical. Horses do not need the premium quality hay needed by dairy cows and the grower benefits with increased tonnage and greater stand persistence.

The combination of well cured, mature, bright green, weed-free hay make for a product ideal for the horse market. Growers generally receive a premium price for this hay, usually five to 25 dollars higher per ton than other production areas.

The environmental conditions mentioned above present high-desert alfalfa growers with some difficult and challenging problems. Water is unquestionably the most serious problem in the high desert. Alfalfa acreage in the Antelope Valley has declined 75 percent in the past 20 years. This decline is almost entirely due to the cost of water. A decline in acreage of this magnitude has not occurred in other areas of the high desert, but the same trend exists. Irrigation costs comprise up to 40 percent of the cash costs to produce alfalfa in the more affected areas. This makes it nearly impossible to compete with other production regions blessed with inexpensive water.

Several factors make water the most critical problem in the high desert. These are 1) the pumping level, 2) electrical power rates, 3) the evapotranspiration of alfalfa in the high desert, and 4) water availability. The relative importance of each issue varies with the production area. The standing water level in some areas is near 300 feet. It is difficult to lift water from that depth and pay the power bill with alfalfa profits. Secondly, the electric rate pricing structure has changed in the past two decades. In the past, a declining block system was used (i.e. the more kilowatt hours one used the cheaper the unit price became). However, electric rates have risen dramatically in the past decade and a comparable declining block rate no longer exists. As noted above, the high desert is arid and summer temperatures are high. Therefore, the water needs of alfalfa are higher (approximately 20% higher) than in other areas that have similar seasonal yields. Lastly, water availability has become an issue. In some areas such as Barstow, current water use exceeds annual recharge of the underground basins and is causing pumping levels to drop. This overdraft, coupled with population increases, presents a serious problem and has resulted in competition between agriculture and domestic users for water.

A common thread which weaves throughout this paper is the arid conditions in the high desert and how they impact alfalfa production. While the arid conditions accelerate curing and give rise to exceptional color, they can also cause poor baling conditions. Most of the state benefits from consistent morning dews that moisten alfalfa leaves and prevent excessive leaf loss during baling. However, having adequate moisture for baling can be a problem in some areas of the high desert. This is particularly true for the Daggettt/Newberry Springs area, where dry conditions are routine for most of the summer, and can result in a reduced time period for baling, excessive leaf shatter and loss, and dry "stemmy" bales.

Another unique production problem in the southern portion of the high desert relates to the Egyptian alfalfa weevil. This weevil is a serious problem in most of California, but it presents a rather distinctive problem in the high desert. As mentioned above, semidormant varieties are most prevalent in the high desert, and therefore, there is minimal alfalfa growth during the winter months. Egyptian alfalfa weevil larvae can be found as early as late January. Daytime temperatures climb above the developmental threshold of the weevil, but below freezing

nighttime temperatures suppress alfalfa growth. Pest management guidelines based on the number of weevils caught in a sweep net, while useful in other areas, are usually worthless in the high desert, since the Egyptian alfalfa weevil can cause significant injury before the alfalfa attains a height sufficient to sweep with a sweep net. Because of weather variations, periods of cool weather alternating with warm spells, weevil development is prolonged and damaging larval populations are present from February well into April. Hence, weevils are especially damaging in the high desert because high population levels are present just as the alfalfa is breaking dormancy, and thus can prevent it from growing. Not only is effective control needed early to allow the alfalfa to grow, but weevil populations must be kept low for a long period because of the prolonged weevil presence.

Grophers are an increasingly annoying problem. While gophers are a nuisance in most alfalfa production areas, they can be especially troublesome in the high desert. Growing conditions (sprinkler irrigation, coarse-textured soils, and extended alfalfa stand life) seem to exacerbate the gopher problem. Unsatisfactory results are being observed with the use of strychnine baits with a mechanical burrow builder (gopher machine), particularly on ranches with a history of strychnine use. Many growers are resorting to trapping. While effective, this method is slow and costly. Employees are paid as much as a dollar per gopher trapped, and in some cases over 100 gophers are caught per day. Improved gopher control strategies need to be developed.

Another issue is the distance to markets. The high desert is so expansive that while the distance to the market is not far in some areas, it is a problem or disadvantage in other areas such as Northern Inyo County and San Bernardino County. Some areas are in excess of two to three hundred miles from potential markets.

Urbanization is now encroaching on agricultural land (primarily in the Antelope Valley, Apple Valley, and Hesperia). This has caused a decline in alfalfa acreage in these areas. Surprisingly, urbanization is also a threat in Inyo and Mono Counties, since an average of 90 percent of the land is held as public lands. The only major land areas presently left for development are the alfalfa ranches in the Tri-Valleys, unless government agencies (Bureau of Land Management, L.A. Dept. of Water and Power) start releasing land for development around towns. Urban development, while a serious threat to alfalfa acreage, is not viewed as a problem by most alfalfa growers in the area. It presents them with a potentially lucrative means of retiring.

In conclusion, the high desert is a novel environment. The climatic conditions dictate production practices and give rise to some unique advantages and disadvantages. The high desert is well suited for producing high quality horse hay for which growers receive a price premium, somewhat offsetting higher production costs. However, alfalfa production in the high desert is likely to continue declining due to urbanization and higher production costs. This is regrettable, as agriculture was once the number one industry in the high desert and the area has built a reputation for excellent alfalfa hay.

Table 1. High desert alfalfa production areas and their characteristics.

Production Area	Towns	Elev.	Growing Season	No. of Cuttings
Silver Valley	Daggett Newberry Springs	1922	255	6-7
Cantil	Cantil	2010	230	6
Barstow	Barstow Lenwood	2142	235	6
Antelope Valley	Lancaster Willow Springs Rosamond	2350	213	5-6
Inyokern	Inyokern	2440	218	6
Mojave River Basin	Apple Valley Victorville Hesperia Helendale Oro Grande	2859	193	5
Lucerne Valley	Lucerne Valley	3015	192	5
Owens Valley	Independence Bishop	3926 4121	200 158	4-5 4
Tri-Valleys	Chalfant Hammil Benton	4200 4679 5473	158 158 150	4 4 4
Fish Lake Valley	Dyer (NV) Oasis (CA)	4835 5100	120 120	4 4
Antelope Valley (N. Mono Co.)	Walker Coleville Topaz	5033	120	3