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University of Kentucky – College of Agriculture

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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. Cool, Wet Soils Increase Risk of Damping Off

Paul Vincelli, Plant Pathology

In most of the Commonwealth, soils were wet with temperatures in the high 40's to lower 50's F for most or all of the period of April 11 to16. These conditions are very favorable for development of infections of corn seedlings by the soilborne organism *Pythium ultimum,* the most common cause of seed rots and seedling damping of field corn in Kentucky. *P. ultimum* thrives in saturated soils. While it actually prefers warmer soils, soil temperatures in the range of 48 to 53 F severely curtail the ability of the corn seedling to defend itself against infection. Thus, a period of cool wet soil conditions can favor stand loss from *P. ultimum,* particularly if the corn seed is of low vigor or the crop is under stress for some other reason.

Fungicidal seed treatment with either metalaxyl or mefanoxam provides very good protection against *P. ultimum* for a period of 10 days, perhaps longer under some conditions. However, 40% of the intended corn acreage had been planted as of April 11, compared to 13 percent for the five-year average. With so much of the corn in the ground, some crops likely were exposed to this period of cool, wet soil conditions after the fungicide had lost its effectiveness.

Assessing Corn Stands

Since corn yields are strongly influenced by plant population, producers should scout fields for plant populations 2 to 4 weeks after emergence.

Guidelines for assessing stands are presented in the "Frost Damage" article of this newsletter and are available in the Extension publication *Kentucky Integrated Crop Management Manual for Field Crops: Corn*, IPM-2. For fields with stands that are poorer than expected, the “Frost Damage” article in this newsletter and the chapter on “Planting Practices” in the publication *A Comprehensive Guide to Corn Management in Kentucky,* ID-139, provide producers with guidelines for determining whether or not replanting is likely to be advantageous.

2. Frost Damage on Young Corn

Chad Lee and Jim Herbek, Agronomy

At least 78% of the corn in Kentucky was planted by May 2, which is 14% above the state average, according to the Crop Weather Report from the Kentucky Agricultural Statistics Service. At least 50% of the corn has emerged, which is 11% above the average. Much of this corn was planted before the spring frost free dates. The early planting of corn increases the likelihood that some of this corn will emerge and be exposed to freezing temperatures.

Factors Required for Damage

The severity of damage to a corn plant from frost depends on temperature, growth stage of the plant, and length of exposure to freezing temperatures. Temperatures between 32 and 28 F typically have little effect on corn. Damage is usually limited to above ground plant parts (leaf tissue). Corn easily recovers from this type of damage early in its development. Temperatures at 28 F or less for a few hours can be lethal to the plant. The growing point of a young corn plant can be injured or killed at these temperatures.

Living plant cells contains water. Temperatures below 28 F cause ice crystals to form in the plant cells. As the ice crystals form, they expand and puncture cell walls. The ice crystals melt back to a liquid once the temperatures rise after daylight. The punctured cells lose water and nutrients and die. Frost damaged plant tissue often has a water-soaked appearance. This appearance is due to the loss of liquid from the punctured cells.

Freezing temperatures can destroy plant tissue but only have a minor impact on final yields on young corn. The growing point of corn is below the soil surface from emergence until about the V5 growth stage in most hybrids. The V5 growth stage is defined as a corn plant with five leaves that have visible collars. At this stage, the sixth leaf is visible in the whorl, but its collar is not yet visible. The soil and the plant typically protect the growing point from a couple hours of freezing temperatures. Corn plants at this stage of growth can experience high levels of leaf damage and still yield comparably to non-injured corn.

Although the growing point is reasonably protected by the soil from emergence through the V5 growth stage, it can be injured or killed if temperatures below 28 degrees F occur for more than a few hours.

The growing point of corn will move above ground at slightly different stages of growth in different hybrids. In general, the growing point is usually above the soil surface by the V6 growth stage. Temperatures of 28 degrees F or less for a couple hours will kill V6 corn.

Managing Frost-Damaged Corn

Wait three to five days after the frost event to accurately access the extent of damage and determine if the crop is capable of recovery. By five days, new growth should be evident in the whorl of the corn plant. If new growth is not evident, then corn plant is likely dead. Warm days after a frost event will benefit recovery, while cooler temperatures will delay recovery. Wet conditions after frost damage can induce pathogenic infections of the dead, moist plant tissue and inhibit recovery.

At times, the frost damage leaves will fuse together near the whorl. This fusing can impede the new growth of leaves. Some farmers have tried mowing the corn plants to resolve the problem of fusing. Mowing provides inconsistent results and is not recommended.

If 55 to 70% of the leaves are defoliated on V4 corn, but new growth is observed, then nothing should be done to these plants. In most cases, the damaged corn will yield as well as non-damaged corn. If 100% of the leaves are defoliated, then wait five days for signs of recovery. If recovery is not evident, then replanting is probably a good option.

Estimated stand of surviving plants is the most important item to measure about five days after the frost event. Frost damage is likely uneven across the field, so multiple stand counts should be made in the field. Both injured and non-injured areas of the field should be counted. Count the number of surviving plants within a row. Use Table 1 to determine how long of a row to count to estimate plant stand. Compare the number obtained in Table 1 to the population numbers in Table 2 to help determine maximum yield. The information in Table 2 was obtained and adapted from the *National Corn Handbook,* NCH-30, "Guidelines for Making Corn Replanting Decisions" and is Table 5 in ID-139, *A Comprehensive Guide to Corn Management in Kentucky*.

Table 2 should be viewed as a general guide rather than an absolute rule. Most of the data in the table is averaged across the Midwest and may need adjustment for your particular area. For example, mid- to late-April plantings in western Kentucky are closer to optimum than plantings after May 10. The optimum date range shifts to early to mid-May for central and eastern Kentucky. Populations above 25,000 plants per acre should provide yields comparable to stands at 25,000 plants per acre based on Kentucky research.

The average corn stand and the date of replanting will both be factors in determining if replanting corn is an option. Other factors involved in a replanting decision include the cost of operation for removing the surviving corn stand and replanting. Seed costs and availability of suitable hybrid seed are other factors to consider. If replanting will occur after June 5 in Kentucky, then an earlier maturing hybrid should be selected. In addition, corn yields will drop about 1% per day when corn is planted after May 10 to 15.

If you have questions regarding the condition of your corn crop, contact your county extension office.

Table 1. Estimating Corn Stand. Determine the length of row to count. Count the plants within that row. Multiply that number by 1,000. The product is the estimated number of plants per acre. This process should be repeated throughout the field in injured areas and non-injured areas.

Row Width (inches)	Length of Row to Count	Number of Plants in Row	Multiplication Factor	Estimated plants / acre
38	13’ 9”		x 1,000	
36	14’ 6”		x 1,000	
30	17’ 5”		x 1,000	
20	26’ 2”		x 1,000	
15	34’ 10”		x 1,000	

Table 2. Grain yields for various planting dates and population rates, expressed as a percent of optimum planting date and population rate (uniformly spaced within row).

Planting date	Plants per acre at harvest						
	12,000	14,000	16,000	18,000	20,000	22,500	25,000
	(% of optimum yield)						
April 15	70	76	81	85	88	91	93
April 20	72	78	83	87	90	93	95
April 25	75	81	86	90	93	96	98
May 1	77	83	88	92	95	98	100
May 6	78	83	88	92	95	98	100
May 11	77	83	88	92	95	98	99
May 16	75	81	86	90	93	96	98
May 21	73	78	83	87	91	94	95
May 26	69	75	80	84	87	90	92
May 31	64	70	75	79	82	85	87
June 5	59	64	69	73	77	80	81
June 10	52	58	63	67	70	73	75

3. Soil Sampling and Testing for Soybean Cyst Nematode

Don Hershman, Plant Pathology

Spring is an acceptable time for collecting soil samples from soybean cyst nematode (SCN). Soil sampling for SCN is often done in the fall, because farmers tend to have more room in their schedules and are likely sampling for nutrient needs. Whether soil samples are collected in the fall or the spring, the only real limiting factor is one's ability to collect a representative soil sample, which requires mixing of soil. If a bulk soil sample cannot be adequately mixed, and a sub-sample taken, then it is unlikely that the sample you send us will be representative of the field. SCN numbers generated from non-representative soil samples may be very misleading.

Why have soil tested for SCN presence and levels? Most frequently, producers simply want to know if they need to plant a SCN-resistant variety. A more specific goal is to determine if it is safe to plant a SCN-susceptible variety. There are not many SCN-susceptible varieties left on the marketplace. If you have a desire to plant one of these, a SCN soil analysis will give you an idea of the yield consequences if you were to plant such a variety. Typically, these samples are taken AFTER corn in a corn - soybean rotation.

Another reason for SCN soil testing is to get a better handle on how a SCN resistant variety has performed when grown in a specific field. Certainly, crop yield is the most common means of assessing variety performance. However, there is also a tremendous difference in how various SCN-resistant varieties impact specific SCN populations. Some varieties will result in net population increases; some will result in population decreases; and some will result in no or very little population change. All three responses can occur in one field, depending on the variety grown. If you have an interest in knowing how specific SCN-resistant varieties are impacting SCN populations on your farm (which may be related to the yields being achieved), arrange to have a SCN soil analysis done for each field in question. These samples would be taken in fall or spring immediately after the resistant variety is harvested (not following corn). In a perfect world, you would also have pre-plant SCN population data from the same year. This would give you baseline information to know if populations went up, down, or stayed the same. However, there is also value in simply knowing if high SCN populations are being maintained in a field, despite the fact that you are growing SCN-resistant varieties. A finding that a field population of SCN is high after growing a resistant variety would indicate that something may be wrong and that you may need to put additional thought and time into making future variety selection decisions.

SCN soil analyses cost \$8.50 per sample. Instructions for collecting and submitting soil samples can be obtained at all county Extension offices. All commercial samples must go through the county Extension office.

4. Corn Response to N Fertilizer in Kentucky

Greg Schwab, Agronomy

Because of the climbing price of nitrogen, recent popular press articles have extensively discussed N management. Fortunately for farmers, the price of corn also has risen, offsetting some of the impacts of expensive N. Regardless of corn prices, practices that improve N use efficiency have a larger impact on your bottom line when N is high. For example, Kentucky research on imperfectly drained soils has shown that N rate can be reduced by 35 lbs/a when N application is delayed until the 4 to 6 leaf stage, saving nearly \$9.00/a. This may sound obvious, but the most important N decision that you will make this year will probably be the overall N application rate you choose.

Agronomists across the Corn Belt conduct N rate studies annually in order to fine tune recommendations for specific regions, soil types, new cultivars, management systems, etc. The goal of these studies is to determine the economic optimal nitrogen rate (EONR) over varying climatic conditions within a specific region. EONR forms the basis for most Universities' fertilizer recommendations. Unfortunately, EONR for a given year is hard to predict, primarily due to the variability of weather conditions during the growing season.

To account for seasonal variability, some state's N recommendations are based on expected or potential yield. Illinois for example uses a factor of

1.2 times expected yield to calculate the N requirements (N credits are then subtracted). This method works well for Illinois farmers as long as estimated yield is reasonably close to the actual yield. Traditionally, Kentucky has used soil drainage classification rather than a yield goal approach to N fertilizer recommendations. Nitrogen fertilizer recommendations are higher on wetter soils because the potential for N loss via denitrification is higher. This method has served Kentucky farmers well, but it is not conducive to variable rate fertilizer applications based on yield monitor data.

The last three years of N rate studies conducted on well drained soils in Kentucky are summarized in Figure 1. For each study, the EONR was determined using a quadratic plateau function and a nitrogen:grain price ratio of 0.10 ($0.30/lb N and $3.00/bu corn). For these studies, there was a good correlation between EONR and grain yield (r^2=0.80). The surprising result was that only 0.75 lbs of N/bu corn was required to reach the EONR even when yield exceeded 200 bu/a. This is much less than the 1.2 lbs/bu that is recommended in most of the Corn Belt. This raises the question of why Kentucky farmers can get by with less N per bushel than their Illinois counterparts. The answer has not been researched, but I believe that it is a result of differing climatic conditions. Although soil organic matter levels are lower in Kentucky, total N mineralization might be higher due to the longer growing season. A second factor might be a lower total N loss in Kentucky due to application timing or soil wetness issues.

Regardless of the mechanisms involved, EONR for well drained soils in Kentucky for the period of 2001 to 2003 is approximately 0.75. If a yield goal approach to N management is used for these soils, applying a factor of 1.2 will most likely result in over-fertilization and reduced N use efficiency.

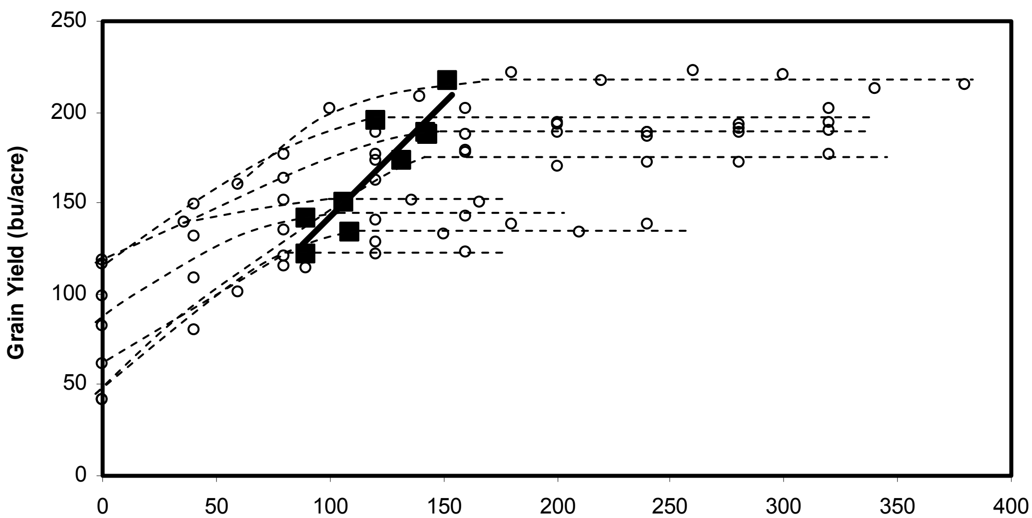

Figure 1. Corn yield response to N fertilizer and EONR (economic optimal nitrogen rate) for studies conducted on well drained soils in KY from 2001-2003.

5. Assessing Harvest and Storage Needs

Sam McNeill, Biosystems and Agricultural Engineering

Grain farmers often assess their potential harvest, handling, drying and storage needs soon after planting. While the ultimate size of the crop obviously depends on weather and pest pressures, farmers usually hope for the best and plan for at least average yields. Planning for an efficient harvest this fall requires attention to many details including matching the combine harvest rate to the hauling capacity and travel time of the grain cart and/or trucks; handling rate of the wet grain conveyor, size of the holding tank, capacity of the grain dryer and associated handling equipment; and total storage capacity for different crops. The reward of spring planning prior to equipment purchase is an efficient fall harvest.

Combines, carts, trucks, conveyors, and dryers

Whether a daily harvest goal is 3,000 or 15,000 bushels in a 10 hour period, general rules can be applied to correctly assess the capacity of different system components such as hauling vehicles, wet grain conveyors, receiving pits and conveyors, holding bins/tanks, dryers, and/or surge tanks for dry grain to eliminate bottlenecks and keep the combines rolling. For one example, the optimum capacity of a wet grain conveyor is based on the capacity of the largest truck, the size of the receiving pit, and available unloading time. In turn, unloading time is a function of the maximum harvest rate, combine unloading rate, travel time to and from the field, and time for miscellaneous activities such as positioning the truck for loading and unloading, checking grain moisture, starting/stopping equipment, conveyors, and cleanup of spilled grain.

Making these calculations by hand can be difficult, tedious and time consuming. Fortunately, a computer program is available to quickly perform these calculations and many others related to possible bottlenecks in the harvesting, hauling, handling, drying and storage system. It is very versatile regardless of the size of an operation and is widely used to properly match different components in the system, simulate harvest activity, and predict equipment performance. It is particularly useful to producers who want to see how changes in their mix of equipment or harvest strategy will affect system performance. For example, farmers who are growing both genetically enhanced (GE) and non-GE crops should plant and harvest GE crops last to avoid mixing and the inherent time-consuming chore of cleaning out equipment completely between fields. Harvesting GE crops last necessitates good planning to ensure that sufficient storage is available for GE grain at the end of harvest. The computer program is free and available to grain farmers and crop managers in Kentucky through the UK Cooperative Extension Service.

Storage bins

Farmers who are dedicated to growing more acres with relatively few varieties of feed grade corn generally choose to build larger bins. In comparison, others who are interested in producing several different varieties with specific genetic traits/attributes may need several smaller bins to enable them to segregate their crops. Fortunately, grain markets abound for many different production scenarios in central and western Kentucky.

A new spreadsheet is available to estimate the capacity of storage bins (in bushels) based on the diameter and grain height. It is freely accessible on the UK Grain Storage homepage (www.bae.uky.edu/ext/GrainStorage/). A table is presented to show the capacity for specific size bins with diameters from 18 to 60 feet and heights from 1 to 60 feet, although values for any size bin are instantly calculated for specific sizes not shown in the table. A second table is also shown to compute the temporary storage capacity of corn, soybean or wheat in the top portion or headspace of a bin (above level full).

6. Corn Responds to Rotation - Even More in a Good Year

John Grove, Agronomy

Several farmers this past winter shared testimonials that they observed exceptionally positive corn yield responses to crop rotation in the 2003 season. Most farmers and researchers agree that corn production benefits from crop rotation. However, most do not know that those benefits might be related to the quality of the corn production season.

To examine the question of whether the benefit of rotation differs with season, data from a long-term crop rotation experiment was analyzed. This long-term experiment was conducted between 1989 and 2001 at the Spindletop Research Farm near Lexington. In this “all no-till” field trial, corn was grown after corn, full season soybean or wheat/double crop soybean. Each year, the same corn hybrid was planted, on the same date (usually the last week in April), at the same population, with the same mixture of herbicides for weed control for all crop rotations. Corn hybrids changed with improvements in corn genetics. No winter cover crops were used. The soil was a well-drained, drought-prone Maury silt loam, on a hillside with an average slope of 3%.

Rotation Benefits

The yield data in Table 1 clearly indicate the benefit of crop rotation to corn. Over the 13 years represented, corn after corn yielded 11 bu/acre less than corn after full season soybean and 22 bu/acre less than corn after wheat/double crop soybean. The benefits of rotation appear to include reductions in foliar and ear diseases and delays in the general senescence of the crop. Occasionally, as in the dry 1994 season, the greater mulch found after corn results in greater soil moisture conservation and greater corn after corn yield.

In an attempt to assess the crop rotation benefits under different growing conditions, the yearly average corn yield for each crop rotation was compared to the overall yearly average corn yield (Figure 1). The three lines represent corn after corn, corn after full season soybean and corn after wheat/double crop soybean. Low corn yields at the left of the graph indicate years of poor growing conditions, while higher corn yields at the right of the graph indicate better growing conditions. The three lines separate as they move from poor to good growing seasons (moving left to right on the graph). This separation indicates that approximately 20% higher yields can be expected for corn rotation. For good years, like last year, absolute yield can be as much as 30 to 40 bu/A higher.

In summary, this research shows the benefits of crop rotation and that the yield benefits are measurably greater in better corn production seasons.

Table 1. Corn yields following corn, full season soybean or wheat/double crop soybeans at the Spindletop Research Farm in Lexington, Kentucky.

	Grain Yield of Corn After:			Season Average
Growing Season	**corn**	**full season soybean**	**wheat/double crop soybean**	**all crop rotations**
year	bu/acre	bu/acre	bu/acre	bu/acre
1989	145	156	169	157
1990	114	143	145	134
1991	94	105	107	102
1992	147	176	186	169
1993	150	158	169	159
1994	140	110	126	125
1995	144	151	163	153
1996	149	158	173	160
1997	112	138	151	134
1998	142	153	169	155
1999	37	34	42	38
2000	161	176	187	175
2001	166	190	198	184
Long Term Average	131	142	153	142
Average % Difference	0	8	14	8

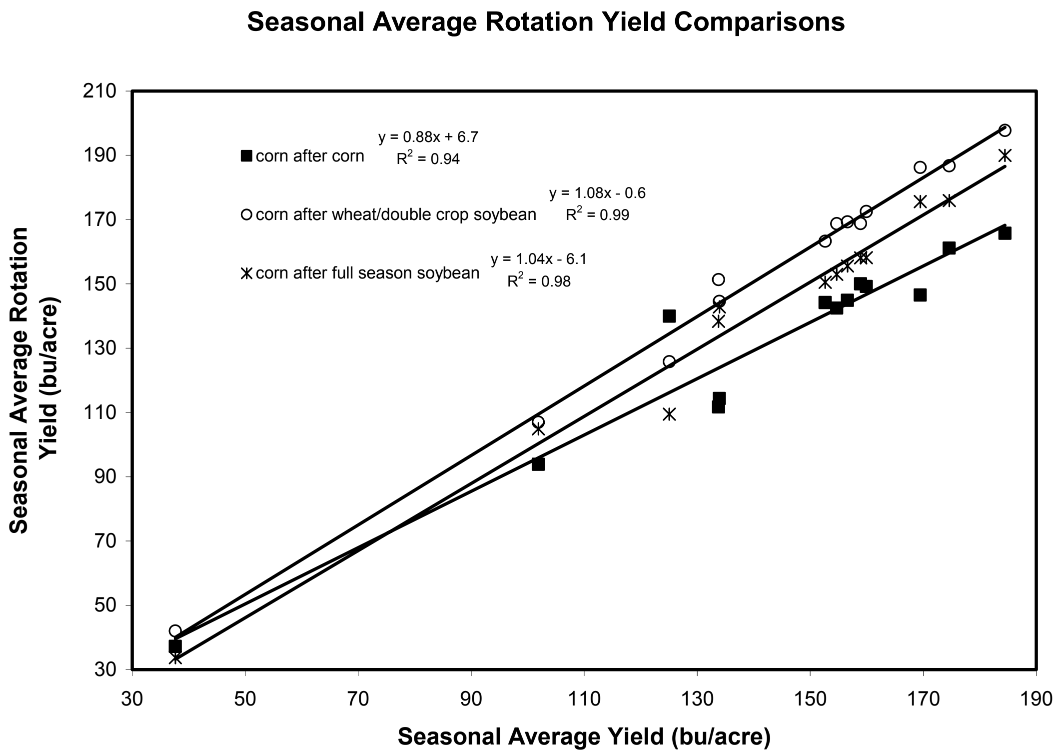

Figure 1. Comparison of yearly average rotational yield against the overall yearly average corn yield, 1989 to 2001.

7. Do You Have Herbicide Resistant Ryegrass?

William W. Witt, James R. Martin, and Dottie Call, Agronomy

The Kentucky Small Grain Promotion Council is funding a project to help us determine the extent of herbicide resistant ryegrass in Kentucky. To complete this project, we need the help of growers and others interested in grain crops production.

Italian Ryegrass and Herbicides

Italian ryegrass (*Lolium multiflorum*), also called annual ryegrass, is a severe weedy grass of wheat and is found in all wheat growing regions in Kentucky. Herbicide resistant ryegrass has not been confirmed in Kentucky but there have been cases where Hoelon (diclofop-methyl) failed to provide adequate control following multiple treatments.

Biotypes resistant to Hoelon, and other ACCase herbicides, were first observed in Oregon in 1987. Since then, ACCase-resistant biotypes were reported in Arkansas, Georgia, Maryland, North Carolina, South Carolina, Tennessee, and Virginia. We need to know if ACCase resistant ryegrass occurs in Kentucky and, if it does, then the magnitude of the problem.

How You Can Help

To participate in this project is easy. All you need to do is collect ryegrass seeds from plants growing in wheat. Here is what needs to be done.

1. Collect seedheads from 25 **mature** ryegrass plants.
2. Place the seeds in a paper bag or similar container.
3. Put your name, field identification, county, and date collected on container.
4. Complete the field history form included.

Chad D. Lee, Grain Crops Extension Specialist

Herbicide Resistant Ryegrass Survey in Kentucky
Field History Form

(Complete a form for each seed source)

Grower Name: ______________________________________

Address: ____

City: _________________________________ Zip Code: _____________________

Field History:

From 1998-2004, how many years was this field in wheat? __________________

How many years was ryegrass a problem in wheat? _______________________

From 1998-2004, how many years was this field in no-till corn? _________________

How many years was ryegrass a problem in no-till corn? _______________________

Herbicide History:

If a wheat herbicide was applied for ryegrass in the fall of 2003 or in 2004, please give the name and amount per acre. Herbicide: ________________________

Amount/Acre ______________

What herbicides were used for ryegrass control in other years? _________________

____

Send this form and ryegrass seeds to:

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411 Plant Science Building
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Lexington KY 40546-0312
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www.uky.edu/Ag/Agronomy/Weeds

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