ALFALFA HARVESTING COSTS

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California's annual production of alfalfa field cured hay averages nearly 7 million tons. Baling is the standard way to harvest this crop but cubing continues to grow in popularity. It is estimated that upwards to 10 percent of the 1973 crop or around 679,000 tons was cubed compared to 1,000 tons cubed in 1960--the first year by this new process.

The 1969 Census of Agriculture lists 6,829 balers on California farms. The number of cubers is estimated at approximately 135 field machines and 24 stationary machines in 1973.

Cubes enjoy good demand and an expanding market. Advantages over bales include mechanized handling and feeding and reduced labor, storage space, and feeding waste.

The information in this paper is condensed from a revision of Alfalfa Harvesting Costs, AXT-346 available at County Cooperative Extension Offices.

Costs of producing alfalfa bales and alfalfa cubes with field and stationary equipment are compared in Table 1. The costs in the table are based upon 10,000 tons annual production, an amount considered reasonable for one stationary cuber and maximum for two field cubers or two balers. These summary data show that cubing is more expensive than baling, and is economically feasible only because of the advantages just discussed. The overall cost of producing cubes in the field is less than for stationary operation when compared at the same annual tonnage. The difference is small when annual production exceeds the capacity of a single field machine.

Hay harvesting involves large investments for equipment and facilities. Table 2 shows the approximate cost of baling and cubing equipment and the auxiliary equipment required for each system. These investment costs are reflected in the overhead cost of producing bales and cubes in subsequent calculations.

TABLE

Comparison of Baling, Field Cubing, and Stationary Cubing Costs--10,000 Ton Production Per Year

	Cost per ton		
	Bale	Field Cube	Stationary Cube
Swath	$ 2.37	$ 2.37	$ 2.37
Combine windrows	.57	---	.57
Field cube	---	5.46	---
Water nurse truck	---	.40	---
Haul cubes to storage	---	2.01	---
Bale	5.71	---	---
Roadside bales	1.04	---	---
Chop dry hay and haul to stationary cuber	---	---	4.05
Stationary cuber	---	---	4.95
Weigh	.08	---	---
Store	.15	2.23	2.23
Management	.35	.75	.75
Total	$10.27	$13.22	$14.92

TABLE 2

Comparison of Equipment Investment for Baling, Field Cubing and Stationary Cubing for 10,000 Tons Per Year

	Number Required	Bale	Field Cube	Stationary Cube
Swather 14 ft. S.P.	2	$29,100	$ 29,100	$ 29,100
Side rakes (2) and tractor comb.	2	14,400	---	14,400
Field cuber1/	2	---	110,000	---
Water nurse truck	1	---	3,000	---
Dump truck to haul cubes	2	---	14,700	---
Baler, 3-wire pull type1/	2	19,800	---	---
Tractor to pull baler	2	10,500	---	---
Auto bale loader and stacker	1	17,700	---	---
Dry hay chopper	2	---	---	10,600
Tractor to pull chopper	2	---	---	27,000
Chopped hay wagon	6	---	---	54,000
Truck to pull wagons	2	---	---	12,800
Stationary cuber with auxiliary facilities2/	1	---	---	107,350
Storage for cubes	1	---	117,900	117,900
Total		$ 91,500	$274,700	$373,150

1/ Maximum annual output estimated at 5,000 tons per machine.

2/ Maximum annual output estimated at 12,000 tons.

Machine Capacity of Cubers

Several variables affect the productivity of the field cubing machine. Weather and its effect on hay moisture is one of the more important elements and cannot be controlled. Other factors like irrigation timing and soil moisture and general field conditions like ground roughness and crop uniformity, can be given limited control.

A stationary operation places the cuber out of the direct influence of field and weather and can operate for as long as the field chopping operation can keep hay reserves available to it. The stationary cuber can therefore be fed more uniformly at a rate near the machine's maximum output. Hay fed to the machine is also at a more uniform moisture content and nearer the optimum moisture level. These factors usually increased the hourly capacity of stationary cubers by at least 50 percent. While the capacities of both types of machines vary with conditions and management, it is not unreasonable to expect an average of 4 tons per hour with a field machine and 6.5 to 7 tons per hour with a stationary machine.

Operating Time of Cubers

The number of hours of operation for a field cuber is limited to the period during the day when the hay is free of dew. In most areas this restricts operation to 8 to 12 hours each day. By contrast, stationary cubers can operate around the clock, if a supply of hay is available. The stationary cuber output in this cost comparison was based on 16 hours a day (two 8-hour shifts) at an average output of 7 tons per hour. The number of days of operation per year may also be increased by either stockpiling chopped hay or using baled hay. Because of the extra costs, these two approaches have so far had only limited use. A normal seasonal operating period of 100 days was used for both the stationary and field machines.

Other Considerations

The stationary cuber can be used to process artificially dried hay in areas where natural drying is unsatisfactory. A standby drier can be used for periods during the season to permit continuous operation of the cuber. Artificial drying, however, adds to the total cost of cubing.

Although cubers are designed primarily for legume forages, they can be used for other materials, particularly agricultural by-products like straw and cotton waste. The stationary machine is best suited for these materials because adhesives must frequently be added and mixed before cubing.

While baling wire and tramp iron in hay cubes are not frequent problems, it is easier to provide magnets and metal removal equipment in a stationary cuber than in a field machine.

The hay supply used in cubing operations is frequently drawn from a fairly large area With field cubers, the entire operation including storage can be shifted to reduce the transport of hay. This is not possible with a stationary installation. Portable stationary cubing units have become increasingly popular in the last 2 years.

The multiple cuber aspect of a field cubing operation reduces the risk of a complete shutdown due to maintenance or repair problems. A mechanical failure in the single cuber of a stationary operation, by contrast, would completely stop cube production, while mechanical failure on one field cuber would stop only that portion of the total. On the other hand, stockpiling of chopped hay can continue despite stationary cuber breakdown, with around the clock operation when repairs are completed.

Somewhat less labor seems required for field cubing than for a stationary plant. A comparison of all systems at 10,000 tons per year shows approximate labor requirement at 0.78 man-hours per ton for the stationary cuber, 0.57 man-hours for the field cuber, and 0.33 man-hours for baling.

Labor rates are figured at $3.50 per hour except the field cuber operator is at $4.00 per hour. These rates include workmen's compensation, social security and other fringe costs.

The need for covered storage varies with local rainfall. Light rainfall damages the pile's surface somewhat, producing some quality loss and waste due to spoilage. Covered storage is recommended, but producers in areas of very limited rainfall may decide that the investment is not justified. For both the stationary and field cubing operations, the costs include a cube storage building to provide storage for 50 percent of the annual tonnage. Costs are based on a flat storage building providing 5 square feet of floor space per ton at $4.00 per square foot. A solid floor, usually concrete, is needed to minimize handling loss and to prevent mixing with dirt or gravel.

Stationary cubing also includes 30,000 square feet of concrete slab for stockpiling chopped hay before cubing. This item is included under stationary cubing cost.

Machine life, output per hour and per season, and machine maintenance are major factors affecting the cost and success of the cubing operation. Machine life is determined by wear-out or obsolescence or both. In the case of a newly developed machine like the cuber, it is hard to estimate what these factors will be. Many field cubers have now completed 8 years of service, and a few have operated for 10 years, so for these, 8 years seems to be a reasonable life. Life expetancy for the stationary cuber is estimated at 10 years because of less severe operating conditions. Life expectancy for other equipment is estimated from various references including ASAE Yearbook.

Except for storage shed and elevators, depreciation and interest charges allow for 10 percent salvage value. "Other" charges in overhead costs are taxes, insurance, and storage of equipment computed at 2 percent of first cost of the machine or facility.

Data from a limited number of field cubers during their first few years of use indicate that expected annual repair costs per hour are 125 percent of the first cost of the machine per 10,000 hours. Die wear is a major part of this total. Many producers completely overhaul their cubing machines during the winter to reduce in-season maintenance. Sandy soil or other factors creating unusual wear can increase repair costs.

Repair cost for stationary cubing was obtained by averaging actual costs of existing installations. Fuel consumption and repair information, unless otherwise noted, were taken from the ASAE Yearbook. Miscellaneous cash costs include office and telephone, interest on operating capital, and various small items.

A management and supervision charge of $0.75 per ton for cubes and $0.35 for bales is included in Table 1.