Integrated Pest & Crop Management





Comparison of the 2012 Drought to other Droughts for Yield Reductions

Part 1: Corn

By Bill Wiebold

Meteorologists have compiled a number of weather statistics to document the severity of the 2012 drought. Crop productivity is also an excellent indicator of drought intensity. Most grain crops have specific stages of development when their yields are most sensitive to drought stress, so timing of stress also influences the amount of yield loss. Greatest yield reductions usually occur with sustained drought stress during late vegetative stages and throughout the reproductive stages.

Corn's most sensitive stage is a three week period centered on R1 (silking). Stress during this period reduces the number of flowers that are successfully fertilized. Stress after silking will result in increased kernel abortion, and if the stress has not been relieved, reduced seed size. Stress during mid-vegetative stages may reduce ear size by reducing the number of flowers on the ear and may reduce plant height and leaf size. Usually, drought stress during early vegetative stages has little effect on grain yield, but nodal root growth can be impacted by dry soil during stages V2 to V5. Unfortunately in 2012, corn plants, at least in some parts of Missouri, were affected by drought stress from shortly after emergence through the end of grain filling. In August, and again in September, USDA estimated the state average corn yield will be 75 bushels per acre, which is 46% below trend line yield.

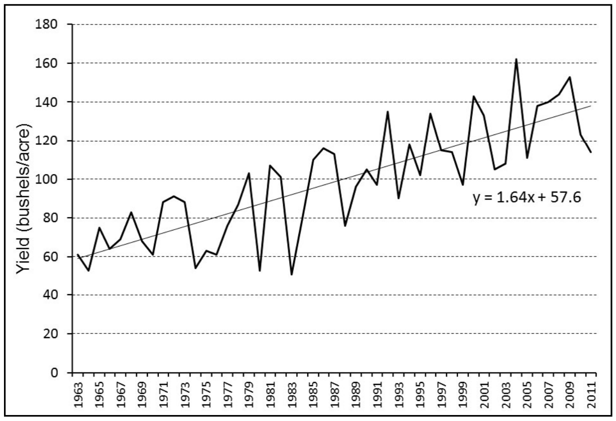

Figure 1: Missouri average corn yield for the past 50 years. Data source was USDA/NASS.

Trend line for grain yield is a straight line drawn through a graph of yield history (Figure 1). A formula for the line is derived so that trend line yield can be calculated for any year. The formula for the trend line in Figure 1 is yield = 1.64X + 57.6 where X is the number of years since 1962. For example, trend line yield for 1997 is (1.64)(35) + 57.6 or 115 bushels per acre.

The formula of the trend line is related to the years included in the calculation. A large enough number of years should be used to smooth out year to year variation. But, it would be wrong to include years before hybrid corn was available or even when

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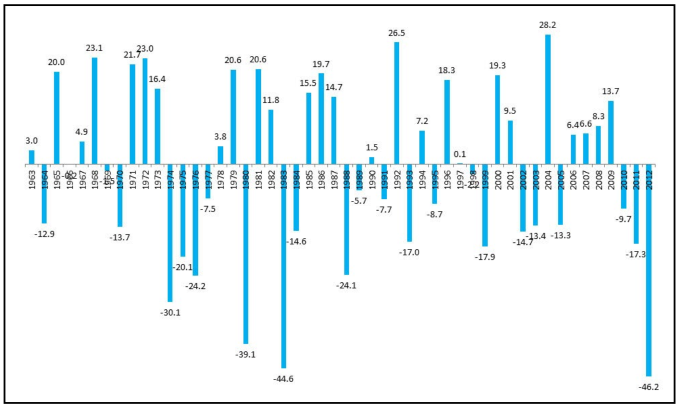

Figure 2: Missouri average corn yield compared to the 50-year trend line. Numbers are percentages above or below trend line. Yield data for 2012 are estimated. Data source was USDA/NASS.

lower-yielding double-cross corn hybrids were prevalent. I used a 50-year period beginning in 1963, but did not include the 2012 yield estimate. For each year, I calculated the deviation of actual yield as reported by NASS from trend line yield. So that years could be compared, I divided the amount of yield lost or gained by the trend line yield to calculate a percentage. These percentages are plotted in Figure 2.

During the drought of 2012 weather parameters were often compared to previous years such as 1980, 1983, and 1988. State corn yield averages were 39, 45, and 24% below trend line in those years, respectively. Drought severity, as calculated by corn yield loss, was greater in 2012 than for any year within the past 50 years. Above normal precipitation in the Missouri and Mississippi River basins caused substantial flooding in 1993. State corn yield average in 1993 was reduced 17%. Somewhat surprising, Missouri average corn yields for the most recent three years (including 2012) have all been below trend line.

The National Agricultural Statistics Service provides yield data for 9 districts in Missouri. I calculated trend line yields and yield losses for the 2012 drought and the three most recent droughts for 8 of those regions. The south central region was not used because total corn production is relatively low in that region. These data are provided in Table 1 on page 111. Figure 3 is a graph of yield losses for each region in each of the four droughts.

Summer weather conditions often vary widely across Missouri. Weather in the SE district is often similar to states south of Missouri, while weather in northern Missouri is often similar to southern Iowa and central Illinois. For example in 1993, SE Missouri experienced drought conditions in July and August while heavy rains were common in central and north Missouri. Large reductions in the state average corn yield almost always means that weather stress occurred throughout the entire state.

Many farmers said that the weather in 2012 reminded them of 1988. Statewide, the yield loss in 1988 was only half of the estimated yield loss in 2012. The 1988 yield loss ranks 6th among yield losses for the past 50 years. The stressful weather and yield losses in 1988 were located mostly in the northern third of the state.

Yield losses of more than 20% occurred in all 8 regions of Missouri in 1980 and 1983. Because of statewide drought conditions, these years rank 3rd and 2nd for yield losses among the past 50 years. The pattern for estimated yield losses among the 8 regions in 2012 was unusual. In 7 of the 8 regions estimated yield loss was greater than 40%. But, in SE Missouri the estimated yield loss was only 9%. According to the Drought Monitor, SE Missouri experience exceptional drought for much of the late spring and summer of 2012. Apparently, the widespread deployment of irrigation for corn in SE Missouri helped maintain corn yield in this region.

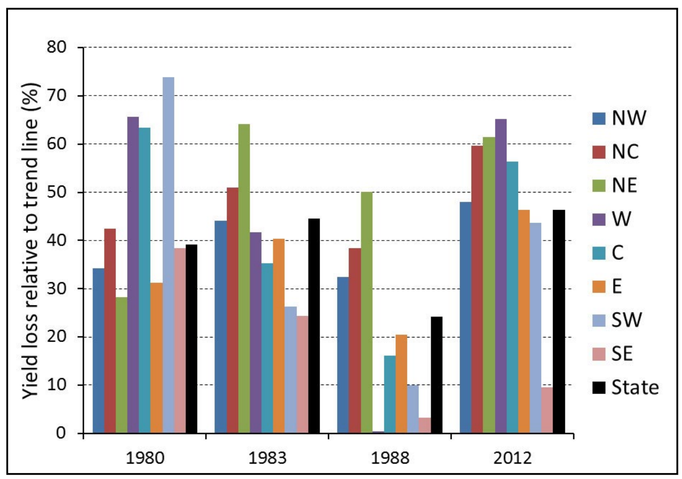

Figure 3: Corn yield losses from four droughts in 8 Missouri regions. Yield losses were calculated as reductions from the trend line and converted to percentages of trend line yield. Yield data for 2012 are estimated. Data source was USDA/NASS.

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Bill Wiebold
WieboldW@missouri.edu
(573) 882-0621

Comparison of the 2012 Drought to other Droughts for Yield Reductions: Part 1

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	1980				1983				1988				2012			
			Yield Loss				Yield Loss				Yield Loss				Yield Loss	
Region	Yield	TL	Actual	Percent	Yield	TL	Actual	Percent	Yield	TL	Actual	Percent	Yield	TL	Actual	Percent
	-----bushels/acre-----			%	-----bushels/acre-----			%	-----bushels/acre-----			%	-----bushels/acre-----			%
NW	58	88.3	30.3	34.3	52	93.0	41.0	44.1	68	100.8	32.8	32.5	72	138.4	66.4	48.0
NC	49	85.2	36.2	42.5	44	89.7	51.0	51.0	60	97.4	37.4	338.4	54	134.0	80.0	59.7
NE	61	85.1	24.1	28.3	32	89.3	64.2	64.2	48	96.3	48.3	50.1	50	129.9	79.9	61.5
W	28	81.3	53.3	65.6	5	85.8	41.7	41.7	93	93.3	0.3	0.4	45	129.4	84.4	65.2
C	31	84.6	53.6	63.4	58	89.6	35.3	35.3	82	97.9	15.9	16.2	60	137.7	77.7	56.4
E	59	85.9	26.9	31.3	54	90.4	40.3	40.3	78	98.0	20.0	20.4	72	134.3	62.3	46.4
SW	20	76.2	56.2	73.8	60	81.4	26.3	26.3	81	90.0	9.0	10.0	74	131.4	57.4	43.7
SE	63	102.2	39.2	38.4	82	108.5	24.4	24.4	115	188.9	3.9	3.3	153	169.1	16.1	9.4
State	53	87.1	34.1	39.2	51	92.0	44.6	44.6	76	100.2	24.2	24.2	75	139.6	64.6	46.3

Missouri Cotton Producers Should Prepare Now for the 2013 Crop

By Allen Wrather

Farmers will finish most of the 2012 Missouri cotton crop harvest by October 20 and should now start preparations for the 2013 cotton crop. The following is a check list of items to consider.

- Identify areas where yields of cotton this year were less than acceptable and then take the time to troubleshoot these areas to determine why yields were less than expected.
- Dig cotton roots after harvest this fall in areas of the field where nematode problems are suspected and examine them for root-knot nematode (RKN) galls. University of Missouri research shows that root gall severity due to RKN is a reliable indicator of the presence of this nematode and the severity of RKN damage to cotton. Producers should complete this soon after harvest because the roots begin to rot by December. Contact me for more information about this method. If RKN is a problem, farmers should make decisions this winter about how to manage it in 2013.
- Select the fields you intend to plant to cotton in 2013 and test a sample of the soil from each field for pH and nutrients if this has not been done since 2009.
- Apply needed lime, phosphorus, and potassium fertilizer this fall or early next spring.
- Break hardpans by subsoiling this fall or next spring.
- Enhance drainage of the fields this fall or next spring to reduce wet soil problems for the 2013 crop.
- Select varieties for planting in 2013 based on University of Missouri cotton variety yield trials and the yields of varieties in your own and your neighbor's fields. The University of Missouri cotton variety yield trial results for 2012 will be available by early-November on the web at http://aes.missouri.edu/delta/cotton/trials/index.stm
- Select treatments to add to seed before planting next year. There are several different treatments available including those to protect the seedling from diseases, insects, and nematodes. Your selections should be based on the problems with pests anticipated next year.
- Hire a cotton scout or consultant to weekly inspect your 2013 crop for pests.

Following these suggested procedures will give Missouri cotton producers a better chance of producing higher yields and greater profits in 2013. For more information contact Allen Wrather at the University of Missouri Delta Center (Phone 573-379-5431; Mobile 573-3790259; E-mail: wratherj@missouri.edu) or check the Delta Center Web Page (aes.missouri.edu/delta).

J. Allen Wrather
WratherJ@missouri.edu
(573) 379-5431

Forage of the Month: Brassica species

By Rob Kallenbach

Brassica species such as turnip, rape, swede, tyfon and kale are not widely grown in Missouri but can furnish good quality forage in late fall and early winter. If planted in late summer, these drought-tolerant plants can provide up to 6,000 lb/acre of forage by December 1. However, because they cannot withstand repeated, severe freeze/thaw events, they cannot be expected to provide feed much beyond January 1 most years. Although forage quality of both the tops and roots is high, bloat and other animal problems can occur if Brassicas are the only feed in the diet. Brassicas do not tolerate poorly drained soils and are notorious for contracting root and crown rot diseases, especially if grown on the same field for two consecutive years. Crop rotation is about the only way to control these diseases. The turnip aphid, flea beetle, and other insects can create problems from planting through the end of September if not controlled.

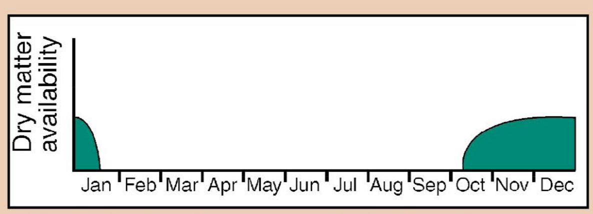
Turnip

Swede

Stemless kale

Tyfon

Origin: Mediterranean
Adaptation to Missouri: Statewide
Fertilization: Apply 75 lb N/acre at establishment.
Timing of production: 70 percent of annual production between Oct. 1 and Dec. 1.
When to begin grazing: Begin grazing to use the forage before early January.
Lowest cutting or grazing height: 0 inches – little regrowth potential.



Yield distribution of *Brassica* species in Missouri.

Rob Kallenbach
KallenbachR@missouri.edu
(573) 884-2213

Comparison of the 2012 Drought to other Droughts for Yield Reductions

Part 2: Soybean

By Bill Wiebold

As described in Part 1, crop productivity is an excellent indicator of drought intensity. Grain crops have specific stages of development when their yields are most sensitive to drought stress, so both stress intensity and timing of stress influences the amount of yield loss.

The most sensitive stage for soybean is stages R3 and R4 (pod development). Stress during this period reduces the number of flowers and small pods that are retained on the plant. These stages usually occur in late July and early to mid-August. Stress during seed-filling (R5 and R6) can result in additional pod abscission, arrested development of one or more seeds in retained pods, and reduced seed size. Stress during vegetative stages and early reproductive stages (indeterminate varieties) may reduce plant height, branch elongation, and leaf size. Usually, drought stress during early vegetative stages has little effect on grain yield. In 2012, some Missouri soybean fields were planted while soils were too dry to promote germination and emergence. Unfortunately in many of these fields, spring rains never occurred and emergence was spotty. In August, USDA/NASS estimated the state average soybean yield will be 30 bushels per acre. That estimate was reduced to 28 bushels per acre in September, which is 28% below trend line yield.

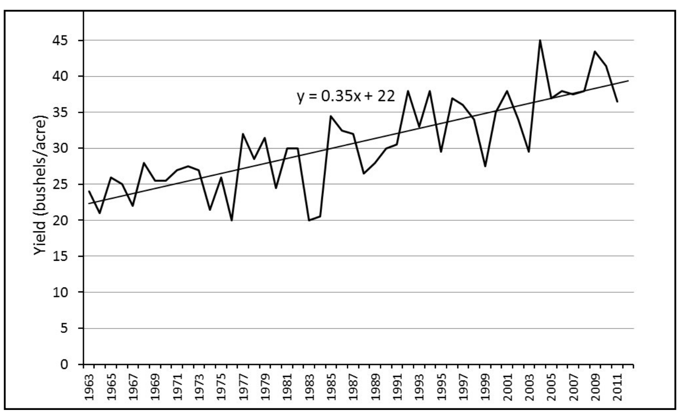


Figure 1: Missouri average soybean yield for the past 50 years. Data source was USDA/NASS.

Trend line for grain yield is a straight line drawn through a graph of yield history (Figure 1). A formula for the line is derived so that trend line yield can be calculated for any year. The formula for the trend line in Figure 1 is yield = 0.35X + 22 where X is the number of years since 1962. For example, trend line yield for 1997 is (0.35)(34) + 22 or 33.9 bushels per acre. The formula of the trend line is related to the years included in the calculation. I used the same 50-year period that I had used for corn beginning in 1963. I did not include the 2012 yield estimate. For each year, I calculated the deviation of actual yield as reported by NASS from trend line yield. So that years could be compared, I divided the amount of yield lost or gained by the trend line yield to calculate a percentage. These percentages are plotted in Figure 2.

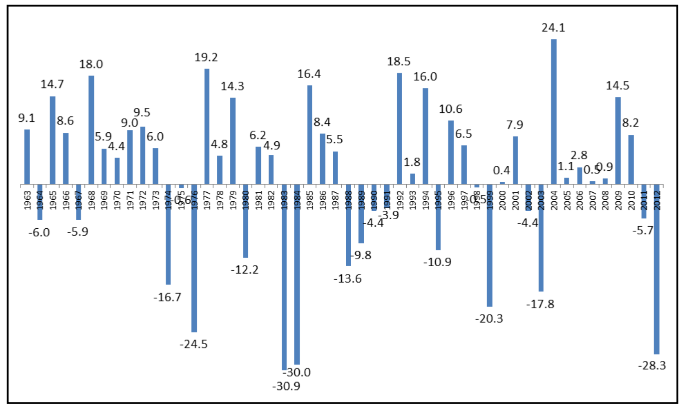


Figure 2: Missouri average soybean yield compared to the 50-year trend line. Numbers are percentages above or below trend line. Yield for 2012 is estimated. Data source was USDA/NASS.

The three years with the greatest reduction in corn yield from drought were 1980, 1983, and 2012 (estimated). For soybean, 1983, 1984, and 2012 exhibited the greatest yield loss from drought. Soybean yield loss in 1980 was only 12%, which ranks 9th among all years. Corn and soybean respond somewhat differently to drought. Part of the reason could be the timing of stress in any one year. Indeterminate soybean varieties possess a development cycle in which vegetative and reproductive growth overlap. And, within a soybean plant development stages among nodes can differ greatly. In Figure 3, I present the top 10 years (within the past 50) for yield reductions for corn and soybean. The two crops share 7 of those 10 years.

The National Agricultural Statistics Service provides yield data for 9 districts in Missouri. I calculated trend line yields and yield losses for 1983, 1984 and 2012 droughts. Because many farmers said that the weather in 2012 reminded them of 1988, I included that year, also. The south central region was not used because total soybean production is relatively low in that region. Figure 4 is a graph of yield losses expressed as a percentage of time line yields for each region in each of the four selected years.

As I stated in Part 1, summer weather conditions often vary widely across Missouri. An extreme example is the summer of 1993. In that year, SE Missouri experienced

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Comparison of the 2012 Drought to other Droughts for Yield Reductions: Part 2

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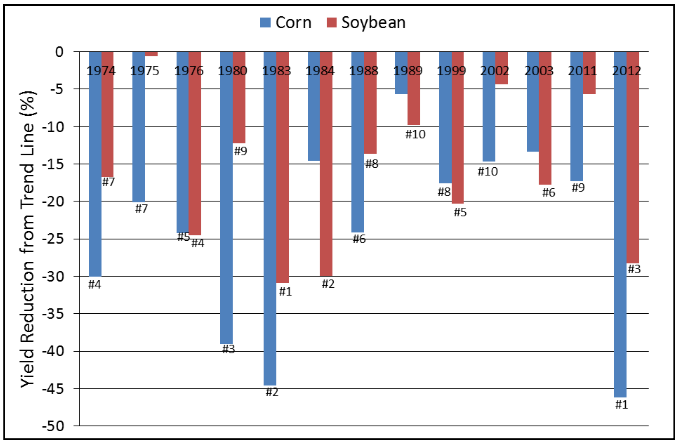

Figure 3: Top 10 yield reductions for corn and soybean in Missouri. Yield losses were calculated as reductions from the trend line and converted to percentages of trend line yield. Yield data for 2012 are estimated. Yield losses from excessively wet years (1993 and 1995 were) excluded. Data source was USDA/NASS.

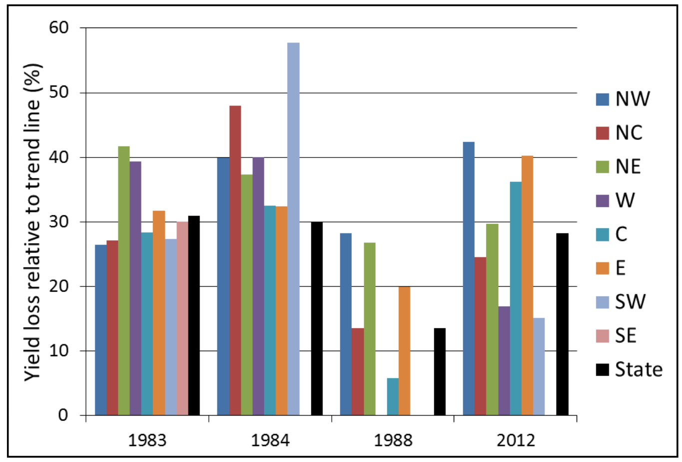

Figure 4: Soybean yield losses from four droughts in 8 Missouri regions. Yield losses were calculated as reductions from the trend line and converted to percentages of trend line yield. Yield data for 2012 are estimated. Data source was USDA/NASS.

drought conditions in July and August while heavy rains were common in central and north Missouri. Farmers in SE Missouri were irrigating crops and increasing levee heights to accommodate northern rains at the same time and in the same fields.

In 1983, yield losses of greater than 26% occurred in all 8 regions. The year ranked #1 among all years for soybean yield loss. Most regions exhibited even greater soybean yield loss in 1984 than in 1983. The exception was SE. Estimated soybean yield loss in 2012 will rank #3 among years and is only 2 percentage points less than 1983 and 1984. The pattern for estimated yield losses among the 8 regions in 2012 is quite variable. USDA/NASS estimates that soybean yield loss did not occur in SE, is less than 20% in two regions, and 30% or greater in four regions. According to the Drought Monitor, SE Missouri experience exceptional drought for much of the late spring and summer of 2012. Although soybean irrigation is common in SE Missouri, the lack of a yield decrease is surprising and may be optimistic.

Many farmers said that the weather in 2012 reminded them of 1988. Statewide, the soybean yield loss in 1988 was only half of the yield loss in 1983 and 1984. The 1988 yield loss ranks 8th among yield losses for the past 50 years. The stressful weather and soybean yield losses in 1988 were located primarily in northwest and eastern Missouri.

Bill Wiebold
WieboldW@missouri.edu
(573) 882-0621

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Crop Management Conference to be held Dec. 18-19

By Kevin Bradley

The Crop Management Conference will be held December 18 - December 19 at the Holiday Inn Select in Columbia. Below is the schedule for the event. If you are interested in learning more information about the conference visit http://plantsci.missouri.edu/cmc.

Crop Managment	Nutrient Management	Pest Management	Soil & Water Management	Professional Development

Tuesday, December 18			
Time	**Windsor I/II**	**Windsor III**	**Windsor IV**
8:30 to 9:15	**Keynote Session: The Future of Agriculture, Dr. Jon Hagler, Director of the MO Department of Agriculture**		
9:30 to 10:30	**Considerations for Nutrient Mgmt. Following a Drought** *Scott Murrell*	**Anhydrous Ammonia Application Uniformity** *Mark Hanna*	**The Changing Paradigm of Corn and Soybean Insect Management** *Wayne Bailey*
10:45 to 11:45	**Considerations for Nutrient Mgmt. Following a Drought** *Scott Murrell*	**Combine Settings to Reduce Grain Loss and Improve Grain Quality** *Mark Hanna*	**Managing Cover Crops in the 21st Century** *Tim Reinbott*
12:30 to 1:30	**Crop Insurance** *Ray Massey*	**Anhydrous Ammonia Application Uniformity** *Mark Hanna*	**The Changing Paradigm of Corn and Soybean Insect Management** *Wayne Bailey*
1:45 to 2:45	**Managing Field Work Days** *Ray Massey and Pat Guinan*	**Combine Settings to Reduce Grain Loss and Improve Grain Quality** *Mark Hanna*	**Managing Cover Crops in the 21st Century** *Tim Reinbott*
3:00 to 4:00	**Crop Insurance** *Ray Massey*	**Utilization of Social Media for Connecting with Customers** *Drew Bender*	**Erosion and the Value of Topsoil: The Long View** *Peter Scharf*
4:15 to 5:15	**Managing Field Work Days** *Ray Massey and Pat Guinan*	**Utilization of Social Media for Connecting with Customers** *Drew Bender*	**Erosion and the Value of Topsoil: The Long View** *Peter Scharf*

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Crop Management Conference to be held Dec. 18-19

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Crop Managment	Nutrient Management	Pest Management	Soil & Water Management	Professional Development

Wednesday, December 19

Time	Windsor I/II	Windsor III	Windsor IV
8:00 to 9:00	**Foliar Fungicides on Corn** *Carl Bradley*	**Soil Health** *Randy Miles*	**Fine-tuning Your Forage Fertilization** *Dennis Hancock*
9:15 to 10:15	**Weed, Insect,& Disease Mgmt. Update** *Wayne Bailey, Laura Sweets, Kevin Bradley*	**Soil Health** *Randy Miles*	**Evaluating Novel Grazing Methods** *Dennis Hancock*
10:30 to 11:30	**Foliar Fungicides on Corn** *Carl Bradley*	**Crop Management to Increase Yield Stability** *Bill Wiebold*	**Fine-tuning Your Forage Fertilization** *Dennis Hancock*
12:30 to 1:30	**Weed, Insect,& Disease Mgmt. Update** *Wayne Bailey, Laura Sweets, Kevin Bradley*	**Drought** *Pat Guinan and Michael Stambaugh*	**Evaluating Novel Grazing Methods** *Dennis Hancock*
1:45 to 2:45	**Showdown in the Show Me State: Waterhemp vs. Us. Who's winning?** *Kevin Bradley*	**Crop Management to Increase Yield Stability** *Bill Wiebold*	**The Long and Short-term Benefits of Cover Crops on Soils** *Newell Kitchen*
3:00 to 4:00	**Showdown in the Show Me State: Waterhemp vs. Us. Who's winning?** *Kevin Bradley*	**Drought** *Pat Guinan and Michael Stambaugh*	**The Long and Short-term Benefits of Cover Crops on Soils** *Newell Kitchen*

Kevin Bradley
BradleyKe@missouri.edu
(573) 882-4039

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Arrested Development in the Soybean Field

Part 1: Flower and pod abscission

By Bill Wiebold

Figure 1: Open soybean flower.

There are only two yield components for grain crops: number of seeds and average seed weight (seed size). Although seed size has been a recently popular topic for discussion, seed number is the more important of the two yield components. So, understanding how plants regulate seed number and how this yield component responds to stresses and crop management are helpful in understanding soybean yield production.

Soybean seed number is determined by the number of flowers produced, the number of pods retained on the plant, and the number of seeds per pod. Because flowers can be produced on all stem and branch nodes, flower number is highly influenced by the amount of branching. The number of branches and branch length are amazingly flexible and respond to stand density and plant spacing. In this article I want to focus the discussion on the number of pods retained.

Unlike corn, soybean plants produce "complete flowers". Complete means that they contain all four basic flower parts: sepals, petals, stamens, and pistil (Figure 1). Soybean flower structure ensures that they are highly self pollinated. The two keel petals enclose the sexual parts making it nearly impossible for wind or insects to carry pollen into flower (Figure 2). The 10 stamens (male parts) are closely situated near the pistil (female structure) so that pollen grains produced in the anthers (part of stamen) are deposited directly onto the stigma (part of pistil) (Figure 3). More than 98% of soybean pods result from self pollination.

Figure 2: Unopened soybean flower with sepals removed; petals cover sexual parts.

Shortly after pollen grains land on the stigma, pollen tubes emerge from the pollen grains and penetrate the stigma. Pollen tubes elongate through the short style. The style tissue provides nourishment and water to the growing pollen tube. It also provides direction, so that the pollen tube's journey ends in the correct place - inside the ovary.

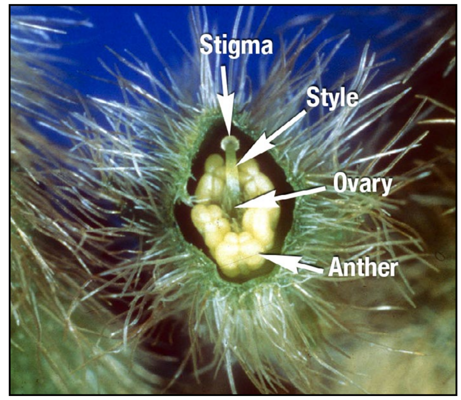

Figure 3: Soybean flower sexual parts; picture of an immature flower so stamens have not fully elongated.

Each ovary contains two to four ovules. The ovary wall will become the pod wall and the ovules will become seeds. As with all agronomic plants, soybean flowers undergo double fertilization. Three nuclei (plural of nucleus) move into the pollen tube. One of the three nuclei directs pollen tube growth and will not be involved in fertilization. The other two nuclei travel down the pollen tube and enter into the ovule once the pollen tube completes its journey. One male nucleus combines with the female gamete to form the embryo within the seed. The other male gamete joins with two female nuclei to form the endosperm. Mature soybean seeds contain almost no endosperm. The large cotyledons accomplish the food storage function usually associated with endosperm.

Each ovule in an ovary requires a separate pollen tube for fertilization. If an ovary contains three ovules, at least three pollen tubes must enter the ovary if all three ovules are to be fertilized. For corn, the number of female flowers that become fertilized is an important determinant of seed number, and that number is highly influenced by weather. Fertilization of soybean flowers is nearly 100%. Reasons for high success rate are: many pollen grains are produced in the 10 stamens; no pollen grains are lost by wind, weather has little effect on maturity sync of stamens and pistil, pollen tubes must travel a short distance from stigma to ovary; and the flower petals cover the pistil, which reduces dehydration.

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Arrested Development in the Soybean Field

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Figure 4: Soybean raceme.

Soybean plants bear flowers on inflorescences called racemes. Racemes have multiple flowers attached by a short stalk (pedicel) to a central, unbranched axis (rachis). After flowers are fertilized, the rachis elongates and separates the developing pods (Figure 4). Flowers in a raceme are fertilized in a specific pattern starting with the flower nearest the plant and proceeding up the rachis to the last flower. It may take 4 to 10 days for all flowers to open on a single raceme. There are three buds at each leaf axil that can produce racemes, so flowers may continue to open at a node for two or more weeks (Figure 5).

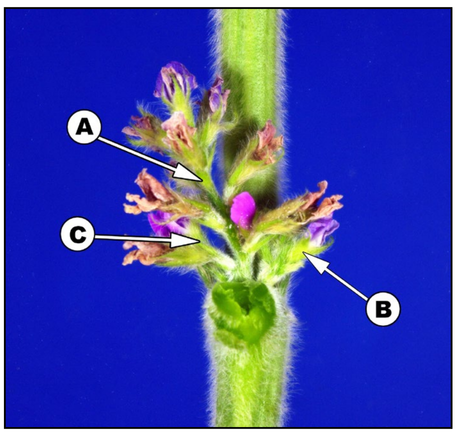

Figure 5: Soybean stem node exhibiting three racemes: primary (A), secondary (B), and tertiary (C)

Soybean plants produce two to three times more flowers than there will be pods at harvest. This excess capacity is part of a strategy to produce viable seeds even if stress causes flowers to abscise. Abscission is an important process that controls pod load (and seed number) on soybean plants. Poor growth conditions including drought stress, shading by weeds, leaf defoliation and even long periods of clouds increase the amount of abscission. But, even under excellent growing conditions, abscission of 50% or more of the flowers is normal.

As stated before, nearly 100% of soybean flowers are fertilized. So, technically all of the reproductive structures that abscise are pods. But, many of the structures that abscise are very small pods that may have petals still attached. Not all flowers have an equal chance of remaining on the plant. Flowers produced on nodes near the bottom of the canopy are more likely to abscise than flowers located in the upper one-third (Figure 6).

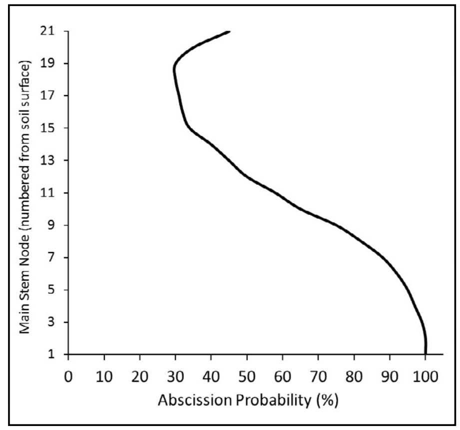

Figure 6: Effect of position within soybean canopy on flower abscission probability. Node 1 is closest to soil surface.

Abscission probability also varies among positions on a raceme. The ages of pods at position 1 (oldest) and position 5 (youngest) on the raceme in figure 7 differ by only 4 to 6 days. But, the sizes of the pods differ greatly. The pods at the first two positions are closer to the source of sugars and other nutrients. They are well nourished and dominate pods at other positions. Development of pods at position 4 and greater is often arrested so that they grow slowly or not at all. Under normal weather conditions, abscission probability is less than 5% for pods at positions 1 and 2 and 75% or greater for pods at position 4 and above (figure 7). Young pods located at upper positions on racemes develop into harvestable pods only if stresses damage pods at lower positions or caused them to abscise.

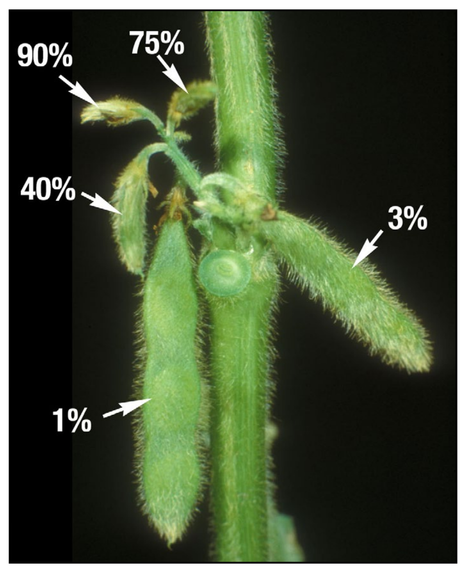

Figure 7: Abscission probability of flowers/pods within a raceme. Picture is from Iowa State University.

Bill Wiebold
WieboldW@missouri.edu
(573) 882-0621

Weather Data for the Week Ending October 30, 2012

By Pat Guinan

Station	County	Weekly Temperature (ºF)						Monthly Precipitation (in.)		Growing Degree Days‡	
		Avg. Max.	Avg. Min.	Extreme High	Extreme Low	Mean	Departure from long term avg.	October 1-30	Departure from long term avg.	Accumulated Since Apr.1	Departure from long term avg.
Corning	Atchison	57	35	82	24	45	-6	2.48	-0.20	3863	+411
St. Joseph	Buchanan	58	37	82	27	46	-6	2.06	-0.74	4142	+700
Brunswick	Carroll	57	34	83	24	45	-7	2.45	-0.50	4022	+529
Albany	Gentry	59	34	84	22	45	-6	1.83	-0.69	3910	+559
Auxvasse	Audrain	59	36	82	28	47	-6	2.45	-0.43	4134	+573
Vandalia	Audrain	59	35	83	26	47	-5	2.84	+0.17	4093	+600
Columbia-Bradford Research and Extension Center	Boone	59	35	82	28	47	-6	2.68	-0.23	4090	+427
Columbia-Capen Park	Boone	62	35	86	24	47	-7	2.64	-0.48	3952	+156
Columbia-Jefferson Farm and Gardens	Boone	59	36	82	28	47	-6	2.31	-0.61	4260	+584
Columbia-Sanborn Field	Boone	60	38	84	29	48	-6	2.64	-0.38	4491	+686
Columbia-South Farms	Boone	58	36	81	28	47	-6	2.47	-0.49	4253	+584
Williamsburg	Callaway	59	36	83	27	47	-6	3.20	-0.10	4147	+654
Novelty	Knox	57	35	80	26	46	-6	3.25	+0.17	3806	+391
Linneus	Linn	58	35	82	24	46	-5	1.95	-0.95	3956	+599
Monroe City	Monroe	58	35	81	26	46	-5	3.93	+1.20	3970	+493
Versailles	Morgan	61	36	83	28	47	-7	3.51	+0.10	4477	+699
Green Ridge	Pettis	58	36	82	27	46	-6	3.39	-0.02	4272	+737
Lamar	Barton	60	38	83	28	48	-7	4.47	+0.88	4466	+512
Cook Station	Crawford	61	35	83	23	47	-7	4.22	+0.85	3993	+237
Round Spring	Shannon	63	33	83	23	47	-6	2.27	-1.23	3824	+230
Mountain Grove	Wright	60	35	79	25	47	-6	2.63	-0.78	4064	+488
Delta	Cape Girardeau	61	41	80	36	51	-4	4.19	+0.40	4301	+131
Cardwell	Dunklin	64	41	82	35	52	-5	3.27	-1.08	4645	+87
Clarkton	Dunklin	63	41	82	35	52	-4	2.81	-0.31	4647	+163
Glennonville	Dunklin	63	41	82	34	51	-6	2.46	-0.63	4668	+218
Charleston	Mississippi	62	4	81	34	51	-5	4.51	+0.94	4599	+382
Portageville-Delta Center	Pemiscot	63	42	83	34	53	-4	2.43	-1.72	4902	+371
Portageville-Lee Farm	Pemiscot	63	41	83	34	52	-5	2.94	-1.04	4845	+351
Steele	Pemiscot	64	42	83	35	52	-6	3.21	-0.68	4936	+392

‡Growing degree days are calculated by subtracting a 50 degree (Fahrenheit) base temperature from the average daily temperature. Thus, if the average temperature for the day is 75 degrees, then 25 growing degree days will have been accumulated.

Weather Data provided by Pat Guinan
GuinanP@missouri.edu
(573) 882-5908

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Editor: Kate Riley (rileyka@missouri.edu).