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High Moisture Earcorn

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High moisture earcorn (HMEC) is a common feed in many dairy states. The feed is relatively new in Idaho with only a few dairy and livestock producers using HMEC in their rations. The ear is removed from the plant, processed by grinding and then ensiled. In Idaho, conventional bunker silos have been used for HMEC storage with good success. The final product is about 85 percent grain with the balance primarily cob. HMEC has more to offer to the dairymen now than in past years because of changing feeding practices. The following discussion will review the current technology on HMEC.

Feeding

Most feeding information is based on research from the Midwest and field observations. Cows will produce about the same on HMEC compared to shelled corn according to Wisconsin research. In 3 years of research trials, no difference was noted in dry matter intake between cows on HMEC vs. shelled corn. Cows on HMEC produced slightly more fat-corrected milk because of higher fat tests. Similar results have been reported in other states. These test data are based on clean HMEC consisting primarily of kernels and cobs with minimum other nonear plant trash.

Dairymen feeding for maximum production with high concentrate levels are usually fighting to maintain ration crude fiber levels above 17 percent on a dry matter basis. High quality, low fiber alfalfa hay also creates a total ration fiber problem. The higher fiber in HMEC (7 to 10 percent on a 100 percent dry matter) is a plus in most Idaho dairy rations. Researchers report less problems with feed intake and milk fat depression when compared to shelled corn.

HMEC has been used to replace standard energy feeds such as barley and corn with good success in both research and field trials. HMEC blends well with roughage and other feeds in complete mixed

rations. Total ration moisture should be considered before HMEC is selected as a feed. Rations based on high moisture roughages (corn silage, alfalfa silage or haylages) may limit intake in high producing cows if HMEC is added as the major concentrate and if total ration dry matter drops below 50 percent. HMEC is usually slightly lower in protein (8 to 10 percent) than barley, corn or wheat and may increase the required supplementation of protein. HMEC may be best suited for dry alfalfa based rations.

Harvesting and Storing

Corn should be harvested after the plant reaches physiological maturity. Kernel moisture normally falls within the 32 to 36 percent range when this occurs. A visual black layer develops at the base of the kernel when the plant has reached this level of maturity (Fig. 1). Maximum nutritive value is obtained at this point in development.

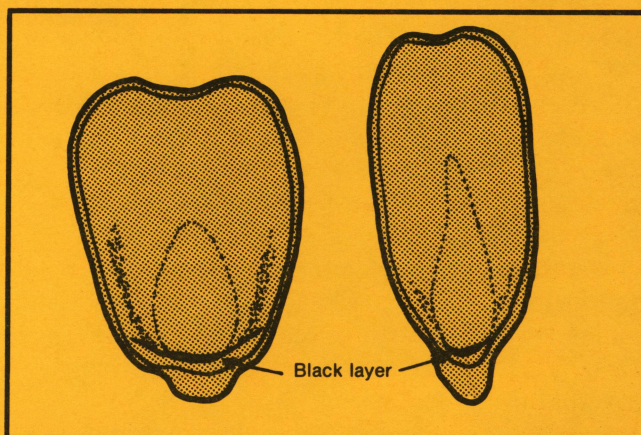


Fig. 1. Allow corn to reach physiological maturity so maximum amounts of nutrients have accumulated in kernels. Check for physiological maturity by taking several ears from random locations in the field. Remove several kernels from the center two-thirds of each ear, and split the kernels. Do not select kernels from the ends of the ear. If the tips have a black layer, the corn is physiologically mature.

Table 1. Dry matter percentages for plant components in high moisture earcorn operations.

Operation	10-ear field sample ¹			
	HMEC DM ²	Cob DM	Kernel DM	Ear DM
	(%)	(%)	(%)	(%)
1	56.0	46.4	59.0	56.0
2	73.0	50.8	73.0	67.5
3	57.3	49.4	68.0	63.9
4	67.4	53.0	72.1	68.4
5	66.0	49.0	78.4	72.4
6	70.5	58.0	75.7	66.8
7	57.3	53.8	73.7	70.3
8	56.2	47.6	65.4	60.9
9	76.8	54.6	77.9	74.3
10	<u>59.5</u>	<u>46.0</u>	<u>65.3</u>	<u>60.9</u>
Average	64.0	50.9	70.9	66.1

¹Ears collected at harvest and separated in cob and kernel fraction before dry matter determination.

²Ground product at the time of harvest.

Most researchers suggest an optimum moisture of 33 percent (67 percent DM) for HMEC. Dry matter in HMEC has been in the 55 to 70 percent range in most Idaho samples and seems to work well for storage in bunker type silos (Table 1).

Each component of the ear will contain a different moisture percentage. For example, the cob portion will be higher in moisture than grain (Table 1). Kernel moisture can be used to estimate whole ear moisture (Table 2). Mold and excess spoilage may occur in HMEC ensiled below 30 percent moisture. Adequate packing is also more difficult on drier HMEC.

A number of field equipment combinations can be used to harvest HMEC. Product quality plus harvest cost should be considered in selecting the most desirable combination. It is generally agreed that clean HMEC is preferred, and added trash (nongrain plant parts) lowers the quality of the final product. HMEC with added trash will be higher in fiber and lower in energy.

Earcorn must be ground before ensiling. HMEC should be ground adequately so nearly all kernels are cracked. Cob pieces should be broken into 1/2 inch diameter to prevent sorting by cattle and separation in handling.

Most Idaho producers are using a forage harvester equipped with a snapper head to harvest and field process HMEC. Screen selection has ranged from 1/2 to 1 inch. Some nongrain plant parts will be harvested using this system.

HMEC can also be processed at the silo. In these operations, the corn is picked and/or harvested with a combine and hauled to the silo. The product is ground and ensiled. Tub grinders have been used with success in southern Idaho. Other types of stationary grinding devices could also be used. Nongrain

Table 2. Approximate relationship of whole earcorn moisture to kernel moisture.*

Kernel moisture	Whole ear moisture
(%)	(%)
22	25 to 26
24	28 to 29
26	31 to 32
28	33 to 34
30	35 to 36
32	37 to 38
34	39 to 40
36	41 to 42
38	43 to 44
40	45 to 46

*University of Wisconsin Extension Bulletin A3095, Preserving and Storing High-Moisture Corn Treated with Propionic Acid.

plant trash is usually held to a minimum in these systems. The combine is usually adjusted to allow cobs to remain with the grain during harvest. Some cobs may be lost in combining.

HMEC silos should be adequately packed and covered to reduce spoilage. Some Idaho dairymen have added water at ensiling to increase moisture and aid in packing.

Setting a Price for HMEC

The majority of HMEC used in dairy and livestock rations is purchased at harvest. The final agreed price between grower and feeder should reflect:

1. Expected animal performance compared to alternative feeds; and
2. Fair market value for the grower compared to alternate harvest methods.

Since HMEC will vary in moisture, buying and selling pricing must be based on dry matter. The buyer and seller must agree upon sampling procedures and methods of dry matter analysis. Dry matter can be handled three ways:

1. Convert harvested yield to 100 percent dry basis;
2. Convert harvest yield to 87 percent dry matter of shelled corn; or
3. Set the desired dry matter, and adjust yield to this base.

HMEC must be treated as a concentrate in pricing the dry matter. Shelled corn makes a logical base since high quality HMEC will be about 85 percent grain on a 100 percent dry matter basis. Samples collected (38) in southwestern Idaho averaged 84.8 percent grain, with two-thirds of the samples falling in the range from 82.4 percent to 87.1 percent grain. These data are similar to values for grain and cob percentages summarized and reported from other projects.

Table 3. HMEC grain composition of 10 field operations.

Operation	Dry matter composition ¹		% husk
	% grain ² kernels and cob only	% grain ³ kernels, cobs and husks	
1	81.3	78.7	3.2
2	81.4	81.4	0
3	83.8	83.8	0
4	85.1	85.1	0
5	86.3	84.1	4.9
6	87.6	82.8	4.7
7	87.1	84.7	3.2
8	80.7	77.3	2.8
9	85.0	82.7	3.6
10	82.7	82.7	0

¹Based on 10-ear field sample. Samples were collected to represent the materials entering the forage harvester.

²Based on total dry matter of kernels and cob.

³Based on total dry matter of kernels, cob and husk.

Under ideal harvest situations, the ground product will consist of kernels and cob. If husks, leaves and stalk parts are harvested, the percent grain is lowered, fiber increases and animal performance will be reduced. Grain levels were calculated in 10 HMEC field operations (Table 3). In six of these operations, 2.8 to 4.9 percent of the total dry matter was husk.

The remaining four operations were processing HMEC consisting of 100 percent kernels and cob. Other nonear plant parts are also ground into the HMEC product in many operations. Price must reflect this noncob and nonkernel fraction. For example, in a random sample of material entering the forage chopper in an HMEC operation, the total dry matter was 75.8 percent kernel, 13.5 percent cob, 5.8 percent husks and 4.9 percent nonear plant parts. The ensiled product was near 13 percent crude fiber. A cleaner HMEC product from the same fields (removing husks and plant parts) would result in feed consisting of 84.8 percent kernels and 15.2 percent nongrain.

Fiber may be the best indicator of grain content in the final product. To illustrate this relationship, data in Table 4 were generated using standard fiber values for grain and nongrain. Acid detergent fiber, energy and/or TDN could also be used to reflect grain content.

Pricing - An Example

Let's assume:

- HMEC harvested at 40 percent moisture; 60 percent dry matter;
- Grain content priced on shelled corn at \$6/100 lb at 87 percent dry matter;
- Nongrain content priced on 1/2 shelled corn price \$3/100 lb at 87 percent dry matter; and

Table 4. Calculated fiber levels of different grain to nongrain ratios in HMEC.*

Grain	Nongrain	Calculated fiber
(%)	(%)	(%)
87	13	6.29
86	14	6.62
85	15	6.95
84	16	7.28
83	17	7.61
82	18	7.94
81	19	8.27
80	20	8.60
79	21	8.93
78	22	9.26
77	23	9.59
76	24	9.92
75	25	10.25
74	26	10.58
73	27	10.91
72	28	11.24
71	29	11.57
70	30	11.90

*Calculations for fiber based on 2% crude fiber for kernels and 35% crude fiber for nonkernel fractions (stalks, cobs, husks, leaves, etc.).

- Grain content estimated at 85 percent of HMEC dry matter.

Step 1 — Convert shelled corn and nongrain base to price per pound dry matter:

\$6.00 shelled corn at 87 percent dry matter =
\$6.90 per 100 lb dry matter (\$6.00 divided by .87
= \$6.90 per 100 lb dry matter)

\$6.90 per 100 lb dry matter = \$.069 per lb dry matter.

\$3.00 nongrain at 87 percent dry matter = \$3.45
per 100 lb dry matter (\$3.00 divided by .87 =
\$3.45 per 100 lb dry matter)

\$3.45 per 100 lb dry matter = \$.0345 per lb dry matter.

Step 2 — Calculate ton value of HMEC on field basis. Per ton calculations are:

2,000 lb HMEC
 .60 dry matter percent
1,200 lb dry matter/ton
1,200 lb dry matter
 .85 dry matter percent grain
1,020 lb grain per ton

1,200 lb dry matter
 .15 dry matter percent
180 lb nongrain per ton

Price per ton calculations are:

1,020 lb grain/ton
 .069 price per lb grain dry matter
\$70.35 grain value per ton

180 lb nongrain/ton
 .0345 price per lb nongrain dry matter
\$6.21 nongrain value per ton

Total Price:
\$70.35 grain value
+ 6.21 nongrain value
\$76.56 per ton HMEC*

*Value per ton field weight based on HMEC harvested at 40 percent moisture and 60 percent dry matter using \$6 shelled corn at 87 percent dry matter and 1/2 shelled corn price for nongrain portion as base prices. Also let's assume HMEC in this example is 85 percent grain on a dry basis. In this example shelled corn is used as a base feed for pricing. The buyer and seller must agree on a base price plus the base feed.

Again, we need to stress that many methods can be used to price HMEC. Details should be agreed upon by the buyer and seller. Important points are: (1) dry matter consideration, (2) estimated grain content, (3) base feed prices to calculated dollar values and (4) harvesting cost.

Summary

HMEC is ideally suited for dairy cattle rations. Moisture content of the total ration must be given consideration before feeding. A high quality product consisting of grain and cobs will produce the best results. Price must be based on dry matter, grain content and base feed prices to reflect accurately animal performance and alternative feed choices.