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Corn & Soybean Science Group Newsletter

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Cooperating Departments: Agricultural Economics, Biosystems and Agricultural Engineering, Entomology, Plant and Soil Sciences, Plant Pathology
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In this Issue:

1. Crop and Pest Management Field School

J.D. Green, Plant and Soil Sciences

The Crop and Pest Management Field School for private consultants, agribusiness professionals, and producers is scheduled for June 30, 2005 from 8:30 am to 4:00 pm at the UK Agronomy Research Farm near Lexington, Kentucky. Topics to be covered include: Herbicide Symptomology on Grain & Horticultural Crops; Weed Identification; Insect Problems, Identification, & Management; Corn Growth and Development Stages; Soybean Production, Soybean Rust, & Other Foliar Diseases; and Phosphorus Losses in Agricultural Soils.

Preregistration of $10.00 is requested by June 17 to participate in this training program. This educational training session has been approved for Certified Crop Advisers CEU credits (3 hrs Pest Management, 2 hrs Crop Management, and 1 hr Soil & Water). CEU credits for Pesticide Applicator Training recertification have also been requested.

The UK Agronomy Research Farm (Spindletop) is located at 3250 Ironworks Pike (Hwy 1973) on the north side of Lexington between Newtown Pike (Hwy 922) and the Kentucky Horse Park. The preregistration form is linked at the Agronomy Extension website: http://www.uky.edu/Ag/Agronomy/Extension/.

2. Soybean Rust on Volunteer Soybeans

Chad Lee, Plant and Soil Sciences

Soybean Rust was confirmed on volunteer soybeans in the southwestern Georgia on April 27, 2005. As soybean rust scouting continues, be sure to check in with the University of Kentucky Soybean Rust website at: www.uky.edu/SoybeanRust. This website contains all of the national links as well as information specific to Kentucky. If you have questions or concerns regarding soybean rust, be sure to contact your county agent.

3. Soybean Production Practices for Soybean Rust

Jim Herbek and Chad Lee, Plant and Soil Sciences

The potential threat of soybean rust this year is on the minds of soybean producers. In discussions with producers, some are considering a change in their production practices because of the potential threat of this disease.

Most production factors will not affect whether a field does or does not become infected with soybean rust; however, a change in certain production practices could reduce yield potential, even if soybean rust is not present. The best management approach to this disease is to use production practices that will maximize yield potential. If rust occurs, the additional costs for fungicides will be a worthwhile investment to protect that high yield potential.

Production practice changes being considered by some producers are: soybean varieties/maturity groups, planting date, row spacing, and plant populations.

Soybean Variety/Maturity Group. Currently, there are no varieties available with resistance to soybean rust and it will be at least 5 to 10 years before resistant varieties are developed. Therefore, select varieties with maximum yield potential, based on performance tests, from maturity groups that are adapted to your area or region. In Kentucky, adapted varieties include those from late MG III, MG IV, and early MG V for various regions of the state.

While selecting varieties from ultra-early maturity groups may possibly allow the crop to avoid rust (assuming rust will come late in the season), the yield potential of these unadapted maturity groups is reduced. Even without soybean rust, their yield would be less than that of varieties from adapted maturity groups.

Planting Date. Plant during the optimum planting period. Begin planting when soil temperature is at least 60 to 65° F to promote rapid emergence and uniform stands. This usually occurs from late April to early May in Kentucky. Complete planting by early June to avoid a yield decline.

While extremely early plantings before soil temperature reaches 60° F may allow the crop to avoid rust (assuming rust will come late in the season), planting date studies show no yield advantage (and often a yield loss) for extremely early plantings over traditional planting dates. With very early plantings, stand uniformity and plant vigor is often reduced.

Spreading out planting dates within the optimum planting period (along with some variation in soybean variety maturity) is a good practice that would result in differential stages of soybean development among your fields. If soybean rust occurred, this would provide a better opportunity (particularly with limited sprayer capacity) to spray soybean acres in the time necessary to protect yield. Based on experiences in Brazil, and unless our experience in the U.S. proves otherwise, significant rust infection usually does not occur until R1 (beginning bloom) and fungicide applications prior to R1 are usually not beneficial.

Row Spacing. There was a 12 to15% average yield advantage for narrow rows (15 inches or less) in previous row spacing research at the University of Kentucky. This yield advantage was greater in high yield environments and also greater and more consistent in late (double-crop) plantings. The great majority of soybeans are planted in narrow rows in Kentucky.

Some producers are considering a switch back to 30-inch rows to better facilitate equipment for late-season spray applications. The yield loss of run-over rows from sprayer traffic (which will vary according to sprayer boom width) in narrow row soybeans; however, will be much less than the yield gained for using narrow rows. A good alternative, by coordinating planter and sprayer size, is to establish skip-rows (unplanted rows) in your narrow row system to facilitate wheel tracks for late-season spray applications. The yield loss for unplanted rows would be very minimal (or non-existent) with a slight savings in seed costs.

Even without soybean rust, wide rows would have a 5 to 6 bu/acre yield disadvantage. If soybean rust occurs, the yield advantage for narrow rows should more than compensate the cost of a fungicide application to protect that yield gain.

Plant Population. While soybean populations most likely it will not have a significant impact on rust, many farmers are using excessive seeding rates. Now may be a good time to reduce seeding costs.
Studies have shown that soybean plant populations as low as 100,000 plants per acre, in many cases, yield as well as 200,000 plants per acre. Reducing seeding rates to achieve final plant densities of 110,000 to 130,000 plants per acre would result in a seed cost savings of over $10 per acre, particularly with higher priced seed. If soybean rust occurs, the seed cost savings could be better invested in fungicides.

4. Control Seed Costs to Manage Profit Margin

Sam McNeill, Biosystems and Agricultural Engineering

Typical seed costs on a per acre basis can vary between $40 to $70 for corn and $20 to $50 for soybean, depending on the desired plant population, variety, seed quality and seed cost per bag. A spreadsheet tool has been developed to help farmers and crop managers easily calculate their actual costs and easily compare total costs for two seeding rates for a number of different varieties.

By entering seed tag data (weight per bag [for corn] or number of seeds per pound [for soybeans], seed germination and purity) and a desired plant population, the weight and number of seed per acre is calculated along with the weight of seeds in a 200-ft planter calibration strip.

Enter the number of acres for each variety and cost per bag of seed to compute the number of bags needed for each variety, cost for each variety/seed lot and per acre cost, as well as the total acres, number of bags and seed cost for the grain enterprise and average cost per acre.

Figure 1 shows a typical range in RR soybean seed costs at different plant populations for 100, 500 and 1000 acre operations. Note that the cost difference between desired stands is $23.16 per 1000 plants/100-acres for this specific mix of seed quality and varieties.

Table 1 illustrates an example comparing soybean seed costs for 140,000 and 175,000 plants per acre for four different varieties on a 500 acre farm. Note that the difference between these populations is a little over $4050 or $8.10 per acre for the entire in this example. Growers are encouraged to use this spreadsheet tool to help record and control seed costs. It can be used to quickly calculate seed costs for other scenarios with corn, soybean or wheat and is available on the web at www.bae.uky.edu/ext/Grain_Storage/Calculators/.

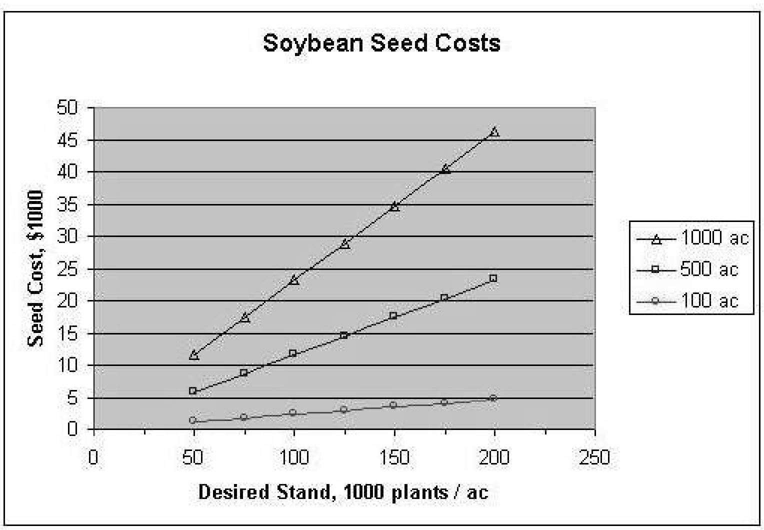

Figure 1. Typical range in RR soybean seed costs at different plant populations for 100, 500 and 1000 acre operations.

Variety	Lot	No. seeds per lb	gm per 1000 seeds	Germ. %	Purity %
SBxx1	BR-549	3500	129.6	90	98.0
SBxx2	BR-abc	3000	151.2	85	98.0
SBxx3	BE-def	3000	151.2	90	98.0
SBxx3	BR-xyz	2500	181.4	90	98.0

Table 1. Illustration of the calculator for comparing soybean seed costs for two different plant populations, based on seed tag/bag data (seeds per pound, germination and purity) and the seed cost per bag (50-lb unit). The number of acres for each variety is also entered to calculate the total number of bags needed for each population and the total and average seed cost. A calculation is also made for a drill or planter calibration at both seeding rates (weight and number of seeds per acre and weight of seed [grams] in a 200-ft strip).

Compare seed costs at two different plant populations.

Desired stand 1000/ac	plants/sq ft	Row Spacing in	Plants per ft	lbs seed per acre	actual seeds per acre	gm per 200 ft of row	No. acres	No. 50 lb bags	Cost per bag	Cost per seed lot	Cost per acre
140	3.2	7.5	2.0								
				45	158,730	59	125	113	$28.00	$ 3,175	$ 25.40
				56	168,067	73	125	140	$28.50	$ 3,992	$ 31.93
				53	158,730	69	125	132	$30.00	$ 3,968	$ 31.75
				63	158,730	83	125	159	$32.00	$ 5,079	$ 40.63
						Total	500	544		$ 16,214	$ 32.43

Desired stand 1000/ac	plants/sq ft	Row Spacing in	Plants per ft	lbs seed per acre	actual seeds per acre	gm per 200 ft of row	No. acres	No. 50 lb bags	Cost per bag	Cost per seed lot	Cost per acre
175	4.0	7.5	2.5								
				57	198,413	74	125	142	$28.00	$ 3,968	$ 31.75
				70	210,084	91	125	175	$28.50	$ 4,989	$ 39.92
				66	198,413	86	125	165	$30.00	$ 4,960	$ 39.68
				79	198,413	103	125	198	$32.00	$ 6,349	$ 50.79
						Total	500	681		$ 20,267	$ 40.53

5. Predicting Soybean First Flowering Date

Chad D. Lee, Dennis B. Egli and James H. Herbek, Plant and Soil Sciences

Soybean first flowering date appears to be a critical time for managing Asian Soybean Rust. Observations from Brazil indicate that soybean rust does not infect soybeans until sometime at or after first flowering, even when spores are present at earlier soybean growth stages. Based on the observations from Brazil, we expect most soybean rust infections to occur sometime after first flowering in the United States. As a result, we would expect most fungicide applications to occur sometime after first flowering.

A crop simulation model (CROPGRO-soybean) was used to predict when soybeans will first flower in Kentucky. Weather data from the University of Kentucky Spindletop Farm was used as input, and first predicted flowering dates were compared with measured dates from several experiments to be sure that the model was accurate.

Flowering date will vary year to year, depending on weather conditions. The variation for first flowering date is greater for soybeans planted early than for soybeans planted late. As a result, we recommend that farmers and field scouts begin checking fields ten days prior to the predicted first flowering dates in Table 1.

The predicted first flowering dates can be adjusted depending on relative maturity of a soybean variety and location of the field. Soybean varieties in the early part of a maturity group category (such as a 4.1 relative maturity in Maturity Group IV) will likely reach first flowering a few days earlier than the predicted date, while soybean varieties in the later part of the maturity group category will likely reach first flowering date a few days after the predicted date.

Flowering depends on both daylength and temperature, so the predicted dates may occur slightly earlier in western Kentucky where temperatures are historically slightly warmer. Farmers in western Kentucky and the two southern tiers of counties may want to adjust the predicted first flowering dates ahead two or three days from those presented in the tables.

More information on predicting soybean flowering dates is available in **AGR-184: Predicting Soybean First Flowering Date**, a new Extension publication. This new publication is available online at www.uky.edu/Ag/GrainCrops/ and is available at any Kentucky County Extension Office.

Table 1. Predicted first flowering date for different maturity groups and planting dates in Kentucky.

Planting Date	Soybean Maturity Group							
	MG II		MG III		MG IV		MG V	
	Predicted First Flowering Date							
	mean[1]	SD[2] (±)	mean	SD (±)	mean	SD (±)	mean	SD (±)
May 1	June 3	2	June 8	4	June 17	4	June 25	5
May 15	June 15	2	June 21	2	June 29	3	July 8	3
May 29	June 27	2	July 5	1	July 12	1	July 19	2
June 12	July 10	1	July 16	1	July 23	1	July 29	1
June 26	July 24	1	July 29	1	Aug 2	1	Aug 8	1

1. Average flowering date for 29 years of weather data.
2. Standard deviation.

6. Northern Corn Leaf Blight, Planning for 2005

Paul Vincelli, Plant Pathology

Northern leaf blight (NLB) was more severe in Kentucky in 2004 than in any year since the early 1990s. The cool, wet, cloudy weather that prevailed during most of the 2004 season in many areas played a major role in disease development. Wet weather with temperatures in the range of 64 to 81^{o}F favors infection and spore production by the fungus that causes NLB (called *Setosphaeria turcica,* but also known as *Exserohilum turcicum* and *Helminthosporium turcicum*). Furthermore, the extended cloud cover makes plants from a susceptible corn hybrid even more susceptible to the disease.

Although unusual weather was only part of the picture, my concern is that there are some indications of a possible trend of increasing pressure from NLB. Records from the UK Plant Diagnostic Laboratories indicate that this disease has increased over the past four to five years. A respected and highly experienced corn pathologist from a neighboring, major corn-producing state reported similar observations to me. The weather in 2004 certainly played a role in the severe outbreaks observed, as explained above.

At this time we don't know the complete reason for the apparent increased severity of NLB over the past several years. It could be due to a new race of the fungus or it could be due to an unintended decline of partial resistance in the currently available hybrids to NLB as breeders have focused on other priorities. It may simply be due to prevailing weather patterns. This issue is currently being researched by pathologists in the Midwest; I'll know more in a few months.

Some Biology of NLB. Symptoms of NLB are elliptical, grayish-green or tan lesions 1 to 6 inches long with smooth margins. The large ones are typical for a susceptible hybrid growing under cool, cloudy, wet conditions. During damp weather, greenish-black fungal sporulation is produced in lesions. Older leaves are affected first. Severely affected leaves can be killed when lesions join together.

The *S. turcica* fungus survives in undecomposed corn residue. Spores are spread by air currents. Severe yield loss can occur when upper leaves become blighted during early grain fill. Strains of the fungus also infect sorghum, johnsongrass, and sudangrass, although strains that attack these plants do not attack corn.

Factors That Can Favor NLB Development

1. Cool, wet, cloudy weather, as mentioned above.
2. Reduced tillage, since the fungus survives in undecomposed leaves of diseased corn.
3. Continuous corn, which favors a buildup of inoculum by repeatedly planting a host.
4. Substantial late-season growth of volunteer corn after harvest (often occurs after an early harvest followed by mild temperatures).
5. Late-planted crops can be exposed at a relatively young age to spore clouds coming from earlier-planted crops, resulting in more yield loss than in an earlier crop.
6. Irrigation, since this provides the humidity and leaf wetness that favors the disease.

Management. Producers should be aware of the level of susceptibility to NLB for all hybrids planted in 2005, but especially in or near fields under conservation tillage where NLB occurred this past season. Recent studies by Dr. Pat Lipps from The Ohio State University suggest that the levels of partial resistance among many, perhaps the majority, of hybrids without *Ht* genes is quite low. Work continues on the question of how much partial resistance exists in the corn hybrids on the market, but the data from Dr. Lipps certainly raise flags, given the high inoculum levels that are now present on many farms.

The law of averages suggests that 2005 season is not likely to be as cool, cloudy, and wet as this past season, in which case many producers would "dodge a bullet". However, with the high inoculum levels that are present in certain areas, especially in western Kentucky, **a repeat of the same kind of weather could result in destructive epidemics on susceptible varieties in some localities**.

There are two types of resistance to NLB: complete resistance (more or less) and partial resistance. In hybrids with partial resistance, fewer lesions form and they are smaller and with less sporulation than on a susceptible hybrid.

In hybrids with (nearly) complete resistance, lesions which form are yellow and limited in size, and sporulation by the fungus is very limited. These are hybrids with one or more Ht genes. For example, on hybrids carrying an Ht_1, Ht_2, or Ht_3 resistance gene, long, yellow to tan lesions with wavy margins and no sporulation are observed on leaves infected with *S. turcica*. These lesions are a resistance reaction and can be easily confused with Stewart's wilt. The HtN gene results in lesions that are necrotic, but these lesions are smaller and much delayed compared to lesions on susceptible hybrids. More commonly, corn hybrids have partial resistance. In that case, NLB can still develop on the hybrid but it usually does so more slowly that on a fully susceptible variety.

Under many circumstances, a moderate to high level of partial resistance would be sufficient to control the disease. However, when exposed to high or very high disease pressure, a hybrid with complete resistance would often outyield a partially resistant hybrid. Consider the factors discussed in the preceding section to decide which fields might need a substantial level of resistance to NLB in 2005.

Conclusion. While sowing fear is not my usual educational style, I am very concerned about the potential risk for serious damage from NLB in 2005. The key here is that this is *potential* risk, since we don't know if the weather will favor disease development. In the meantime, I encourage producers to pay close attention to the level of NLB resistance in the hybrids they choose, especially for late plantings and particularly for use in or near fields that had serious damage this past season.
Thanks to Bill Meacham of Pioneer Hi-Bred for observations of the association of volunteer corn with NLB.

7. Fungicides for Use Against Northern Leaf Blight

Paul Vincelli, Plant Pathology

Since corn hybrids have been selected and much corn has been planted, there are some management options should epidemics of northern leaf blight (NLB, caused by the fungus *Setosphaeria turcica*) occur in 2005. Inoculum levels are high in many fields, and if sustained periods of unusually cool, wet weather occur, which would favor the development of NLB, we could see very damaging outbreaks in fields without adequate

resistance.
If a combination of crop rotation and hybrids with moderate to high NLB resistance were selected, then there should be no reason to spray a fungicide. However, there could be isolated instances where the producer may see a benefit to the application of a fungicide. For example, imagine a field sown to a susceptible hybrid that has a 180+ bushel/acre yield potential within two weeks on either side of tasseling. If that field is showing large (3-6 inches) lesions indicative of a susceptible reaction of NLB on or above the ear leaf, and the long-term forecast calls for continued cool, wet weather, it may be worthwhile to protect the high yield potential by applying a fungicide. Such cases would be few in number, but they may occur, depending on the weather.

Fungicide Options. There are several fungicides labeled for use against NLB. Based on the research I have seen, the most effective against this disease is Quadris Flowable®. If applied once at 9.2 to 15.4 fl oz/acre rate, a producer would pay about $21.56 to $36.09 for the product and $7.50 to $8.00 per acre for aerial application (assumes a product price of $300/gal). Be aware that the label requires a minimum application volume of 5 gal/acre in grain crops. I've seen indications of yield losses of anywhere from 5 bu/acre to 50 bu/acre from NLB on susceptible and moderately susceptible hybrids during the 2004 season. Given the above cost estimates for applying Quadris7, one would have to avert a yield loss of at least 14 to 21 bu/acre to break even for the costs of applying fungicide (assuming a $2.25 /bu crop value). Quadris has a seven-day pre-harvest interval for field corn.
Tilt® (or PropiMaxEC®), which has the same active ingredient) also can be applied for control of NLB, but in the research I have seen indicates that Tilt is not consistently as effective as Quadris. When applied once at 2to 4 fl oz/acre, a producer would pay $5.59-11.19 /acre for the Tilt7 and $7.50 to 8.00 for application costs (assumes a product price of $358/gal). Like Quadris, Tilt has a restriction of a minimum of 5 gal/acre when applied aerially. Other important label restrictions include: (1) Tilt may not be applied after silking, and (2) there is a 30-day pre-harvest interval in field corn.

Stratego®, a pre-mix of propiconazole and trifloxystrobin, is labeled also for NLB control. I am aware of only one 6-year old field test evaluating the performance of Stratego specifically for NLB control, and that test does not include rates on the current label. Therefore, I can't make a definitive statement about its relative efficacy against this disease. When applied at 10 to 12 fl oz/A, a producer would pay $11.72 to14.06/acre for the Tilt and $7.50 to 8.00 for application costs (assumes a product price of $150/gal). Among several restrictions indicated on the label is the prohibition against application to field corn after silking.

Products containing chlorothalonil (Bravo®, for example) or mancozeb (Dithane®, etc) are labeled for NLB control. However, research shows these contact fungicides are not as effective as either systemic fungicide listed above. Furthermore, it seems likely that the incomplete coverage of leaf surfaces that one expects with aerial applications would be a serious limitation for these two contact fungicides.

Note that for several of these fungicides, the disease is called "Helminthosporium leaf blight" caused by *Helminthosporium turcicum*, an old name for the fungus that causes NLB.

Potential Benefits of Fungicide Application in Limited Instances. In the situation of high disease pressure described above, one would probably at least recoup the cost of a fungicide application, and exceed it in some instances. In addition to protection of yield, if NLB is "brewing" in a susceptible hybrid, a fungicide application could help protect test weight and stalk quality. When leaves are blighted during grain fill, the corn plant draws reserves out of the stalk in order to fill the grain. This results in weak stalks susceptible to lodging. Thus, some producers may feel a fungicide treatment is justified on the basis of retention of stalk quality. The application might allow the producer to let the crop dry down for a time in the field, instead of having to rush in to harvest at black layer and dry the corn down from 30 to 35% moisture concentration, resulting in less flexibility in scheduling harvests, higher drying costs, and increased risk of stress cracks from drying operations.

There are no simple answers as to whether a fungicide application will be worth applying. So much depends on complex factors that are often unpredictable. However, perhaps these comments will help producers think through some of the ramifications of applying a fungicide if faced with a NLB outbreak this year.

8. Resistance Management Grouping Codes Now Appearing on Some Pesticide Labels

Ric Bessin, Kenny Seebold, Doug Johnson, and Lee Townsend,
Entomology and Plant Pathology

In an effort to make management of pesticide resistance easier for pesticide users, some companies have begun to place mode-of-action classification codes on the front of their pesticide labels. These designations appear as a three part box, as in the examples below:

GROUP	1B	INSECTICIDE

or

GROUP	11	FUNGICIDE

These classification schemes for insecticides and fungicides provide growers with an easy to recognize numerical group for a particular pesticide based on its mode of action. Pesticide products with multiple modes of action will multiple classifications listed. These numerical schemes should make identifying pesticides with the same modes of action simpler and should help pesticide avoid the overuse of a single class of pesticide.

Generally, the more frequently a grower sprays the same mode of action to control a pest problem, the more quickly a pest is likely to develop resistance. Many factors affect the rate of pesticide resistance development and most of those are out of our control (development rate of the pest, migration rate from susceptible populations, background levels of resistance), but we can control judicious use of pesticides and rotation of chemicals with different modes of action when repeated applications are needed.

Keys to using this system correctly:

- ❖ Read and recognize the numerical groups on the pesticide labels. Those with different designations have different modes of action.
- ❖ To delay and/or prevent the development of resistance by pests, growers must avoid the repeated use of the same mode of action. Users need to alternate different pesticide classes periodically when repeated sprays are needed. Alternate products from different numerical groups for repeated applications.
- ❖ Do not tank mix to pesticides from the same numerical group (same mode of action).
- ❖ As always, only use pesticides at labeled rates and according to labeled spray intervals.

Other factors that delay the development of pesticide resistance:

- ❖ Always time pesticide sprays when they will do the most good. Most pests have a stage when they are most vulnerable. Don't wait too long to begin applications of pesticides. In the case of fungicides, "rescue" applications of chemicals to severely diseased fields can lead to the development of resistance in pathogen populations (more of the pathogen population is exposed to the fungicide and therefore the odds of selecting for resistant individuals go up).
- ❖ Take an integrated approach to pest control and maximize the utility of proper cultural controls, crop rotation, resistant varieties, and natural enemies of pests.
- ❖ Use pest and weather monitoring and economic thresholds as guides when making decisions to make pesticide applications.
- ❖ Try to preserve natural enemies of pests through the use of selective pesticides or targeted applications.
- ❖ Mix and apply pesticides carefully to ensure correct dosage and coverage. Sprayers must be calibrated regularly to account for nozzle wear. Use the proper spray volumes and pressure to ensure adequate coverage.
- ❖ Eliminate crop residues after harvest when practical to remove overwintering sites for pests.

9. Corkscrew Corn

Chad Lee, Plant and Soil Sciences

Reports have come in of twisted or corkscrewed and horizontal corn seedlings beneath the soil surface. For normal seedlings, the white portion of the shoot which comprises the mesocotyl and coleoptile grows nearly straight upward toward the soil surface. For corkscrew and horizontal seedlings, the shoot does not grow straight to the soil surface but resembles a corkscrew or remains horizontal under the soil surface (Figures 1 and 2). In some instances, the seedling will not make it through the soil surface and leaves could unroll underground. There are several factors that may cause twisted or horizontal shoots.

Figure 1. Image of corn seedling growing horizontally from the seed. Source: Mike Smith, Kentucky Cooperative Extension Service, Henderson County.

Figure 2. Image of a corn seedling with horizontal and mild corkscrew growth. Source: Mike Smith, Kentucky Cooperative Extension Service, Henderson County.

Cool Weather. Soil temperatures less than 55 degrees Fahrenheit for an extended period or rapid changes in temperatures, such as air temperatures in the 80s and dropping below 55, can cause the twisting. Seed that imbibes water as cold as 50 degrees Fahrenheit can go through imbibitional cooling, which can result in corkscrewing. If the coleoptile has already emerged from the seed, then I speculate that as the coleoptile grows toward the soil surface until it comes into contact with the cool temperatures and starts to grow down, then back up and then down again causing the corkscrewing effect.

Soil Compaction. Restrictions in the soil around the germinating seed can cause the mesocotyl and/or coleoptile to grow around the restriction zone. Sidewall compaction, heavy rains immediately following planting, and soil clods can all cause restriction zones that result in the twisting appearance.

Herbicides. Soil-applied herbicides that are seedling shoot inhibitors (containing one of the following active ingredients: alachlor, acetochlor, metolachlor, dimethenamid, or flufenacet) in combination with cool, wet weather and crusted soils can disrupt proper growth of the shoot. Since most of these herbicide products are formulated with a safener, herbicide injury from these products at proper use rates is extremely rare. However, the cooler temperatures can slow corn growth and increase herbicide injury. Factors inhibiting or slowing shoot growth, such as those mentioned above, are usually required before herbicide injury occurs at proper use rates.

Kernel Position in the Soil. As the mesocotyl elongates, the coleoptile emerges from the embryo side of the seed and grows toward the dent end of the kernel. If the embryo side is facing down, then the coleoptile will grow along the kernel until it grows past the dent end of the kernel. At this point, the coleoptile will begin growing upward. In greenhouse studies, shoots from kernels with the embryo facing down require about one more day to emerge then shoots from kernels with embryos facing up. I would expect cooler temperatures and soil compaction to delay emergence even more.

Seeing the Light. Seedlings that manage to "spike" through the soil surface and leaf out above ground will likely recover from the corkscrew symptoms and produce an acceptable yield. However, continued cool temperatures and cloudy skies will slow seedling growth and could limit the amount of recovery. The cool temperatures and cloudy skies not only slow corn growth but also favor seedling diseases and insects. Field scouting is necessary to determine the crop condition and to make management decisions accordingly.

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