Is there loss of corn dry matter in the field after maturity?

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Is there loss of corn dry matter in the field after maturity?

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Background

Mystery yield loss, phantom yield loss, and now invisible yield loss – all are terms used for the concept that dry matter (yield) is being lost in-field between maturity (at about 28% moisture) and harvest (approximately 15% moisture). Popular press articles continue to indicate up to 1% dry matter loss per 1% grain moisture decrease. If this amount of dry matter loss occurs it would be significant in marketing terms. Some believe that this loss is caused by seed respiration.

From 1991 to 1994, grain dry matter was determined for three hybrids over the course of four years in Indiana (Nielsen et al. 1996). This work had an average yearly overall dry matter loss of 0.9% to 1.1% in 3 of 4 years. The fourth year was excluded because the results were non-significant. Follow up studies were published by Elmore and Roeth (1999), Pordesimo et al. (2006), and Thomison et al. (2011).

In Nebraska, Elmore and Roeth concluded that kernel dry matter weights were consistent across harvest dates even though there were slight differences between hybrids in 1996 and 1997. Pordesimo et al. (1995), showed that dry matter accumulation increased over the growing season, then plateaued over a 51-day sampling period; there was no decrease in dry matter following the plateau. Thomison et al. (2011) in Ohio investigated dry matter response to seeding rate, hybrid and harvest date. The results indicated that no yield reductions occurred between the October and November harvest dates. Yield losses between the November and December harvest dates were due to lower stalk strength and greater stalk lodging.

Nielsen et al. (1996) offers seed respiration as a possible cause of dry matter loss. Respiration is a metabolic reaction for retrieving stored energy and carbon while using up oxygen and releasing carbon dioxide. In, Knittle and Burris determined that seed respiration decreased dramatically from 35 days after silking to 80 days after silking. Seed respiration was non-significant from 80 to 95 days after silking. Additional studies in storage environments have reported 1% dry matter loss over 10 to 50 days of corn storage (after harvest) for 23-28% corn at 75-85 degrees F (Saul and Steele, 1966; Seitz et al., 1982). These losses were primarily due to storage fungi, not seed respiration. Dry matter losses would be much less in unharvested field conditions since average temperatures in the Corn Belt are 55-65 degrees F in late September and 50-60 degrees F in early October.

Delaying harvest in order for in-field grain drydown to occur results in decreased stalk integrity (i.e. greater stalk and root lodging) potentially causing more dropped ears. Farmers should weigh the cost of harvesting grain at 20-25% moisture versus waiting for in-field drydown to occur and potentially increased yield losses due to field losses other than grain dry matter loss.

Timeliness losses at corn harvest were traditionally associated with dropped ears from a weakened ear shank, often from European corn borer damage. Each loss of a single ear in 1/100th acre (436 sq ft) is the equivalent of 1 bu/acre field loss. Losses due to corn borer damage were variable by year, but frequently are estimated at 1/3 %/day loss for each day beyond mid-October (ASABE, 2014). Widespread use of corn with bacillus thuringiensis (BT) traits has greatly reduced this type of damage. Lodged stalks with ears close enough to the ground to escape gathering by the corn head are now the primary cause of preharvest loss in most fields (due to the combine not capturing the crop).
Study methodology

Field procedure

Ears were collected from a date of planting maturity trial at the Iowa State University research farms near Kanawha, Ames, and Crawfordsville, IA. The plots were 50 feet long by 20 feet wide, in 4 replications of each hybrid at a location. Selected planting dates and hybrids are listed in Table 1. Ear collection was weekly starting at physiological maturity for six weeks. Seven consecutive ears from the outside rows of the eight row plots were collected at each sampling period. The middle four rows were used for yield measurement in the planting date study. For subsequent sample collections, 7 consecutive ears were skipped before collection the next set of ear samples.

Table 1. Dry-matter loss study field design

<table>
<thead>
<tr>
<th>Location</th>
<th>Dates of Planting</th>
<th>Hybrid (Maturity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kanawha, IA</td>
<td>April 17, 2016</td>
<td>P9526AMX (95-d)</td>
</tr>
<tr>
<td></td>
<td>May 18, 2016</td>
<td>P0407AMXT (104-d)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P0987AMX (109-d)</td>
</tr>
<tr>
<td>Ames, IA</td>
<td>April 15, 2016</td>
<td>P0407AMXT (104-d)</td>
</tr>
<tr>
<td></td>
<td>May 15, 2016</td>
<td>P0987AMX (109-d)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P1151AM (111-d)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P1365AMX (113-d)</td>
</tr>
<tr>
<td>Crawfordsville, IA</td>
<td>April 14, 2016</td>
<td>P0636AM (106-d)</td>
</tr>
<tr>
<td></td>
<td>May 9, 2016</td>
<td>P1151AM (111-d)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P1365AMX (113-d)</td>
</tr>
</tbody>
</table>

At each harvest date, 100 stalks (with ears) adjacent to the harvest area were evaluated. Each ear within one foot of the ground was assumed to equal one percentage point of preharvest loss due to stalk lodging.

This design gave 480 samples as (3 hybrid x 4 rep x 2 DOP x 6 sampling x 2 location + 4 hybrids x 4 rep x 2 DOP x 6 sampling x 1 location). The samples were hand harvested, bundled in groups of 7 ears in strong plastic trash bags and shipped to Ames immediately after harvest.

Laboratory analysis procedure

The samples were husked and refrigerated immediately on receipt. Two ears were picked randomly from each bag, hand shelled and tested for moisture in the GIPSA-approved UGMA moisture meters, Perten AM5200 and Dickey-john GAC2500. This was the “harvest moisture” to be used for informational purposes in tracking maturity. This moisture was not used in dry matter balance calculations.

The remaining 5 ears in each sample were dried with forced room air to below 20% moisture. The ears were weighed, then shelled after drying. Both cobs and kernels were collected and weighed, which provided a mass balance check of ears versus cob and kernels. Moisture was measured of cobs and kernels, which established the dry matter weights on a full ear basis. Finally the kernels were cleaned with a Kice laboratory aspirator; this improved the operation of the seed counter by preventing partial seeds from counting.

A Seedburo seed counter was used to count 1000 kernels, which were then weighed. The dry matter content per seed was determined using the kernel moisture measured after shelling. Corn composition (protein, oil, starch and density) was determined with an Infratec 1241 analyzer calibrated at Iowa State University.
**Results** *(to 11/09/2016)*

![Harvest Moisture Progression](image)

**Figure 1.** Corn harvest moisture contents over the 6-week dry matter loss study.

Figure 1 shows the progression of harvest moisture across the harvest samplings, by location, all hybrids averaged. This showed a predictable trend starting at about 30% moisture after black layer, to a relatively dry 15-16% in the fourth week. The plots in Ames were accidentally harvested after the third sampling week. The field drydown rates were very nearly the same for all locations.

Figure 2 shows the progression of kernel dry matter weights across the harvest samplings, by location, with all hybrids averaged. There was no consistent trend. The anecdotal estimate of 10% loss would have been a decline of 0.03 g/seed. Further analysis will separate hybrids at each location, will include the composition data (protein, oil and starch), and will assess the statistical significance of the changes we did see. The increase at Ames over the first three weeks of sampling could indicate that the corn at that location was not fully mature at the first sampling.

**Summary**

Some sources contend that corn dry matter is consumed by respiration and other factors, up to a 10-15% loss in dry matter, in the field before harvest and after corn reaches maturity. A study of dry matter loss in the field was done in 2016, using dry matter weight per kernel over progressive harvest dates as the indicator variable. Data analyzed to date (11/04/2016) indicate that there is no change in kernel dry matter over 6 weeks of harvest, beginning at maturity.
Figure 2. Corn dry matter content per kernel over the 6-week dry matter loss study

References


