



Estimating Price Risk from Corn Harvest Losses

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Two factors that can influence the price that a corn grower receives are (1) the moisture content of the crop at harvest and (2) the associated drying costs to reach a desired moisture content specified (or preferred) by the local elevator. Collectively, these factors can be considered harvest losses, expressed as a portion of the price per bushel. Estimating these two factors against the projected price received are key determinants as to when a corn grower might begin their corn harvest operations.

The first factor associated with corn harvest losses relates to the removal of moisture from grain during the drying process that causes a reduction in grain quality, referred to as moisture shrink. The formula for moisture shrink is expressed by the following equation.

$$\frac{(\text{initial moisture content} - \text{final moisture content})}{(100 - \text{final moisture content})} * 100$$

For example, assume that the initial moisture content is 25% and the final desired moisture content is 15%. Using the aforementioned equation, moisture shrink (%) is calculated to be 11.76%. Expressed mathematically as:

$$\frac{(25 - 15)}{(100 - 15)} * 100 = 11.76$$

Alternatively stated, the weight reduction in 1,000 pounds of corn that dries from 25% to 15% moisture content is 117.6 pounds (11.76% * 1,000 pounds). Often times, grain elevators calculate the shrink (difference between the grain moisture and 15%) and deduct it from the weight recorded at the scale. Grain that is drier than 15% continues to lose weight but buying points do not consider this in calculating salable weight. Therefore, under this example, corn growers should try to sell their grain at or above this 15% level to avoid losing weight to shrinkage resulting in economic loss.

The second factor considers the cost of drying. Grain drying costs are based on either dry or wet grain and can be estimated with the following equations expressed as dollars per dry bushel. The two formulas consider the use of LP gas or natural gas to dry the grain.

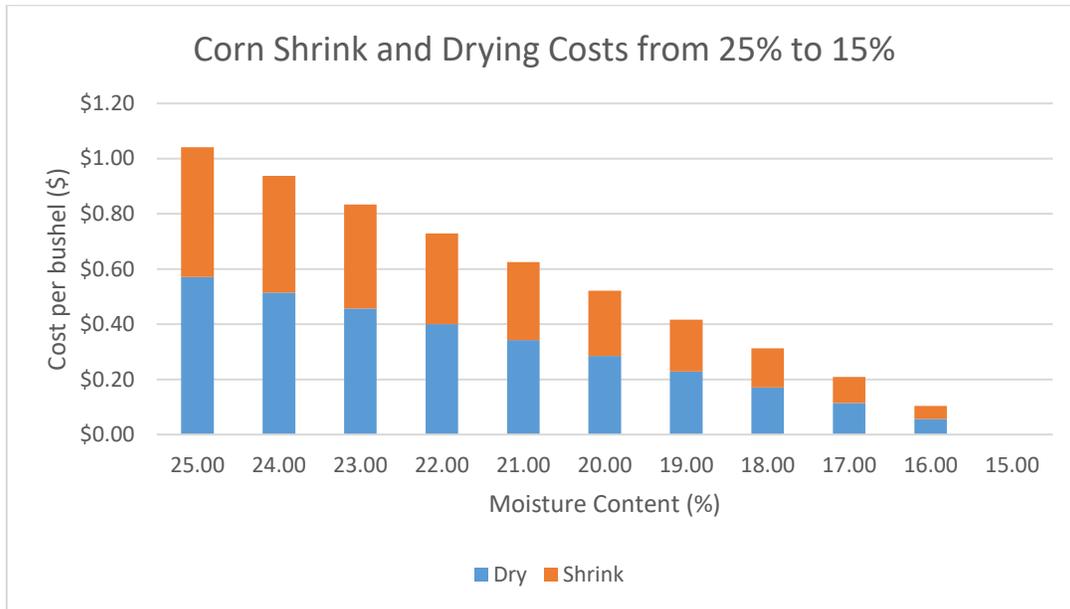
$$[(\text{LP gas price} * 0.02) + (\text{electricity price} * 0.01)] * (\text{initial moisture} - \text{final moisture})$$

$$[(\text{natural gas price} * 0.018) + (\text{electricity price} * 0.01)] * (\text{initial moisture} - \text{final moisture})$$

These calculations are based on the assumption that it requires 0.02 gallons of LP gas (or 0.018 Therm of natural gas) and 0.01 KWH of electricity to remove 1% of moisture per bushel.

Grain elevators often charge corn growers a per bushel fee to dry grain based on the moisture level and their costs of running and maintaining drying equipment at the facility.

The figure below shows a chart of the shrinkage and drying costs based on the corn moisture at harvest and the costs of propane and electricity for corn priced at \$4.00 per bushel.



In tabular format, the information can be evaluated across multiple harvest moisture content levels for corn priced at \$4.00 per bushel. The following decision tool was developed through which a producer, by inputting their initial expected price of corn at harvest, estimated harvest and target moisture levels, price per gallon for liquified petroleum gas and price per KWH for electricity, can calculate their risks or potential losses associated with moisture, shrinkage and price risk. The objective of this research is to afford producers some idea as to the range of losses/risk that can be expected given a projected corn price with varying initial moisture levels (%) with a targeted final moisture content of 15% per bushel.

Economic Estimation of the Factors Associated with Corn Harvest Losses										
Projected Corn Price (\$ per bu)	\$4.00									
Factors Associated with Corn Harvest Losses: Moisture Shrinkage										
Enter Initial Moisture Content Percentage (bu)	25.00	24.00	23.00	22.00	21.00	20.00	19.00	18.00	17.00	16.00
Enter Final Moisture Content (bu)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Moisture Shrink (%)	11.76	10.59	9.41	8.24	7.06	5.88	4.71	3.53	2.35	1.18
Estimated Moisture Shrinkage Cost (bu)	\$0.47	\$0.42	\$0.38	\$0.33	\$0.28	\$0.24	\$0.19	\$0.14	\$0.09	\$0.05
Factors Associated with Corn Harvest Losses: Drying Costs										
LP Gas Price (\$ per gal)	\$2.80	\$2.80	\$2.80	\$2.80	\$2.80	\$2.80	\$2.80	\$2.80	\$2.80	\$2.80
Electricity Price (\$/KWH)	\$0.11	\$0.11	\$0.11	\$0.11	\$0.11	\$0.11	\$0.11	\$0.11	\$0.11	\$0.11
Estimated Energy Cost (\$ per dry bu)	\$0.57	\$0.51	\$0.46	\$0.40	\$0.34	\$0.29	\$0.23	\$0.17	\$0.11	\$0.06
Factors Associated with Corn Harvest Losses: Price Risk										
Total Cost (\$ per bu)	\$1.04	\$0.94	\$0.83	\$0.73	\$0.62	\$0.52	\$0.42	\$0.31	\$0.21	\$0.10

The user-specified decision tool also contains a worksheet that allows a corn grower to enter their initial moisture content and the final desired moisture content so that the total cost per bushel can be calculated on a per bushel basis. Cells containing blue font in both worksheets can be changed by the grower. The grower can also enter their gas and electricity costs to estimate the drying costs.

Economic Estimator of the Factors Associated with Corn Harvest Losses		
Projected Corn Price (\$ per bu)	\$4.00	Enter corn price
Factors Associated with Corn Harvest Losses: Moisture Shrinkage		Enter initial moisture content
Enter Moisture Content at Harvest (%)	25.00	Enter final moisture content
Enter Target Moisture Content (%)	15.00	
Moisture Shrink (%)	11.76	Enter gas price
Estimated Moisture Shrinkage Cost (bu)	\$0.47	
Factors Associated with Corn Harvest Losses: Drying Costs		Enter electricity price
LP Gas Price (\$ per gal)	\$2.80	
Electricity Price (\$/KWH)	\$0.11	
Estimated Energy Cost (\$ per dry bu)	\$0.57	
Factors Associated with Corn Harvest Losses: Price Risk		
Total Cost (\$ per bu)	\$1.04	

Elevator dockage rates range somewhere around 2.5% per percentage point for grain moisture levels above 15 percent. Dockage must cover shrinkage losses, drying facility and energy costs, labor, and costs associated with bearing the risk for the grain that is being handled and dried. Drying and handling costs are the same regardless of grain price per bushel. Shrinkage and risks costs do increase with an increase in grain prices. Therefore, corn price has a role in determining at what moisture level a producer should initiate harvest operations. As corn price increases, the moisture at which it becomes profitable to start harvest increases. Likewise, as corn prices decline, the target moisture for harvesting corn decreases. Corn growers must be aware of the time needed in order to complete harvest. Generally, growers with high capacity equipment can start harvest closer to their targeted moisture level while growers with less harvesting capacity or drying capacity will need to start their harvesting operations at a higher target moisture in order to avoid field losses.

As an addendum to this report, another factor should be considered in corn harvest operations involves matching crop size to both combine harvest and on-farm drying capacities. We have listed below a formula that calculates the acres harvested per hour which, in turn, serves as an estimate of harvesting capacity. We assume a machine efficiency of 83% (percent of time on the row) which is typical for a corn harvesting operation.

$$APH = \frac{(\text{header width (feet)}) * \text{machine speed (mph)}}{10}$$

The following table is calculated assuming that 100 dry bushels of corn will be the net result of drying corn at various moisture contents from 28 to 15 %. The wet bushels shown are what is required to produce 100 dry bushels with a targeted moisture content of 15%. Dockage is calculated at 2.5% for each 1% of moisture above the 15% target. Marketable bushels are calculated by multiplying the wet bushels for a given field moisture percentage by 100 minus the total dockage percentage. Market value per 100 bushels is computed for several market prices. To get a “true” dockage cost per bushel, simply take the difference in market value for the two moisture contents in question and divide by 100. For example, 109 bushels of corn with an initial harvest moisture level of 22 percent moisture and \$4 per bushel is worth \$359.62 after dockage. The same corn dried down to a moisture level of 15% (whether field-dried or

dried in bins or the elevator) is worth \$400 with zero dockage. The difference is \$40.38 per 100 bushels, or \$0.40 per bushel.

% Moist	Wet BU	Dockage %	Market BU	Market Value/100 Dry BU @ \$/BU				
				\$2.50	\$3.00	\$3.50	\$4.00	\$4.50
28.00	118.06	32.50	76.69	199.22	239.06	278.91	318.75	358.59
27.00	116.44	30.00	81.51	203.77	244.52	285.27	326.03	366.78
26.00	114.86	27.50	83.28	208.19	249.83	291.47	333.11	374.75
25.00	113.33	25.00	85.00	212.50	255.00	297.50	340.00	382.50
24.50	112.58	23.75	85.84	214.61	257.53	300.46	343.38	386.30
24.00	111.84	22.50	86.68	216.69	260.03	303.37	346.71	390.05
23.50	111.11	21.25	87.50	218.75	262.50	306.25	350.00	393.75
23.00	110.39	20.00	88.31	220.78	264.94	309.09	353.25	397.40
22.50	109.68	18.75	89.11	222.78	267.34	311.90	356.45	401.01
22.00	108.97	17.50	89.90	224.76	269.71	314.66	359.62	404.57
21.50	108.28	16.25	90.68	226.71	272.05	317.40	362.74	408.08
21.00	107.59	15.00	91.46	228.64	274.37	320.09	365.82	411.55
20.50	106.92	13.75	92.22	230.54	276.65	322.76	368.87	414.98
20.00	106.25	12.50	92.97	232.42	278.91	325.39	371.88	418.36
19.50	105.59	11.25	93.71	234.28	281.13	327.99	374.84	421.70
19.00	104.94	10.00	94.44	236.11	283.33	330.56	377.78	425.00
18.50	104.29	8.75	95.17	237.92	285.51	333.09	380.67	428.26
18.00	103.66	7.50	95.88	239.71	287.65	335.59	383.54	431.48
17.50	103.03	6.25	96.59	241.48	289.77	338.07	386.36	434.66
17.00	102.41	5.00	97.29	243.22	291.87	340.51	389.16	437.80
16.50	101.80	3.75	97.98	244.95	293.94	342.93	391.92	440.81
16.00	101.19	2.50	98.66	246.65	295.98	345.31	394.64	443.97
15.50	100.59	1.25	99.33	248.34	298.00	347.67	397.34	447.00

References

Heiniger, R. "Harvesting Corn: What Grain Moisture Should I Harvest Corn At? North Carolina State University Extension Service.
Willcutt, H. "Harvesting, Drying, and Storing Corn". Mississippi State University Extension Service.

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