Cooperative Extension Service
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AGRON-O-GRAM

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This is the first issue of Agron-O-Gram that has been published for several years. The Extension Agronomy staff has decided to bring the Agron-O-Gram newsletter back and try to publish it on a regular basis. The primary purpose of the newsletter is to provide timely information to the people of Colorado through our Extension Agents. We do not plan to send this letter to a large mailing list. It will be limited primarily to the Extension Agents for their information and use.

Each newsletter will try to focus on one topic so that it can be filed under a specific subject. The newsletter in this issue is on "Alfalfa Harvesting and Processing for the Markets," and was written by Bob Croissant.

We are very anxious to receive your comments on this newsletter and your suggestions on subjects that you would like to see in future issues.

Sincerely,

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ALFALFA HARVESTING AND PROCESSING FOR THE MARKETS

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When selecting a method to harvest your alfalfa hay crop, it is necessary first to decide or consider how the hay will be used or sold. Will it be sold to the horse market, a dairy, used in a cow/calf operation or will it strictly be a cash crop sold to the open market. Another important question is what distance is it from the field to the point of sale or use.

At this point, a person can make additional decisions as to the type of product that you desire to construct. For example, do you want conventional bales, round bales, large square bales, loose hay stacks, cubes, silage or haylage. Each of these systems obviously are designed for specific types of livestock operations and they vary in cost considerably.

The most important aspect of producing hay is maintaining quality hay. When considering alfalfa, a very important factor in producing quality hay is the stage of harvest. First cuttings of alfalfa for highest quality is best cut at the bud stage while subsequent cuttings are best cut at the one-tenth bloom stage. (See Table 1) The

Table 1. Recommended stages to harvest various hay/forage crops.

1.	Alfalfa	1st cut - bud stage 1/10 bloom, 2nd & 3rd cuttings - 1/10 bloom
2.	Orchard - Timothy	Boot to early head
3.	Red Clover	Early bloom - 1/2 bloom
4.	Sweet Clover	Seedling year - cut high 2nd year - early bloom
5.	Sudangrass, Pearl Millet, Sorghum Hybrids	40-inch height or early boot
6.	Oats, Barley, Wheat	Boot to early head

Burns, Evans & Lacefield; Univ. Tn, Univ. Ky & Univ. Ky

primary difference between the bud and the one-tenth bloom stage for first and subsequent cuttings deals with stem quality. First cutting alfalfa stems normally are considerably more fibrous and coarser in nature than subsequent cuttings. If we look at the representative analytical values for alfalfa hay at various maturities, (See Table 2.) we find that harvesting at prebloom the crude protein is generally higher than 19% and full bloom is usually less than 12% protein. At the same time, acid detergent fiber is less than 31% at prebloom and more than 40% at full bloom. We still hear of values of

protein on alfalfa at 26% or higher in the so-called super alfalfa and poor quality hay certainly can test lower than 8% protein.

Table 2. Representative analytical values for alfalfa hay at various maturities.

Stage of Maturity	Crude Protein %	A. D. F. %
Pre Bloom	19+	-31
Early Bloom	17-19	31-35
Mid Bloom	12-16	36-40
Full Bloom	-12	-40+

Smith, CSU

If alfalfa is harvested green for silage or haylage, the first constraint is the terrific amount of tonnage that must be moved from the field to storage. If a person would assume eight tons of 80% moisture alfalfa, 6,000 pounds of water would have to be removed for one ton of 20% moisture hay. By the same token, lesser amounts of water would be removed if the crop was stored as haylage. If the latter option is chosen, some feel that the addition of preservatives aid in maintaining high quality haylage.

By harvesting as dry hay, field losses do occur prior to the formation of bales or stacks. If we look at Table 3, we see the effect of handling conditions on alfalfa hay losses. From this we find if all cuttings were handled improperly, dry hay losses could approach 34%, crude protein 44% and total digestible nutrients 40%.

Table 3. The effect of handling conditions on alfalfa hay losses.

	Losses Lb/Ac				Total
	1	2	3	4	Percent
Dry Hay	2900	700	100	1000	34
Crude P.	660	210	60	290	44
T.D.N.	1710	480	90	680	40

1	Raked and baled correctly	Lb/Ac
2	Raked too dry	Lb/Ac
3	Baled too dry	Lb/Ac
4	Raked and Baled too dry	Lb/Ac

USDA/University of California

When handling hay, there are several rules of thumb that a person should go by. To reduce hay losses, first rake the hay at 40% or more moisture and second, bale it at approximately 20% moisture. Obviously, a person must consider the type of product that you are constructing as to how far from these limits a person can deviate. Large bales, either round or square, are packed very dense and 20% moisture hay is to high. Moisture levels of 14-16% are more realistic for the maintenance of keeping quality. A person attempts to reduce the stem moisture at a higher rate than that occurs normally while

attempting to maintain the leaves on the plant. Drying agents can be used to spray on the alfalfa speeding up the drying process to maintain the higher quality of hay. Preservatives can also be applied preventing excessive microbial activity in the bale. Another factor to consider is the size and compactness of the bale. Large bales are packed extremely tight to obviously aid in stacking and transporting the product. Round bales are packed extremely tight to prevent water infiltration into the bale. In either case, these large bales when packed extremely tight release moisture at a slower rate and may mold before the hay dries to a safe level. At this point in time, I am neither encouraging or discouraging the use of drying agents or preservatives on alfalfa hay.

Let's talk a little bit about types of machinery designed for alfalfa harvest. Obviously, the kind of equipment you purchase and operate depends entirely on the amount of hay that is put up. New windrowers mow the hay and may condition it depending on options. These new self-propelled windrowers, depending on the size, brand and options, cost somewhere around $40,000 to $60,000. Pull type machines range from $11,000 to $20,000. Custom rates for windrowers average $7.06 an acre for swathing and conditioning. These custom rates for swathers and all other machines mentioned hereafter are averages of those surveys from Colorado, Kansas, Nebraska and Wyoming. One must keep in mind that a custom rate quoted for large number of acres certainly is cheaper than that for a small job. A person must also keep in mind that some custom work is done by farmer friends that will do a job considerably cheaper than someone in the custom business. By observing the numbers in the custom rates quoted, it was common to see deviations from the average as high as 30% to 40%.

The standard baler, a unit producing about 85 pound bales, costs about $12,000. Custom rates for this machine range from .30 to .35 cents a bale for large acreages and for small jobs, the custom rates may double the previous mentioned rates.

The stack wagon, obviously for large acreages, is very desirable to load and haul standard bales for storage. This machine costs about $70,000 depending upon how it is equipped and custom rates are approximately .20 cents a bale plus .02 cents per bale per mile hauled.

Round balers have become popular with farmer/ranchers feeding their own hay. Round bale machines will produce bales from 800 to 2,000 pounds in size and, obviously, they are difficult to transport. A big round baler producing 1,500 pound bales may cost $12,000 to $20,000 depending on how it is equipped and the brand name and custom rates average $4.93 per ton. Round bale storage must be handled in a specific way to prevent spoilage. If the bales are stacked on end, any moisture that falls on top of them will penetrate straight down, thus causing hay losses. Bales laying on their side stacked one deep with air space in between is recommended to maintain hay quality.

So at this point, square bales are convenient to haul and round bales save labor. Again, it depends on each specific use for each type of product.

The large 4x4x8-foot bales weigh about a ton and are far easiest to transport from one area to another. These big square balers cost in the neighborhood of $50,000 plus a person needs at

least a 150-horsepower tractor on the front of it. The custom rates for the big square bales vary between $12 to $14 per bale.

The large loaf stackers range in size from one ton to six ton stacks. Here, alfalfa is picked up and pressed into loaves, hauled to a central storage site and extracted from the stack wagon. For comparative purposes, a six-ton stacker would cost about $17,000 new with custom rates approximately $45 per stack. These stacks can be picked up and moved down the road for several miles but it is not feasible to move them any farther than that.

The hay cuber-wafer system certainly automates the movement of hay. Stationary cubers or portable systems can be purchased for between $70,000 and $100,000 depending on how they are equipped. Custom rates for cubers or wafers averages $29 per ton.

If we analyze the total harvesting system for typical costs for baling, hauling and feeding, we find that costs to own and operate haying systems at 100 tons per year (See Table 4) are extremely high.

Table 4. Costs (per ton) to own and operate haying systems at 100 Tons/year.*

Conventional Baler	$ 32.00
SP Bale Wagon	105.00
Round Baler (800 Lb)	36.00
Round Baler (2000 Lb)	56.00
Stacker (1T)	32.00
Stacker (6T)	65.00
Big Baler (1T)	133.00

*Typical cost for baling, hauling and feeding
Dr. A. Rider

For example, using a conventional baler, the costs are $32 per ton, and for the big square baler constructing one-ton bales, the price is $133 per ton. If the tonnage harvested per year is over 150 tons per year, (See Table 5) costs are considerably cheaper. Here a person can see

Table 5. Costs (per ton) to own and operate haying systems at 1500 tons/year*.

Conventional Baler	$ 24.00
SP Bale Wagon	14.00
Round Baler (800 Lb)	16.00
Round Baler (2000 Lb)	12.00
Stacker (1T)	10.00
Stacker (6T)	10.00
Big Baler (1T)	19.00

*Typical cost for baling, hauling and feeding
Dr. A. Rider

the value of handling larger stacks or bales. By looking at the break-even point for ownership of various alfalfa hay harvesting machines, (See Table 6) we find that a rancher would require about 175 tons per year processed to justify using a conventional baler as opposed to 800 tons per year for justification of the big baler.

Table 6. Breakeven point for ownership of various alfalfa hay harvesting machines.

Conventional Balers	175 Tons/Yr
Round Baler (800-1200)	125-150 Tons/Yr
Round Baler (2000)	200 Tons/Yr
Big Stacks (3T)	175 Tons/Yr
Big Stacks (6T)	250 Tons/Yr
Big Bales (1T)	800 Tons/Yr

It is obvious that different volumes of hay per year affect total man hours required for each kind of harvesting system. (See Table 7 for a comparison of the conventional bale system, the big round bales and the big stack system.)

Table 7. Typical Man-hour requirements.

100 Ton/Year

Conventional Bale System:

9-1/4' Mower-Conditioner	24 man hours/yr
Medium Duty Baler	16 " "
Hand Haul	111 " "
Feed Bales (w/Pickup)	100 " "
	251 man hours/yr

Big Round Bale System:

9-1/4" Mower-Conditioner	24 man hours/yr
Big Round Baler	13 " "
Mover (Tractor Mounted)	40 " "
Feed Bales (Tractor Mounted)	33 " "
	110 man hours/yr

Big Stack System (1-Ton Stack Wagon):

9-1/4" Mower-Conditioner	24 man hours/yr
1-Ton Stack Wagon	20 " "
Stack Mower	40 " "
Stack Feeding Equipment*	10 " "
	94 man hours/yr

400 Ton/Year

Conventional Bale System:

14' Windrower	72 man hours/yr
Medium Duty Baler	64 " "
Bale Wagon (55 Bale-PTO)	80 " "
Feed Bales (w/Pickup)	400 " "
	616 man hours/yr

Table 7. Typical Man-hour Requirements (Continued)

Big Round Bale System:	
14' Windrower	72 man hours/yr
Big Round Baler	52 " "
Mover (5 mi. Truck)	60 " "
Feed Bales (Tractor Mounted)	132 " "
	316 man hours/yr
Big Stack System:	
14' Windrower	72 man hours/yr
3-ton Stack Wagon	60 " "
Stack Mover	80 " "
Stack Feeder*	44 " "
	256 man hours/yr

600 Ton/Year

Conventional Bale System	
14' Windrower	108 man hours/yr
Medium Duty Baler	96 " "
Bale Wagon (104 Bale-PTO)	78 " "
Feed Bales (w/Pickup)	600 " "
	882 man hours/yr
Big Round Bale System:	
14' Windrower	108 man hours/yr
Big Round Baler	78 " "
Mover (5 mi. Truck)	90 " "
Feed Bales (Tractor Mounted)	198 " "
	474 man hours/yr
Big Stack Sytem:	
14' Windrower	108 man hours/yr
6-Ton Stack Wagon	78 " "
Mover (Farm)	60 " "
Stack Feeder*	30 " "
	276 man hours/yr

*StakFeeder man-hour requirements are computed from averaged data. Individual management techniques and haying conditions may raise or lower man-hour figures. 100T stack feeding figure based on .10 man-hours per ton; 400T stack feeding figure based on .11 man-hours per ton; 600T stack feeding figure based on .05 man-hours per ton.