

Drought Impact on Corn Yields

By: Chad Lee, Ph.D.



The drought conditions faced earlier this growing season in Kentucky have certainly impacted the corn crop across the state. The real question is how much yield was lost due to the drought stress? The answer is: it varies, depending on crop growth stage at the time of drought stress, and duration of the drought.

Drought Stress at Pollination

Dry conditions will have the greatest impact on corn that was tasseling and pollinating during the drought. Pollination requires the release of pollen from the tassels and capture of that pollen by the silks. The pollen then travels down each silk to fertilize the ovule. Dry weather will reduce pollination in a couple of ways. First, dry weather will delay silking and could result in pollen dropping before silks are exposed. Second, dry weather will cause the silks to dry out quicker and reduce the ability of the silks to capture and move pollen to the ovules. Nothing can be done to regain unfertilized ovules after pollination. Adequate moisture following poor pollination will help the fertilized ovules develop kernels, but yield losses are certain with poorly pollinated corn. Yield losses from a drought during pollination can be as high as 100% but more often the yield losses are much less.

A quick way to determine how many ovules are fertilized within about 10 days after pollination is with the ear shake method. With this method, use a sharp knife to cut through the husk, but not the cob, from the base of the ear to the tip. Gently remove the husk from the ear, taking care to not remove any silks. Once all husks are removed, gently shake the ear. The silks of fertilized ovules should fall off. If an ovule was not fertilized, then the silk will remain on the ear. Repeat this method several more times at different areas in the field to determine how well the field of corn pollinated.

By about two weeks after pollination, the corn should reach the blister stage and fertilized kernels should be visible. From the blister stage on, pollination success can be determined by examining the number of developing kernels on each ear.

Drought Stress Before Pollination

Corn undergoing drought stress prior to pollination still has many chances to regain most of the yield potential. Ear size, kernel rows and potential ovule numbers are starting to be determined by leaf stage V9 through V12. Drought stress can reduce these components. However, if adequate moisture occurs by pollination, the corn plant probably will recover and yield losses can be as little as 5 or 10%.

Drought Stress After Pollination

Fertilized ovules develop into kernels and the first stage of this development following pollination is the blister stage. Dry conditions during this stage could result in aborted kernels. Aborted kernels are shrunken and white compared to plump, developing kernels. Kernels at

the tip of the ear are most susceptible to abortion.

The developing kernels will progress through the blister, dough and dent stages before reaching physiological maturity. The kernels are gaining weight during the dough and dent stages. Water is a key component to kernel weight gain. Dry weather during the dough and/or dent stages will reduce final kernel weight and reduce yields. Dry weather will reduce yields more during the dough stage than during the dent stage.

Yield Reductions

Specific yield loss levels were not mentioned throughout this article partly because the final yield of the corn plant depends so much on the amount and timing of stress. Water stress is never good but stress closer to pollination will result in the greatest yield losses, compared with water stress at other growth stages. Reductions in ear length, kernel row and/or kernel numbers can be offset by adequate moisture during seed fill, resulting in larger kernels. However, larger kernels cannot compensate fully for large losses in kernel number. Stress during seed fill will reduce seed size.

Resources:

Nielsen, R.L. 2002. A Fast & Accurate Pregnancy Test for Corn. Chat 'n Chew Cafe.
URL: http://www.kingcorn.org/news/articles.02/Pregnancy_Test-0717.html

Ritchie, S.W., J.J. Hanway, G.O. Benson, and J.C. Herman. 1993. How a Corn Plant Develops. Special Report No. 48. Iowa State University Press.
URL: <http://maize.agron.iastate.edu/corngrows.html>