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G1398 Corn Grain Yield and Kernel Weight Stability After Black Layer

Fred W. Roeth
University of Nebraska - Lincoln, froeth1@unl.edu

Roger Wesley Elmore
University of Nebraska-Lincoln, roger.elmore@unl.edu

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Corn Grain Yield and Kernel Weight Stability After Black Layer

Roger W. Elmore, Extension Crops Specialist
Fred W. Roeth, Extension Weed Specialist

This NebGuide disputes previous reports that corn yields are reduced after black layer if harvest is delayed.

An October 1995 article in a national farm publication reported that corn dry matter decreased 1 percent for every percent loss in rain moisture as corn dried in the field after black layer (physiological maturity). The dry matter loss reportedly was hybrid specific and possibly due to seed respiration. This observation was based on research conducted at Purdue University with three hybrids over four years. All hybrids tested had significant dry matter losses in three of the four years. A report of similar observations from farmers and agronomists appeared in 1984 in a regional farm magazine. Many farmers have also documented yield losses associated with delayed harvest. If large dry matter losses occur during field dry down, it may be more cost effective to dry grain with artificial heat.

Several researchers have investigated kernel weight and/or yields after black layer. In most of the studies no changes in kernel dry weight were observed following black layer; however, in one report, four of 18 hybrids and five of 42 hybrids studied had changes in kernel dry matter as corn dried from 35 percent to about 15 percent grain moisture. Of the hybrids with dry matter changes after black layer, some had increased dry matter and some had decreased dry matter. These dry matter changes however, were not consistent over years.

Seed respiration is cited as a possible cause for the reported large dry matter losses following black layer. Respiration rates are greatest when grain moisture is near 50 percent and decreases to a minimal level as grain dries to 15.5 percent. These dry matter losses increase with greater temperatures and with greater mechanical damage to kernels. But, with good kernel quality and typical fall temperatures in the corn belt (average daily temperatures ranging between 50°F and 65°F), it would take an estimated 25 to 50 days for 1 percent dry matter loss to occur from respiration. This is far less than the 1 percent dry matter loss reported for every percent moisture loss after black layer.

Study Description

We conducted a preliminary study in October 1995 and more detailed studies in 1996 and 1997 to determine if corn kernels lose dry matter as they air dry. Most of our procedures are listed in *Table I.* Other procedures were as follows:

1) Kernel handling: On each harvest date for the laboratory and the field dry down/hand harvest methods, 100 kernels from the middle of two ears per plot were shelled by hand, weighed (wet weight) and oven-dried for three days at 194°F before they were reweighed to determine dry weight. Percent moisture was calculated as: ((wet weight - dry weight) / wet weight) x 100. To determine kernel weights in the field dry down/machine harvest method, two 100-kernel grain samples were obtained per subplot for moisture and kernel weight determination and then processed like the hand-harvested samples.

2) Harvest losses from dropped ears and kernels were measured and added back in to adjust yields.

Applied Questions

Was corn yield reduced or did corn kernels lose dry matter during drying after black layer?

No. In 1995 kernel dry weights were not affected by either date of harvest or by the storage environment. Kernel weights differed among hybrids in both 1996 and 1997 but within a hybrid were consistent across harvest dates. Similarly, grain yield obtained from the machine-harvested plots, with dropped kernels and ears added back in, did not change over the eight harvest days (*Figures 1* and *2*). Nine drying environments/harvest method combinations were studied with six hybrids over three years. There was no evidence of kernel dry matter loss following physiological maturity.

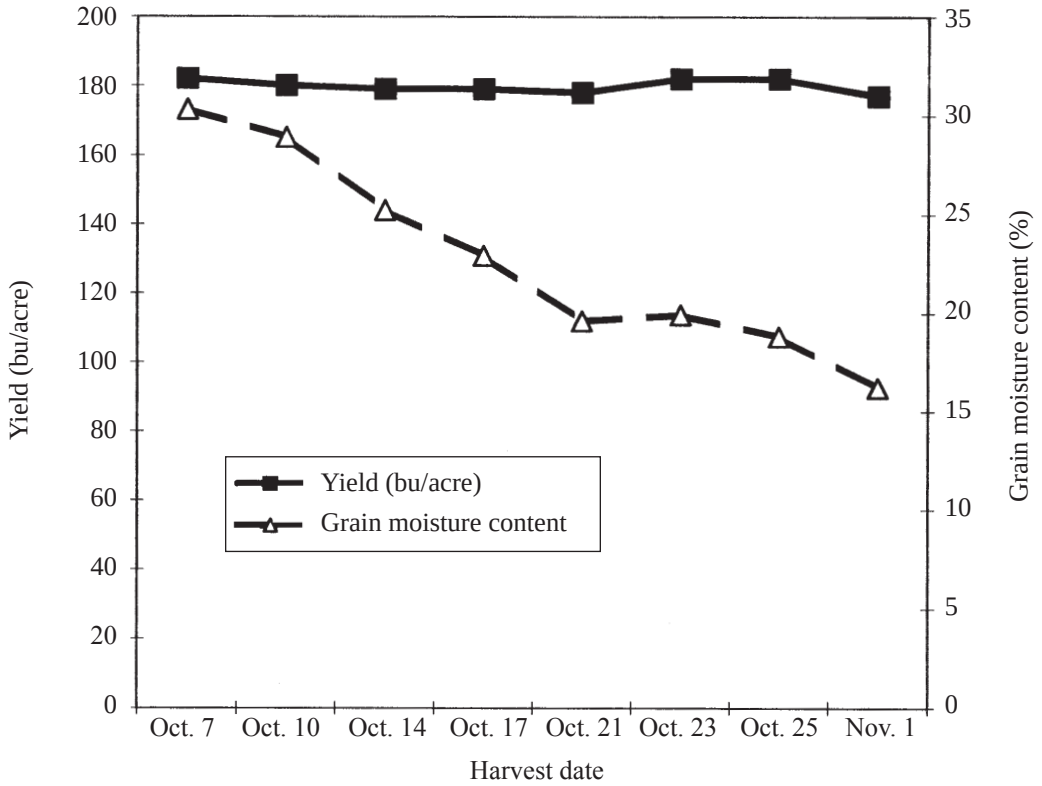

Figure 1. **Machine harvested yield and moisture content, five-hybrid average. 1996. University of Nebraska, South Central Research and Extension Center.**

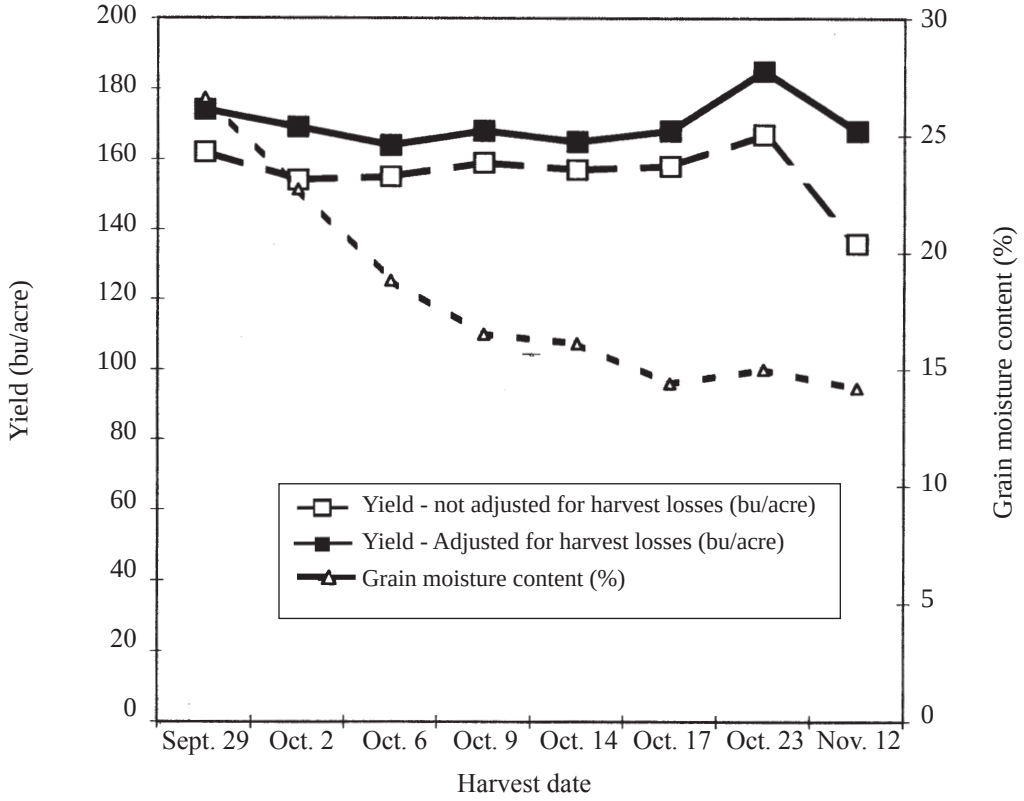

Figure 2. **Machine harvested yields and moisture content, six-hybrid average. 1997. University of Nebraska South Central Research and Extension Center.**

Table I. Hybrids, number of harvest dates, drying environments/harvest methods, and variables measured. University of Nebraska, South Central Research and Extension Center, Clay Center, 1995-1997.

Year	*Hybrids*	*Number of harvest dates*	*Drying environments/ Harvest methods*	*Variables monitored*
1995	*Pioneer hybrid 3225*	Nine	1) Lab table/Hand 2) Low-humidity chamber/Hand 3) Field/Hand	Kernel weight
1996	*Ciba hybrids:* Max 21 4394 Max 454 4494 *Pioneer hybrid 3225*	Eight	1) Lab table/Hand 2) Field/Hand 3) Field/Machine	Kernel weight Grain yield
1997	*Ciba hybrids:* Max 21 4394 Max 454 4494 *Pioneer hybrids:* 3225 3245	Eight	1) Lab table/Hand 2) Field/Hand 3) Field/Machine	Kernel weight Grain yield

Why do those results differ from that of other reports?

As a comparison, in 1997 Pioneer hybrid 3245 was included. In the Purdue University study, it had had the highest dry matter loss (1.3 percent per percent decrease in grain moisture). We did not measure any dry matter loss in this hybrid. The Purdue scientists used whole-ear samples. We sampled 100 kernels from the middle part of the ears to monitor kernel weights. We also sub-sampled from the tip and butt ends of two hybrids to see if kernel weight loss occurred at those positions. It did not. The differences in conclusions between the two studies are probably because of differences in grain moisture determination procedures. In the Purdue study grain moisture was estimated with an electronic moisture meter. Moisture meters are often less accurate at moisture contents above 25 percent. We used oven-dry weights. Differences between our study and reports from farmers may be that they did not account for field losses and/or differences in the way grain moisture was estimated.

Recommendation

We recommend that harvest schedules be based on grain moisture, stalk quality, and ear retention after black layer. Producers should monitor these variables of individual corn hybrids and fields and base decisions on these variables rather than on concerns of dry matter loss. Our results show stable grain dry matter after black layer and do not support the need for early harvest and the associated energy expense for grain drying.

For more information contact the authors or see the research report, *Corn Grain Yield and Kernel Weight Stability During Post-Maturity Drydown,* by R.W. Elmore and F.W. Roeth, published in the Journal of Production Agriculture, 12:300-305, 1999.

Acknowledgment

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