UK COOPERATIVE EXTENSION SERVICE
University of Kentucky – College of Agriculture

LEXINGTON, KY 40546

CORN AND SOYBEAN SCIENCE GROUP NEWSLETTER

Cooperating Departments: Agronomy, Agricultural Economics, Biosystems and Ag. Engineering, Entomology, Plant Pathology
Morris Bitzer, Department of Agronomy, Editor

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2003 Corn and Soybean Production Contests: Each year the Agronomy Department, Cooperative Extension Service, sponsors a corn and soybean production contest. The rules and regulations for these contests should be in the Extension offices by the end of July. Hopefully many of you have signed up for the National Corn Growers Association Corn Yield Contest. If you sign up for the NCYC, please send a copy of your entry form to the local Extension office. Following harvest of your contest plot, make sure that a copy is entered in the State Contest, also. The state contests (corn and soybean) are open to any producer in Kentucky. The top entries in the corn and soybean contests will be eligible for an expense paid trip to the National Commodity Classic in Las Vegas, Nevada. If you want to enter either the corn or soybean contests this year, contact your local county agricultural agent for the necessary forms. They should help you measure your yields and fill out the necessary forms.

New European Union Regulations for Genetically Engineered Crops

Chad Lee, Grain Crops Extension Specialist, Agronomy Department

The European Union has voted in favor of labeling of foods and feeds derived from genetically modified crops. The regulations will also require traceability of all commodities from production on the farm to purchase from the grocery store. The 15 member states are expected to approve these new regulations later this fall and the regulations are expected to take effect next year. Genetically engineered crops include Roundup Ready soybeans, Roundup Ready corn, Liberty Link corn, Bt Corn, and Bt Rootworm corn. Each of these crops has a new or altered protein that helps the plant survive herbicide application or insect infestation.

Any food or feed derived from a genetically engineered crop will have to be labeled as such in the European Union. This labeling is even required on foods that do not contain the protein from genetically engineered plant. For example, all crackers and cookies with soybean oil derived from genetically engineered soybeans will have to be labeled as "This product contains genetically modified organisms" or “produced from genetically modified soybeans".

In addition to labeling of all foods and feeds that are derived from genetically modified foods, the European Union will require that all foods are traceable. That traceability means that the European Union wants to know from what farm each food product came. This traceability requirement will be extremely challenging for the U.S. grain industry.

The impact of these regulations on U.S. commodities for export is unknown at this time. As we learn more about the details and implications of these regulations, we will do our best to keep you informed. Updates on this and other topics will be posted to the Grain Crops Extension website at: http://www.uky.edu/Ag/GrainCrops/.

Are Early Soybean Varieties Better?

D.B. Egli, C. D. Lee and J.H. Grove, Research and Extension Agronomy Specialists, Agronomy Department

Drought stress frequently reduces soybean yield in Kentucky. Average rainfall is higher than some surrounding states that produce higher yields, but Kentucky is plagued with summer rainfall that is highly variable and with shallow soils that don’t hold much water. We wondered if planting early maturing soybean varieties on these shallow soils would reduce water stress and increase yield. The shorter growth cycle of early maturing varieties uses less water to produce the crop, plus reproductive growth occurs earlier in the growing season when the chances for adequate soil water availability are greater. If water is limiting on the shallow soils, early varieties will finish growth sooner and might show a yield advantage.

We tested this idea by growing soybean crops in a computer simulation model that mimics growth in the field. We used the CROPGRO model, developed at the University of Florida, to compare very early (Maturity group (MG) II), early (MG III), mid-season (MG IV) and late (MGV) varieties growing on shallow and deep soils over 30 growing seasons. The yield of all varieties in the model was the same on a deep silt loam soil (similar to the best soil in Illinois), but there was a yield advantage for the very earliest variety (MG II) on shallower soils. The advantage for the MG II variety over MG IV or V, averaged over 30 years, was between 20 and 30% on the shallowest soil.

We know that CROPGRO does a good job of predicting soybean growth and yield in the field, but it is only a collection of mathematical equations - a model - not a plant growing in the soil in the field. For this reason, we are testing this idea in an experiment on Spindletop Farm at Lexington, where we are growing varieties from MG II to V (two varieties per MG) on four landscape positions (summit, footslope, shoulder, backslope) that include deep and shallow soils. We will monitor reproductive development and determine yield at maturity. The variety response will probably depend upon how much and when it rains, so one year's data will not tell us if growing early varieties on shallow soils is a good idea. We could quickly evaluate the response for 30 years of weather in the model – a big advantage for models – in the field we can only do one year at a time, so it will take at least three years to determine if our idea will work.

This research is being sponsored by the Kentucky Soybean Board.

The Green Stem Syndrome in Soybean

D.B. Egli and W.P. Bruening, Crop Physiology Specialists, Agronomy Department.

Maturation in a soybean field is usually very dramatic – all leaves turn bright yellow and fall off the plant and the pods and stems turn brown. Occasionally something goes wrong with this process and the stems stay green after the pods turn brown. Fortunately the green stem syndrome only occurs sporadically, but it can cause serious problems at harvest time. The green succulent stems are hard to run through the combine and require slower ground speeds. Waiting for the green stems to turn brown may result in over-drying the seeds which will increase mechanical damage during harvesting and handling after harvest. Mechanical damage will also reduce germination and vigor of seed that will be used to plant the next crop.

No one knows for sure what causes green stems. Some think it is caused by disease, especially viruses - for example, in some fields, bean pod mottle virus has been found in plants with green stems - or by insects feeding on pods. Others think it is more common when yields are high and speculate that it may result from the development of high-yielding varieties, perhaps as a result of selection for the stay-green trait. The sporadic occurrence of green stems suggests that environmental conditions may play a significant role.

While searching for a common characteristic in this list of possible causes, we, along with others, thought that green stems could be a result of not having enough pods on the soybean plant. We know that carbohydrates and nitrogen move from leaves and stems to seeds as the plant matures. This transfer is part of the normal aging of the plant. At maturity when the leaves fall and the stems and pods are brown most of the nitrogen and carbohydrates are gone. The carbohydrates and nitrogen would have no place to go if the pod load is too small, so they would stay in the stems and the stems would stay green.

We investigated this idea in a field experiment in 2001 and 2002 with three early, (Maturity Group III), three mid-season (Maturity Group IV), and three late (Maturity Group V) high-yielding soybean varieties. Two replications of each variety were planted in 30-inch rows at the recommended population. Pods were removed from all plants in 3 feet of row early in the seed filling period (beginning of growth stage R6) to artificially reduce the pod load. A 50% pod removal treatment was applied by removing all pods from alternate nodes. A 25% pod removal treatment (all pods removed from one node out of 4) was added in 2002. We made visual ratings of pod and stem color and counted the brown stems on control and depodded plants every third day as the plants matured.

The stems on the depodded plants stayed green much longer than stems on the control plants and the delay was greater for 50 than for 25% depodding (Fig. 1). Stems on the depodded plants sometimes turned brown, but it took from 11 to as much as 32 days longer when comparing all varieties in both years. Many varieties still had green stems when the plants were killed by frost.

The appearance of brown pods on the depodded plants was also delayed, relative to the plants that were not depodded, but the delay was not nearly as large as for the stems. Most of the pods on the depodded plants were brown 2 to 10 days after the control plants.

Nitrogen and total carbohydrate (soluble sugars and starch) levels in stems of depodded plants were generally higher (more than 10 times higher for some varieties) than control plants when the pods turned brown (Table 1). These high levels confirmed our hypothesis that reductions in pod number would limit the movement of these compounds out of the stem during seed filling.

Seed moisture levels when the pods turned brown were almost the same for all treatments (Table 2). However, seeds from green-stem plants may be much drier if they are harvested later. Threshing such dry seeds could cause serious mechanical damage, damage that could reduce the market value of seeds sold for grain.

Delayed harvest may be especially troublesome for seed producers. Mechanical damage will reduce seed germination and vigor – important quality characteristics of seed that will be used for planting. Delayed harvest may increase seed infection by fungal pathogens which will also decrease seed germination and vigor.

All varieties developed green stems in the depodding treatments in both years. But there were large differences among varieties in how long it took the green stems to turn brown. The browning process was slower in 2002 than 2001, but there were no variety differences that were the same in both years. We still do not know if some soybean varieties are more susceptible to green stem than others – more research is needed to answer this question.

Our results demonstrate that the green stem syndrome can occur when the soybean plant does not set enough pods, or in crop physiology terminology, the source and the sink are not balanced. We think the imbalance – the number of pods is not balanced with photosynthesis - is the key. Low pod numbers and low photosynthesis caused, for example, by a consistent season-long stress, would not be out of balance and, although yields would be low, there would probably not be any green stems. We think green stems occur only when the balance is disturbed by reducing pod number when photosynthesis remains high. The 2002 results suggest that the imbalance does not have to be large – only a 25% reduction in pod load created green stems in all varieties. Pod number could be reduced by disease, insect feeding, or changes in weather conditions between flowering and pod set, and seed filling. Green stem may have many causes, but our data suggests that they all create the problem by reducing pod number.

Table 1. Stem total carbohydrate (soluble sugars and starch) and nitrogen concentrations when the pods on each treatment turned brown, 2002.

Variety and maturity group		Stem Composition[1]: Total carbohydrates			Nitrogen		
		Control	25%[2]	50%[2]	Control	25%	50%
		mg g^{-1}					
III	Early[3]	14	24	49	3	4	8
IV	Mid-season	11	19	65	3	5	12
V	Late	15	60	79	3	8	10

[1]Samples taken when all pods were brown on each treatment.
[2]Percent pod removal - all pods from one of every four nodes (25%) or o every two nodes (50%) were removed at the beginning of seed filling.
[3]Average of three varieties per maturity group, except maturity group V where only one variety was harvested before a killing frost on Nov. 8.

Table 2. Seed moisture levels when the pods on each treatment turned brown, 2002.

Variety and maturity group	Seed Moisture[1]: Control	25%[2]	50%[2]
	%		
III Early[3]	22	22	13
IV Mid-season	22	19	19
V Late	23	23	24

[1]Samples taken when all pods were brown on each treatment.
[2]Percent pod removal – all pods from one of every four nodes (25%) or of every two nodes (50%) were removed at the beginning of seed filling.
[3]Average of three varieties per maturity group, Except maturity group V where only one variety was harvested before a killing frost on Nov. 8.

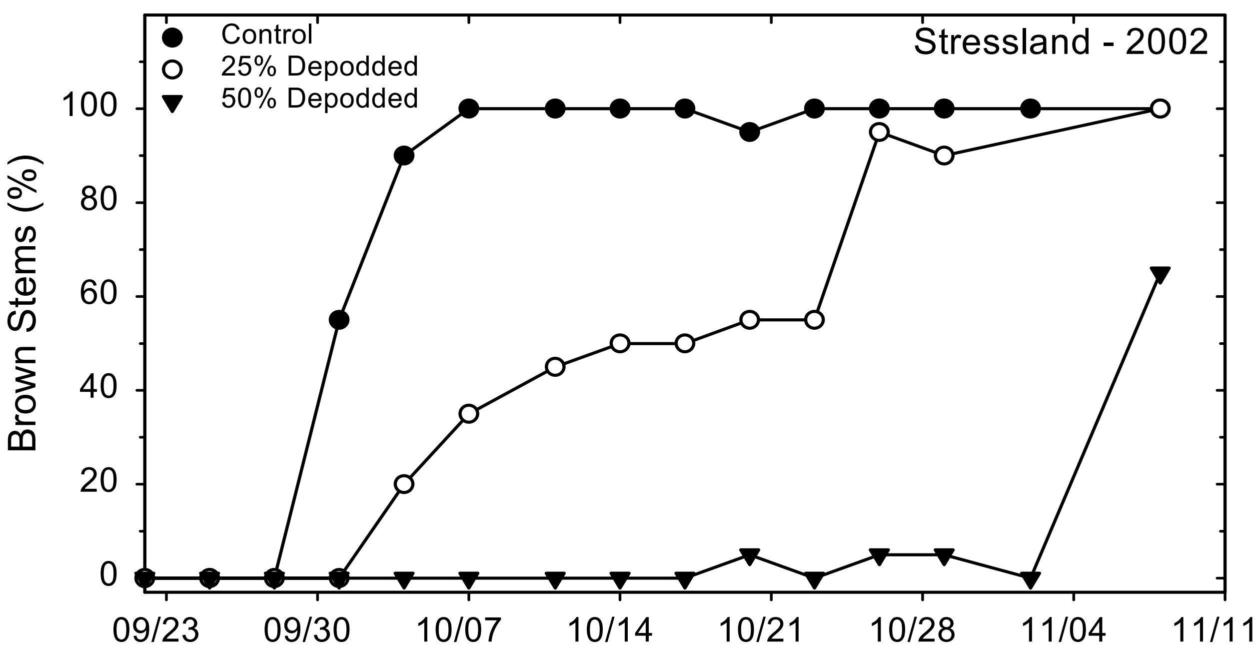

Fig. 1. The effect of depodding on the development of brown stems in Stressland (Maturity Group IV) in 2002.

Wheat Cultivar Effect on Double-Crop Soybean Growth and Yield

Todd Pfeiffer, Dave VanSanford, and Dave Pilcher, Plant Breeders and Research technician, Agronomy Department.

Soybean double-cropped after wheat accounts for, depending on the year, 20% to 40% of the soybean acreage in Kentucky. Double-crop soybean yield, on average, 75% of full season soybean. There are numerous factors that contribute to this reduced yield including later planting date with reduced soil moisture reserves following the wheat crop, shorter day lengths during seed filling, and more frequent dry periods during the seed filling period. Several soybean producers have commented to us that the prior wheat crop directly affected double-cropped soybean in ways such as reduced stand establishment, soybean plant growth and soybean yield. Mike Garland, a private soybean breeder, conveyed to us that in his experience soybean cultivars were differentially affected by double cropping behind wheat. Furthermore, in a science fair project that his daughter conducted, soybean growth was reduced by watering with wheat straw leachate compared to using only water. In the 1970s Dr. C.E. Caviness at the University of Arkansas conducted research on the phytotoxic effects of wheat residue on soybean growth. He reported on greenhouse pot studies which showed 18% to 38% reduced soybean growth due to the addition of 20g wheat straw / kg soil (Crop Science 26:641-643, 1986). Grain crop farmers in Kentucky will continue to follow the wheat/soybean double-cropping system. We want to determine if wheat and/or soybean cultivar selection can overcome some of these obstacles inherent in double cropping. Our first question was whether, in field production tests, straw residue from wheat cultivars grown in Kentucky had differential effects on double-cropped soybean growth and yield.

Research Approach: This experiment was conducted at the UK experiment station farm at Lexington, KY in 1997 – 1999. Data are reported for 1997 and 1998 as no soybean plots were harvested in 1999 due to the severe drought. Tests in all years were conducted on a Maury silt loam soil. The University of Kentucky routinely conducts a wheat cultivar performance test which includes released cultivars and promising breeding lines. These tests are conducted with four replications planted in six row plots 10 ft long and 4 ft wide. The wheat performance test in 1997 consisted of 48 entries and in 1998 consisted of 53 entries. Thirty entries were common in the two years. Wheat was harvested when all cultivars in the trial reached maturity. Wheat cutting height was approximately six inches and all straw residue from the combine remained in the field, mostly laying on the plot from which it came or in the alley between plots. Soybean cultivar Asgrow A4715 was planted with a no-till planter in 15 inch rows with a seeding rate of six seeds/ft. Planting dates were 8 July 1997 and 2 July 1998. Gramoxone and Dual were applied pre-emergence. Soybean plots were 10 feet long, and alleys between the soybean plots corresponded to the alleys between the previous wheat plots. Depending on the alignment of the no-till planter and the straw rows in the prior wheat plots, three or four soybean rows were situated entirely within a wheat plot, and three rows were harvested from each plot with a small plot combine. Three inches of irrigation water were applied in September 1998. Soybean matured before the first freeze in both years.

Data were collected on plant stand by counting the number of plants in one m of two adjacent rows. Plant height was measured at R1 (first flower) and at R8 (maturity). Plots were harvested with a small plot combine and yields were expressed as bu/a at 13 % moisture.

Results: The two-year means of soybean growth as affected by the straw residue from 30 wheat cultivars are shown in table 1. Soybean yields ranged from 27.4 to 20.0 bu/a with a two-year mean yield of 23 bu/a. The yields differed significantly in the two years, averaging 25.8 bu/a in 1997 and 18.2 bu/a in 1998. There was no significant effect of wheat cultivar on soybean yield averaged over the two years ($p>0.10$), and there was no significant cultivar x year interaction (Table 2). The two-year average of soybean plant height at flowering ranged from 43 to 39 cm depending on the wheat cultivar in the plot with a two-year mean height of 41 cm. There was a statistically significant difference due to the wheat cultivar. The average soybean plant height at flowering differed significantly in the two years, 46 cm in 1997 and 33 cm in 1998, but the year x cultivar interaction was not significant (Table 2). The two-year soybean plant height at maturity ranged from 70 to 66 cm with a mean of 68 cm but did not differ significantly depending on the prior wheat cultivar in the plot. The plant height at maturity differed significantly between the two years, 79 cm in 1997 and 50 cm in 1998. The wheat cultivar in the plot did not affect the soybean plant stand, and there was no year effect or year x cultivar interaction (Table 2). The average plant stand for the 30 cultivars grown in the two years was 159,000 plants/a.

Summary: We were not able to measure a significant differential effect of wheat cultivar straw residue on soybean yield. However, the mean yields were low and were particularly affected by the dry August and September in 1998. We did measure a statistically significant difference in soybean plant height at flowering depending on the wheat cultivar straw residue in which the soybean was planted. However, a height difference of 4 cm, which was the maximum due to wheat variety, may not be agronomically important except in low yielding environments with very short plant height. Plant height measurements are more repeatable than yield measurements, and in this experiment the CV (a measure of relative variability) for plant height was 8% compared to the CV for yield of 19%. A CV of this magnitude is common for yield measurements in double-crop soybean experiments. There was a significant correlation between the two-year means for soybean height at R1 and soybean yield ($r=0.44$, $p<0.05$). This indicates that a small differential effect of wheat cultivar straw residue that affects plant growth early may affect soybean yield. Our experimental techniques are not precise enough to quantify this effect if it actually exists. The research by

Caviness et al., which showed differential soybean cultivar responses to wheat straw in greenhouse pot experiments, was also not verifiable in field scale experiments (Crop Science 26:641-643, 1986).

Table 1. Two year (1997 and 1998) means of soybean yield, stand, and plant height at flowering (R1) and maturity (R8) as affected by wheat cultivar straw residue from prior wheat plots.

Wheat Cultivar	Soybean Yield	Soybean Stand	Soybean Plant Height at R1	Soybean Plant Height at R8
	bu/a	plants/a	cm	cm
Wakefield	27.4	168,000	43	70
25R26	25.6	204,000	42	66
25R57	25.1	155,000	42	67
Ernie	25.1	188,000	42	70
Terra SR204	25.1	158,000	43	69
Patterson	24.8	181,000	43	68
FFR 558	24.5	167,000	43	69
NK Coker 9803	24.5	158,000	39	68
Glory	24.5	154,000	40	69
KY86C-61-8	23.8	179,000	43	68
2552	23.2	135,000	41	67
Caldwell	23.0	167,000	41	66
Becker	23.0	143,000	40	68
Madison	23.0	149,000	43	68
KAS Patriot	23.0	158,000	40	68
Verne	22.7	127,000	40	68
2540	22.5	133,000	43	69
FFR 555	22.5	176,000	43	68
NK Coker 9663	22.4	177,000	41	68
Jackson	22.2	167,000	40	67
Agripro Foster	22.1	146,000	40	67
KY86C-127-3	22.1	177,000	40	67
2568	22.1	175,000	43	68
NK Coker 9543	21.7	155,000	42	68
Agripro Elkhart	21.7	138,000	40	68
Clark	21.4	143,000	39	68
Beck 103	21.3	155,000	40	67
FFR 523	21.1	202,000	39	67
NK Coker 9704	20.1	158,000	41	66
KAS Justice	20.0	183,000	41	68

Table 2. The levels of statistical significance are indicated for the year, wheat cultivar and year x cultivar interaction sources of variation for soybean yield, stand and plant height of soybean cultivar A4715 planted double-crop following 30 different wheat varieties in 1997 and 1998 at Lexington Kentucky.

Source of Variation	Soybean Yield	Soybean Stand	Soybean Plant Height at R1	Soybean Plant Height at R8
Year	**	NS	**	**
Wheat cultivar	NS	NS	**	NS
Yr x cultivar	NS	NS	NS	NS

** significant at the p=0.01 probability level

NS not significant at the p=0.05 probability level

Soybean Insects to Watch in Late Summer

Doug Johnson, Extension Entomologist, Entomology Department

Traditionally, Kentucky grown soybeans are free of major insect problems. However, there are a few insects that can cause significant problems. Fortunately, controlling an insect infestation in soybeans is pretty easy. Generally, the question that needs to be answered is not if we can control the insects, but if we should control the insects. Soybeans are very tolerant to insect damage. The mere fact that insects are present does not call for treatment. Three insects that may cause problems in Kentucky soybean late in the summer are grasshoppers, mites and soybean pod worm. Drought favors the increase of the first two of these.

Grasshopper damage is easy to identify if you find it early when the hoppers are still in the field. Grasshoppers are notorious for moving in, feeding and moving out before they are noticed. If you have what appears to be a hopper problem and they are still in the field, they are relatively easily controlled. To make your decision, use defoliation as your threshold. For more on grasshoppers look for Entfact – 116 on Entomologies web pages at: http://www.uky.edu/Agriculture/Entomology/entfacts/eflists.htm

Spider mites are a far different problem. They are more difficult to diagnose and control. The first symptom is usually a "bronzing" of the leaves on the plants. Spider mites are very small. You may be able to see them with the naked eye but you will have to use a hand lens to see any features. They are more closely related to spiders than insects and have eight legs. The two-spotted spider mite is the most commonly seen insect in Kentucky soybean fields. It is greenish yellow to dull orange with a large irregular-shaped spot on each side of the body. If you suspect spider mites, shake some leaves over a piece of white paper and look for tiny spots moving on the paper.

In most cases, symptoms of spider mite damage will be noticed before the mites. Spider mites feed with long stylet like mouthparts that they stick into individual cells and suck out the contents. This type of feeding kills individual cells and appear as small white or yellow spots on the leaf. These small spots give the leaves a stippled appearance. The result is a reduction of photo-synthetic capacity. As damage increases, plants take on a yellowed, then bronzed appearance. If high levels of pressure continue the plants will defoliate. Remember this is a double whammy as it usually occurs in the presence of drought stress.

Making a control decision is very difficult. The general rule of thumb is: if you expect to make a crop then treat the damaged areas as if the plants were defoliated. If the drought is relieved by a sustained rain (increased humidity), mite populations will be reduced. If however, a heavy (drought relieving rain) is quickly followed by a clearing sky and low humidity, the mite populations may stick around.

Probably the most consistently dangerous insect to soybean yields is the soybean pod worm. Also, known as the corn earworm, this late season pest can really put a dent in soybean yields, is hard to detect and can be hard to control. This is usually a very late season pest. Look first in fields in which the canopy has not closed. This might be from late planting, or drought delay, but it does not make any difference why the canopy is open only that it is. It only takes two worms per row foot of beans to require treatment. This does not happen often but when it does look out! Look for Entfact –144 on the above listed web pages.

You can find insecticide recommendations for soybeans (and other crops) in our Insect Management Recommendations for Crops and Livestock. You can view them on line at: http://www.uky.edu/Agriculture/PAT/recs/rechome.htm. As always you can obtain printed copies of these publications from your County Extension Office.

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