Nutritional Differences in Hay
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Cut May 31 Baled June 3		Cut June 26 Baled June 30	
Digestibility	68%	Digestibility	50.5%
Protein	17.7%	Protein	11.4%
Fiber	18.5%	Fiber	31.8%
Value per ton	$31.46	Value per ton	$13.79
Intake 1300# cow	56 lb	Intake 1300# cow	30 lb
	84% alfalfa 49% leaves		19% alfalfa 8% leaves

By D. Hillman, B. H. Bean, J. W. Thomas, and E. J. Benne[1]

Nutritional value of hay often varies considerably from field to field and from farm to farm.

Recent research of hay from mid-Michigan farms, where known harvesting procedures were used, showed substantial differences in protein and fiber content as well as digestibility and intake of animals. This affects value per ton.

Most of the causes for these variations can be controlled by the haymaker. The research showed that:

Hay harvested June 1 returned $8.70 more per ton in higher digestible dry matter and protein value than that harvested June 20. The June 1 hay was worth 530 pounds more potential milk production per ton than hay harvested June 20. The early hay required an estimated 7.3 pounds less grain per cow per day to maintain the same level milk production as that from hay harvested June 20.

Each 10% loss of leaves reduced feed value $4.81 per ton.

Percentage of protein in the hay varied directly with alfalfa content.

Weather damage reduced feed value an average of $3.49 per ton, ranging from no detectable loss to total loss.

Second and third cuttings tended to be uniform in quality and more valuable than late harvested first cutting but none were as good as the best early harvested first cutting hay.

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DATE OF HARVEST

Harvesting date proved to be the most important single factor affecting all four measures of quality--digestibility, digestible dry matter intake (DDMI), protein, and fiber. Table 1 shows the average value of the hay samples at various harvesting dates.

Digestibility of forages (90% dry matter) ranged from 68% to 48%, a 42% difference in feed value. Digestibility decreased by about three-tenths percent every day harvesting was delayed after May 30. This rate of decrease is similar or less than that found for hays in northeastern U.S.

Protein content of hay decreased at the average rate of 0.16 percentage units per day. The average protein content on various dates of harvest is shown in Table 1.

Dollar value of forages was based on a price of $20 per ton for ordinary hay harvested June 20 and the difference in replacement value of total digestible nutrients (TDN) and protein from corn at $2 per bushel and soybean meal at $5 per cwt.--TDN costing 1.7¢ per pound and protein 9.3¢ per pound.

Table 1. Nutritional and Dollar Value of First Cutting Hay Harvested on Various Dates

	Harvesting Date					
	May 25	June 1	June 13	June 20	June 27	July 10
	%	%	%	%	%	%
Digestibility	63.0	61.0	57.0	54.0	51.0	48.0
Crude protein	18.0	17.2	15.3	14.1	12.9	11.2
Crude fiber	20	22	26	29	32.0	35
Dollar Value	$32.15	$28.70	$23.45	$20.00	$16.55	$12.01

Based on 90% dry matter hay. Estimated from the following equations where x = no. days after April 30.
Digestibility = 70.1 − .3x
Crude protein = 24 − .16x
Crude fiber = 14.5 + .34x
Digestibility = 78.1 − .72x (x = % crude fiber)

The combined effects of decreased digestibility and protein content resulted in a daily decline in feed value of 45 cents per ton of hay harvested. Hay harvested May 25 was worth $12 per ton more in feed value than that harvested June 20.

Digestible dry matter intake (DDMI) declined directly with delay in harvesting.

Table 2 indicates a DDMI of 31.5 pounds daily from hay harvested May 25, sufficient to produce 67 pounds of milk daily. In contrast, the cow consumed only 24 pounds of digestible nutrients from hay harvested June 20, enough to produce 44 pounds of milk. The hay harvested June 20 would require an additional ten pounds of shelled corn to provide the same amount of nutrients as supplied by the hay harvested May 25. Earlier harvesting results in higher digestibility of hay, higher consumption, and higher potential milk production--with less grain required.

Table 2. Estimated Digestible Dry Matter Intake (DDMI) , Milk Production and Grain Required to Balance Forages Cut on Various Dates (1,300- lb. Cow)

	Harvesting Date					
	May 25	June 1	June 13	June 20	June 27	July 10
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
DDMI per 100 lbs. body weight	2.42	2.24	2.00	1.85	1.70	1.41
Hay intake	50.0	48.4	45.6	44.4	43.2	38.1
DDMI per day	31.5	29.5	26.0	24.0	22.0	18.3
DDMI available for milk	21.5	19.5	16.0	14.0	12.0	8.3
Milk production per cow per day*	67.0	61.0	50.0	44.0	37.5	26.0
Grain to equal May 25	0	2.7	7.3	10.0	12.0	17.6
Milk potential per ton of hay	2,770	2,400	2,190	1,970	1,740	1,360

DDMI/cwt = 2.97 − .022 x (x = days after April 30)
* Allowing 10 lb. DDM per day for maintenance and 0.32 lb. DDM per lb. of milk.

WEATHER DAMAGE

Rain damage tended to reduce digestibility, protein content, and DDMI, and increase crude fiber content of hay.

The average reduction in feed value due to weather damage was $3.49 as shown in Table 3. Reduction in DDMI was 0.77 lb per 100 lb of body weight or about 10 lb of hay per day. Effect of weather damage varied considerably depending on the amount of exposure to rain, and handling required to re-dry the hay. One sample that was exposed to rain several times over a period of 13 days and raked repeatedly was estimated to be worth $15 per ton less than comparable hay without weather damage. In reality, this hay was worthless for feed since cattle refused to eat it. Where there was very little rain damage, there was not a detectable difference in feed value from hay cut on the same date without rain.

Table 3. Effect of Rain on First Cutting Hay – 90% Dry Matter, Barry County Samples 1967

	Digestibility	Protein	Fiber	Hay Intake*	Value per Ton
	%	%	%	lbs.	
No rain	58.1	14.2	25.2	3.32	$21.61
Rain	52.3	13.4	32.5	2.55	$18.12
Loss due to rain	5.8	-.8	+7.3	-.77	$-3.49

* Per 100 lbs. of body weight.

ALFALFA CONTENT

Protein content was closely related to the percentage of alfalfa in the hay. Protein is generally more expensive than energy and was estimated to be worth 9.3 cents per pound for corn at $2/bu. and soybean meal at $5/cwt. While hay without alfalfa was estimated to contain 9 percent protein, each 10 percent increase in alfalfa content increased protein 1.15 percent and dollar value $2.12 per ton.

However, the high value of alfalfa is advantageous only to the extent that the protein is required in the livestock ration. Once protein requirements have been met, it is worth no more than energy for livestock production.

Alfalfa content is apparently not related to digestibility of hay. For example, a very leafy timothy hay harvested May 25 was the second most highly digestible of the samples, although containing only 10.6 percent protein.

LEAF CONTENT

The second most important item affecting the digestibility and protein content of hay was leaf content. Samples ranged from 8 percent to 49 percent leaf content. Digestibility and protein content were highly correlated with leaf content.

Each 10 per cent loss of leaves reduced digestibility 4.7 percent, protein 1.73 percent, and feed value $4.81 per ton by requiring additional corn and soybean meal.

Harvesting methods that preserve a high percentage of leaves are important to produce high quality forage. These include: cutting in bud stage of maturity, raking when damp, avoiding flail type mower conditioners that strip leaves from stems, proper use of hay conditioners to dry stems and leaves uniformly, avoiding rain damage, avoiding baling or chopping when too dry, and using covered wagons for chopping hay or haylage.

SECOND AND THIRD CUTTINGS

Second and third cuttings tend to be more uniform in quality than first cuttings and more valuable than late harvested first cuttings, but none were as good as the best first-cut hay. Average values for various times of cutting are compared in Table 4. Note that first cuttings harvested before June 10 averaged higher in digestibility than either second or third cuttings. Small variations in protein content tended to put a higher price tag on second and third cuttings even though their value in animal production may have been lower than early harvested first cutting hay. Usually, re-growth should be harvested 35-40 days after the previous cutting.

Table 4. Feed Value of First, Second, and Third Cutting Hay – 90% Dry Matter Barry County 1967

	Digestibility	Protein	Hay Intake*	Value/Ton
	%	%	lbs.	
First cutting	56.2	13.9	3.06	$20.45
Second cutting	55.0	16.9	3.73	$25.67
Third cutting	60.0	17.2	3.91	$27.71
1st cutting-before June 10 (no rain)	62.5	15.6	3.59	$25.64
1st cutting-before June 10 (rain)	58.6	15.3	3.22	$23.72
1st cutting-after June 10	52.4	11.9	2.82	$13.31

* Per 100 lbs. of body weight.

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