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ROUND BALE HAY FEEDING SYSTEMS EVALUATION

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ROUND BALE HAY FEEDING SYSTEMS EVALUATION

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HAY IS AN IMPORTANT crop in most cattle producing areas. One major concern in the haying operation is the labor involved. The advent of large hay packaging systems has given cattle growers additional alternatives for hay handling which show great potential for reducing handling and labor costs. Researchers in Auburn University's Agricultural Experiment Station have compared several systems for handling and feeding hay. One of these was a comparison of stack and bale systems. Results from this study are available in Bulletin 455, which was published in 1974. In a later study, tests were conducted using large round and conventional bale systems and results were presented in Circular 216, which was published in 1975. The large hay packages have some attractive features, they also can produce some problems. In early feeding trials, using loose stacks fed free-choice, hay losses as high as 40 percent were reported. Field conditions adjacent to the stacks also became very muddy during winter rains.

In view of the problems sometimes encountered with large hay packages, Alabama researchers began a series of experiments to examine in detail some methods of handling these systems. This publication presents some of the results from the study.

GENERAL TEST CONDITIONS

The basic concerns of this research were to examine transport and feeding efficiency problems associated with round bales. This was a cooperative experiment among several units of the Agricultural

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Experiment Station System of Auburn University, including Departments of Agricultural Engineering, Agricultural Economics and Rural Sociology, and the Black Belt Substation in Marion Junction.

Twine wrapped bales of johnsongrass hay, 6 feet in diameter and 5 feet long, were used in the study. The bales were stored 1 foot apart on dallisgrass sod and were not covered. These bales were later used in several hay handling and feeding studies. Feeding sequences using four bales, one bale, and one-fourth bale per feeding were studied. Some bales were unrolled on the ground and others were placed inside feeding panels. Bales were transported with a pickup truck or with a tractor equipped with a front-end loader.

MACHINE AND SYSTEMS DETAIL

The above concepts were combined into three procedures referred to as Systems 1, 2, and 3. In System 1 bales were fed one at a time inside a panel. For System 2 the feeding rate was approximately one-fourth bale, unrolled on the sod, per feeding. The feeding rate per animal for System 2 was the same as System 1, so the only difference in the treatment was the method of feeding. In System 3, hay was fed four bales at a time inside two panels, each containing two bales. Details for each system were as follows:

System 1

Feeding Concept . . . . . One bale was fed at a time. It was fed free choice, on sod, inside a round metal panel.

Transport and Handling

Method 1A . . . . . A pickup truck was used to transport one bale per trip. The truck was driven to the open end of the panel and the bale rolled from it. Then, the panel was closed around it.

Method 1B . . . . . A tractor and front-end loader were used to transport bales to the feeding location and to place bales inside the panel.

System 2

Feeding Concept . . . . . Limited feeding in which unrolled parts of round bales on the sod were used. Hay was fed daily in the same quantity as in System 1 above.

Transport and Handling

Method 2A . . . . . Hay was loaded and transported the same as in System 1A. Bales were rolled from truck to ground. A tractor with a bale carrier and unroller were used to unroll hay on the ground for feeding. A tractor and carrier moved bales to an adjacent temporary storage area until the next daily feeding.

Method 2B . . . . . Much the same as 2A except that a pickup truck with a special frame was used for hauling two bales per trip. The first bale was unloaded and fed the same as in 2A. A second bale was placed in adjacent temporary storage and fed using a tractor and carrier after the first bale was utilized.

System 3

Feeding Concept . . . . . Four bales at a time were fed free choice on sod. Two bales were placed at each of two locations inside feeding panels. Four bales per feeding were used.

Transport and Handling

Method 3A . . . . . Two bales were transported per trip by pickup truck, unloaded by hand on sod and enclosed with a panel.

Method 3B . . . . . A tractor and front-end loader were used to transport one bale per trip and to place hay inside panels.

RESULTS

Results from the study are presented in several categories. These include labor, capacity, cost, animal performance, and managerial problems associated with each of the feeding systems.

Capacity and Labor

The labor needs and capacities of the systems under study are presented in Table 1.

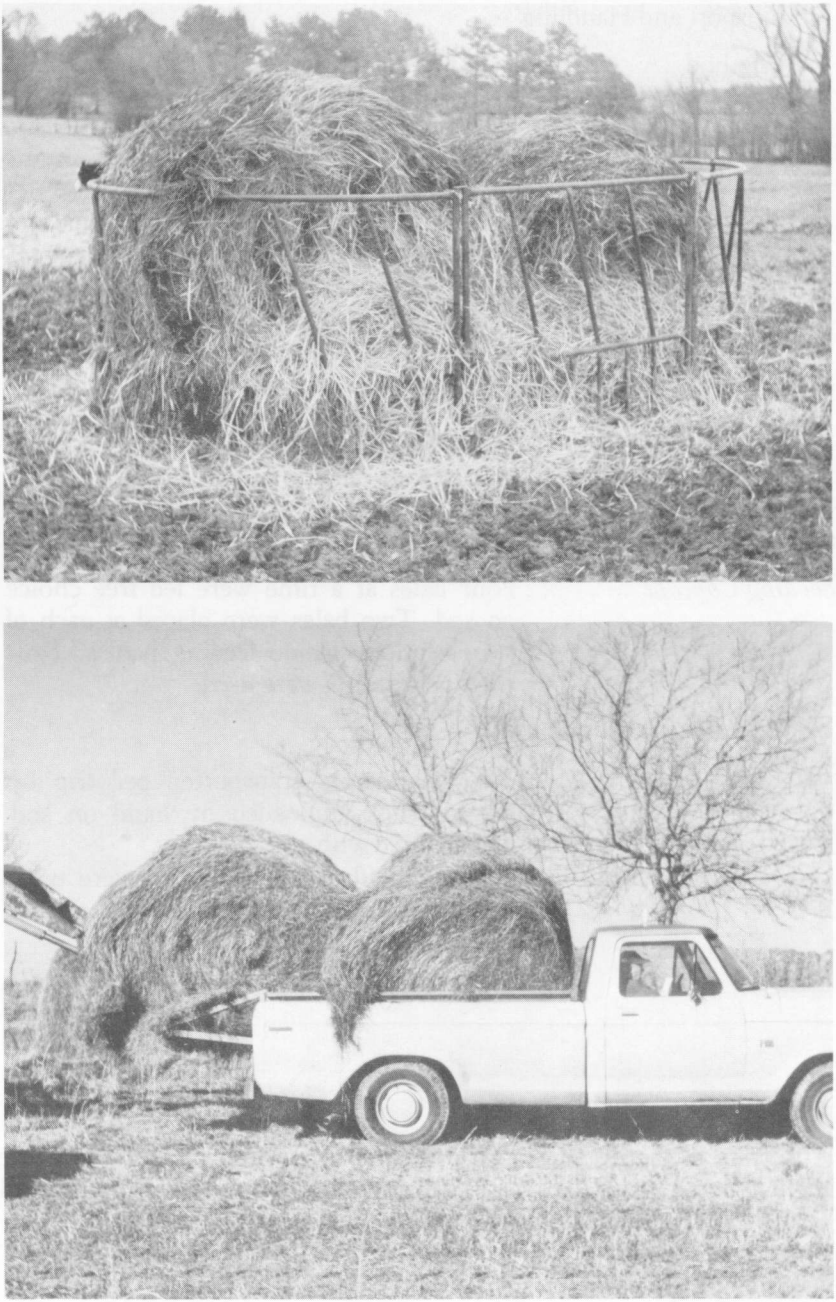

FIG. 1. (top) Two bales in two-bale panel as used in System 3. (bottom) One method of transport, hauling two bales on a pickup truck, specially equipped with an extension frame.

FIG. 2. (top) Two bales being transported with a tractor. NOTE: Front loaded bales should be transported close to the ground and at slow tractor speeds (see Highlights of Agricultural Research, Vol. 24, no. 2) (bottom) Round bale unrolling mechanism used in System 2.

TABLE 1. LABOR NEEDS AND CAPACITY FOR THREE ROUND BALE FEEDING SYSTEMS

Item	System 1		System 2		System 3	
	Method 1A	Method 1B	Method 2A	Method 2B	Method 3A	Method 3B
Bales per trip . . .	1	1	1	2	2	1
Bales per feeding .	1	1	¼	¼	4	4
Feeding concept .	Free choice		Limited*		Free choice	
Manpower used .	2	1	2-1**	2-1**	2	1
Hours per ton . . .	.28	.47	1.4	1.45	.28	.47
Man hours per ton	.56	.47	1.83	1.76	.56	.47

* Obtained same amount of hay as animals in System 1.
** Two men used only to transport bale, one man used remainder of time for feeding.

Unrolling hay daily on sod, System 2, required the largest amount of labor, about three times as much as the other systems. Transporting with a pickup truck and placing the bales in panels required the least amount of time in hours per ton. However, for efficient operation, this System requires two men. A truck with a dump bed could replace the second man. Transporting with the tractor and front-end loader and feeding bales in panels was intermediate in hours per ton but lowest in man hours per ton since only one man was used.

It is also interesting to note that transporting two bales per trip on a pickup truck did not increase the system efficiency over hauling one bale at a time in these feeding studies. The second bale was difficult for two men to push off the truck and required more time. A dump bed or a mechanical loader on a truck would help with this problem.

Animal Performance

Table 2 shows that animals in System 3, four bales in panels every 12 days, had the highest average daily gain, 1.44 pounds per day. System 2, hay unrolled on the sod, had the lowest gain, 1.11 pounds per day.

Hay needed per pound of animal gain was lowest for animals in System 1 and highest for System 3.

Economic Considerations

Table 3 shows the feeding cost per ton of hay for the three feeding systems for several levels of hay handled per year. These figures include machinery and labor costs.

System 2, unrolling one-fourth bale daily on sod, had the highest cost per ton. This might be expected since this system also has the highest machinery investment and greatest labor need.

The lowest feeding cost was for System 3A, hauling two bales per trip on a pickup truck and feeding four bales every 12 days. The next lowest cost was System 1A, hauling 1 bale per trip on a pickup truck and feeding one bale every four days.

Table 3 also suggests that using a tractor and front-end loader to transport round bales for feeding is more expensive than using a pickup truck. This was true for both the one bale and four bale feeding systems. From Table 3 it is evident that machinery and labor costs per ton decrease as the tons fed increase.

PROBLEMS

A number of problems were encountered during these hay feeding studies. Several of these were associated with unrolling hay in System 2. As hay was unrolled animals tended to gather around and walk on

TABLE 2. STEER UTILIZATION OF HAY IN THREE ROUND BALE FEEDING SYSTEMS

Item	System 1 one bale in panel	System 2 hay unrolled on sod	System 3 four bales in panels
Animals, no.	13	14	14
Days on test, no.	94	94	94
Initial av. wgt., lb.	496	493	503
Final av. wgt., lb.	605	597	639
Gain, lb.	109	104	136
Av. daily gain, lb.	1.17	1.11	1.44
Hay available per pound gain, lb.	15.04	16.00	16.45
Hay available per day per animal, lb.	17.7	17.7	23.6

TABLE 3. HAY FEEDING COSTS FOR THREE ROUND BALE FEEDING SYSTEMS

Item	Volume of hay per year Ton		
	250	500	1,000
System 1A **One Bale in Panel-Pickup Truck Hauling One Bale**			
Feeding cost per ton of hay	$ 3.17	$ 3.15	$ 3.12
System 1B **One Bale in Panel-Tractor w/Front-End Loader Hauling One Bale**			
Feeding cost per ton of hay	$ 4.62	$ 4.02	$ 3.59
System 2A **Hay Unrolled on Sod by Tractor-Pickup Truck Hauling One Bale**			
Feeding cost per ton of hay	$ 9.85	$ 9.22	$ 8.61
System 2B **Hay Unrolled on Sod by Tractor-Pickup Truck Hauling Two Bales**			
Feeding cost per ton of hay	$ 9.70	$ 9.06	$ 8.45
System 3A **Four Bales in Panels-Pickup Truck Hauling Two Bales**			
Feeding cost per ton of hay	$ 2.53	$ 2.52	$ 2.49
System 3B **Four Bales in Panels-Tractor w/Front-End Loader Hauling One Bale**			
Feeding cost per ton of hay	$ 4.19	$ 3.57	$ 3.14

*Cost determined using recommendations from ASAE Agricultural Machinery Management Data D230.2.

it. This resulted in hay contaminated with mud and increased hay waste.

In the unrolling studies two tractors were used, one to load bales at the storage area and another to unroll hay for feeding. Some farmers would object to using two tractors for this operation. Where hay is stored adjacent to the feeding area, the tractor with unroller could be used to transport hay. Since hay is unrolled, daily labor requirements may be excessive for some cattlemen. If controlled or limited feeding is practiced, it is difficult to unroll the amount of hay desired for each day.

When feeding panels are used, mud becomes a problem during wet weather in the area around the panels where the animals feed. Some farmers have reported loss of pasture grass stands under hay in the panels and the adjacent feeding area. Periodic relocation of feeding panels should relieve these problems.

CONCLUSIONS

The following conclusions can be drawn from these round bale feeding studies:

(1.) Feeding round bales daily by unrolling hay on sod showed labor needs as high as 1.83 man-hours per ton of hay fed. Machinery and labor feeding costs were also highest for this system.

(2.) Using the pickup truck and two men to feed round bales in panels required the least hours per ton.

(3.) Using a tractor and front-end loader to feed round bales in panels requires the least man-hours per ton.

(4.) The lowest labor and machinery cost per ton of hay fed was the system using a pickup truck hauling two bales per trip and feeding four bales at a time, System 3A.

(5.) Labor for feeding was needed daily in System 2, every 4th day in System 1 and every 12th day in System 3.


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