

Industry Perspectives  
**Hay**



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Industry Perspectives

# Hay

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## Industry overview

Hay is a vital component of U.S. agriculture, supporting diversified farming, export markets, and livestock operations. Key crops include legumes like alfalfa and clover, and grasses such as timothy, bermuda, straw and orchard. These crops are cultivated primarily for commercial sale and are essential to supporting the broader agricultural ecosystem. The Western U.S. is a surplus production region, exporting nearly one-third of its annual hay output through West Coast ports. Primary consumers include dairies, exporters, beef cattle feeders, and retail feed stores, with dairy and export markets driving demand and pricing. The hay supply chain begins with producers optimizing yields and quality, followed by baling, storage, and distribution. Export markets, particularly in Asia, value Western hay for its high nutritional quality, while domestic demand is led by the dairy industry, where alfalfa is essential for milk production. Factors like water availability, labor shortages, and transportation costs pose challenges, but the industry remains resilient.

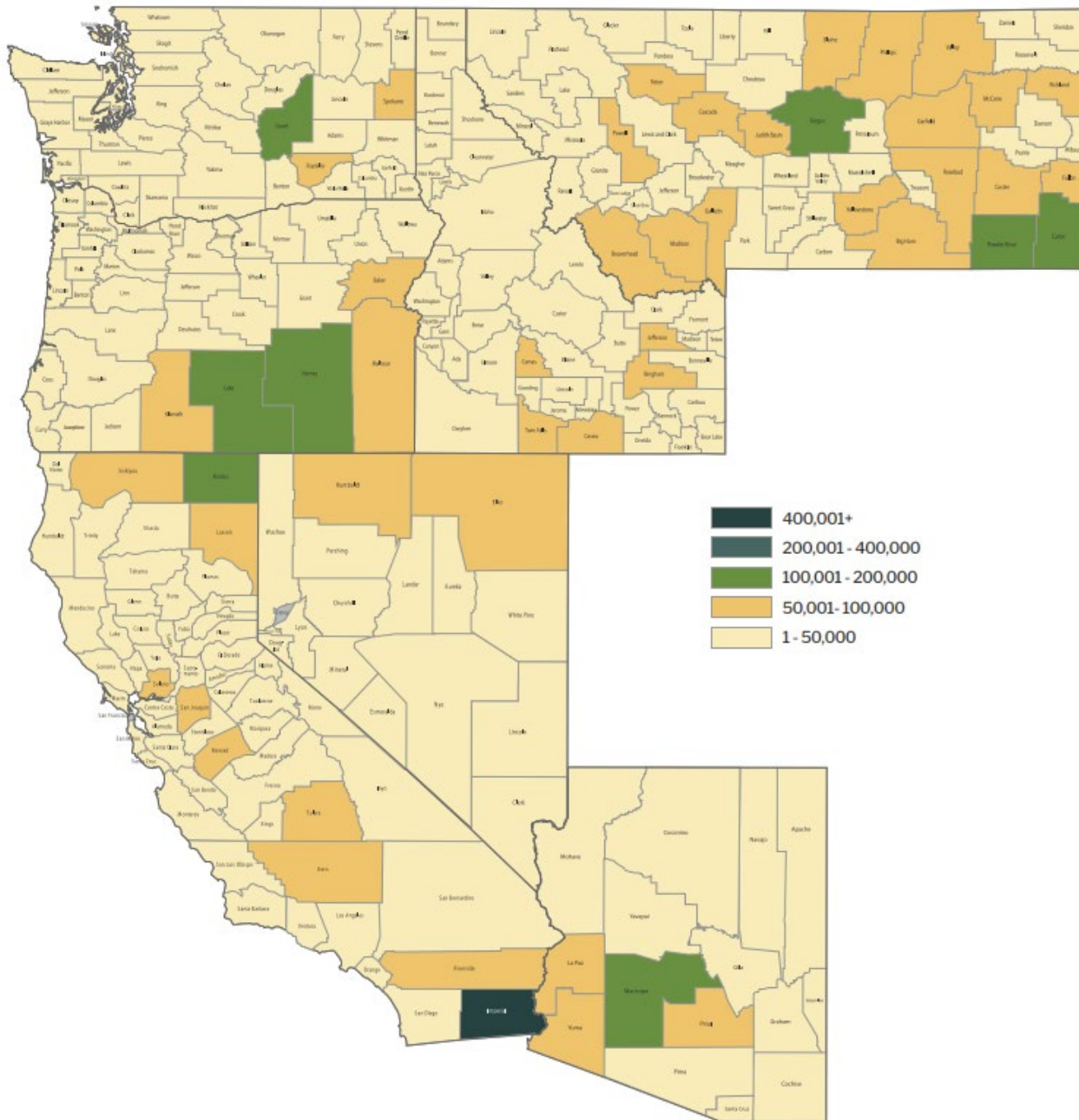
## Production trends

Ideal growing conditions for hay depend on the type of hay being cultivated but generally include a combination of moderate climates, well-drained fertile soils, and consistent access to water. Alfalfa thrives in regions with warm days and cool nights, as these conditions promote optimal growth and nutrient density. Adequate irrigation or rainfall is critical, especially in arid regions, to support multiple cuttings per season.

Global hay production plays a vital role in supporting livestock industries worldwide. Alfalfa and grass hay are the most widely cultivated types, with the United States, China, and Australia among the largest producers. In the United States, hay is grown across nearly every state, but production is concentrated in regions with optimal growing conditions. The Midwest and Western states dominate, with alfalfa being the primary crop due to its high nutritional value and versatility.

Hay production is a cornerstone of agriculture in the Western U.S., renowned for its high-quality alfalfa and grass hay. Leading states like California, Idaho, Washington, and Oregon excel in hay output, thanks to fertile soils, robust irrigation systems, and favorable growing conditions. Alfalfa, the region's most prominent hay crop, typically yields 3 to 5 cuttings per year in cooler climates such as northern California and the Pacific Northwest. In contrast, arid regions with irrigation, like California's Imperial Valley, can achieve an impressive 8 to 11 cuttings annually. Grass hay varieties, including timothy and orchard grass, are also widely cultivated, thriving in cooler temperatures with sufficient rainfall. As a surplus production region, the Western U.S. exports a significant portion of its hay to international markets, meeting global demand for premium forage.

## Hay production by county (tons) for AgWest territory



Source: USDA Census of Agriculture, 2022.

### Hay production and markets

The process for harvesting hay – cutting (swathing), raking (drying), baling and stacking – is similar for all hay types. While the basic process is similar, the area, climate conditions, hay type and desired use drive varying yields and number of cuttings. Producers’ break-even sales price also varies according to geographical location, the hay variety cultivated, and the method of production and harvest.

### Hay quality

Hay is normally sold per ton. Price is based on quality grade. Grade is determined by the hay’s impact on animal performance based on intake (consumption and palatability), digestibility, nutritional value and visual appearance. The following USDA quality grade standards for alfalfa are recognized throughout the hay industry:

- **Supreme:** Characteristics include an extra-leafy grade with soft, pliable stems because of cutting at an early stage of maturity. Supreme hay has a high palatability and nutritive value, possesses an excellent green color and is free of foreign material and mold.

- **Premium:** This early-maturity, extra-leafy and fine-stemmed grade also boasts a high nutritional value. Premium hay has a good green color and is free of damage or foreign material.
- **Good:** With early to average maturity and a leafy, fine- to medium-stemmed grade, good hay is free of damage other than some slight discoloration.
- **Fair:** This late maturity crop has moderate- to low-leaf content, contains more coarse stems, and may show light weather damage and some weed content.
- **Utility (Low):** A very late-maturing crop, utility hay frequently includes an output that must be discounted due to excessive weather damage, heavy weed content and/or mold intrusion.

These USDA quality standards are based on various tests that measure hay quality according to its dry matter (DM), crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), relative feed value (RFV) and total digestible nutrients (TDN).

The visual appearance of color, coarseness of stem, leaf retention, head or flower development, and possible damage also factor into the grade of grass and alfalfa hay. The table below shows the generally accepted hay test guidelines. Higher quality hay typically commands higher prices.

To preserve quality, hay is stacked in sheds or covered with tarpaulins (tarps) to minimize the potential for weather damage.

#### Alfalfa hay test guidelines

	TDN (90% DM)	RFV (100% DM)	CP (100% DM)
Supreme	>55.9	>185	>22
Premium	54.5-55.9	170-185	20-22
Good	52.5-54.5	150-170	18-20
Fair	50.5-52.5	130-150	16-18
Low	< 50.5	<130	<16

Source: USDA Agricultural Marketing Service.

#### Hay grades and markets

Due to the uncertainties of weather and harvest timing, hay growers often produce and market several quality grades in the same season. The grade of hay usually determines its end market.

- **Feeder** - Typically marketed to cow-calf operations and feedlots or fed to a grower's own cows.
  - Feeder grass hay normally goes to feed on the farm.
- **Good** - Typically exported or marketed to dairies as dry cow feed. (Dry cows have lower nutritional requirements.)
- **Premium** - Most often exported, but may also be sold to retail. Premium commodities in general are often exported to tap into international markets where there is a higher demand and willingness to pay for quality products. This allows producers to maximize their profits.
- **Supreme**
  - Supreme alfalfa is most commonly sold to dairies.
  - Supreme grass hay is most often exported or sold in the retail market for horses.

#### Bale types

Producers determine bale type by the end use of the hay, the maturity of the hay at harvest, current weather conditions and availability of equipment. Common bale types include:

#### Common bale size and weight

Bale Type	Weight	Dimensions
Two-string	100 pounds or less	14"x18"x46" or 16"x18"x46"
Three-string	90 to 130 pounds	15"x21"x44" or 16"x22"x44"
Big square	1,100 to 2,000 pounds	3'x3'x8' or 3'x4'x8' or 4'x4'x8'
Round	600 to 2,000 pounds	4' or 5' wide and 36"-72" in diameter

- **Two-string bales** - normally sell for higher prices but also have higher handling costs. Small bales are preferred for retail and small farm operations.

- **Three-string bales** - are typically for export.
- **'Big square' bales** - were historically marketed to dairies or feedlots. However, the export market has developed processes for slicing and compressing big bales, resulting in increased demand.
- **Round bales** - are typically fed to animals on the producer's operation.

Within U.S. markets, hay production has trended away from the smaller, labor-intensive two-string bales to the larger, machine-handled bales. For the export hay market, three-string and big bales are compressed into smaller, more densely packed bales to reduce transport costs. Most exporters have the capacity to process both big bales and three-string. Diverse processing capacity expands processor options in procuring supplies and allows them to take full advantage of the reduced production and handling costs associated with the larger bales.

## Value and supply chain

Market participants are primarily hay producers, diversified producers and hay brokers who market to dairies, exporters, feedlots, cow-calf producers and retail (feed stores and direct-to-consumer).

### Livestock markets

**Dairy operations** are the primary consumer of high-quality alfalfa hay produced in the West. Two basic types of dairies exist, with the type influencing demand for hay:

- Integrated dairies grow most of their own feed. This is a traditional style of dairy with land proportionate to the number of cows milked. Integrated dairies can better manage feed costs and have the added benefit of using manure from dairy as a source of nutrients for hay/forage production.
- Dairies that purchase most of their hay, sometimes referred to as the "California model," require only a small amount of land to operate. Producers of this type can focus management and labor on the core business of producing milk. However, these dairies are vulnerable to changing hay prices.

**Cow-calf operations** normally produce their own hay and will often stockpile it from year to year. Use of stockpiled hay depends heavily on the duration and severity of winter. Extended periods of snow cover or extremely low temperatures result in increased use and faster depletion of stockpiles. Drought and fires also impact hay and pasture availability, as well as productivity. These factors often lead cow-calf producers to replenish or supplement hay stocks with outside purchases.

**Feedlots** use low-quality hay as a source of fiber. On feedlots, the prices of fiber substitutes, and other protein and energy sources, are carefully considered.

### Export and retail markets

**Exporters** purchase or grow their own hay, then compress field-baled hay into "double compressed" or "pressed" bales. Exporters may also cube hay for retail sale or export. The compressed hay bales are loaded into 20-foot shipping containers and trucked to ports; the containers are then loaded onto container ships bound for markets around the world. Timothy grass comprises as much as half of hay exports, while the remainder is alfalfa or grass-seed straw. Hay that does not meet strict export standards is diverted to domestic markets (feedlots, dairies or cow-calf operations).

**Retailers** cater to small/hobby farms. In this market segment, grass and alfalfa are evaluated by the visual appearance of color, coarseness of stem, head or flower development and contaminants. Two-string bales often fetch premium prices, but those who sell in this market tend to have an inconsistent customer base and must calculate that risk.

## Drivers

Industry drivers are those industries listed in the market chain above, as well as cattle markets, alternative crop prices and technological advances.

### Dairy markets

Over the past 20 years, U.S. milk production has steadily increased. In the last five years, herd sizes have remained relatively stable, with minor fluctuations due to changes in milk prices and, more recently, strong prices for cull cattle and replacement heifers.

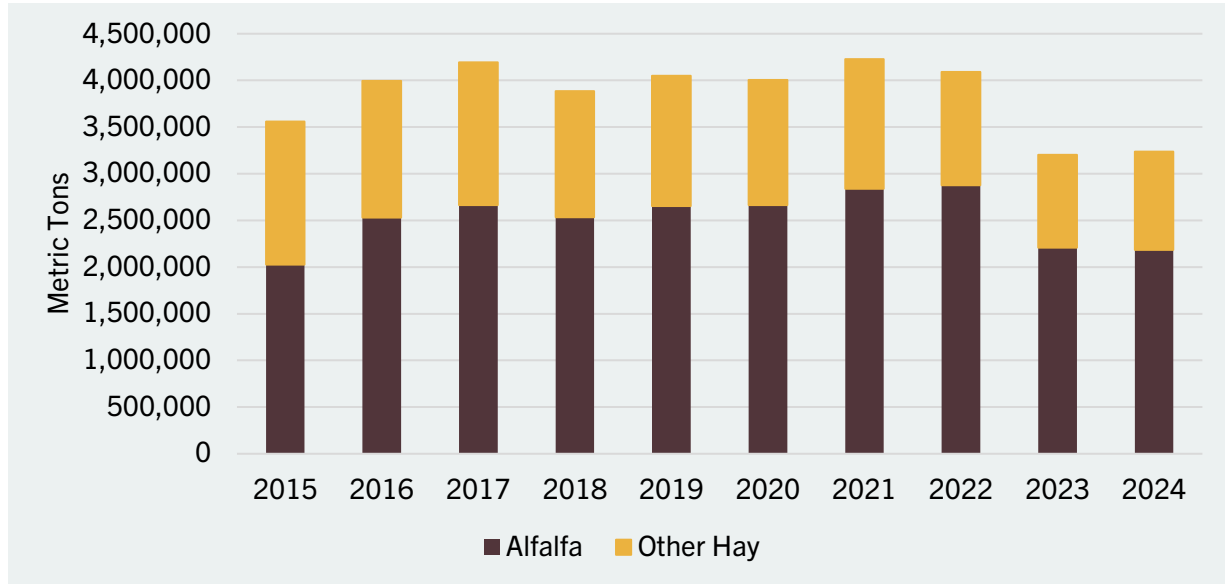
As regional and national dairy production increases, demand for high-quality hay follows suit. California, Idaho and Washington are the largest dairy production states within AgWest territory. In Washington, hay prices tend to follow nine months behind milk prices with an 80% correlation. Idaho follows the same trend, with alfalfa hay prices lagging seven to nine months behind milk prices and with a correlation of 79%. Hay prices in California also tend to lag about nine months behind milk prices with a slightly lower correlation of 68%.

Alternative feed sources, like corn silage, almond hulls or high protein meals, may displace alfalfa feed use in dairy rations when economic conditions favor substitution. While there are other substitutes that may have increased use when hay prices are inflated, cattle will still require fiber and roughage from hay in their diets for proper gut health function and rumen development.

### Export demand

Export demand is another significant driver in hay markets. In 2024, West Coast exporters shipped over 3 million metric tons of alfalfa and other hay. Exports represent 31% of the West Coast's total hay production and about 3.1% of the U.S. total. Demand for U.S. hay can be affected by a foreign country's economic, political, and other circumstances.

*Hay exports per metric ton, 2015-2024*



Source: USDA Foreign Agricultural Service, GATS.

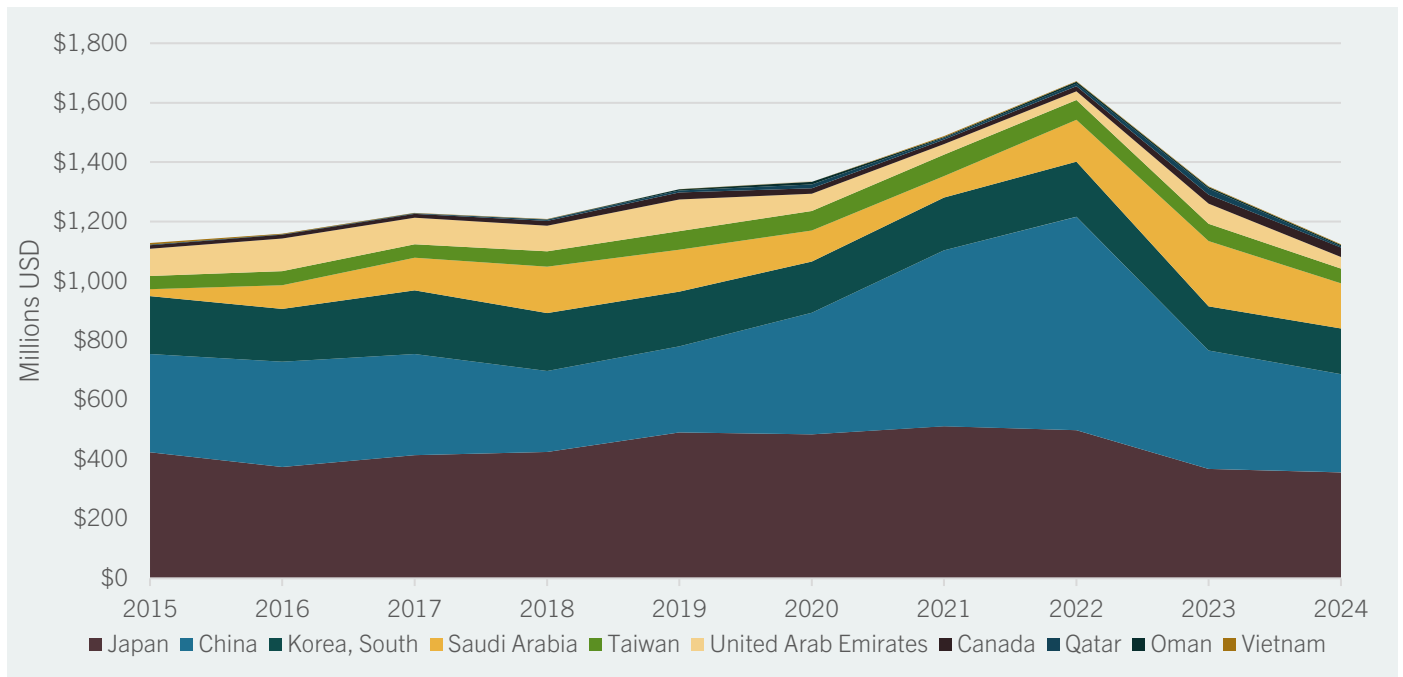
Increased demand for U.S. forage products over the past decade is linked to shifting global consumer demographics. Population migration from rural to urban areas and a growing middle class are driving increased protein consumption in the form of milk and red meat.

Export demand has been a significant factor supporting hay prices over the past several years. Established markets, including Japan and South Korea, have been stable to declining. Markets such as China, Saudi Arabia and the UAE (United Arab Emirates) have experienced significant growth followed by volatility.

- China became the largest hay export market for the West Coast in 2021 and maintained that position through 2023. However, purchases declined sharply in 2024. A growing dairy industry, combined with agronomic and logistical challenges, has kept domestic hay production from meeting demand, driving imports of U.S. forage products. Increased use of alfalfa pellets as feed for pregnant sows also boosted pellet imports. Yet, a slowing economy and government programs to reduce dairy herds significantly cut hay purchases in 2024. These reductions deepened in 2025 as tariffs and geopolitical tensions further constrained China's imports.
- The inflated cost of alfalfa and timothy in recent years has led Japanese buyers to increasingly substitute U.S. hay for lower-cost alternatives such as domestically produced products, Chinese rice straw, and oaten hay from Australia.
- Middle Eastern governments have prioritized water for human consumption and higher-value crops over alfalfa production, driving demand for imported hay. However, rising hay prices in 2022 and 2023 led buyers in the region to seek more affordable sources from other countries. Shipping container availability also plays a role in export markets.

The ports of Los Angeles, Long Beach and Oakland handle more ocean-going containers than the ports of Seattle and Tacoma. California's ports tend to have a higher supply of empty containers available, reducing ocean freight charges. This price difference leaves Northwest hay exports at a slight shipping disadvantage.

## Top 10 hay export markets 2015-2024



Source: USDA Foreign Agricultural Service, GATS.

### Cattle markets

The U.S. cattle herd most recently peaked in 2018 and has begun a steady, cyclical decline that continues. However, the West has experienced overall growth in cattle herds since the late 1980s. In general, increasing herd populations leads to increased consumption of feeder hay.

### Alternative crop prices

The value of competing crops drives land rental rates throughout the country as producers compete for irrigated farmland. Land costs and rental rates have been volatile since the 2020 COVID pandemic in conjunction with U.S. Treasury rates and crop price volatility. Permanent vineyard and orchard plantings reduce irrigated land available for hay production. Hay remains a preferred rotation with high-value crops like potatoes, onions and sugar beets.

### Technological advancements

Today's hay production technology – including mechanized harvest and handling equipment, mechanical conditioning and improved irrigation practices – has increased quality and production efficiencies. Innovative technologies and products, such as steam-injection balers and hay-preservation products, help mitigate weather risk and produce consistent crops.

New seed varieties of alfalfa and other hay have increased yield potential by a quarter ton per acre, and plant resistance to pests and disease. Genetically modified organisms (GMO), also called genetically engineered (GE) varieties, are being developed to enhance pest and disease control, improve forage quality, lessen maturity differences and boost yields. While U.S. hay producers have broadly accepted GMO hay, some export markets have banned it.

## Appendix A: Best practices

Hay producers implement various strategies to remain competitive and position their businesses for long-term success. This section details best practices used by hay producers and hay processor/marketer/exporter operations.

### Production practices

The hay production segment is diverse regarding operation size, type of hay grown and farming practices used. Successful hay producers are generally progressive, low-cost operators who have:

- Proven production, marketing and financial management
- Diversity in products grown
- Diverse geographical locations to mitigate weather risk
- Access to a reliable source(s) of water
- Adequate capitalization (balance sheet liquidity and equity)
- Strategic alliances with suppliers and buyers
- Thorough due diligence on prospective and existing hay buyers
- Multiple marketing channels for hay based on type and quality
- An advisor network of outside professionals to develop and execute business strategies
- Risk management addressed at all levels of the business
- Invested in proven technology that improves efficiencies
- Good knowledge of the market and the compelling demand of buyers

### Strong management decisions

Maintaining prudent management practices to preserve quality and reduce risk and having the ability to adjust in response to a changing market, are both crucial to the success of today's hay operations. By continually seeking the most efficient means of production and the most economical way to package and provide a consistent quality product, top-tier hay operations can build and retain a solid customer base.

### Strong marketing decisions

Successful producers understand the differences among market segments concerning the importance of hay quality. For example, beef and horse producers generally desire more mature forage than dairy producers with high-production cows. Hay quality testing is becoming more critical in the industry as it provides the producer with a marketing edge and aids in maximizing returns on the product. Top producers know the quality of the product they are selling and represent the product with integrity.

Top producers are also aware of potential changes in market demand and the subjective factors that impact quality preferences. Identification of sensitivities (e.g., the market tolerance of biotech traits) inherent to their market is crucial for operational viability and maintaining flexible management practices.

### Efficiency

Successful producers make the highest and best use of available resources and grow the best products possible. They also keep the long-term perspective of customer satisfaction and retention. They can determine the direction of the business, the extent of improved technology and equipment use, and the quality of their product to fully capitalize on the demand of current and future customers.

The most successful operators recognize volatility in input costs and constantly seek ways to stabilize them. They take steps to mitigate cost risk by staying in constant contact with suppliers and by making their suppliers aware of their needs for the upcoming season, which helps from a price as well as an input availability perspective. In addition to managing input costs, successful producers leverage their operation's capacity against the constantly changing hay market.

### Strong business plan

Today's environment compels hay producers to be business owners first and growers second. Good marketing plans are imperative. Successful producers conduct thorough due diligence on prospective buyers and use buy/sell contracts or require a substantial down payment to help mitigate marketing risk.

### Hay processor/marketer/exporter

The following summarizes characteristics that are important in a successful hay processor/marketer/exporter operation. A successful business in this sector will have implemented reasonable strategies in the three core management areas: production/processing/marketing, financial and operational.

## **Production, processing, marketing**

A successful business operator must have a firm grasp on all aspects regarding input, throughput and output. Key differentiators are:

- Dependable and consistent supply of hay
  - Hay supply can come from a managed grower base, captive hay production or a mixture of both. The supply must be dependable, contain the right variety mix to meet consumer demand and consist of a desirable quality and size profile.
  - If captive hay acreage exists, it should be able to stand on its own from a profit and loss standpoint and not require year-to-year subsidies from the processing operation.
  - The business must maintain strong strategic alliances with suppliers and buyers, and complete thorough background research.
- Exporting considerations
  - Top exporters have a specific quality objective and provide a product that meets the demand of their customers consistently. Importer standards may be entirely different concerning the perception of quality, as compared with quality standards in the U.S.
  - Export producers are also familiar with the differences between cultures and are sensitive to their clients' customs.
  - Some exporters have a Letter of Credit as secondary line of defense for the exporter if the importer doesn't perform as agreed.

## **Financial management**

The management team should include a seasoned CFO/controller to support business initiatives. Inventory and accounting controls should be implemented and monitored frequently, and the business should be mitigating exposure to foreign exchange rate risk.

## **Operational management**

The management team should include a seasoned operations manager to execute company initiatives. Differentiators include:

- Good geographic location
  - Accessible location for both inbound and outbound hay shipments.
  - Proximity to Interstate routes and seaports is favorable.
- Business model
  - An operation's long-term business model is a key factor in extending credit.
  - Intentional planning and goals are essential.
- Crop strategy
  - Within the West, most hay producers grow multiple crops. Diversification is an excellent risk management tool as it helps reduce the fluctuations in income that normally accompany crops sold primarily on the open market.
  - Types of hay produced and proximity or access to key markets must be considered when developing a new, or revisiting an existing, business model.
- Modern equipment
  - Effective processors have a plan in place that addresses capital expenditures for maintenance and replacement of equipment, cost containment and deployment of emerging technology.
  - A modern equipment line provides benefits in efficiency, timeliness, labor and resource use, and product quality.

## Appendix B: Glossary

**Dairy-quality hay:** Contains less neutral detergent fiber (NDF is a bulky, slow-to-digest feed component) that is more digestible and allows for greater dry matter intake that leads to higher milk production and thus maximum returns in milk.

**Dry cow:** Non-lactating dairy cow.

**Export shipments:** Export hay is compressed via a commercial compressing machine to maximize container weights. Because ocean freight is charged on a per-container basis, exporters will attempt to maximize the container weight (+/- 28 tons depending on the individual container). Hay is exported on shipping vessels to foreign ports in 40-foot non-refrigerated containers. Exporters must closely watch container weights so as not to exceed an individual container's maximum weight or the maximum weight allowed by a particular country (some countries have low-weight road restrictions).

**Feeder hay:** May refer to low-quality alfalfa or grass hay.

**FOB – Freight on board:** The determined location of the point of sale for a stack or load of hay. It is common for hay to be purchased either 'at the stack' with the buyer paying for transportation costs or 'delivered' to a specified location with the grower/seller paying for transportation. A common practice is for the hay to be weighed via a certified scale to determine the total value.

**Forage:** A general term for livestock feed that may include pasture, hay, corn silage, and haylage (see below).

**Green chop:** A type of harvesting method that works well for the first and last cuttings when there is a threat of poor weather or when animals are close to the alfalfa field. Hay is harvested in the early bud stage and then directly fed to the livestock from the field to the feeding site daily. With 75% to 80% moisture content, this is a high-energy feed that must be handled and fed carefully to avoid bloating.

**Haylage:** Silage made from alfalfa or grass that has been partially dried.

**Press:** Refers to either a machine that physically compresses hay into higher-density packages (hay press) or the facility where hay is compressed into higher-density packages (press facility).

**Shed/storage:** It is important to keep hay protected from rain and water damage. Hay is often stored in a shed if it is not covered with a tarpaulin. Common shed structures include fully enclosed, simple pole-type structures with a roof, a barn or a hoop building where no temperature control is required. The outside surface of bales will become sun-bleached if stored with outside light exposure; however, the color under the exposed surface will remain intact if there is no moisture damage.

**Silage:** Grass, alfalfa or other green fodder compacted and stored in airtight conditions, typically in a silo, without first being dried, and used as animal feed in the winter.