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Corn & Soybean Science Group Newsletter

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Cooperating Departments:
Agronomy, Agricultural Economics, Biosystems and Agricultural Engineering, Entomology, Plant Pathology

In this Issue:

1. When is Fall Tillage Necessary?

Lloyd Murdock, Agronomy

Fall is the best time to till a soil because the soil is usually dryer. This means less possible compaction from the traffic of the tillage process and better disturbance of compacted layers.

Farmers primarily use two types of tillage in the fall: 1) surface tillage to prepare for the spring planting of corn and soybeans; and 2) subsoiling, which is mainly done on no-tilled/mostly no-tilled fields. Land is surface tilled, also, for planting wheat and other fall seeded crops, but we will concentrate on corn and soybeans here.

Fall tillage can provide benefits to poorly drained and compacted soils.

Surface Tillage

Although surface tillage is used on all soil types, it is mainly beneficial on the more level and poorly drained soil types. These soil types have poor surface and internal drainage which cause delayed planting or poor stands and growth if high amounts of residue are on the surface during cool wet springs. Fall tillage reduces the amount of surface residue and allows the soil surface to warm and dry faster in the spring. This allows an earlier planting and sometimes a better corn stand, which is helpful on these soils. Tillage also reduces internal drainage and increases water loss by evaporation. These characteristics of tillage are usually not that detrimental to poorly drained fields because water is usually available to the plant throughout the growing season. The reduced internal water movement and increased water loss are detrimental to soils that are not poorly drained. The increased water loss will reduce yields if a droughty period occurs during the growing season on soils that are well or moderately drained. Therefore,

tillage would usually not be recommended on these soil types.

If tillage is used on erodable land, remember to leave at least 30% of surface covered with residue. This residue cover will greatly help reduce erosion and help preserve some of the moisture during the growing season.

Subsoil Tillage

Subsoil tillage is mainly used on no-till land or mostly no-tilled land. Farmers use it to increase internal drainage and loosen the soil. This type of tillage is, by far, best done in the fall because of the depth of tillage. The soil moistens from the top down in the fall and dries from the top down in the spring. Therefore, the subsoil will usually be dry enough to shatter in the fall, but may remain too wet in the spring to get proper shattering.

When compaction exists, subsoiling can increase the yields by 10% to 25% depending on severity of compaction. If compaction does not exist, I have never measured a significant increase in yields due to subsoiling. However, Agriculture Extension Agents and farmers have measured economical yield increases under these conditions. Therefore, there is a chance of a yield increase by subsoiling uncompacted soil. However, the chances are not great and an economic return for the subsoiling would be questionable not to mention the extra labor and management that would be required.

Recent research indicates that over time continuous no-till systems actually correct compaction that exists in a field. However, subsoiling field end-rows and other high traffic areas to aid in correcting compaction would be prudent.

Conclusions

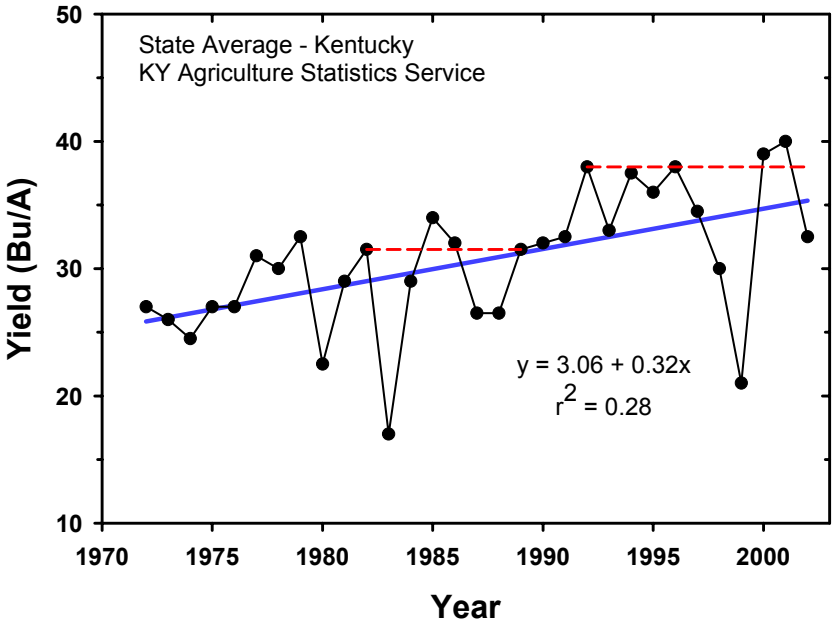
Fall is an excellent time for tillage, whether it be surface or subsoil tillage. However, places and conditions where tillage has proven to be beneficial are not great. The benefits of tillage occur mainly on poorly drained soil for surface tillage and compacted soils for subsoil tillage.

2. Have Kentucky Soybean Yields Reached a Plateau?

Dennis B. Egli, Agronomy

Some of Kentucky's soybean producers believe that yields are no longer increasing. Is this true? Are we approaching a yield barrier? Many farmers expect good yields this year, but the Kentucky Agricultural Statistics Service's September estimate of the average state yield is only 38 bushels per acre. Kentucky first reached this yield level in 1992. Our all-time record yield, 40 bushels per acre, occurred in 2001. The same yield in 1992 and 2003 might suggest a plateau, but the record yield occurred just two years ago, suggesting that yields may be increasing still.

Figure 1. Soybean yield averages for Kentucky from 1970 to 2002.



How do we know if yields are increasing or stagnant? Soybean yields are determined by the yield potential of the variety, management practices, soil type and the weather – primarily rainfall. The amount of rainfall and when it occurs are critical in Kentucky, causing much of the year-to-year variation in yield (Fig. 1). This variation makes it difficult or impossible to spot a yield plateau until it is well established. Is the nearly constant yield from 1992 to this year a plateau or just a run of years with bad weather? What about the 1980's? Its hard to say for sure, but one or two years

with excellent weather and record yields will destroy any plateau and restore the upward trend, just as it did in the early 1990's.

Over the long haul, soybean yields in Kentucky have increased. Trend analysis of average state yields (data from Kentucky Agriculture Statistics Service) in Kentucky from 1972 to 2002 suggests that yields increased at an average rate of 0.3 bushels per acre per year (Fig. 1). That increase is less than 1% of the projected yield for 2003. No wonder it is easy to get the impression that yields are not increasing. The average rate of increase was a little higher in Illinois (0.4 bushels per acre per year) where average yields are usually higher than in Kentucky. We also evaluated yield increases in selected high-yielding counties in Kentucky and Illinois. The average increase was up to 0.4 bushels per acre per year in Henderson and Davies counties in Kentucky and 0.5 and 0.8 bushels per acre per year in the Illinois counties. By comparison, the increase in low yielding counties in Kentucky and Illinois was much lower (only 0.1 to 0.2 bushels per acre per year). We always found that the yield trend was upward but, at best, it was not very large and in areas with low yield potential it was almost zero. Such small increases are easily masked by variation in weather creating the impression that yields have reached a plateau at times. Looking at yields over 31 years (Fig. 1) makes the trend for higher yields clear, but it doesn't tell us if the stable yields over the past 10 years represent the beginning of a yield plateau or just a run of years with bad weather.

Plateau or not, yields now are higher than they were 30 years ago, primarily because modern varieties have higher yield potential, better agronomic characteristics, and broader disease resistance. Are varieties still improving? The average rate of increase in yield of the three highest yielding varieties in each maturity group from the Kentucky Soybean Performance tests was 0.3 bushels per acre per year from 1975 to 2002, which is just about the same as the increase in average state yields. Soybean varieties available to Kentucky producers are constantly improving and there is no indication that this trend will end soon, as the highest yields over the 28 years (> 50 bushels per acre) occurred in 2001.

Data from Kentucky and Illinois demonstrate that soybean yields have increased and I think they have the potential to keep increasing slowly. The modest yield potential in Kentucky will limit us to a slow increase, just like in the past, and the year-to-year variability in yield may often mask the increase. Is there anything that can be done to increase yields faster? Research over the past 40 years at the University of Kentucky and in other states has done a good job of defining the Best Management Practices for growing soybean. This system starts with good seed of the best high-yielding variety available. Plant the seed in May or early June at an optimum population in narrow rows on a soil with adequate levels of fertility. If weeds and the soybean cyst nematode are controlled and harvest losses minimized, you should have the potential for high yields. Actual yield will depend on the inherent productivity of the soil and the weather - neither of which can be controlled. Unfortunately there are no magic bullets or potions out there that will produce dramatic increases in yield, but applying the Best Management Practices package and praying for rain should keep Kentucky soybean yields edging slowly upward.

3. Glyphosate Does not Increase SDS

Chad Lee, Agronomy

Much of the blame of the current soybean yield plateau has been directed at Roundup Ready soybeans. One area of blame was with sudden death syndrome. But, is this blame worthy?

When Roundup Ready soybeans were first used on a wide scale in 1997, a severe epidemic of sudden death syndrome (SDS) occurred in the southern Midwest. Of course, the southern Midwest also experienced unusually wet weather that year. Still, some accused the Roundup Ready soybean system for the SDS epidemic.

In a recently published article from *Agronomy Journal* (2003, volume 95, pages 1140-1145), researchers evaluated the effects of glyphosate herbicide on SDS and *Fusarium solani* f. sp. *glycines*, the casual agent of SDS. The researchers investigated ten Roundup Ready soybean varieties in central and southern Illinois. They applied glyphosate herbicides when the soybeans were at the V3 growth stage. They monitored SDS development and compared their results to soybeans that were not sprayed with glyphosate. The scientists found that applications of glyphosate did not increase *Fusarium* colonization of soybean roots. In addition, applications of glyphosate did not increase SDS. The

researchers did observe different levels of variety tolerance to SDS.

So, were Roundup Ready soybeans more susceptible to SDS? The answer is yes and no. Yes, some varieties were more susceptible to SDS and no, some varieties were more tolerant to SDS. Don Hershman, Extension Plant Pathologist, suggests that some earlier Roundup Ready varieties were more susceptible to SDS because of the agronomic package of the parent material. Most companies rate soybean variety tolerance to SDS and other pathogens. Those ratings are included in the Soybean Variety Performance Reports.

The take home message is to check the variety disease tolerance ratings before selecting your varieties, and to apply glyphosate to Roundup Ready soybeans without concern about disease interactions.

For more information about SDS and its management, you can read ***PPA-37: Soybean Sudden Death Syndrome in Kentucky***. You can receive a copy of this extension publication from your county extension agent or online at: http://www.ca.uky.edu/agc/pubs/ppa/ppa37/ppa37.htm.

4. Cool, Wet Weather Reduces Mycotoxin Risks

Paul Vincelli, Plant Pathology

The cool, wet weather that prevailed for much of the growing season in most areas was good news from the standpoint of mycotoxins. Although mycotoxins are not a serious and widespread problem in Kentucky, there are instances where they can cause unacceptable levels of contamination in corn. Mycotoxins are toxic substances produced by fungi.

Two mycotoxins in Kentucky are aflatoxins and fumonisins. Aflatoxins are probably the most well-known mycotoxin, because they have been regulated by the US. Food and Drug Administration for the longest period of time. Fumonisons are not as well known but are the most common mycotoxin in Kentucky corn crops.

Mycotoxins, in general, are rare in Kentucky corn fields. Aflatoxins require sustained drought stress and high temperatures during grain fill. Hot, dry weather and drought stress prior to and during silking, followed by period of high humidity, have been associated with many outbreaks of fumonisin contamination in corn. Given the weather experienced this growing season, we would not expect to find aflatoxins or fumonisins in the 2003 corn crop.

However, these mycotoxins can accumulate in stored corn, if environmental conditions permit, even if the corn was not contaminated with mycotoxins in the field. **Spores (**microscopic fungal "seeds") of the mycotoxin-producing fungi can be present on the outside of kernels as the grain is harvested and stored. By themselves, the spores do not produce significant levels of aflatoxins or fumonisins. However, if the stored corn is held at moisture contents above 18%, spores can germinate and grow into the corn kernels. This growth in stored grain can result in high levels of aflatoxins and fumonisins. There was a case from western Kentucky this past summer of milk that had to be dumped because of aflatoxin contamination from the 2002 crop. Thus, always be sure to store corn properly to reduce the risk of mycotoxin buildup in storage.

Several Extension resources are available on these complex subjects. For more information, see the following:

- *Moldy Grains, Mycotoxins, and Feeding Problems*. http://www.oardc.ohio-state.edu/ohiofieldcropdisease/Mycotoxins/mycopagedefault.htm
- *Aflatoxins in Corn.* http://www.ca.uky.edu/agc/pubs/id/id59/id59.pdf
- *Fumonisin, Vomitoxin, and Other Mycotoxins in Corn Produced by Fusarium Fungi.* http://www.ca.uky.edu/agc/pubs/id/id121/id121.pdf
- Various Extension publications on grain storage are available at: http://www.bae.uky.edu/ext/Publications/pubs_Grain.htm

5. Protecting Stored Seed and Grain from Insects

Doug Johnson, Entomology

Protecting stored seed is a somewhat different task form protecting stored grain/seed in the food /feed system. The same insects attack the seed and some of the tools for prevention and control are the same. However, several of the tools are different and the type of protection needed is different.

Grain or Seed

There are two general groups of insecticides available for protection. The first group is labeled for stored grain while the second group is labeled for protecting the seed.

Products labeled for stored grain are ***Actellic***, ***Reldan*** and ***Storcide***. These products specifically seek labeling against stored products insects such as bran bugs, weevils grain moths, etc. ***Actellic***, ***Reldan*** and ***Storcide*** are approved for use on commodities that are destined for food and feed.

Formulations of ***Cruiser***, ***Gaucho*** and ***Lorsban*** are labeled for protecting the seed. Most often they provide protection of the seed as it germinates and in the small seedling stages, from insects in and on the soil such as wireworm, aphids, seed beetles and maggots. ***Cruiser***, ***Gaucho*** and ***Lorsban*** also may provide protection from stored grain insects, but are for use on seed to be planted, **not** for use on grain immediately destined for food and feed.

Managing Stored Seed/Grain

The seed/grain storage manager must look closely at the intended use of that seed/grain and whether or not that use is likely to change. Also, the manager must decide whether or not the seed/grain must be able to germinate or will simply be in a bulk that needs to be protected from becoming "buggy".

Regardless of the intended use the pesticide label must be examined closely. Not all company claims are equal in either the list of pests for which protection is claimed, the ease of treatment and the level of protection.

The following tips can be of help in protecting seed:

- These recommendations assume that the seed is initially free from insect infestation. If the seed is infested it must be fumigated to control existing populations then treated with one of the seed protectants.
- Thoroughly clean the storage area. Use shovel, broom and vacuum cleaner. Remove **all** old grain, broken pieces and grain dust from the area.
- Treat the storage area. ***Tempo SC Ultra*** at a rate of 0.27 to 0.54 fl. oz. (8 to 16 ml) per gal of water is a good choice for this. Apply as a general surface, spot, crack and crevice treatment. ***Tempo SC Ultra*** may **NOT** be applied to the grain. Other insecticides may be used. However, using a different insecticide for treating the premises than is being applied to the seed is a good idea.
- If the storage area can not be adequately cleaned it may have to be fumigated.
- Thoroughly clean the seed. Many of the most common insect pests can not live on whole, solid kernels. Most infestations are based on broken, or cracked kernels and dust.
- Consider applying a seed/grain protectant. If you do this follow the label closely!
- "Small" quantities of seed can be stored in a cooler. Temperatures below 50^{o}F will prevent insect damage.

6. Testing grain crops for seed quality

Cindy Finneseth, Division of Regulatory Services

There is a complete service testing program for seed quality of grain crops available to Kentucky corn, wheat and soybean producers. This resource is the Seed Testing Laboratory of UK's College of Agriculture. This laboratory routinely tests seed of grain crops as well as clovers, grasses, tobacco and vegetables. The laboratory is located in the Poundstone Building, Division of Regulatory Services at the corner of University and Alumni Drives on the UK campus.

The seed laboratory tests 150 to 200 corn samples and 500 to 700 soybean samples each year for farmers, seedsmen and other businesses. Tests often requested on corn seed lots are standard germination, cold test, accelerated aging, moisture content and Roundup™ tolerance. Tests most commonly requested on soybean lots are a complete

test, standard germination, accelerated aging, moisture content, Roundup™ tolerance and seed count. A description of each test follows.

Complete Test

A complete test includes crop purity, noxious weed and germination evaluation of the seed lot. Crop purity includes separating the seed sample into a pure seed component (corn or soybeans), other crop seed (i.e. wheat or ryegrass), inert matter (broken seeds, plant parts and insects) and weed seed (morningglory, ragweed, or black nightshade seeds) as well as noxious weeds (i.e. johnsongrass). This test is necessary if you plan to label and sell your seed, as you must know and list these components on the seed label

Germination Test

The standard germination test is a measure of how many seeds are going to sprout. Seeds for each crop are planted under optimum laboratory germination conditions (temperature, light and moisture). Seedlings are then evaluated to determine the percentage of seeds that will produce a normal seedling during a seven or eight day germination test. Thus, the germination percentage reported is the maximum potential emergence for that seed lot if planted in nearly ideal field conditions. Unfortunately, field conditions are not always ideal and field emergence may be equal to or less than the values reported for the germination test. For this reason, some farmers and seedsmen also conduct seed vigor tests which relate more closely to emergence in stressful field conditions.

Seed testing is available to Kentucky producers.

Cold Test

The cold test is a seed vigor test routinely used for corn seed and sometimes also used for soybean seed. When conducting this test seeds are planted in a soil medium which contains pathogens and are exposed to a chilling treatment (50° F) for seven days prior to exposure to warm temperatures similar to the standard germination test. Those seeds that survive and produce a normal seedling are more tolerant to cold stress. Thus, seed lots with a high cold test value are better suited to early field planting than lots with a low cold test value, which may be damaged by cool temperatures.

Accelerated Aging

The accelerated aging test is another measure of seed vigor. This test is often used for soybean seed lots and exposes seeds to high moisture and high temperature for a short duration (i.e. three days) prior to planting for a germination test. Seed lots that perform well after this aging treatment are high vigor lots and have a greater emergence potential under stressful field conditions and greater storage potential than low vigor seed lots.

Roundup™ tolerance

The test for Roundup™ tolerance is exactly as it sounds. The corn or soybean seeds are exposed to Roundup™ during germination testing and the test measures how many of the seedlings are damaged by the herbicide. A seed lot with a low value is not resistant to glyphosate (i.e. conventional seed lot) and a seed lot with a high value is resistant to application of Roundup™ (i.e Roundup Ready variety). All Roundup™ Ready varieties should show high resistance to Roundup™ in this test.

Moisture content

Moisture content is a measure of the seed moisture percentage of a seed lot. This information is valuable from a storage perspective. Seed lots with a high moisture level (above 14%) should be dried prior to storage to prevent heating and pathogen growth that may occur, both of which can significantly damage the quality of a seed lot.

Seed Counts

Seed counts are expressed on a per pound basis. A high seed count per pound reflects small or light seeds and a low seed count indicates heavier or larger seeds. This information can be combined with results of the germination test to adjust planting rates to maximize field emergence and stand.

Fees and Contacts

The seed laboratory charges a fee for testing seed. Prices range from $4.00 for a seed count on any seed kind to $14.00 for a complete test on corn. Samples can be submitted directly to the laboratory or through your local county extension office. A report with the test information is sent when seed testing is completed. For a complete price list, other tests offered, submission information or additional information about seed testing, please contact the laboratory. Information is available at the seed

laboratory website (www.rs.uky.edu) or you can reach the laboratory by telephone at (859) 257-2785 or by email cfinnese@uky.edu. If you have questions regarding tests available or meaning of the results, you are welcome to contact us.

7. Basic Research Focus: Improving Soybeans through Biotechnology

Chad Lee, Agronomy

Most of the articles in this newsletter focus on field issues and attempt to provide crop management recommendations. These articles are written by Extension faculty whom you probably have met at various Extension meetings. Extension faculty are dedicated to helping the Kentucky producer with current, field-based information. However, there is another component at the University of Kentucky who may not attend Extension meetings but are working equally to benefit the Kentucky producer. These individuals have a basic research focus. That means their efforts today may not reach the field for another ten years, but they are on the cutting edge of science.

One such cutting-edge scientist is Dr. Glenn Collins who is using biotechnology to improve soybeans for Kentucky farmers. "Our major thrust is on developing bean pod mottle virus (BPMV) and soybean mosaic virus (SMV) resistant soybean germplasm," Dr. Collins said. Virus resistance is not the only area of crop improvement as Dr. Collins continued, "We are also attempting to genetically engineer soybeans for improved protein and oil composition in the seeds." A specific target for improving protein is to improve the content of amino acids that contain sulfur. Developing soybeans with less saturated fatty acid content in the oil is another goal. Dr. Collins cooperates with several field scientists to test developments in both the laboratory and the field. Although these efforts are several years away from reaching a producer's field, Dr. Collins' group is making good progress. In addition, he appreciates the support he has received from the Kentucky Soybean Promotion Board for this research.

Because Dr. Collins is involved heavily in research and education, he may never appear at an Extension meeting. However, Dr. Collins is just one example of the many researchers in the College of Agriculture at the University of Kentucky who are working to benefit Kentucky producers.

In the Next Issue:

- **Does Quadris, Warrior, Cobra and/or 2,4-DB increase Soybean Yields?**
  (Drs. Herbek, Hershman and Johnson are analyzing the data and will report on their findings.)

Chad D. Lee, Grain Crops Extension Specialist