Managing Insects in Wheat with Special Reference to Cereal Aphids and Barley Yellow Dwarf[1].

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Introduction

Kentucky is located in a unique ecological situation between the cold winters of northern prairie states and the very mild winters of the deep-south. Though cold enough to stop most insect activity during mid-winter, the great variation in date of first frost, fall onset of continuous cold, and spring onset of general warm weather, makes it particularly difficult to predict insect impact in any given year.

In Kentucky, wheat is grown as a "winter crop" planted in the fall, usually following corn, and harvested the following summer. Most often varieties which mature early enough to allow planting of "double-crop" soybeans are used (1). This production system divides the insect pests into three groups: those that infest in the fall, and that either, do or do not over-winter, and those that infest in the spring. We will examine these pests in order of appearance through the production year.

Insect pests are common in Kentucky wheat. Typically, one can find all of these insects in almost every field every year, but rarely do their populations grow to economically important numbers. Nonetheless, each pest has the potential to cause significant damage under appropriate conditions.

What will this information mean to Indiana farmers? Generally, the situation in southern Indiana will be similar to that in west Kentucky. Conversely, as one moves further north the likely hood of encountering these pests, especially in economically important situations, is very much reduced. In any given year the importance of several of these pests, particularly Hessian Fly and the cereal aphid – barley yellows virus complex, will be dependent of the short term weather, most importantly temperatures.

Scouting

In general, Kentucky grown grain should be scouted weekly to determine pest activity and plant growth stage from plant emergence to maturity when the temperature is above 48 - 50^{o}F. This will provide the best description of pest status, and plant stage, and will allow important management decision to be made in a timely manner. An outline for taking this data in a standard format can be found in the University of Kentucky Integrated Pest Management (UK-IPM) scout manual for small grains (2). In addition, there are other methods of collecting data on important pests such as the use of pheromone baited traps to capture adult moths (3). Whatever method you use, try to avoid "selecting" your data by using randomly assigned data collection points (4).

Insect Pests[3] in General Order of Appearance

Fall Pests

The fall armyworm, *Spodoptera frugiperda* (J.E. Smith), is a common pest of several late summer and early fall planted crops. Fall armyworm (FAW) cannot over-winter in Kentucky. FAW migrates into Kentucky from the gulf coast in mid-summer, initially infesting corn and grain sorghum as its primary crop hosts. In late summer/early fall, as corn/sorghum begins to mature, it colonizes newly seeded grasses. Damage is most common in lawns, reclaimed land, ditch banks, roadsides, etc., but may also infest small grains. FAW can result in seedling death if it feeds on new plants before roots are established. If plants are established, FAW feeding is rather more like grazing. FAW can remain active until the first killing frost and will survive longer where crop residue provides shelter from the cold (conservation tillage).

Infestation typically results from early planting. Often, planting after the Hessian fly free date will avoid this situation. Occasionally frost and the onset of cold weather are late enough to allow infestation of small grains even after this date. Additionally, late occurrence of a "Killing Frost" allows the survival of volunteer corn, which serves as a "green bridge" providing a food source between the time of summer grain maturity and winter grain emergence. Insecticidal control is relatively easy; but, there are no established thresholds. Damaged fields are sometimes replanted, but this is a risky technique. Many damaged plants will survive, thus, replanting may result in a denser than desirable stand. Very dense stands will, in turn, result in problems in the spring such as lodging, and increased armyworm and disease pressure.*Fall and Spring Pests*

The cereal aphid complex primarily comprised of four common grain aphids; bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus), corn leaf aphid, *Rhopalosiphum maidis* (Fitch,) greenbug, *Schizaphis graminum* (Rondani), and English grain aphid, *Sitobion avenae* (Fabricius) are considered the most important aphid pests in our region. In addition, the rice root aphid, *Rhopalosiphum rufiabdominalis* (Sasaki), has been confirmed as occurring in Kentucky (5), and is very likely playing an important role, though little is known of this aphid in Kentucky. It is interesting to note that these aphids are not considered important for their direct damage. Though some information on the importance of direct damage, particularly from the bird cherry-oat aphid, is coming to light, they are by far more notorious for their ability to spread the viral pathogens that result in Barley Yellow Dwarf (BYD) disease. On the other hand, there are at least twenty five aphids that can move the yellows viruses among plants. Regardless of the aphids present, the risk, real and perceived, of Barley Yellow Dwarf and by association the cereal aphid complex is, without doubt, the major driver of insecticide use in Kentucky-grown wheat (6).

Though other insects may require insecticidal control from time to time, only the cereal aphids are treated in a routine manner. Beginning in the early 1990's, increases in insecticide use, especially the systemic disulfoton (Di-Syston®), and then in the mid-90's the synthetic pyrethroid lambda-cyhalothrin (primarily Karate® and Warrior®**)** over the historic use pattern were quite evident (6). Moreover, there has been some historic use of systemic insecticide seed treatments, primarily imidacloprid (Gaucho®), and now

thiamethoxam (Cruiser®). Use of these latter seed treatment products is likely to increase.

Control of the cereal aphid complex is relatively easy to obtain. As with most other insect pests of wheat, it is hard to decide **if** treatment is warranted. The difficulty of finding aphids, combined with the small number required for application, the relative low cost of insecticides and the fear of catastrophic loss to BYD probably result in more insecticide use than is needed to mitigate the risk. The treatment of these questions is dealt with in the southeast region in a new publication (7). This publication was certainly developed for the southeastern states, but the driving force behind this problem remains fall and winter temperatures. To the extent that local fall temperatures are warmer and frost /freeze is later than expected, this publication may serve as a guide.

The Hessian fly, *Mayetiola destructor* (Say), is another common insect pest infesting small grains in the fall (8). In general, planting after the "fly free" date will provide adequate control in Kentucky. Traditionally resistant varieties have been used in concert with the "fly free" date to provide control. Most of these varieties originate from the northern breeding programs. Certainly, agronomic and cultural factors favoring strong stems and stand-ability of the plant are preferred, but at last examination all resistance factors can be overcome by the biotypes present in the state. There are no rescue treatments (foliar applied insecticides), though use of systemic insecticides as soil and seed treatments and fall/ spring foliar applications of systemic insecticides have been used in the deep south to combat this problem. Many of these insecticides are no longer available. The newer seed applied systemic insecticides may be providing some control. In Kentucky, in the presence of good agronomic practices, preplant soil insecticide treatment is not warranted.

The wheat curl mite, A*ceria tosichella* Keifer, is a common pest of wheat in Nebraska and other plains states but is rarely a problem in the Midwest. Wheat curl mite (WCM) was first noticed in Kentucky in 1987, with a larger outbreak in 1988 (9). Since that time, a significant infestation of WCM mite occurred in south central Kentucky in 2000, with smaller scattered infestations in more recent years.

It was first believed that outbreaks of this pest were the result of mites carried in on winds from more western production areas. Though this is possible, and wind is a method of dispersal, it appears more likely that this outbreak occurred because of the lack of weed control (thus increase in volunteer wheat) in soybeans during the preceding summer. Volunteer wheat provides a "green bridge" that may have allowed the WCM to "over-summer" and build into much larger than normal numbers. This is the typical cause of economic problems with WCM in the western states. Typically in Kentucky there would be no green bridge. Conversely, in some poor soybean production years, weed control is reduced or abandoned and, thus, volunteer wheat remains in fields.

Spring Pests

The cereal leaf beetle, *Oulema melanopus* (Linnaeus), was first noted feeding in south central Kentucky in the mid-1980s (10). Since that time it has moved generally westward

to the Mississippi River counties. Cereal leaf beetle (CLB) is a sporadic pest with a tendency to damage the later maturing varieties.

Control of CLB is comparatively easy. Still, determining the need to control in a timely fashion is the more important decision. Work done in the late 1990's (11) produced scouting procedures and thresholds that are currently in use. However, this insect is so rarely a problem it is likely the "old" threshold of one CLB per head bearing stem is most often used, except in the most highly managed wheat.

The armyworm, *Pseudaletia unipuncta* (Haworth), also known as, "True" armyworm, is usually the first pest of wheat to appear in the spring (12). Armyworm (AW) makes its annual appearance each spring in "flights" of the adult moths. These flights can be monitored by capturing males using pheromone baited traps (3, 13). The numbers caught using this technique can provide an advanced warning of the insect, allow calculation of when the damaging stage (worm) will appear (14) and can be compared to trap capture data from previous years (15).

AW is very common in Kentucky but only rarely does sufficient damage to warrant control. In spite of this, spectacular outbreaks of this pest do occur. One recent outbreak occurred in 2001. In this year our early "peak" trap captures were more than three times the "average" (15, 16). Very large populations appeared first in the south, then progressively through the Midwest into Canada. Considerable damage was done to the first cutting of grass hay in Kentucky. Conversely, effects on small grains are debatable because of the late occurrence of the infestation.

AW is most often controlled by naturally occurring predators and parasitoids. For example, eggs of tachinid flies (Diptera: Tachinidae) are commonly found just behind the head on armyworm larvae. Very dense plant stands and especially lodging, along with cool cloudy springs, favor AW populations. Insecticidal control is relatively easy, if necessary.

Important Natural Enemies

There are many natural control agents operating in the small grain fields of Kentucky. As previously mentioned, caterpillars parasitized by tachinid flies, plus braconid wasps (Hymenoptera: Braconidae), and infections by fungal and viral pathogens are often seen. Braconid parasitoids in the genus *Aphidius* have been collected from the grain aphids. In addition there are a plethora of predators, e.g., ground beetles, (Coleptera: Carabidae) and syrphid flies (Diptera: Syrphidae), easily observed. Though often given short shrift, these natural controls, combined with good cultural practices, probably account for much of the insect pest control in Kentucky wheat.

Pesticide Strategies

Insecticide use is an important tool in managing insect pests in small grains (17). Still, **if**, **when**, and **how** applications are made are often more important than **what** insecticide is used. This is especially true when calculating economic returns.

Soil Applied Insecticides - Decision must be made before planting. Treatments are very general, broadcast over a wide area, and affect many animals other than the target pests. Few insecticides available, and most are relatively toxic. This technique has most certainly decreased.

Seed Applied Systemic Insecticides - Like soil insecticides these must be chosen before planting, in fact when the seed is purchased. Treatments are more targeted affecting mostly insects that feed directly on the plant. They are a good choice for crops at increased risk to BYD (early planted), but relatively more expensive than other applications.

Foliar Applied Insecticides - Decisions can be made as pests begin to appear. Like the soil insecticides, foliar applications are general applications made over a broad area and affect many animals other than the target pests. Though, if targeted in time and area and based on pest threshold values; they are probably the most cost effective. If used correctly, they require the most management skill.

References[4]

You may find the references listed below to be of some use. Nonetheless, you should recognize that entomologist and crop production specialists in your state(s) will have similar publications tailored for your production area(s).

Kentucky Pest News newsletter. Weekly during field crop season, biweekly in winter. Delivered by regular post, e-mail, and available on the web at: http://www.uky.edu/Ag/kpn/kpnhome.htm

1. Sandell, L. [ed.] 2002. Crop Profile for Winter Wheat in Kentucky.http://pestdata.ncsu.edu/cropprofiles/docs/KYwheat.html

2. Kentucky Integrated Crop Manual for Field Crops: Small Grains. P. Lucas [ed.]. IPM-4. http://www.uky.edu/Ag/IPM/manuals.htm.

3. Johnson, D. Using pheromone traps in field crops. Entfact – 112.

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6. Johnson, D. and L. Townsend. Aphids and Barley yellow dwarf (BYD) in Kentucky grown wheat. Entfact – 121.
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8. Johnson, D. Hessian fly in Kentucky. Entfact – 101.

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16. Lucas, P. IPM Trap Counts (Weekly). http://www.uky.edu/Ag/kpn/kpn_06/pn060925.htm#trap

17. Johnson, D. Insecticide Recommendations for Small Grains. ENT- 47. http://www.uky.edu/Ag/PAT/recs/rechome.htm

Footnotes

[1.] Proceedings of the Indiana Certified Crop Advisors Conference. Indianapolis, IN. 5 Dec 2007.

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[3.] Common and scientific names of insects from: Common Names of Insects and Related Organisms. Entomological Society of America. http://www.entsoc.org/pubs/books/common_names/index.htm#About_this_Publication

[4]. The Entfacts may be found at: http://www.uky.edu/Agriculture/Entomology/entfacts/eflists.htm. Other on-line references contain direct links.