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COST COMPARISONS of JOHNSONGRASS SILAGE and HAY
Black Belt Substation, 1953-54

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Increased interest in preserving grass silage has been shown by Black Belt dairymen in recent years. The Black Belt Substation preserved Johnsongrass silage and Johnsongrass hay as a part of the experimental work carried out during 1953 and 1954.

Data presented in this report are based primarily on actual experience and records kept during the 2 years. However, production costs of Johnsongrass were calculated from previous research work.

Costs, as presented, will vary among farms and years, but they are given to help farmers make decisions on how to preserve this forage crop.

Production Costs

The production costs of Johnsongrass included an annual land charge of 6 per cent on land valued at $100 per acre. Caley peas were grown on this land during winter, and Johnsongrass during summer.

Johnsongrass was seeded every 5 years, and Caley peas every 3 years. Five hundred pounds of 0-16-8 fertilizer per acre was applied annually. One-third of all costs was charged to each of two cuttings of Johnsongrass, and one-third to Caley peas.

The total production cost of Johnsongrass, which included land preparation, seed, fertilizer, and seeding, is given in Table 1. The costs per ton are based on a yield of 1.33 tons of hay per acre for each cutting and a yield of 4.41 tons of silage per acre.

Harvesting Silage and Hay

In the summer of 1953, a 12-acre field of Johnsongrass about three-fourths of a mile from the silo and barn was divided into two equal areas. One area was harvested as silage, and the other as hay. Harvesting of both silage and hay was begun the same day. The silage and hay were used in a feeding experiment with dairy cows in the winter of 1953-54.[2]

1/ Superintendent and Assistant Superintendent, Black Belt Substation, The authors acknowledge the assistance of J. L. Butt, Associate Agricultural Engineer, and J. H. Yeager, Associate Agricultural Economist, Agricultural Experiment Station of the Alabama Polytechnic Institute, Auburn.

2/ See mimeographed report, "Johnsongrass Silage and Hay Feeding Experiment with Dairy Cows, Black Belt Substation" by W. B. Kelley, L. A. Smith, and George E. Hawkins, Jr. Issued February 1955.

Most of the Johnsongrass was in the boot stage at cutting time, with an occasional seed head showing. For silage, it was cut with a forage harvester (driven by tractor power take-off) and blown directly into a trailing wagon.

One man with a 32-horsepower tractor operated the forage harvester. Another man with tractor shuttled two wagons between the field and the silo. One wagon was equipped with a canvass unloader, and the other with a false end-gate unloader. Both unloaders worked satisfactorily. A third man stayed at the silo and helped unload the wagons. Between loads, the man at the silo leveled and packed the silage.3/ A third tractor located at the silo powered the silage blower.

Silage with a moisture content of 66.8 per cent was blown into a 44-foot upright steel silo. No preservative was added. A summary of harvesting costs is given in Table 2. Harvesting machinery costs were calculated at two different levels of annual use to point out how costs per hour decrease with more use. The machinery costs included depreciation, insurance, taxes, housing, interest on investment, repairs, fuel, and lubrication.4/

Johnsongrass hay was cut and the stems cracked with a hay crusher to permit rapid drying.5/ Costs given in Table 3 are based on use of a hay crusher with mower attachment; therefore, only one tractor was required to mow and crush the hay.

One man with a 32-horsepower tractor operated the hay mower-crusher. One man with a side-delivery rake on a tractor windrowed the hay. The windrow was turned once before baling, and one man using a pickup baler with auxiliary engine baled the hay. The hay was loaded on a 1½-ton truck with a bale loader. A crew of three men was used in hauling; one man drove the truck and the other two took bales from the loader and placed them on the truck. The three men unloaded the hay by hand and stacked it in a hay barn.

The original costs of new harvesting machinery used in making silage and hay are given in Table 4.

Additional data on harvesting of silage and hay follow:

Silage

1. Average time to load wagon (1.85 tons) was 37 minutes.
2. Average total travel time per load was 11 minutes.
3. Average time to unload wagon was 13 minutes.
4. Average time for lubrication, adjustments, sharpening knives, etc. was 5.85 minutes per load.
5. Average number of tons hauled and placed in silo per hour was 2.59.
6. Average number of man hours required per ton was 1.16.

3/ Based on subsequent experience, more thorough packing is needed than was done by one man in this instance.
4/ For an explanation of how machinery costs were calculated, see Appendix.
5/ See mimeographed report, "Report of Results from Testing Hay Crushing Machines" by J. L. Butt, W. B. Kelley, C. M. Martin, and L. A. Smith. Issued May 1953.

Hay

1. Mowing and crushing was done at the rate of 1.28 acres or 1.70 tons per hour.
2. Raking and turning windrow once was done at the rate of 1.70 acres or 2.26 tons per hour.
3. Baling was done at the rate of 101.5 bales (average of 74 pounds each) or 3.76 tons per hour.
4. Loading on truck, hauling, and stacking in barn was done at the rate of 1.67 tons per hour.
5. Average number of man hours per ton of hay was 3.10.

Storage of Silage and Hay

The storage costs of Johnsongrass silage and hay are given in Table 1. Silage was stored in an upright silo with a capacity of approximately 120 tons of Johnsongrass silage. New cost of the silo was $2,164. Depreciation, taxes, and interest on investment were calculated at 3 per cent, 0.52 per cent, and 3 per cent, respectively, of the new cost.

The baled hay was stored in a 40-ton capacity barn of pole and metal construction. New cost of the barn was $769. Annual use costs were calculated on basis of depreciation at 3 per cent, taxes at 0.63 per cent, interest on investment at 3 per cent, and insurance at 0.84 per cent of the new cost.

Feeding of Silage and Hay

The costs of feeding silage, given in Table 1, were for silage thrown down by hand from the silo into a silage cart and forked from the cart into troughs near the silo. Cost of labor was figured at 50 cents per hour. The hay was placed directly from the storage barn into feed racks.

Results

The total cost of producing, harvesting, storing, and feeding Johnsongrass hay was less than that of Johnsongrass silage. Johnsongrass hay cost $3.72 per ton less than Johnsongrass silage on a dry matter basis when the basis for calculating costs of harvesting equipment was 150 hours of use per year.

The cost of harvesting Johnsongrass hay was 32 per cent more per ton of dry matter when the equipment was used 60 hours per year than when it was used 150 hours per year. The cost of Johnsongrass silage was 35 per cent more when the equipment was used 60 hours per year than when it was used 150 hours. These data show conclusively that with normal farm use harvesting costs per ton of both Johnsongrass silage and hay decrease as the total annual hours of machinery use increase.

Table 1. Summary of Production, Harvesting, Storage and Feeding Costs of Johnsongrass Silage and Hay, Black Belt Substation, 1953-54

Cost item	Cost per ton at two levels of equipment use[1]			
	60 hours per year		150 hours per year	
	Silage	Hay	Silage	Hay
Production	$ 1.41	$ 4.68	$ 1.41	$ 4.68
Harvesting	3.93	8.83	2.90	6.68
Storage	1.18	1.44	1.18	1.44
Feeding	.54	.25	.54	.25
Total cost	$ 7.06	$15.20	$ 6.03	$13.05
Total cost per ton of dry matter[2]	$21.27	$16.82	$18.16	$14.44

1/ See Appendix for method of calculating costs and explanation of hours' use of equipment.
2/ Moisture content of the silage was 66.8 percent and of the hay, 9.66 per cent.

Table 2. Cost of Harvesting Johnsongrass Silage, Black Belt Substation, 1953

Machinery and equipment used	Cost per ton at two levels of equipment use[1]	
	60 hours per year	150 hours per year
1 32-HP tractor (pulling forage harvester)	$ .47	$ .46
1 32-HP tractor (pulling wagons)	.40	.39
1 26.5-HP tractor (pulling silage blower)	.31	.31
1 forage harvester, 48-inch cut (driven by tractor power take-off)	1.50	.68
1 silage blower	.55	.36
2 silage wagons	.12	.12
Total machinery cost per ton	$ 3.35	$2.32
Labor cost per ton (50 cents per hour)	.58	.58
Total harvesting costs per ton	$ 3.93	$2.90
Total harvesting costs per ton of dry matter[2]	$11.84	$8.73

1/ See Appendix for method of calculating costs and explanation of hours' use of equipment.
2/ Moisture content of silage was 66.8 per cent.

Table 3. Cost of Harvesting Johnsongrass Hay, Black Belt Substation, 1953

Machinery and equipment used	Cost per ton at two levels of equipment use[1]	
	60 hours per year	150 hours per year
1 32-HP tractor (pulling hay crusher)	$ .76	$ .76
1 32-HP tractor (pulling hay baler)	.30	.30
1 26.5-HP tractor (pulling side-delivery rake)	.36	.36
1 hay crusher (mower attached)	2.03	.90
1 side-delivery rake	.29	.22
1 pickup baler (with auxiliary engine)	1.49	.71
Wire for bales	.95	.95
1 1½-ton truck	.72	.72
1 bale loader	.38	.21
Total machinery cost per ton	$7.28	$5.13
Labor cost per ton (50 cents per hour)	1.55	1.55
Total harvesting cost per ton	$8.83	$6.68
Total harvesting cost per ton of dry matter[2]	$9.77	$7.39

1/ See Appendix for method of calculating costs and explanation of hours' use of equipment.
2/ Moisture content of the hay was 9.66 per cent.

Table 4. Cost of New Silage and Hay Harvesting Machinery and Equipment Other Than Tractors and Truck, Black Belt Substation, 1953

Machinery and equipment	Cost new
For silage:	
Forage harvester, 48-inch cut, power take-off driven	$1,585
Silage blower	750
2 silage wagons	600
Total	$2,935
For hay:	
Hay crusher, mower attached	$1,400
Side-delivery rake	400
Pickup baler with auxiliary engine	2,900
Bale loader	400
Total	$5,100

Appendix

Procedure for Calculating Machinery Costs

Machinery costs as presented in Tables 1, 2, and 3, with one exception, are based on information included in the publication "Crop Machines Use Data", AE Data 2, published June, 1949, by the American Society of Agricultural Engineers, Saint Joseph, Michigan, revised January, 1953. Repair costs on all tractors were figured at 70 per cent of new costs, rather than at 35 per cent.

The general procedure for calculation of machinery costs was as follows:

A total of 525 hours of general farm use per year was assumed for tractors. The 60 and 150 hours of use for harvesting hay and silage were in addition to general use. Depreciation costs per hour per $100 of new costs were derived on basis of these hours of annual use, 7,500 hours of life, and 15 years until the equipment is obsolete. This figure multiplied by the number of hundred dollars of new cost gave the depreciation cost per hour. Repairs, interest, housing, taxes, and insurance were calculated by a similar method. In addition, operating costs per hour, which included fuel, oil, and lubrication, as well as time for lubrication, adjustments, sharpening knives, etc., were determined on basis of actual use. Costs per ton were calculated by dividing the total costs of harvesting hay or silage (based on hours of use of machinery and equipment and cost per hour) by the total tons harvested.

Costs for the use of all machinery and equipment were based on levels of 60 and 150 hours. However, in the silage operation the blower would actually be used only 18 hours for blowing into the silo the quantity harvested by the forage harvester in 60 hours. If costs for operating the silage blower had been calculated for 18 instead of 60 hours and for 45 instead of 150 hours, total costs per ton would have been slightly different from those reported.

In harvesting hay, 60 or 150 hours of use for the baler would necessitate more than this amount of use for the hay crusher, rake, and bale loader. Therefore, if costs were calculated on this basis, they would be somewhat less per ton than those presented in Table 3. An actual use basis for each machine rather than the two levels of use assumed for all machines in calculating harvesting costs would not alter the conclusions on comparative costs of Johnsongrass silage and hay.

The importance of using machinery and equipment more hours per year in order to reduce costs per hour is further shown in Appendix Table 1.

Appendix Table 1. Relationship of Hours of Use to Fixed Costs per Hour for Selected Equipment Used in Johnsongrass Silage and Hay Study, Black Belt Substation, 1953

Hours of use per year	Fixed costs per hour of use[1]	
	Pickup baler ($2,900 new cost)[2]	Forage harvester[3] ($1,585 new cost)
30	$10.53	$7.61
60	5.31	3.88
90	3.69	2.70
150	2.36	1.75

1/ Fixed costs include depreciation, interest, housing, taxes, insurance, and repairs but do not include the cost of fuel and lubrication for the baler and lubrication for the harvester.
2/ This does not include cost of wire used by the baler, which would add $3.57 to each of these amounts.
3/ Depreciation rate on the forage harvester was assumed to be the same as that for a combine.