

Grain Harvest and Drying



Kernel Dry Weight Loss During Post-Maturity Drydown Intervals in Corn

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Objective:

The objective was to determine whether dry weight of mature corn kernels changes during normal drydown periods in the field.

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- Pioneer Hi-Bred International, Inc.
- Purdue University Crop Diagnostic Training & Research Center.

Project Description:

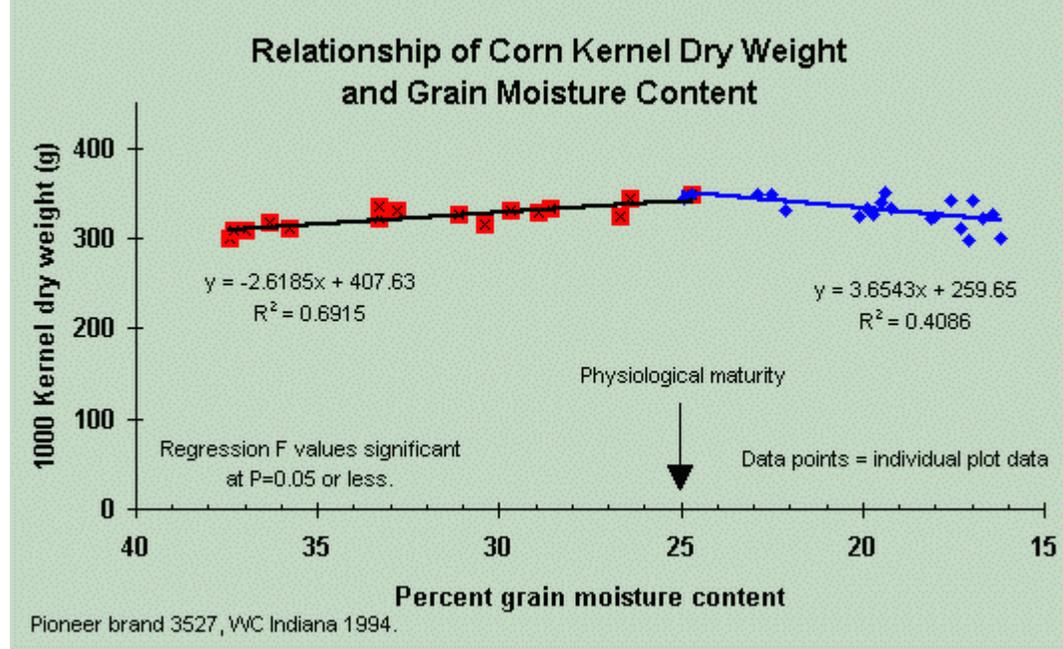
Previous reports from the seed industry and some grain farmers suggested that grain yield of mature corn can mysteriously 'disappear' when the grain is allowed to dry normally in the field prior to harvest. During the course of a four-year study (1991-94) designed to investigate the effects of delayed planting on corn hybrids' seasonal GDD requirements, we measured kernel dry weight of grain samples harvested twice weekly beginning at near 40 % grain moisture content and ending at grain moisture contents below 20 %. On each sampling date, five ears were randomly harvested from three replications each of three corn hybrids (Pioneer brands 3527, 3394, and 3245).

The approximate developmental stage of the kernels was determined by visually scoring the development of kernel black layer of 20 kernels removed from the center of each ear. Once physiological maturity occurred for any given plot, black layer scoring ceased. The remainder of the shelled grain from the five ears was thoroughly mixed, grain moisture content was estimated with a Dickey-john GAC 2000 electronic moisture meter, and the number of kernels in a 200 gram subsample was counted. Thousand kernel dry weight was calculated from the grain moisture content and the number of kernels in the 200 gram subsample. Grain sampling in the field ceased when grain moisture content decreased to less than 20 %. The field study was conducted at the Purdue University Agronomy Research Center, near West Lafayette in westcentral Indiana.

Results:

Physiological maturity of the corn kernels, defined as the point of maximum kernel dry weight, occurred at an average grain moisture content of 28.4 percent, and ranged from 25 to 35 percent during the course of the study. Maximum kernel dry weight averaged 317 grams per thousand kernels. Maximum kernel dry weight usually preceded the occurrence of a distinct kernel black layer, more often coinciding with a distinct kernel brown layer.

During three of the four years of the study, kernel dry weight of mature corn grain of all three hybrids decreased during drydown periods in the field. The rate of dry weight loss among years and hybrids ranged from 0.6 to 1.6 percent per point decrease in grain moisture content. Figure 1 illustrates the changes in kernel dry weight for Pioneer brand 3527 as grain



moisture content decreased from about 37 % to about 16 % in 1994 at the Purdue Agronomy Research Center in westcentral Indiana. Kernel dry weight increased until physiological maturity occurred at about 25 % grain moisture content. During the post-maturity drydown interval, kernel dry weight decreased at a rate equivalent to 1.1 % per point decrease in grain moisture content.

During the three years where kernel dry weight losses were observed, the average rate of kernel dry weight loss, per thousand kernels, was about 3.4 grams (or about one percent) per point decrease in grain moisture content (Table 1). The average percent loss in

kernel dry weight for the three hybrids ranged from 0.9 to 1.3 % per point of grain moisture decrease. Kernel dry weight losses each year, averaged across hybrids, ranged from zero (nonsignificant) in 1993 to 1.2 % loss per point drydown in 1992 (Table 1). No significant changes in kernel dry weight were observed in 1993 for any of the three hybrids.

Table 1. Kernel dry weight loss during field drydown of mature grain for three Pioneer brand corn hybrids. Purdue Agronomy Research Center, westcentral Indiana, 1991-94.

Hybrids (averaged over years)	Physiological maturity		Kernel dry weight loss per point decrease in GMC	
	1000 Kernel dry weight (g)	% Moisture at maturity	grams/1000 kernels	% dry weight loss
3527	298.7	27.9	2.7	0.9
3394	326.9	27.8	3.2	1.0
3245	324.2	29.5	4.1	1.3
Years (averaged over hybrids)				
1991	297.0	29.8	3.2	1.1
1992	303.7	32.5	3.5	1.2
1993	305.4	25.8	ns	ns

1994	360.2	25.3	3.4	0.9
Average	316.6	28.4	3.4	0.9
<i>GMC = Grain moisture content (%)</i>				
<i>ns means not significant at P=0.10 or less.</i>				

Bottom Line:

The results of this study support earlier claims made by the seed industry and farmers that grain yield can 'disappear' when corn is allowed to remain in the field to dry after physiological maturity has occurred. Our data suggest that the potential rate of yield loss averages nearly one percent per point decrease in grain moisture content. Thus, if mature grain were allowed to dry down ten percentage points in the field (say, from 28 % to 18 % grain moisture content), the potential yield loss would be ten percent.

The data reinforce the long-held notion that optimum grain moisture content for harvest is near 25 %. Harvesting grain at moistures much greater than this often results in damaged kernels, while harvesting at moistures less than this often results in increased mechanical harvest losses (ear droppage, kernel shattering). Our data suggest that additional yield loss, beyond that due to mechanical harvesting, can occur if grain is allowed to dry in the field once physiological maturity has occurred.



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