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# Corn & Soybean News

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Cooperating Departments: Agricultural Economics, Biosystems and Agricultural Engineering, Entomology, Plant and Soil Sciences, Plant Pathology
Editor: Chad Lee

**In this Issue:**




## 1. Did the Dry May Affect Yield in 2007?

D.B. Egli, Plant and Soil Sciences

- Dry May is a poor indicator of final yields.
- There have been many dry Mays before Global Warming became an issue.

The 2007 cropping season is off to a rough start. The unexpected heavy frosts in April that wreaked havoc with our wheat crop were followed by an exceptionally dry May with statewide rainfall (2.43 inches) about half of normal[1]. The only drier May in the last 30 years was May of 2005 when only 2.33 inches of rain fell. Is a dry May a bad omen for the future? Should we expect low corn and soybean yields this fall?

Before this year, there were six Mays in the weather records for the past 30 years (1978 – 2007) with average state rainfall of roughly 2 inches or more below normal. Soybean yields were above the trend line in two of the six years, essentially on the line in one year, and below the line in the other three (Fig. 1). Corn yields were below the trend line in three years, on the line in one year and above it in two years. It seems that a dry May does not automatically spell disaster in Kentucky. Fig. 1 clearly shows that good yields can follow a dry May, which is not surprising since it is the rainfall during flowering, seed set and seed filling that is the most important in determining yield. Both corn and soybean can usually recover completely from stress during early vegetative growth if enough leaf area is produced to provide complete ground cover before flowering and there is adequate rainfall during the critical periods.

Summer rainfall doesn't always have the same affect on corn and soybean yield in Kentucky as shown clearly by the variation in the ratio of corn and

soybean yield (calculated on a bushels/acre basis) (Fig. 2, also discussed in the February 2007 (Vol. 7, No.1) issue of the Corn & Soybean Science Newsletter). The high ratio in 1999 reflects the exceptionally low soybean yield that year while low ratios result from lower corn yields relative to soybean. The crop that gets the rainfall during the critical periods is favored; some years it's soybean and some years it's corn and some years there is no favorite (ratio close to the mean).

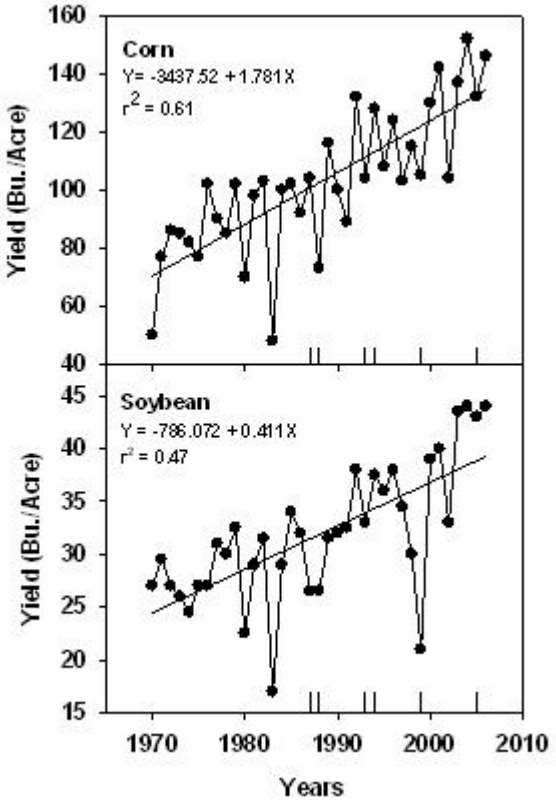


Fig. 1. Average state corn and soybean yields in Kentucky, 1970 - 2006. Vertical lines on the x-axis mark years when May rainfall was roughly 2 inches or more below normal.

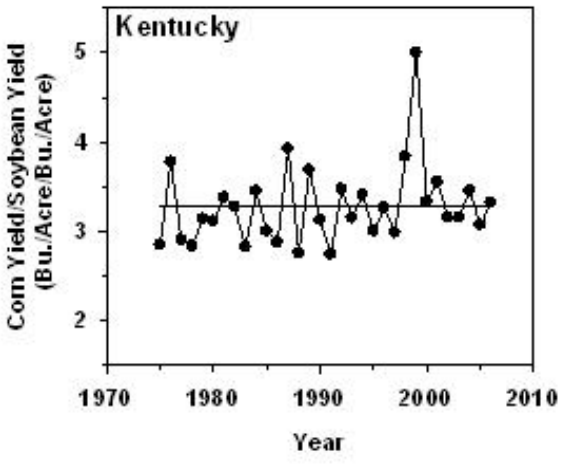


Fig. 2. Ratio of average state corn to soybean yields, 1975 to 2006. The ratio was calculated using yield in bushels per acre. The average ratio was 3.3

Did global warming and climate change contribute to our abnormal spring? Many climate models predict that global warming will increase extreme weather events and cause changes in precipitation patterns. It is impossible, however, to determine if global warming was responsible for our disastrous weather this spring. What we do know is that dry Mays have occurred before, in fact, many occurred long before global warming was a topic of

conversation. Statewide precipitation records show that there were twelve Mays in the last 113 years (back to 1895) when precipitation was less than half of normal. The record low was in 1932 (1.38 inches) and five years from 1930 to 1941 had less than 2 inches. We don't have to invoke global warming to explain this year's dry May, it happened before, long before global warming was thought to be a force in shaping our climate.

Historical weather and yield records suggest that a dry May is no reason to panic. We still have about a 50% chance of good yields – it all depends on the rainfall in July and August. Remember that in 2005, a single storm, the remains of Hurricane Katrina, played a major role in producing excellent yields in Kentucky. The difference between success and failure can hinge on a few rainfall events at critical times, events that no one can forecast.

[1] The weather data and the analysis used here were obtained from the website of the University of Kentucky Agriculture Weather Center which can be accessed at http://wwwagwx.ca.uky.edu/ or through the College of Agriculture webpage (http://www.ca.uky.edu/).

## 2. Corn Development during Water Stress

Chad Lee and Jim Herbek, Plant and Soil Sciences

Corn across Kentucky ranges in height from 10 inches to 6 feet as June 15, 2007. Shorter corn is probably close to V6 (six visible collars), while taller corn is probably close to V15. Areas of the state are still in a water deficit, Current drought conditions across Kentucky can be accessed at http://drought.unl.edu/dm/DM_state.htm?KY,MW. Many producers are asking what impact continued dry weather will have on corn yield.

- Corn is relatively tolerant to dry weather at early growth stages.
- As leaf area increase, water demands increase.

By the V6 growth stage, tassel development and ear shoot development have both started. Corn at V6 is still using relatively little water (probably less than 0.1 inch per day in 90 degree temperatures) and is relatively tolerant to dry weather.

Corn with rolled leaves, symptomatic of water stress.

Once the corn reaches V6, the stalk will begin to grow rapidly. As each new

leaf is added to the plant, water demands will increase. When the corn reaches V15, it is about 10 to 12 days from silking and is passing through the most critical stage for yield determination. Dryweather from V15 through pollination could reduce final ear size and kernel number. Even with the current stress, a timely rain during pollination and seed fill could result in good yields.

The bottom line is that corn needs rain, and we need it now. Corn that is in earlier stages of development has more time and opportunity to produce good yields. Corn that is close to tasseling still has a chance to make good yields, but it needs rain now.

Resources:
Rosenburg, N.J., B.L. Blad, and S. B. Verma. 1983. The Biological Environment, 2nd Ed. John Wiley & Sons. New York.
How a Corn Plant Develops, Special Report No. 48. Iowa State University. http://www.extension.iastate.edu/pages/hancock/agriculture/corn/corn_develop/CornPlantStages.html

## 3. Present Status of Soybean Crop

Jim Herbek and Chad Lee, Plant and Soil Sciences

Approximately 80% of the intended soybean acreage in Kentucky was planted as of early June. Most of the soybeans are still in vegetative growth stages; ranging from V4 to V6 for early May plantings and V1 to V3 for mid-late May plantings. The lack of moisture in May has resulted in slower plant growth and development. However, this should have little, if any, effect on yield potential at these early vegetative growth stages. If the moisture stress continues to be prolonged, yield may be reduced because of less plant growth (fewer nodes for pod development). Unfavorable weather stress will have more of an impact on yield during the reproductive stages of R3 to R4 (pod development) and R5 to R6 (seed development) than vegetative stages.

- Soybeans in vegetative stages have time to recover from dry weather.
- Dry weather during seed filling is detrimental to yield.

The small acreage of soybeans planted in April are further along in development. These earlier planted soybeans have 6 to 7 vegetative nodes and are in the flowering process (R1 to R2) depending on the maturity group. Some flower abortion has occurred, but should have a negligible effect on yield, since some flower abortion occurs every year. The soybean plant is very resilient and can compensate within reason for brief stress periods as it continues plant development, unless the stress is prolonged.

## 4. Common Nutrient Deficiencies During Drought

Lloyd Murdock & Greg Schwab, University of Kentucky

K deficiency on lower corn leaves.

Many fields of corn may be displaying symptoms of nitrogen (N) or potassium (K) deficiency, even though adequate levels of fertilizer were applied. All nutrients and their uptake are affected by the amount of water in the soil. N and K (as well as some other nutrients) mainly depend on mass flow (riding the flow of water into the plant root) as their mechanism of uptake. Drought conditions reduce the flow of water – and nutrients- into the plant. Both N and K are required in large quantities by the plant, so deficiencies of N and K usually appear under drought conditions.

- N and K require water to move into plants.
- Dry weather can cause deficiencies, even if adequate fertilizer was applied.

**Nitrogen**

Fertilizer N applied to the soil surface requires water to move it to the root zone. Under drought conditions, the soil surface will remain dry and the fertilizer N will not move into the root zone or the corn plant. If the added fertilizer N is below recommended levels, corn will begin to show the deficencies first. The lower leaves will begin to yellow at the leaf tip and move towards the stalk. The midrib section of the leaf will yellow first. When rain returns, the plant will begin to take up N at a more rapid rate and the plant will recover.

If part of the nitrogen was applied at or before planting, it will be located deeper in the profile and N deficiencies will be slow to appear or will not appear. The best way to use sidedressed N is to apply about 1/3 of the N preplant. This helps prevent a temporary N deficiency during drought years.

If most or all the N was sidedressed, it may be positionally unavailable during droughts. This is the biggest risk to sidedressing N. The nitrogen on or near a very dry soil surface causes the roots to have difficulty extending into that area or removing N and water in large quantities from this area. A rain will correct this situation. Injecting the N helps place it in a better environment for uptake. Also no-tillage usually results in more moisture and more roots in the soil surface which also helps some.

**Nitrogen Losses**

The loss of N is usually minimal during extended dry periods. When N deficiencies become apparent during this time, many producers think they may have lost a lot of the applied N but that is usually not the case.

The main avenue of loss when N is applied to dry soils is volatilization. The sources of N where this would be prevalent are urea and liquid N (UAN).

Volatilization N losses are greater with surface applied N sidedressed and no-tilled. Conditions that increase volatilization are applications of urea and UAN to moist soils, followed by dry and windy weather. If urea and UAN are applied to the surface of dry soil less volatilization will occur. Due to the reduced N uptake during a drought, high N losses are suspected. This is usually not the case.

Factors that reduce volatilization losses are injection or streaming of UAN (injection is much more effective) also rainfall or irrigation within 2 days after N application, as well as urease inhibitors added to the N fertilizer.

**Potassium**

K is less available under drought conditions. With our tillage practices used today, most of the available K is in the surface 3 to 4 inches. There is K in the lower parts of the profile but at a reduced level. If the top few inches become severely dry then the uptake of K is severely reduced and K deficiencies can occur.

K deficiencies during dry weather usually occur when the K soil test levels are low and/or soil compaction exists. Soils with proper levels of soil test K will have more K available for the plant and will reduce chances for a deficiency. During normal or moist years, low soil test K levels are many times adequate due to better conditions for uptake.

If K deficiencies exist, check soil test levels in the field, especially in the K deficient areas. Also, check for compaction in these areas. The soil test for K should be kept in the medium to high range or recommended levels of K fertilizer need to be added. Adding K fertilizer to K deficient fields can correct the deficiency but only if sufficient rainfall occurs to move the K fertilizer into the soil. With adequate rains, the K fertilizer will quickly dissolve and move into the soil for rapid uptake.

## 5. Fungicides Did Not Make the Rotation Effect Go Away

John H. Grove, Plant and Soil Sciences

- The rotation effect had more impact on yields than fungicides.
- Fungicides in the absence of disease pressure did not improve yields.

In a previous newsletter, the rotation effect, the yield reduction that occurs to corn grown after corn, relative to corn grown after another crop, was shown to increase as the general yield level rose (it gets worse as the season gets better). Research done at the West Kentucky Research and Education Center, near Princeton, has looked at a number of corn residue management techniques, but none of these successfully increased corn after corn yield. There have been a number of testimonial reports that plant diseases are more prevalent in corn after corn. Two trials, on different soils, with different hybrids and planting patterns, evaluated the benefit of a foliar fungicide application at growth stage R2 (late silking) on both corn after corn and corn after wheat/doublecrop soybean at the Kentucky Agricultural Experiment Station farm near Lexington (Spindletop).

The first trial was on a moderately eroded hillside (Maury silt loam), with Monsanto-DeKalb DKC61-45 planted 13 May in 36-inch rows. The at-harvest stand averaged 27,000 plants/acre. The corn after corn treatment was 23$^{rd}$ year continuous corn in 2006. The second trial was on a summit

landscape position (Loradale silt loam), with Pioneer 33R76 planted 8 May in 30-inch rows. The at-harvest stand averaged 28,100 plants/acre. The corn after corn treatment was 2nd year continuous corn in 2006. Foliar disease pressure at the time of fungicide (combination of Tilt and Folicure) application was low, in both experiments. Yield results of the two experiments are given in Table 1, below.

Table 1. Corn grain yield response to use of fungicides on corn in two crop rotations in two different field experiments.

| | | Trial 1 | | |
|---|---|---|---|---|
| Fungicides Applied? | Previous Crop | Grain Yield | Rotation Response | Fungicide Response |
| | | ---------- bu/acre ---------- | | |
| No | Corn | 165 | | |
| | Wheat/Soybean | 190 | + 25 | |
| Yes | Corn | 168 | | + 3 |
| | Wheat/Soybean | 188 | + 20 | - 2 |

| | | Trial 2 | | |
|---|---|---|---|---|
| Fungicides Applied? | Previous Crop | Grain Yield | Rotation Response | Fungicide Response |
| | | ---------- bu/acre ---------- | | |
| No | Corn | 201 | | |
| | Wheat/Soybean | 219 | + 18 | |
| Yes | Corn | 198 | | - 3 |
| | Wheat/Soybean | 220 | +22 | + 1 |

Rotation was generally beneficial (average of +21 bu/acre), regardless of whether fungicide was used. There was no benefit to the use of fungicide (average of -0.25 bu/acre), regardless of rotation. There was no fungicide by rotation interaction, so use of these fungicides was not of greater benefit to corn after corn than to corn after wheat/soybean. This represents only one year of information, but the data suggest that the rotation effect was quite significant (about 10% of yield potential), despite low foliar disease pressure and use of hybrids with good foliar disease resistance. Use of fungicides, in the absence of foliar disease, did nothing to alleviate the rotation effect.

## 6. Corn Hail Damage

Chad Lee, Plant and Soil Sciences

Isolated hail storms hit areas of central and eastern Kentucky on June 5, 2007. While phone calls and field visits have addressed the concerns of most of those fields, we decided to include a refresher issue on assessing hail damage. The extent of damage depends on the growth stage, leaf area destroyed and surviving stand.

- Hail damage on young corn normally will hurt yields very little.
- Replanting corn now will result in at least 30% yield losses.

### Growth Stage

The growing point usually begins to move above ground as corn approaches the 8-leaf stage (8 leaves drooping) which is usually equivalent to V6 growth stage (six visible collars). Corn is highly tolerant to hail damage at these early stages of growth. As the growing point moves above ground and the corn plant gets closer to tasseling, it becomes more susceptible to hail damage. Corn is most susceptible to hail damage just prior to tasseling

through early milk. Once corn passes through the early milk stage, it becomes more tolerant to hail damage.

### Percent Leaf Area Destroyed

Estimate the amount of leaf material that is missing or no longer green. Any green leaf material, even that which is shredded, should not be counted as destroyed. The following table is adapted from the National Crop Insurance Association's "Corn Loss Instructions" (Rev. 1984). The entire Table can be found in a Nebraska Extension publication (Vorst, 1986). The 8-leaf stage as determined by a hail adjuster is usually equal to a V6 leaf stage (six collars visible). The numbers in Table 1 assume that the corn stand was not reduced by hail.

***Table 1. Estimated percent yield loss occurring from defoliation.***

| | Percent Leaf Area Destroyed | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Growth Stage* | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 7-leaf | 0 | 0 | 0 | 1 | 2 | 4 | 5 | 6 | 8 | 9 |
| 8-leaf | 0 | 0 | 0 | 1 | 3 | 5 | 6 | 7 | 9 | 11 |
| 9-leaf | 0 | 0 | 1 | 2 | 4 | 6 | 7 | 9 | 11 | 13 |
| 10-leaf | 0 | 0 | 2 | 4 | 6 | 8 | 9 | 11 | 14 | 16 |
| 11-leaf | 0 | 1 | 2 | 5 | 7 | 9 | 11 | 14 | 18 | 22 |
| 12-leaf | 0 | 1 | 3 | 5 | 9 | 11 | 15 | 18 | 23 | 28 |
| 13-leaf | 0 | 1 | 3 | 6 | 10 | 13 | 17 | 22 | 28 | 34 |

*Hail adjusters' method for staging corn. (8-leaf stage is usually similar to V6 corn, where 6 collars are visible).

### Estimating Stand

Reductions in corn stand may reduce yields. For most of Kentucky, stands ranging from 22,000 to 30,000 plants/acre are ideal. Stands below 22,000 plants/acre will cause yield reductions. At this time, replanting corn would result yield losses of at least 30%.

### Tied Whorls and Silking

Corn plants damaged by hail early in the season usually recover from tied whorls and bruised stalks. The corn will usually grow through these tied whorls within 3 or 4 weeks (Mangen and Thomison, 2000). Stalk bruising had little impact on lodging. If bruising occurs directly on the growing point of the corn plant, then the corn plant may not survive. Silking will be delayed on severely damaged corn plants. Corn from V5 through V7 that received 100% leaf loss had a 1 to 1.5 week delay in silking compared with plants that received 80 to 90% leaf loss.

## Looks Worse than It Is

Hail damage early in the growing season almost always looks worse than it really is. Wait about five days before making any kind of stand assessment. If replanting does become necessary, then switch to an earlier hybrid.

References:

Vorst, J. J. 1986. Assessing Hail Damage to Corn, G86-803-A: http://ianrupus.unl.edu/fieldcrops/g803.htm

Mangen, T. and P. Thomison, 2002. Early season hail damage in corn: effects of stalk bruising and tied whorls. Agronomic Crops Team On-Farm Research Projects 2000. Special Circular 179-01. http://ohioline.osu.edu/sc179/sc179_16.html

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