



ENTFACT-121

## APHIDS AND BARLEY YELLOW DWARF (BYD) IN KENTUCKY GROWN WHEAT

Doug Johnson and Lee Townsend, Extension Entomologists

Insect-disease interactions pose difficult problems for growers. While it may take the feeding of many insects to damage a healthy plant, only one insect carrying a pathogen can severely stunt or kill a plant.

- BYD is a virus disease that is moved from grasses and some crops to and within wheat fields by aphids. Severity of the disease varies from year to year because of a complex interaction between aphids, weather, the virus, and plants. There are no management tactics to attack the virus directly.
- **Planting date** is the most important factor that determines the intensity of aphid infestations, and consequently, BYDV levels in fields. This approach is not fool-proof but it is more effective than a preventive spray program in minimizing yield loss to the disease.

### APHID - BYDV INTERACTIONS

Healthy plants can become infected only after being fed upon by aphids that are carrying BYD virus. Aphids pick up the virus as they feed on the sap of infected plants. After a few hours, they can inject it into other plants. Once infective, aphids carry the virus for the rest of their lives. There is no other means of spread.

### APHID BIOLOGY

#### Description

Aphids are small insects with soft, pear-shaped bodies and piercing sucking mouthparts. A pair of tubular structures, (cornicles) project like tail pipes from the end of their bodies. Adult aphids may or may not have wings. Large colonies are often seen on tender new plant foliage. Once they find a good host, nymphs and wingless adults tend to stay in one place.

#### Movement

Aphid movement can be categorized as flying, flitting, or walking. These are based on the method and relative distance traveled. Each type benefits the aphid in specific ways but also results in a specific type of BYDV spread.

Generally most adult aphids in a colony will be wingless. However, a small number in each generation will have wings. This allows for continual population expansion.

Environmental factors such as poor weather, overcrowding and reduction in food quality cause a greater number of them to have wings so the colony can escape unfavorable local conditions.

### WAYS APHIDS MOVE

- Some will fly long distances. Individuals can move from one field to another field or to a weed host. Most fly in the fall. In general, they are moving from drying summer grasses to young fall grasses, including small grains. This movement brings BYDV into a wheat field.
- Some will make short flights, just a few feet to a few yards. This moves BYDV to new spots in a field.
- Aphids often walk from plant to plant. This gradually expands the area of an existing population and produces circular spots of infected plants if the virus is present. The earliest infected plants are near the center and the most recently infected ones are near the edges. The spots expand in size over time.

#### Life cycle

Aphid life cycles are very complicated and vary considerably between species and even between individual populations of the same species. The following is a very abbreviated description intended to help understand what is going on in Kentucky's small grain fields.

In Kentucky wheat fields aphids reproduce asexually. That is to say all the aphids you see are female and all of their offspring are born female. Very few if any males are present and play little roll in the BYD incidence. Aphids overwinter as juveniles and adults. At present we do not believe that eggs play any roll as they would further north. However, temperature is very important. In general the warmer the temperature the more aphids can survive, move and reproduce. Conversely, colder temperatures result in lower survival rates, fewer offspring and less movement. As a rule of thumb it needs to be about 50° F for aphids to be active and temperatures below 30° F result in increased aphid mortality. However, even at very low temperatures some aphids will survive. A warm and dry winter will aid aphid survival and BYDV spread while a cold and wet

winter will reduce aphid survival and movement.

**MOST IMPORTANT SPECIES**

The bird cherry-oat aphid (BCOA) is the most common one found in wheat in the fall and winter and our most important vector of BYDV. This dark green aphid with a rounded body has antennae that are nearly as long as the body. Cornicles (tubes) at the end of the abdomen are green with black tips. The area surrounding and between the cornicles is red or orange. Legs are green with black joints.

The corn leaf aphid (CLA) is a bluish green insect with a ‘velvety’ or ‘fuzzy’ appearance. It’s body is flatter and longer than the bird cherry oat aphid. The black antennae are and about 1/3 as long as the body. The cornicles are short, and black and the area around them is often darker than the rest of the body.

These aphids are common on corn or grain sorghum just as these plants begin to form a tassel. CLA can be found on wheat in the fall but disappear as temperatures drop.

The English grain aphid (EGA): is bright green but may vary to brown or pink. The antennae are as long as or longer than the body. The long black cornicles reach past the end of the body. The legs also are long and completely black. They give the aphid an appearance of being perched over the leaf surface. This is a very common spring species in KY. They are often found in the heads during grain filling time.

Greenbugs (GB) are light green with a very distinct dark green band down the middle of the back. The mostly black antennae are shorter than the body. The relatively short cornicles have black tips. Legs are green with the joints and ends black.

Greenbugs can be found in KY but rarely reach damaging levels. Unlike the other grain aphids in KY, GB injects a toxin into the plant causing that tissue to die. For this reason GB damage is very easy to diagnose and it is potentially a serious pest.

**APHID / BYDV PEST MANAGEMENT**

There are relatively good guidelines for managing aphids as plant pests. These insects use their piercing-sucking mouthparts to feed on plant sap and, as long as numbers of aphids don’t reach levels that stress the plant, little damage is done. Typically, it takes several aphids per plant so there is plenty of time to detect them and make a management decision.

The picture changes if the insect is carrying BYDV. In this case, a single aphid can infect and stunt many plants. In turn, these infected plants can provide the virus to other aphids and quickly increase the disease level in the field. Under the right conditions, a very small number of aphids can have a major impact on crop yield.

It would be nice to know what proportion of aphids arriving in a wheat field carry the virus in a given year but this cannot be determined easily. However, it is risky to attempt to reduce the incidence of BYDV in fields entirely through aphid control. There are no simple steps to follow for success.

- Delayed planting (using the Hessian Fly Free Date) is the single most important and reliable management tool available to the farmer. This date is based on the first hard frost, which kills large numbers of soft-bodied insects like aphids and Hessian Flies. This leaves fewer to fly into crop fields. In addition, temperatures are generally cool enough to greatly reduce movement and reproduction of those aphids that do arrive in the field.

Research shows that fields planted later in the fall have small aphid populations which take longer to grow and spread. The lack of research information on aphid flights in the fall keeps us from providing a specific date. However, in general planting after the Hessian Fly free date is a good bench mark.

- The risk of BYD infection varies from year to year. Table 1. Shows BYD was at epidemic levels in the 1992-93 season, while the 1993-94 season BYD incidence was very low. 1994-95 proved to be an intermediate year. BYD was almost non-existent in the 1995-96, 1996-97 and 1997-98 crops.

Table 1. Average Percent BYDV Infection in Non-treated Plots at two KY Locations in Five Harvest years.						
Location	Harvest Year					
	1993	1994	1995	1996	1997	1998
Princeton	59	19	35	Trace	Trace	Trace
Keysburg	70	4	23	2	Trace	

- Wheat varieties do not respond equally either in yield loss or symptom expression. You need to know how your variety selections respond to the BYDV.
- The most important time for controlling aphids to prevent BYD is the first 30 days following emergence. The second most important time is the second 30 days following emergence. Generally, an insecticide applied after the wheat reaches Feeke's 4.0 probably does little good. Current research data support the following treatment guidelines.

Table 2. The number of aphids per foot of wheat row required to support an insecticide application for management of BYD.

Crop Age	Aphids per Foot of Row
30 Days post emergence	3
30to 60 days post emergence	6
More than 60 days post emergence	10

#### **FACTORS TO CONSIDER WHEN DECIDING ON USING AN INSECTICIDE TO SUPPRESS APHIDS AND BYDV.**

1. Factors that **REDUCE** the potential of return from applying an insecticide to control aphids and to reduce BYD infection.

- Hot, dry preceding summer.
- Non-intensive management of factors such as fertility.
- Use of BYDV tolerant varieties.
- Planting after Hessian fly free date.
- An early hard frost followed by a cool fall
- Aphid numbers remain below treatment guidelines.
- Cold, open winter.
- Late, cool following spring.
- Wheat development beyond Feeke's stage 4.0

2. Factors that **INCREASE** the potential of a return from applying an insecticide to control aphids and to reduce BYD infection.

- Normal summer temperatures with adequate rainfall
- Intensive wheat management, high fertility, etc.
- Use of BYD susceptible varieties
- Planting before Hessian fly free date.
- Late, warm fall.
- Aphid numbers greater than treatment guidelines
- Mild winter or snow cover.
- Early warm following spring.
- Wheat development has not reached Feeke's stage 4.0

#### **THINGS TO CONSIDER**

- Aphid numbers alone do not give a clear answer. The percentage of aphids carrying the virus is unknown. There can be many aphids on the crop but only a very low percentage carrying the virus. However, small numbers of infective aphids can cause a very serious disease problem.
- Follow treatment guidelines to avoid an application that is too early.

In seasons of warm weather, large aphid populations, high yields, and good prices be prepared to make more than one application.

In years of low aphid populations, low prices, or low yields, be prepared to accept some BYD symptom expression, as sprays may not pay for themselves.

#### **POTENTIAL OUTCOMES**

- In epidemic years, sprays may pay for themselves but will **PROBABLY** not protect the maximum yield potential.
- In years of slight BYD, sprays will cost the producer.
- In intermediate years, sprays may pay for themselves and a larger percentage of the potential yield will be protected.
- Planting after the Hessian fly free date is worth one spray, and possibly two.
- Although there is some effect of spring infection/movement, fall effects appear to be far more important.
- In the long term, obtaining the ability to predict, or at least estimate disease severity, will be the most important management tool for producers.