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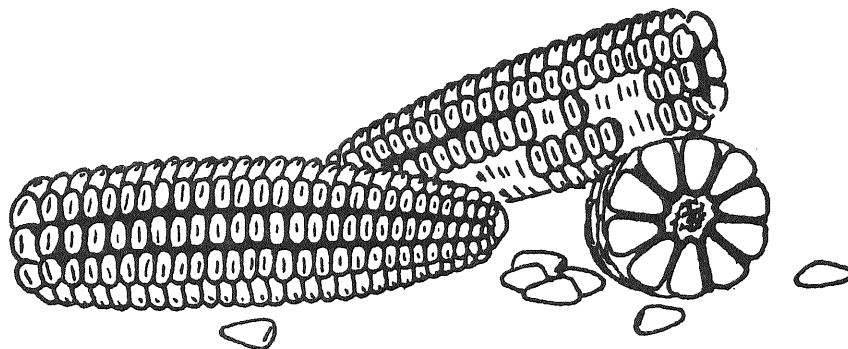
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PRICING HIGH MOISTURE CORN



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Introduction

A substantial number of New York dairy and other livestock farmers purchase grain in various forms for livestock feed. Some of these farmers can use high moisture corn as part of their feeding programs. Some New York growers can tap this market for high moisture corn, thereby avoiding drying costs and perhaps escape the shrink that occurs in addition to water loss to dry corn to 15.5% moisture.

This material is an update of A.E. Extension 77-26, "Buying and Selling High Moisture Shelled and Ear Corn," by George L. Casler. It has been prepared to aid corn growers and livestock feeders in the sale and purchase of high moisture shelled corn and high moisture ear corn. Tables 1 and 2 refer to shelled corn; Tables 3 and 4 refer to ear corn.

Tables 1 and 4 have been prepared to help the livestock feeder, particularly a dairyman, decide whether high moisture corn (shelled or ear) is a good buy in relation to dry shelled corn. In table 1, the feeding value of shelled corn has been computed on the basis that dry matter has a constant value regardless of the moisture content of the corn. Table 4 assumes that for feeding dairy cattle, dry ear corn has a nutritional value equal to the nutritional value of dry shelled corn. This is higher than the ratio of either net energy or protein in ear corn to the same nutrients in shelled corn. However, animal scientists at Cornell believe that for feeding dairy cattle, ear corn is nutritionally worth about as much as shelled corn. The values of ear corn at various moisture levels in Table 4 are computed on the basis that dry matter has a constant value regardless of the moisture of the corn.

Tables 2 and 3 have been prepared to help the grower decide whether he should sell high moisture corn directly to a livestock feeder rather than paying the drying charge, taking the shrink and selling the dry corn to a dealer.

Each of the tables 1-4 has been prepared for kernel moisture levels of 20, 25 and 30%. Equivalent values for other moisture levels can be calculated by using the procedures outlined on pages 9 through 11. Approximate values for moisture levels between 20 and 30% can be found by interpolation.

Shrink and drying charges used in preparing tables 2 and 3 are given in the heading of Table 2. Tables 2 and 3 are valid only when using these shrink and drying charges. Values for other shrink and drying charges can be calculated by following the same method of calculation.

Many factors other than those accounted for in the tables and calculations in this bulletin affect the decision of whether to market corn as high moisture corn directly from growers to livestock feeders. Some of these are:

1. Transportation costs for moving corn in various forms to alternative markets.
2. Storage costs and losses for ear vs. shelled and high moisture vs. dry corn.

3. Interest on the money invested in corn in storage.
4. Risk related to seasonal price changes.
5. Risk of non-payment for corn delivered by the grower to various markets.

Corn sellers and buyers should carefully consider these factors as well as those included in the tables that follow.

Grain Shrinkage

When grain is dried, "shrinkage" occurs due to loss of water and loss of fines. The amount of shrink depends on these factors:

- a) the beginning kernel moisture
- b) the final kernel moisture after drying
- c) the dry matter loss (fines) during drying expressed as invisible loss. This loss is often estimated to be one-half percent.

To calculate the amount of shrink as a percent, the following formula is used:

$$\% \text{ Grain shrink} = 100 - \left(\frac{100 - \text{initial moisture } \%}{100 - \text{final moisture } \%} \times 100 \right) + \text{invisible loss}$$

$$\begin{aligned} \text{Example: } \% \text{ Grain Shrink} &= 100 - \left(\frac{100-24}{100-15.5} \times 100 \right) + 0.5 \\ &= 100 - \left(\frac{76}{84.5} \times 100 \right) + 0.5 \\ &= 100 - 89.94 + 0.5 = 10.56 \end{aligned}$$

Using the above equation and any beginning or final moisture the resultant shrinkage can be calculated.

The shrink tables used by many commercial corn drying firms include more shrink than water loss to attain 15.5% moisture plus 0.5% invisible loss. Part of the difference is because the shrink is based on drying to a moisture content below 15.5%, for example 13%. Another reason for the difference may be that the experience of the drying firm indicates that actual shrink is greater than the calculated shrink based on water loss plus 0.5% invisible loss.

The shrink used in preparing tables 2 and 3 is taken from the shrink schedule used by one central New York drying firm. This schedule is based on drying to 13% moisture and is reasonably typical of those used by New York commercial drying firms. This schedule is believed to provide a more realistic basis for decisions of whether to have corn dried commercially or to sell it as high moisture corn than is a schedule based on calculated water loss plus 0.5% invisible loss.

Equivalent Values of Shelled Corn at Various Moisture Levels
for Constant Dry Matter Prices

Table 1 is designed to show the price that a dairyman could pay for wet shelled corn at various prices for dry shelled corn. A dairyman comparing the purchase of either shelled or ear corn at harvest time with the frequent purchase of dairy ration or ration ingredients must also consider the cost of storing and grinding and the interest on the money invested in corn.

Table 1. Equivalent Values of Shelled Corn at Various Moisture Levels for Constant Dry Matter Prices¹

Price/ton of dry corn (15.5%)	Price/bu. of dry corn (15.5%)	Equivalent value per ton of wet shelled corn ²		
		20% kernel	25% kernel	30% kernel
\$ 80	\$2.24	75.74	71.01	66.27
85	2.38	80.47	75.44	70.41
90	2.52	85.21	79.88	74.56
95	2.66	89.94	84.32	78.70
100	2.80	94.67	88.76	82.84
105	2.94	99.41	93.20	86.98
110	3.08	104.14	97.63	91.12
115	3.22	108.88	102.07	95.27
120	3.36	113.61	106.51	99.41
125	3.50	118.34	110.95	103.55
130	3.64	123.08	115.38	107.69
135	3.78	127.81	119.82	111.83

¹See page 9 for method of calculation

²No charge for drying and no adjustment for storage costs.

Note: Shelled corn is worth more in terms of feed value (Table 1) than in terms of selling as dry corn (Table 2), because of drying costs and because the shrink factors used by grain buyers are larger than calculated moisture loss. For example, when dry corn is worth \$100 per ton, 25% moisture shelled corn is worth \$88.76 per ton in terms of feed value but only \$72.57 to the grower who must pay the drying charge. The difference of \$16.19 per ton should provide a basis for selling corn directly from the grower to the feeder who can use high moisture corn. However, the feeder must have storage and feeding facilities to handle high moisture corn.

Equivalent Values of Dry Shelled Corn and Wet Shelled Corn

Table 2 is designed to show the break-even price a corn grower could receive for wet shelled corn compared to paying for commercial drying and taking the shrinkage. At prices above the break-even values in the table the grower would be better off selling wet shelled corn than paying the drying and taking the shrinkage.

Table 2. Equivalent Values of Dry Shelled Corn and Wet Shelled Corn After Drying¹

Price/ton of dry corn (15.5%)	Price/bu. of dry corn (15.5%)	Equivalent value per ton of wet shelled corn ²		
		20.0% mois. 9.1% shrink \$9.64 drying	25.0% mois. 16.0% shrink \$11.43 drying	30.0% mois. 24.7% shrink \$16.42 drying
\$ 80	\$2.24	\$63.08	\$55.77	\$43.82
85	2.38	67.63	59.97	47.59
90	2.52	72.17	64.17	51.35
95	2.66	76.72	68.37	55.12
100	2.80	81.26	72.57	58.88
105	2.94	85.81	76.77	62.65
110	3.08	90.35	80.97	66.41
115	3.22	94.90	85.17	70.18
120	3.36	99.44	89.37	73.94
125	3.50	103.99	93.57	77.71
130	3.64	108.53	97.77	81.47
135	3.78	113.08	101.97	85.24

¹Drying charges and shrinkage deducted. Equivalent values for moisture levels other than 20, 25 and 30 percent can be calculated by using the procedure on page 9.

²Individual buyers may use different drying charges and shrink factors based upon their own experience and buying policy.

NOTE: This table is based on the drying and shrink schedule used by a typical central New York grain buyer. A corn grower with his own dryer may be able to dry corn for less than the charges listed here and may have less shrink than indicated above.

Equivalent Values of Dry Shelled, Dry Ear and Wet Ear Corn

Table 3 is designed to show the break-even price a grower could take for high moisture ear corn rather than delivering it to a dealer, having it shelled, paying for drying and taking the shrink. Shelling costs are not included in Table 3 and would need to be deducted from the calculated values in the table.

Suppose the price of dry shelled corn is \$100 per ton. A grower with ear corn with kernel moisture of 25% could sell it for \$56.38 per ton (less any shelling costs) and be as well off as selling dry shelled corn for \$100 per ton, assuming that his drying costs and shrink are the same as those used in computing the values in Table 2. Any difference in trucking costs to the dealer vs. to the destination of high moisture ear corn would also need to be considered.

Table 3. Equivalent Values of Dry Shelled, Dry Ear and Wet Ear Corn¹

Price/ton of dry shelled corn (15.5%)	Equivalent value/ton of dry ears (16%)	Equivalent value per ton of wet ear corn ²		
		20.0% kernel 22.6% ear	25.0% kernel 29.2% ear	30.0% kernel 34.6% ear
\$ 80	65.50	50.40	43.33	33.47
85	69.59	54.03	46.59	36.35
90	73.68	57.66	49.86	39.22
95	77.78	61.30	53.12	42.10
100	81.87	64.93	56.38	44.98
105	85.96	68.56	59.65	47.85
110	90.06	72.19	62.91	50.73
115	94.15	75.82	66.17	53.60
120	98.25	79.45	69.44	56.48
125	102.34	83.08	72.70	59.35
130	106.43	86.72	75.96	62.23
135	110.53	90.35	79.23	65.11

¹See page 10 for method of calculation.

²Calculated on the basis of the value of the dry shelled corn contained in one ton of wet ear corn less drying charge for the shelled corn using the data in tables 2, 5 and 6.

NOTE: This table is based on the drying and shrink schedule used by a typical central New York grain buyer. A corn grower with his own dryer may be able to dry corn for less than the charges listed here and may have less shrink than indicated above.

Equivalent Values of Ear Corn at Various Moisture Levels
for Constant Dry Matter Prices

Table 4 is designed to show the price that a dairyman could pay for ear corn at various prices for dry shelled corn. A dairyman comparing the purchase of either shelled or ear corn at harvest time with the frequent purchase of dairy ration or ration ingredients must also consider the cost of storing and grinding and the interest on the money invested in corn.

Table 4. Equivalent Values of Ear Corn at Various Moisture Levels for Constant Dry Matter Prices¹

Price/ton of dry shelled corn (15.5%)	Equivalent value/ton of dry ear corn ³	Equivalent value per ton of wet ear corn ²		
		20.0% kernel 22.6% ear	25.0% kernel 29.2% ear	30.0% kernel 34.6% ear
\$ 80	\$80	\$73.95	\$67.39	\$61.83
85	85	78.57	71.60	65.69
90	90	83.19	75.81	69.56
95	95	87.81	80.02	73.42
100	100	92.43	84.24	77.29
105	105	97.05	88.45	81.15
110	110	101.68	92.66	85.02
115	115	106.30	96.87	88.88
120	120	110.92	101.08	92.75
125	125	115.54	105.30	96.61
130	130	120.16	109.51	100.47
135	135	124.78	113.72	104.34

¹See page 11 for method of calculation.

²No charge for drying and no adjustment for storage costs.

³Calculated on the basis that for feeding dairy cows dry ear corn is worth 90 percent as much as dry shelled corn.

NOTE: Ear corn is worth more in terms of feed value (table 4) than in terms of selling as dry shelled corn (table 3) because of drying costs, feed value in cobs, and because the shrink factors used by corn buyers are larger than calculated moisture loss. For example, when dry shelled corn is worth \$100 per ton, ear corn with 25% kernel moisture (29.2% ear moisture) is worth \$84.24 per ton in terms of feed value but only \$56.38 to the grower who must pay the drying charge. The difference of \$27.86 per ton should provide a basis for selling corn directly from grower to feeder who can use high moisture ear corn. However, the feeder (or possibly the grower) must have storage (cribs or silos) for wet ear corn.

Table 5. Relationships of Kernel and Ear Moisture and Wet Ear Bushel Weight Required for 1 Bushel of Dry Shelled Corn¹

Percent Moisture in Kernel	Percent Moisture in Ear ²	Lbs. of Ear Corn Required to Equal 56 lbs. of Shelled Corn at 15.5% Kernel Moisture ³
12.0	11.9	65.1
13.0	13.0	66.0
14.0	14.2	66.9
15.0	15.3	67.9
15.5	16.0	68.4
16.0	16.6	68.9
17.0	18.0	70.1
18.0	19.7	71.3
19.0	21.2	72.6
20.0	22.6	74.0
21.0	23.9	75.4
22.0	25.2	76.8
23.0	26.6	78.2
24.0	27.9	79.8
25.0	29.2	81.2
26.0	30.4	82.8
27.0	31.5	84.2
28.0	32.6	85.6
29.0	33.6	87.0
30.0	34.6	88.5
31.0	35.5	89.9
32.0	36.4	91.4
33.0	37.4	92.8
34.0	38.3	94.3
35.0	39.3	95.7
36.0	40.3	--
37.0	41.2	--
38.0	42.1	--
39.0	43.1	--
40.0	44.1	--

¹The relationships between ear moisture and kernel moisture will vary with hybrid and season. The values given in this table are averages based on the best available data and are for corn dried in the field. Corn dried in a crib usually will have a lower ear moisture relative to kernel moisture. Therefore, the information in tables 3 and 4 is more accurate for corn sold at harvest time than for corn sold after drying in cribs.

²From "Relations of Kernel, Cob and Ear Moisture in Dent Corn," Purdue University Station Bulletin 599, S. R. Miles and E. E. Remmenga, July 1953.

³From Iowa State College Publication, Agron. 205.

Table 6. Number of Pounds of Corn Required to Equal a Bushel of Shelled Corn at 15.5% Moisture (47.32 lbs. Dry Matter)¹

Percent Moisture in Kernel	Pounds of shelled corn required to equal 1 bu. No. 2 corn at 15.5% ²	Component weights of bushel		
		Pounds of Dry Matter	Water Pounds	Quarts ³
12.0	53.77	47.32	6.45	3.1
13.0	54.39	47.32	7.07	3.4
14.0	55.02	47.32	7.70	3.7
15.0	55.67	47.32	8.35	4.0
15.5	56.00	47.32	8.68	4.2
16.0	56.33	47.32	9.01	4.3
17.0	57.01	47.32	9.69	4.6
18.0	57.71	47.32	10.39	5.0
19.0	58.42	47.32	11.10	5.3
20.0	59.15	47.32	11.83	5.7
21.0	59.90	47.32	12.58	6.0
22.0	60.67	47.32	13.55	6.4
23.0	61.45	47.32	14.13	6.8
24.0	62.26	47.32	14.94	7.2
25.0	63.09	47.32	15.77	7.6
26.0	63.94	47.32	16.62	8.0
27.0	64.82	47.32	17.50	8.4
28.0	65.72	47.32	18.40	8.8
29.0	66.65	47.32	19.33	9.3
30.0	67.60	47.32	20.28	9.7
31.0	68.58	47.32	21.26	10.2
32.0	69.59	47.32	22.27	10.7
33.0	70.63	47.32	23.31	11.2
34.0	71.70	47.32	24.38	11.7
35.0	72.80	47.32	25.48	12.2
40.0	78.86	47.32	31.54	15.1

¹Source FM-126, University of Minnesota, C. Cuykendall and L. Christenson, 1969.

²Does not include invisible loss.

³8.34 pounds of water = 4 quarts = 1 gallon.

Method of Calculation -- Table 1

Column 2: Price per ton bushels per ton = price per bushel.

Example: \$100 35.71 = \$2.80 per bu.

Column 3: 20% moisture shelled corn

$$\frac{(100 - \text{initial moisture})}{(100 - \text{final moisture})} = \frac{(100 - 20)}{(100 - 15.5)} = \frac{80}{84.5} = 0.9467$$

Therefore, 1 ton of 20% shelled corn contains 0.9467 tons of 15.5% shelled corn

Value of dry shelled corn x 0.9467 = feed value of wet shelled corn.

Example: \$100 x 0.9467 = \$94.67 = feed value of 1 ton of 20% shelled corn when dry shelled corn is worth \$100 per ton.

Columns 4 & 5: Calculated in the same way as Column 3 using the appropriate conversion factor.

Method of Calculation -- Table 2

Column 2: Price per ton 35.71 bushels per ton = price per bushel.

Example: \$100 35.71 = \$2.80 per bu.

(This column is present only to show equivalent prices per bushel of dry shelled corn. It is not used in subsequent calculations.)

Column 3: 20% moisture

9.1% shrink

\$9.64 cents per wet ton drying charge

1 ton of wet corn = 0.909 ton of dry corn (9.1% shrink)

\$100 x 0.909 = \$90.90 = value of dry corn in 1 ton of wet corn

less: \$9.64 = drying charge

\$81.26 = value per wet ton

The grower would obtain equal return from selling the 20% moisture corn for \$81.26 as from taking 9.1% shrink, paying \$9.64 per wet ton for drying and selling the dry corn for \$100 per ton.

Columns 4 & 5: Calculated in the same way as column 3 using the appropriate shrink factor and drying charge.

Method of Calculation -- Table 3

Column 2: 68.4 lbs. of dry ear corn are required to yield one bushel (56 lbs.) of 15.5% moisture shelled corn (see Table 5).

Therefore, the shelled corn content of ear corn is $56 \div 68.4 = 81.87\%$

Hence, the value of the dry shelled corn in a ton of dry ear corn is 81.87% of the price per ton of dry shelled corn.

Example: $\$100 \times 0.8187 = \$81.87 =$ value of a ton of dry ear corn

Column 3: 20% moisture kernel (22.6% moisture ear)

It requires 59.15 lbs. of shelled corn with 20% kernel moisture to equal a bushel (56 lbs.) of dry (15.5%) shelled corn (Table 7). With 20% kernel moisture, 74.0 lbs. of ear corn are required to equal 56 lbs. of dry shelled corn (Table 5). When 84 lbs. of this ear corn is shelled, there should be 59.15 lbs. of shelled corn with 20% moisture. When this amount of corn is artificially dried, it will not necessarily produce 56 lbs. of dry corn. The amount of dry corn will depend on the shrink factor used as shown below.

1 ton of wet ear corn will contain 0.799 tons of wet (20%) shelled corn as shown below.

$\frac{59.15}{74} = .799 =$ proportion of wet shelled corn in wet ear corn

The 0.799 ton of wet shelled corn will be subject to 9.1% shrink and a drying charge of 27¢ per bushel or \$9.64 per wet ton.

Shrink $0.799 \times 0.909 = 0.7263$ ton of dry corn

$\$100 \times 0.7263 = \$72.63 =$ value of dry shelled corn in 1 ton of wet (20% kernel) ear corn

less: \$7.70 = drying charge = $\$9.64 \times 0.799$ ton of wet shelled corn

\$64.93 = value per ton of wet ear corn

less: selling \$ _____ (your cost)
charge

\$ _____ = net value per ton of wet ear corn after deducting shelling cost.

Columns 4 & 5: Calculated in the same way as column 3 using appropriate shrink factor and drying charge.

Method of Calculation -- Table 4

Column 2: Price of dry shelled corn = feed value of dry ear corn.

Column 3: 20% kernel moisture

74.0 lbs. of 20% kernel moisture ear corn is required to yield
68.4 lbs. of ear corn with 15.5% kernel moisture (Table 5).

$\frac{68.4}{74.0} = 0.9243$ = adjustment factor to reduce wet ear corn
(20%) to dry ear corn (15.5% kernel)

$\$100 \times 0.9243 = \92.43 = feed value of one ton of ear corn
with 20% kernel moisture when dry
shelled corn is worth \$100 per ton.

Column 4 & 5: Calculated in the same way as Column 3 using the
appropriate conversion factor.