

# Irrigated Alfalfa Management

for Mediterranean and Desert Zones

 **Buy Manual**

## Alfalfa Marketing and Economics

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**H**istorically, and in some regions, alfalfa has been viewed as a “low value” rotation or pasture crop, of economic importance primarily as a supplement to other higher value row and specialty crops. However, in recent decades, alfalfa has become a valuable and profitable crop in its own right, competing successfully with many higher-value specialty crops, especially in California. Many growers approach this crop as a serious business enterprise, with careful consideration of costs, value, and markets. The value of alfalfa in California has approached \$1 billion in recent years, and it has competed economically with many other specialty and row crop options in the state.

Alfalfa is an extremely versatile crop. It is widely grown in many environments and in many types of farming systems. It can be harvested and packaged into several sizes and shapes of bales and cubes, or cut for silage, grown for seed, or used for pasture. It can be fed to a wide variety of livestock. Income from alfalfa will vary by the forms marketed, forage quality, market outlets, yield, and the supply and demand situation for each market category. Since there is a tradeoff between quality and yield, growers must consider optimizing the crop quality (and therefore price), as



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### Chapter 23

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well as tonnage per unit area (see Chapter 13, “Harvest Strategies for Alfalfa,” for a detailed discussion of the yield–quality tradeoff).

Alfalfa is a crop that can be used on-farm, with milk or meat as the primary economic return, or sold to other livestock producers. Although nationwide most alfalfa is consumed on-farm, in California and other western areas, the vast majority of hay is sold on the open market as a cash crop. The primary markets are dairy, horse, and beef, with minor markets for sheep, goats, zoo animals, export, and other uses (e.g., pellets for pets, alfalfa tablets).

## Alfalfa Markets in California

An estimation of alfalfa sales to different market segments in California is provided in Table 23.1. It is clear that dairy production markets dominate, with horses an increasingly important component of the market. Secondary markets are domestic beef, small ruminants, and export. Specialty markets, such as certified organic hay or certified weed-free hay, are a small but increasing component of the alfalfa market (current estimates rank organic hay at less than 0.5 percent of the California alfalfa market). There is no systematic data collected that would provide accurate information regarding use by various alfalfa consumers, so keep in mind that the data herein, although

based on the best available sources, are estimates.

## Dairy Markets

Dairy producers are unquestionably the most important purchasers of alfalfa hay in California, and indeed the nation. California has 1.8 million dairy cows and is home to some of the most intensive dairy operations in the world, particularly in the southern San Joaquin Valley. The dairy market is characterized by emphasis on quality, as defined by low-fiber, weed free, leafy, high-protein hay products. It is driven primarily by the needs of high-producing dairy cows, since milk production is enhanced with high-quality hay.

The dairy market is segmented into several quality categories: Supreme, Premium, Good, Fair, and Utility grades (see Chapter 16, “Forage Quality and Testing,” for a complete discussion and definition of hay quality categories). Dairy markets favor what is termed “dairy-quality” (Supreme and Premium) hay; the cutoff for high-producing dairy cows is typically between 25 and 29 percent acid detergent fiber (ADF, equivalent to 54.5–58 percent total digestible nutrients or TDN on a 90 percent dry matter basis). Dairies also utilize considerable quantities of medium (Good and Fair) and even low (Fair and Utility) quality hay for lower-producing animals and “dry” (nonlactating)

cows, calves, and heifers. The dairy markets largely function with “supply and demand” curves for each of these hay quality categories, affecting price.

Hay for high-producing dairy cows is frequently analyzed by laboratories, sometimes even two or three times, by sellers, brokers, buyers, and nutritionists. Domestic dairy markets, particularly the “dairy-quality” categories,

**TABLE 23.1**

Estimation of alfalfa hay consumption in California and alfalfa hay entering and leaving California, expressed as a percentage of production

Category	Estimated Percentage Utilization*
Dairy (including milk cows, heifers, dry cows)	75–85%
Horse	10–15%
Beef	5–10%
Small Ruminant	1%
Export from State*	1–2%
Imported into State	8–12%

\* Total utilization in state may exceed 100 percent, since imports into California from neighboring states often exceed exports to foreign countries. Estimates by authors.

have the dominant effect on demand, price, and quality definition. These quality categories have changed to some degree over the years (see Chapter 16, “Forage Quality and Testing”), and no single regulatory body determines dairy quality definitions. Hay quality guidelines are published by USDA Hay Market News, but quality factors are generally loosely decided by industry habit and practice, and can be freely modified by individual buyers and sellers, depending on their needs and the realities of the market.

### Horse Markets

Alfalfa and alfalfa–grass mixtures are the most important hay crops for the California and U.S. horse industry, and weed-free, bright green alfalfa or grass–alfalfa mixes are in high demand by horse owners. There are probably 6–7 million horses in the United States, and some authors have estimated that there are over 650,000 horses in California. Collectively, horses make up a large and expanding sector. The horse hay market is characterized by a large number of small buyers, each with their own views on quality and value. Feed stores often play a significant role in determining price and quality. This market is much more subjective than dairy markets. Buyers do not value lab tests to the same degree, and weed-free (especially free of poisonous or noxious weeds), non-moldy, dust-free hay is especially valued. Alfalfa competes to some degree with perennial grasses and oat hay for the horse dollar. Demand for bright green, weed-free alfalfa that is mold-free and well-conditioned, or alfalfa–grass mixtures of medium or even high fiber content has been strong, and prices have often exceeded dairy prices.

### Beef, Sheep, Goats

Beef, sheep, and goat markets are similar in some respects to dairy markets, because all of these classes of animals are ruminants, and similar quality considerations are in force. However, beef, sheep, and goat markets typically put less emphasis on high-quality alfalfa

than is the case for high-producing dairy cows, with the exception of dairy goats. Medium- and lower-quality hay is frequently acceptable for nonlactating and meat-producing animals in these classes. Beef producers tend to be highly sensitive to price because of the low margins of that industry and will often accept lower-quality hay or compare alfalfa with other types of hay that are adequate for maintenance or weight gain. Grazing of winter alfalfa growth by sheep through a cash transaction is a significant component of the alfalfa system in the southern areas of California. This provides a benefit for herdsmen and growers alike, since haying is difficult during winter months. Dairy goats are a small but increasing component of the miscellaneous markets for high-quality alfalfa hay.

### Exports

Pacific Rim nations, including Japan, Korea, and Taiwan, are major importers of California alfalfa hay and cubes. Although cubing has historically been important, double-compressed hay has dominated exports in recent years. Hay is hydraulically compressed to about 25 pounds per cubic foot by specialty equipment—this provides superior packing geometry and ease of handling compared with cubes. About 80 percent of California’s exports are compressed bales (excluding nonalfalfa hays) and 20 percent cubes—similar to exports from the Pacific Northwest. California exports include hays produced in neighboring states, particularly Utah and Nevada.

The vast majority of both baled and cubed alfalfa goes to dairies in Japan. The Korean market averages about one-quarter to one-third of the Japanese market. Products are shipped overseas in 40-foot cargo containers.

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Double-compressed hay is typically cut from larger bales and packaged in compressed small bales (e.g., 30–50 lb or 14–23 kg) for delivery to Japanese dairy farmers for direct hand-feeding.

Many countries have stringent import regulations. Containers are fumigated before shipment to their destination. Agricultural inspectors in the destination country may reject loads with pests or foreign contamination (noxious weeds). If the shipment is rejected it may be destroyed or returned to the United States, and the buyer can seek price relief from the seller based on issues with quality, foreign matter, damage, or changes in market conditions (price). Export figures from California include some hay and a large volume of cubes from Nevada and Utah entering California but destined for export (see California Department of Food and Agriculture [CDFA] for information on exports, [www.calagexports.com](http://www.calagexports.com)).

**TABLE 23.2**

Imports of hay bales and cubes from neighboring states 2004–2006 (short tons)

State	Package	2004	2005	2006
Arizona	Bales	208,651	186,000	112,198
	Cubes	264	176	65
Nevada	Bales	290,089	283,323	291,040
	Cubes	16,103	8,047	6,449
Utah	Bales	197,748	325,769	279,912
	Cubes	85,741	83,877	90,994
Oregon	Bales	56,353	80,073	67,429
	Cubes	*	*	*
Idaho	Bales	10,295	18,155	15,661
	Cubes	4,692	*	*

\*None reported

Source: USDA, AMS, Livestock and Grain Market News, Moses Lake, WA.

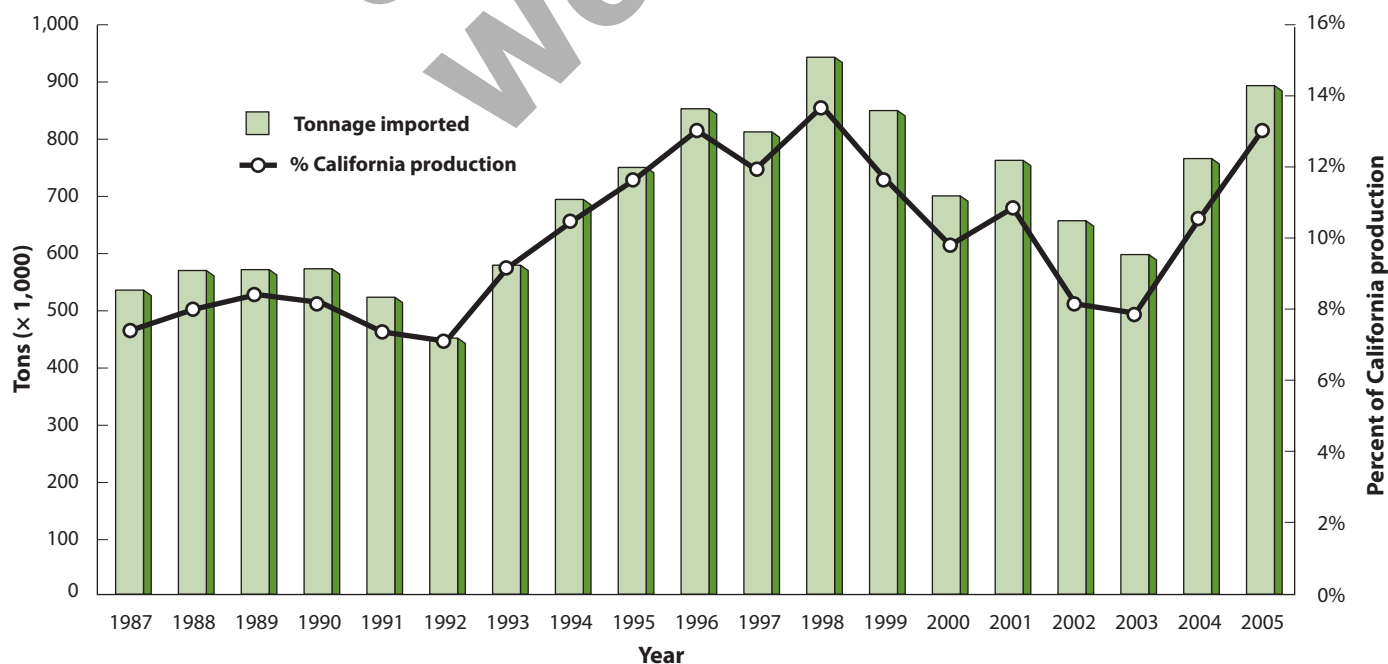
Alfalfa Hay: California Market Summary, 2004, 2005, 2006

### Hay Moving In and Out of California

Alfalfa hay and cubes are shipped into California for the dairy, horse, and export markets (Table 23.2, Fig. 23.1). Due to the presence of millions of dairy and beef cows, horses, sheep, and goats, California is a “sink”

**FIGURE 23.1**

Tonnage of alfalfa hay imported from neighboring states into California, 1987–2005, also expressed as percentage of CA production. Data adapted from Hoyt (2006 Western Alfalfa & Forage Conference Proceedings, see <http://alfalfa.ucdavis.edu>), based on CDFa border stations, USDA–Hay Market News Service, and USDA–NASS production data.



for much of the hay produced in neighboring states, particularly Nevada and Utah, but also Oregon, Arizona, and sometimes Idaho. This imported hay increases supply by an average of nearly 10 percent over the state's production (Fig. 23.1), significantly impacting market price. Alfalfa hay imported from other countries is not significant, although a small quantity may enter occasionally from Mexico. The highest-quantity alfalfa enters from Nevada, followed by Arizona (Table 23.2). Utah is the largest supplier of cubes. Some of this "imported" hay, especially the cubes, is trans-shipped from California ports to overseas ports.

## Packaging Methods for Different Markets

Alfalfa is marketed in California in several forms. The predominant method of harvest is baled hay production, with a small minority of production in greenchop, silage, cubes, or grazing (see Chapter 14, "Harvesting, Curing, and Preservation of Alfalfa," and Chapter 18, "Alfalfa Grazing Management"). The yield advantages and costs of production for harvest operations for bales, cubes, and silage differ significantly.

### Bales

Baled alfalfa packages are produced in a range of forms, but the predominant form is rectangular bales of various sizes (see Chapter 13, "Harvest Strategies for Alfalfa," and Chapter 14, "Harvesting, Curing, and Preservation of Alfalfa"). Growers in California and other western states very rarely use round bales, due to the stacking and shipping disadvantages of these packages. The traditional "small" square bale with three ties weighs about 125 pounds (57 kg), in contrast to the eastern United States, where "small" rectangular bales are largely 40–60 pound (18–27 kg) two-tie bales (although some of the latter is used for the horse market in the West as well). Large, rectangular bales have become very important in the past two decades. These rectangular bales

range from 750 to 2,000 pounds (340–907 kg). The dairy industry is the primary user of large, baled alfalfa, but the smaller 125-pound (57-kg) bales have greater flexibility for market purposes. Large bales have superior trucking and handling characteristics but are at greater risk of hay fires or mold because of the low surface area for escape of moisture. Their primary application is for larger feedlot operations.

### Cubes and Pellets

Alfalfa cubes are a minor-use package used in California for horses, dairy, or export. Both mobile and stationary cubers are used, but stationary cubing units are more important. Cubes or pellets are popular with the horse industry because of convenience, reduced feed waste, ease of handling, and reduced respiratory problems. Alfalfa cubes for horses are mechanically compressed into 1.25 × 2-inch (3 × 5-cm) cubes that are not as dense as those produced for cattle.

Manufacturers of cubes must provide guaranteed levels of protein, fat, and fiber. Cubing facilities can accept hay at a higher moisture content compared to moisture levels when hay is baled, shortening field drying time. The drying and cubing process dramatically decreases the moisture level and the opportunity for mold to develop. Some companies may offer cubes that provide a combination of Timothy or other cool-season grasses and alfalfa, targeting the horse market.

### Silage and Greenchop

Most alfalfa silage and greenchop is grown within a few miles of its use, with the dairy producer as the predominant grower as well as end user. However, there is some marketing of alfalfa as silage or greenchop through

*The predominant package for California alfalfa is baled hay production, with a small minority of greenchop, silage, cubes, or grazing.*

contracts or other agreements. The added cost of hauling moisture limits the distance that alfalfa silage will be transported from point of harvest for market purposes. The advantages and disadvantages of silage and greenchop are discussed in Chapter 14, “Harvesting, Curing, and Preservation of Alfalfa.”

## Relationship of Markets to Forage Quality

The USDA Agricultural Marketing Service tracks the prices paid for different quality grades of alfalfa in California. The categories of Supreme, Premium, Good, Fair, and Utility are described in Table 23.3 and are tracked by market subregion within California in Table 23.4. Differences in prices between regions are primarily a function of distance from dairy markets—production in the Imperial Valley and other Low Desert areas takes place 100–200 miles (160–320 km) from the Chino milk shed and a greater distance from the dairy concentrations in the lower San Joaquin Valley. Intermountain production in California and Nevada is mostly shipped south to the mar-

kets in the Central Valley. The highest prices and greatest premiums based on quality are realized in the San Joaquin and Sacramento Valleys; farm hay prices are lower in the Intermountain and Southern Desert regions. Year-to-year variation in price is affected by supply and demand factors, including milk price, alfalfa acreage, weather, and exports. However, alfalfa price is strongly influenced by forage quality in all years (Fig. 23.2). For a more in-depth discussion of alfalfa quality, refer to Chapter 16, “Forage Quality and Testing.”

## Market Behavior

Alfalfa hay is one of the most freely traded agricultural commodities in the United States, and more hay is commercially traded in California than in any other state. Alfalfa does not have government price support, nor even formal market-quality standards or market regulation. The market-quality factors described here are guidelines, and buyers and sellers are free to adhere to or ignore those guidelines, or develop additional criteria. Thousands of buyers and sellers determine price and service (e.g., storage, financing, and delivery) based on mutual agreement. Buyers differ in their requirements. Therefore, each alfalfa producer must develop a business strategy for alfalfa production to make production and marketing decisions that best fit their overall farm business plan.

**TABLE 23.3**

USDA hay quality guidelines for nationwide market news reporting adopted in 2002 for domestic livestock use and not more than 10 percent grass<sup>1</sup>

Category	ADF	NDF	RFV <sup>2</sup>	TDN <sup>3</sup>	TDN (90% DM) <sup>4</sup>	CP
Supreme	<27	<34	>185	>62	>55.9	>22
Premium	27–29	34–36	170–185	60.5–62	54.5–55.9	20–22
Good	29–32	36–40	150–170	58–60.5	52.5–54.5	18–20
Fair	32–35	40–44	130–150	56–58	50.5–52.5	16–18
Utility	>35	>44	<100	<56	<50.5	<16

Source: 2006 USDA, AMS, Livestock, Hay and Grain Market News, Moses Lake, WA. Alfalfa Hay: 2006 California Market Summary

<sup>1</sup> Guidelines are used along with visual appearance to determine quality. All figures are expressed on 100% DM, except as noted.

<sup>2</sup> RFV is calculated from ADF and NDF:  $RFV = [88.9 - (.779 \times \%ADF)] \times [(120 \div \%NDF) \div 1.29]$

<sup>3</sup>  $TDN = [82.38 - (0.7515 \times ADF)]$  according to Bath and Marble, 1989.

<sup>4</sup>  $TDN (90\% DM) = TDN \times 0.9$ .

Abbreviations: ADF = Acid Detergent Fiber. NDF = Neutral Detergent Fiber. RFV = Relative Feeding Value. TDN = Total Digestible Nutrients. DM = Dry Matter. CP = Crude Protein.

## Business Strategies

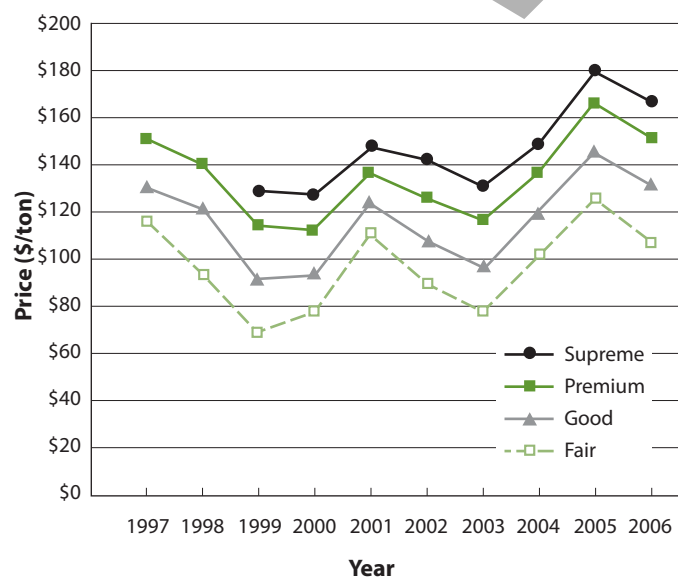
There are several potential business strategies for alfalfa hay production that growers might employ to meet market expectations. They include the low-cost production strategy, product-quality differentiation or niche-marketing strategy, and provision of additional service strategy. Most growers will predominantly follow one of these strategies, with consideration of one or both of the others.

### Low-cost, High-yield Production Strategy

A grower can choose to simply produce maximum yields and compete with other growers primarily on price. This strategy is the least complex and historically the primary strategy employed by growers. There is little question that controlling costs and maximizing yields are the fundamentals of alfalfa economics. However, over time, most growers have had to pay much more attention to quality or other factors to differentiate their hay in the market to maximize ranch profits, even when high crop yield remains the primary goal.

**FIGURE 23.2**

Average prices due to differences in forage quality, 10-year period, all California markets. *Source:* USDA, AMS, Livestock, Hay and Grain Market News, Moses Lake, WA. Alfalfa Hay: California Market Summary.



## Quality Differentiation Strategy

Another marketing strategy is to differentiate the alfalfa products by quality or targeted market use, thereby creating a unique perception about the products for buyers. Although “quality” is most often associated with the dairy

**TABLE 23.4**

Differences between regions in price structure due to hay quality category (10-year average, 1997–2006)

Region	Hay Quality Category			
	Supreme	Premium	Good	Fair
	(\$/ton)			
<b>Southern California</b>				
Imperial Valley	121.00	115.24	100.29	86.35
Blythe/Parker	120.14	114.52	99.38	82.56
Chino/LA	148.37	140.34	125.65	110.74
Mojave Desert	129.11	123.01	111.86	93.52
<b>San Joaquin Valley</b>				
Kern County	139.45	128.07	110.01	92.57
Tulare/Visalia/Hanford	163.54	149.42	129.83	109.13
Hanford/Corcoran/Tulare	146.25	132.62	113.75	94.08
Fresno/Madera Counties	145.24	129.77	108.48	92.27
Los Banos/Dos Palos	147.21	136.66	116.92	96.98
Escalon/Modesto/Turlock	161.69	148.94	130.23	109.20
<b>Delta/Sacramento Valley/North Coast</b>				
Tracy/Patterson/Stockton	145.99	134.13	113.05	94.25
Sacramento Valley	135.74	125.97	106.04	83.81
Petaluma	163.57	151.49	129.29	109.81
<b>Intermountain</b>				
Northern Mountain	124.42	116.24	103.56	85.79

*Source:* USDA, AMS, Livestock, Hay and Grain Market News, Moses Lake, WA. Alfalfa Hay: California Market Summary, various issues.

industry, with its demand for low-fiber, high-protein hay (as judged by laboratory tests), quality can also be more broadly interpreted for different markets. Consistent with this strategy is the development of a small but well-defined market niche to get top dollar for a consistently high-quality product. This might mean developing a reputation for green, weed-free alfalfa (or alfalfa–grass mixtures) grown for horses, or a specific grind or package designed for the export market. Specialty differentiation may include designation such as “certified weed-free” hay (available in some areas), certified organic hay (a rapidly growing market), hay grown in a region with a reputation for quality, marketing a specific cube product that includes grasses for horses, or “low-potassium” hay that is suited for close-up dairy cows (milk-producing cows just before and just after giving birth). Growers frequently market first cutting (sometimes second cutting) and fall clippings separately from lower-quality summer harvests as a method to differentiate quality. It should be noted that these growers who focus on quality also pay close attention to yields.

### Additional Services Strategy

A third strategy is to discover methods to provide a service to the customer along with the forage product. This might entail investing in storage facilities so that hay is available to customers on demand (lessening weather risk to the buyer), meeting specific baling requirements (e.g., precise weight or bale dimensions), developing favorable payment or delivery contracts, offering quality warranties, or allowing the customer to harvest the alfalfa themselves for silage. Some growers have offered silage-making services, including storage and daily delivery, or greenchop delivery marketing services as part of their overall marketing strategy.

Many farmers use a combination of these strategies. These marketing strategies for the alfalfa enterprise must be integrated with the rest of the farm business with respect to resource use, business growth, risk management, cash flow, capital investment, and the personal vision of the farmer.

### Cash Flow Characteristics of Alfalfa

Many farmers value the favorable cash-flow characteristics of alfalfa in their crop mix, which provides steady, season-long income, while waiting for the cash returns from other crops that are harvested only once per year. This is a key economic attribute of alfalfa grown in rotation with specialty crops, row or grain crops, or integrated with cow–calf operations. The stability of the alfalfa production systems, with their relatively low risk and predictable cash flow, is quite attractive to many farmers. Some grow higher-risk crops, such as tomatoes or lettuce, that generally have more volatile prices than alfalfa. All of these annual crops are harvested only once compared to alfalfa, which is harvested 4–10 times per year, generating cash flow over several months or throughout the year if hay products are stored.

Additionally, alfalfa may provide economic benefits through crop rotation, which benefits a following crop, lowers the nitrogen requirement, improves water infiltration, and provides excellent soil tilth and weed management for rotation crops (See Chapter 1, “Alfalfa Production Systems in California”). The bottom-line profitability of the alfalfa operation, by definition, depends on the income generated and the costs of production for the crop itself. The economic performance of the alfalfa enterprise is then integrated into the whole farm business performance.

*Many farmers value the favorable cash-flow characteristics of alfalfa in their crop mix, which provides steady, season-long income while other crops are harvested only once per year.*



## Marketing Through Contracts, Associations, or Brokers

There are a range of advantages and disadvantages to marketing through intermediaries such as individual brokers or hay grower associations. There are thousands of registered individual hay brokers licensed in California who have a widely varying range of reputations for performance and honesty. Hay brokering is often performed by the hay growers or dairy operators themselves, or by third-party brokers.

The San Joaquin Valley Hay Growers Association (in business for over 60 years) and High Mountain Hay Growers are examples of associations that market hay for grower owner-members; these associations represent the growers and fulfill the role of intermediary. Associations may provide services in addition to brokering hay, such as insurance benefits, testing of hay, better prices on seed or fertilizer supplies, guarantees that all hay will be sold, and guarantees that a seller will be paid. Because development of a market requires considerable time and knowledge of issues like forage quality and market preference, in many cases growers may prefer to work through brokers or join associations that have invested time in developing this expertise. On the other hand, growers must give up a portion of the value of their crop for this expertise and run the risk that brokers may seek market advantages that do not necessarily accrue to the producer.

Other marketing arrangements, such as forward contracting with buyers for a given price or pre-payments, have been tried. These arrangements have the advantages of making supply and price more predictable, and thus may be advantageous to both buyer and seller. Various types of contracts have been tried, for example, delivery of a certain quantity of alfalfa hay of a specific quality on a regular schedule. A key stumbling block is often the unpredictable influence of season or weather on forage quality (or yield), which must be addressed in the contracting arrangements.

## Production Costs and Budgets

Alfalfa is unique among field crops. Once established, it is harvested for several years and several times throughout each of those years. Thus, there are two parts to any cost analysis for alfalfa production. The first part is the costs associated with stand establishment before any harvest takes place. Second, the annual cost of production includes annual cultural costs, harvest costs, business overhead costs, and capital recovery for equipment, land, and stand establishment amortized over the life of the stand.

*Alfalfa is unique among field crops. Once established, it is harvested for several years and several times throughout each of those years.*

## Cost Studies

Cost studies are useful as a first approximation of the relative costs of producing a crop. From these data, growers can adjust estimated costs of their own operation. The Department of Agricultural and Resource Economics at UC Davis, in cooperation with UC Cooperative Extension Farm Advisors, has produced several cost and return studies for alfalfa production under a variety of conditions throughout the state (Table 23.5). Each study includes detailed information about typical production practices, input costs, expected yields and prices, and a list of equipment and costs, as well as a monthly calendar of operations and cash flow. Because costs and returns vary so much from farm to farm and year to year, these should be viewed as examples of what one would expect, not absolute values. Tables 23.6 and 23.7 provide an example of a cost study for alfalfa from the study "Costs to Establish and Produce Alfalfa—Sacramento 2003." All studies, including updates, are available at <http://coststudies.ucdavis.edu>.

**TABLE 23.5**

Alfalfa cost and return studies available for California production. New and updated costs studies can be found at <http://coststudies.ucdavis.edu/>

County/Region	Year	Production Conditions
Intermountain (North)	2007	Wheel line and center pivot irrigation
Intermountain (North)	2007	Center pivot irrigation
Sacramento Valley (N. Central)	2003	400 acres, flood irrigation
Sacramento Valley (N. Central)	2007	Organic production practices
San Joaquin Valley (S. Central)	2003	50-acre unit, flood irrigation
San Joaquin Valley (S. Central)	2003	300-acre unit, hay and haylage, flood irrigation
Imperial County (South)	2004	Bed planted irrigation method
Imperial County (South)	2004	Flat field (check flood irrigation)

Source: Department of Agricultural and Resource Economics, University of California, Davis (<http://coststudies.ucdavis.edu/>)

### Stand Establishment Costs

University of California cost and return studies estimate that costs to establish a stand of alfalfa can vary from \$300 to \$750 per acre (\$741 to \$1,853/ha), including the cultural costs, taxes and insurance, and ownership costs of equipment and land. The costs vary substantially due to the specifics of the extent of land preparation before planting and how much of the land preparation is done by the owner/operator vs. custom operators. The land preparation will vary depending on soil conditions, the irrigation system, and the previous crop. For example, flood irrigation using checks will require more land preparation than sprinkler irrigation, but labor or pumping costs might be greater for sprinklers, depending on type of sprinkler.

The cost of stand establishment must be amortized over the life of the stand when calculating annual costs of production. Stand life tends to decrease from north to south in California, starting at a high of 5 to 8 years in the northern mountain areas and decreasing to an expected 3 years in Imperial County. The majority of California alfalfa fields in Mediterranean and desert zones last from 3 to 5 years.

### Annual Cultural Costs

Once established, annual cultural costs, including irrigation, pest control, and fertilization, will range from about \$150 per acre to \$300 per acre (\$370 to \$740/ha).

The largest source of variation is the cost of water. Water cost per acre foot (ha/m) varies, depending on the source of water and the irrigation district and degree of pumping required. Also, the amount of water used varies, depending on the climate, with

approximately 2.5 acre feet per acre (760 mm) applied in the Intermountain North, 4.5 acre feet per acre (1,370 mm) in the San Joaquin Valley, and 7 acre feet per acre (2,130 mm) in the Imperial Valley.

Land costs vary significantly across the state and contribute to the large variation in total costs. The type of irrigation system also affects costs; sprinkler and center pivot systems are more expensive than flood irrigation systems due to the capital investment required. The cost per acre tends to be higher for smaller fields than for larger fields because the equipment and building costs are spread out over a smaller number of acres.

### Harvesting Costs

Harvesting costs typically range from \$100 to \$200 per acre (\$247 to \$496/ha) per year, depending on the number of cuttings and whether an operator owns harvesting equipment. Generally, the number of cuttings increases from north to south through the state. The number of cuttings in the northern part of the state is three to four per year, six to eight cuttings in the Central Valley, and in the

**TABLE 23.6**

Cost per acre to establish alfalfa, Sacramento Valley, 2003. This is provided as an example of how to calculate costs, and should be adjusted for each situation

Operation	Operation Time (Hrs/A)	Cash and Labor Cost per Acre				Total Cost
		Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/Rent	
<b>CULTURAL:</b>						
Disc Stubble (2 times)	0.27	4	8	0	0	12
Chisel Field	0.19	3	5	0	0	8
Laser Level 1 time each/7 years	0.00	0	0	0	11	11
Disc	0.10	1	3	0	0	4
Triplane (3 times)	0.36	6	7	0	0	13
Border Preparation (3 times)	0.09	1	1	0	0	2
Fertilize (11-52-0) 33% Cost	0.00	0	0	16	2	18
Fertilize (Sulfur)	0.00	0	0	11	6	17
Plant (including seed)	0.26	4	3	54	0	61
Harrow and Ring Roll	0.09	1	1	0	0	2
Irrigate—Sprinkle	0.80	8	0	12	0	20
Weed (including herbicide)	0.07	1	0	46	0	47
Pickup truck	0.12	2	1	0	0	3
ATV Use	0.12	2	0	0	0	2
<b>TOTAL CULTURAL COSTS</b>	<b>2.47</b>	<b>33</b>	<b>29</b>	<b>139</b>	<b>19</b>	<b>220</b>
Interest on operating capital @ 7.14%						4
<b>TOTAL OPERATING COSTS/ACRE</b>		<b>33</b>	<b>29</b>	<b>139</b>	<b>19</b>	<b>224</b>
<b>CASH OVERHEAD:*</b>						
Liability Insurance						1
Office Expense						34
Property Taxes						1
Property Insurance						1
Investment Repairs						3
<b>TOTAL CASH OVERHEAD COSTS</b>						<b>40</b>
<b>TOTAL CASH COSTS/ACRE</b>						<b>264</b>
<b>NON-CASH OVERHEAD</b>						
<b>*(Investments)</b>		<b>Per producing acre</b>	<b>— Annual Cost —</b>			
			<b>Capital Recovery</b>			
Irrigation—Hand Line Sprinkler		4	1	1		1
Forklift		7	1	1		1
Buildings		20	2	2		2
Shop Tools		4	0	0		0
Fuel Tanks		1	0	0		0
Hay Barn		98	9	9		9
Equipment		125	16	16		16
<b>TOTAL NON-CASH OVERHEAD COSTS</b>		<b>259</b>	<b>29</b>	<b>29</b>		<b>29</b>
<b>TOTAL ESTABLISHMENT COSTS/ACRE</b>						<b>293</b>

Source: <http://coststudies.ucdavis.edu>.

**TABLE 23.7**

Cost per acre to produce alfalfa, Sacramento Valley, 2003

Operation	Operation Time (Hrs/A)	Cash and Labor Cost per Acre				Total Cost
		Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/ Rent	
<b>CULTURAL:</b>						
Summer Weed Control (Treflan)	0.06	1	0	21	0	22
Insect: Aphid/Weevil (Warrior)	0.00	0	0	11	9	20
Irrigation	1.26	12	0	96	0	108
Insect-Worm (Lannate)	0.00	0	0	20	9	29
Insect-Worm (Steward)	0.00	0	0	13	9	22
Fertilize 1 time every 2 years (11-52-0)	0.00	0	0	16	3	19
Winter Weed Control (Velpar/Karmex)	0.00	0	0	27	9	36
Pickup Truck	0.40	6	3	0	0	9
ATV Use	0.24	4	1	0	0	5
<b>TOTAL CULTURAL COSTS</b>	<b>1.96</b>	<b>23</b>	<b>4</b>	<b>204</b>	<b>39</b>	<b>270</b>
<b>HARVEST:</b>						
Harvest	0.00	0	0	0	196	196
<b>TOTAL HARVEST COSTS</b>	<b>0.00</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>196</b>	<b>196</b>
Interest on operating capital @ 7.14%						12
<b>TOTAL OPERATING COSTS/ACRE</b>		<b>23</b>	<b>4</b>	<b>204</b>	<b>235</b>	<b>478</b>
<b>CASH OVERHEAD:</b>						
Liability Insurance						0
Office Expense						35
Crop Share 20% of Gross						140
Property Taxes						1
Property Insurance						1
Investment Repairs						3
<b>TOTAL CASH OVERHEAD COSTS</b>						<b>180</b>
<b>TOTAL CASH COSTS/ACRE</b>						<b>658</b>
<b>NON-CASH OVERHEAD:</b>						
		<b>Per producing acre</b>	<b>— Annual Cost —</b>			
			<b>Capital Recovery</b>			
Buildings		21	2	2		
Hay Barn		123	11	11		
Forklift		7	1	1		
Fuel Tanks		1	0	0		
Shop Tools		5	0	0		
Alfalfa Establishment Costs		264	77	77		
Equipment		25	4	4		
<b>TOTAL NON-CASH OVERHEAD COSTS</b>		<b>445</b>	<b>94</b>	<b>95</b>		
<b>TOTAL YEARLY PRODUCTION COSTS/ACRE</b>						<b>753</b>

Source: <http://coststudies.ucdavis.edu>.

Imperial Valley, growers typically make nine harvests, but could harvest up to twelve times per year (including winter grazing). The current practice of green chopping throughout the winter in the southern San Joaquin Valley has increased the number of harvests there to eight or ten. Custom operator costs for swathing, raking, baling, and “road siding” (moving bales from the field to a stack) vary, depending on the size of the field being harvested, the proximity to the custom operator, and the tonnage. The current range is \$30–\$38 per ton (\$33–\$42 per MT) for custom harvest. Many harvesting companies swath, rake, bale, and roadside the harvested hay for a single fee. In this case, fees are based on a per-ton (or MT) basis, with a minimum of 1 ton (0.907 MT) of hay per acre. Some companies charge by individual operations. Individually, swathing and raking are charged on a per-acre (ha) basis, and baling and road-siding are charged on a per-ton (MT) basis.

Obviously, with nine cuttings per year, Imperial Valley harvest costs are much higher than costs in Siskiyou County, which averages three cuttings per year. However, each cutting in the Intermountain regions can be as high as three tons per acre (6.7 MT per ha) for the first or second cutting, whereas in the rest of the state, one to two tons per acre (2.2 to 4.4 MT/ha) per cutting is more typical. The per-acre annual yields vary tremendously throughout California, from 4.5 to 14 tons per acre (10.1 to 31 MT/ha) depending on location, quality of the stand establishment, weed and insect pressures, and the age of the stand. Average yields in California are between 6.5 to 7.5 tons per acre (14.6 to 16.8 MT/ha).

Statistics on hay prices are maintained by the USDA-Market News Service, and can be found at: <http://www.ams.usda.gov/lsmnpubs/hsum.htm>.

Statistics on alfalfa and other hay production from the United States are maintained by the USDA-National Agricultural Statistics Service, and can be found at: <http://www.nass.usda.gov>.



## Additional Reading

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