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CROPPEST ONTARIO

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Welcome back!! This is the 12th year for the **Ontario Ministry of Agriculture, Food and Rural Affair's** Field Crop Production and IPM Newsletter (better known as the CropPest Ontario). Time passes so quickly when you are having fun (good thing for coffee and late evenings). As always I would like to take time and thank our sponsors: **Bayer CropScience, BASF, Growmark FS, Hyland Seeds, Monsanto Canada, Pioneer Hi-Bred International, Syngenta Crop Protection, and Syngenta Seeds.**

Although the primary authors continue to be the OMAFRA Field Crop Specialists (Agriculture Development Branch) we must acknowledge the contributions from research scientists at Agriculture and Agri-Food Canada and the University of Guelph (Ridgetown Campus and Guelph), as well as U.S. based extension personnel.

Our intention is to provide you with the best practical, theoretical or research based information to assist you in making informed decisions for yourselves and your clients. In addition many of the articles are further distributed through the farm press, retailers, internet, and OMAFRA technology vehicles such as the CropLine. Good Luck in 2007! – Albert Tenuta, CropPest Ontario Editor!

Bt Refuge is More Important than Ever!

Tracey Baute, Field Crop Entomologist, OMAFRA, Ridgetown

With 10 years of experience to go on, Bt corn has proven to be an effective control measure that has practically eliminated the need for foliar insecticide use on field corn, changing how we control a primary pest in corn production. If resistance to Bt was to develop in our corn borer population, it would cause a major shift back to the more intensive crop management practices relied on in the past. So far no case of resistance by ECB to Bt corn has been reported, indicated that the insect resistance management strategies have been effective.

Now there are new Bt corn options, with hybrids that contain a different Bt that specifically controls corn rootworm larvae. And like buying a car, you can even get the "all options in one" package, the stacked hybrids containing both types of Bt to control both ECB and rootworm. But with progress comes risk. Unfortunately, corn rootworm has a history of successfully adapted to its control measures, developing resistance to certain soil insecticides, foliar insecticides and even crop rotation. Now that we are exposing it to transgenic Bt corn, resistance management strategies need to be followed and taken very seriously if we want to continue to use Bt corn in the future. But given all of the options now for Bt corn, the refuge requirements can get a bit confusing. Hopefully this article can help make it easier to understand.

20 Percent Rule for ALL Bt hybrids

One common rule for ECB Bt corn, rootworm Bt corn, or the stacked traits for controlling both (Herculex XTRA or YieldGard Plus) is that 20% of your total corn acreage needs to be planted as non Bt refuge. You can not rely on your neighbours' fields to be your refuge. It is your responsibility to ensure the proper use of Bt technology, which includes following resistance management strategies to ensure the longevity of the technology.

Refuge Location – Why ¼ mile away or within?

The whole point of a refuge is to increase the likelihood of mingling and mating amongst individuals that survived feeding in Bt fields with individuals from the non Bt refuge that have never been exposed to Bt so they can mate with each other and dilute the resistant traits within the gene pool. To complicate things, ECB and rootworm have very different mating behaviors, forcing us to follow different refuge requirements.

ECB females venture out of corn fields and find weedy areas along ditch banks and fields to find a mate. They fly up to ¼ mile away to find their mate. There, they mingle and mate and then fly into an ideal corn field to lay their eggs. This is why the non Bt refuge for ECB can be planted as far as (but not farther than) a ¼ mile from the Bt corn field.

Unfortunately things are different for rootworm. Male rootworm adults emerge out of the soil first. They walk along the soil surface and are able to detect where females are underground and about to emerge. They sit and wait

for the females to come out and mate with them nearly on the spot or within that same area. The female rootworms do not leave the area until they have mated, decreasing the opportunity for them to mix and mingle with other individuals who have not fed on Bt yet.

Research has proven that some rootworm adults already do emerge alive from rootworm Bt corn. If the rootworms do not feed on the roots of the Bt hybrid until they are older/bigger larvae, they are less susceptible to the Bt and can survive. It is therefore crucial that the non Bt refuge is planted within or adjacent to the rootworm Bt cornfield, to help encourage mingling and mating among the individuals that come from the Bt and refuge areas. The refuge can be separated by a road or ditch from the Bt field but not by another field or larger obstruction.

With the stacked traits (Herculex XTRA or YieldGard Plus), the non Bt refuge must be planted within or adjacent to the Bt field, ensuring there is an opportunity for rootworm to mingle. ECB will be fine with this arrangement too since they again will fly out of the field and meet in “action sites” along field edges. As long as the refuge was planted within their flying zone, they are likely to mix and mingle. But rootworm adults need a little help from us to introduce them to individuals not exposed to Bt yet.

Refuge Configurations – How Can you Make it Work?

Within-Field Refuge Options

As long as there is a comparable non Bt hybrid available (ie. same maturity, good agronomics etc) to the Bt hybrid being planted, most growers prefer to plant the refuge within the same field as the Bt. This fits the bill for both rootworm and ECB requirements whether you plant ECB Bt, rootworm Bt or hybrids with the stacked Bt traits. Within field refuge options include Strips (at least 4 rows or wider), Blocks and Headland/Perimeter plantings. (**See Figure 1)**

Going Outside the Bt Field

When planting the refuge outside of the Bt field, distance is important. For ECB Bt corn, the refuge can be planted in any other field that you own as long as it is within ¼ mile from that field.

For rootworm Bt or the stacked Bt hybrids the refuge must be planted adjacent to the Bt field. This means that the field that borders or is directly across the road from the rootworm Bt field must be planted with a hybrid that does not contain the Bt gene to control rootworm. That field also needs to have the same crop history as the rootworm Bt field, making it just as likely to have rootworm currently present in the soil as the Bt field does. **(See Figure 2)**

If the Bt field (field on the left in diagram) is going to be rootworm Bt only (not stacked with both Bt traits) the adjacent field could be planted with ECB Bt corn since it won’t have any effect on rootworm and can act as the refuge for the rootworm, but then

another non Bt refuge field will need to be planted within ¼ mile of this field to act as the refuge for the ECB Bt field. **(See Figure 3)**

Regardless of which configuration you decide to use, it is your responsibility to ensure that it meets all refuge requirements to ensure that resistance does not occur so that Bt technology is here for the future.
For more information on Bt corn and Insect Resistance Management, visit the Canadian Corn Pest Coalition website at www.cornpest.ca

Figure 1

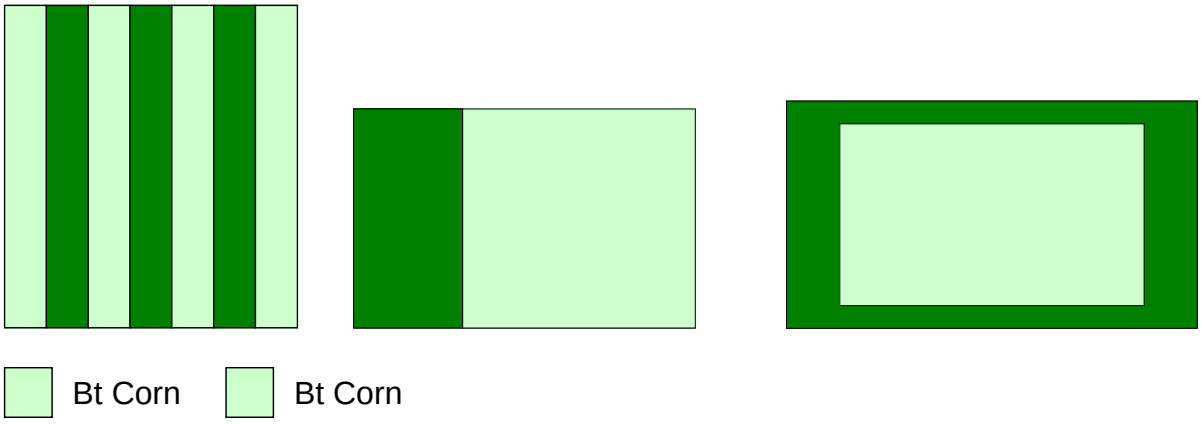


Figure 2

Diagram of Potential Refuge Option for Rootworm Bt or Stacked Bt Hybrids

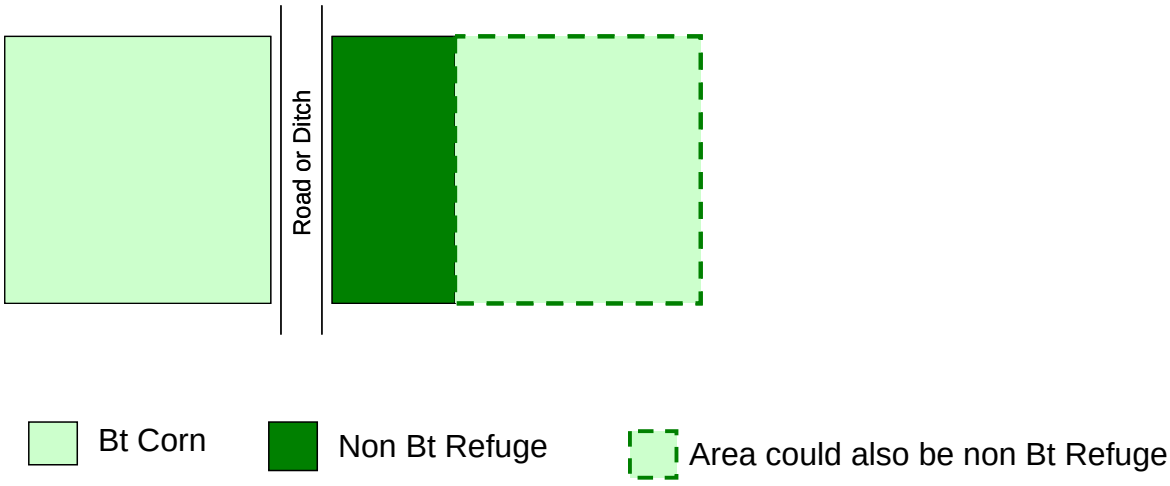
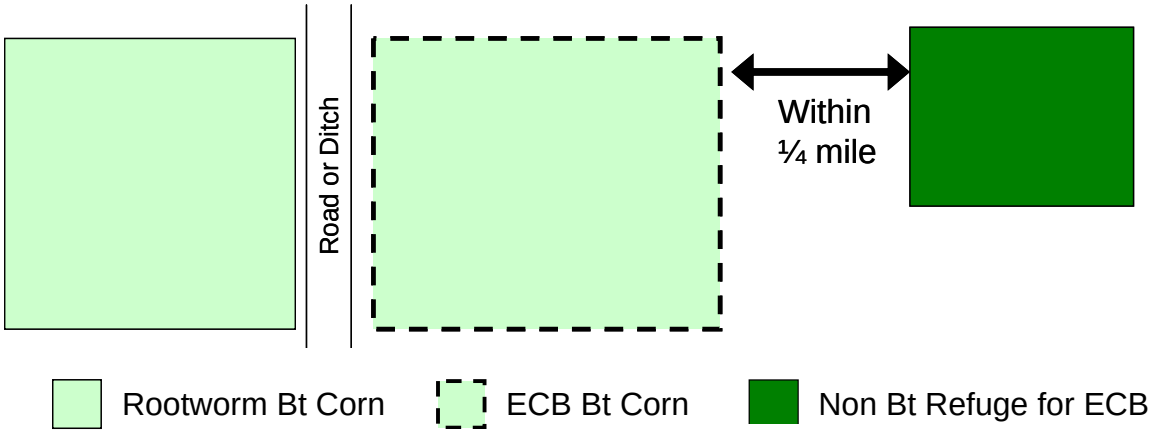


Figure 3



Avail – Can It Improve Phosphorus Fertilizer Efficiency?

Robert Mullen, Soil Fertility Specialist, Ohio State University

A new additive to phosphorus fertilizer is currently being marketed in Ohio called Avail. Unfortunately, at this point limited research data is available from land-grant universities to validate its efficacy, but some data out of Kansas on corn is intriguing. Avail is a polymer that can be used as a coating for dry phosphorus or as an additive to liquid phosphorus fertilizers. The polymer has an extremely high cation exchange capacity (reportedly 1800 meq/100 g) that binds soil cations calcium, magnesium, and aluminum decreasing their ability to interact with phosphorus in solution. The primary mechanisms affecting phosphorus plant availability are interactions with positively charged species (calcium, magnesium, aluminum, iron, etc.) in soil solution. Theoretically, application of this material with a phosphorus fertilizer source should improve phosphorus availability at least in the short term.

Data collected at Kansas State University in 2001-2003 showed that Avail coated monoammonium phosphate (MAP) applied at planting increased corn yields in two of the three years compared to uncoated MAP (<http://www.oznet.ksu.edu/library/crpsl2/srp957.pdf - page 34). The soil test P level was 23 ppm using Bray-Kurtz P1 extractant and not considered deficient.

The greatest concern regarding Avail is that very little information is available at this point, so widespread use of this product may not be warranted. The other issue to be considered is how does high soil P fertility affect response. High P soils are unlikely to benefit from application of this material, but research information is not available at this time.

Asian Soybean Rust Sentinel Plots

We are still looking for a few locations across the province with early planted soybeans. If you are interested or have a customer that would like to participate, please contact Albert Tenuta (519-360-8307) or Cheryl Van Herk (519-674-1694). Thanks !

Stewart's Wilt of Corn –"The Tale of Two Models"

Albert Tenuta, Field Crop Plant Pathologist, Tracey Baute, Field Crop Entomologist, OMAFRA, Ridgetown

Disease forecasting models have been proven to a very effective "tool" in predicting and limiting producer losses from disease. One of the oldest and most widely used disease predicting models is for Stewart's wilt of corn. The initial model was developed in the 1930s but has gone through various transitions over the years and is referred to as the **Stevens-Boewe Stewarts wilt disease forecasting system**. This model (Table 1) adds the average monthly air temperatures for December, January and February which is used to predict disease severity for the upcoming season. Based on the Stevens-Boewe Model, Essex county (Windsor-Leamington) and west Chatham-Kent would be at higher risk (moderate to severe) of the disease developing in 2007 (Table 3). For areas North and East of these, the model would suggest trace levels except for the Sarnia (light to moderate).

We have been validating a newer model developed at Iowa State University which also uses air temperature from the same three months but interprets the data differently. Each month's average winter air temperature is given a point score if the average was below - 4.4°C (°24 F) and the point scores are added up for each of the months. For example, if over the winter 3 points were accumulated then your risk of Stewart's wilt is high. If you accumulate fewer points, the risk of Stewart's wilt decreases. Using the IOWA model in 2007, it also predicted that the risk to Stewart's Wilt would be moderate to high from Windsor through to Niagara and London (Table 3).

This should be a good year to evaluate the different Stewarts wilt computer prediction models. These two computer model outputs are very similar to what Michigan State University is predicting for Michigan. Corn disease surveys conducted by OMAFRA (Ridgetown) and AAFC (Ottawa) found Stewart's wilt disease was more frequent in 2006 across the province on commercial corn and as expected in seed corn production fields in Essex and Chatham-Kent.

The bacteria overwinters in the gut of adult corn flea beetles, which hide through the winter in protected areas. Mild winters can result in beetles successfully overwintering and therefore an increased number of beetles the following spring. Overwintered adult flea beetles feed on corn in the seedling-to-whorl stage and susceptible varieties will develop a stem wilt resulting in complete plant loss. This occurs rarely in corn hybrids but can be devastating in seed corn inbred parents. The next generation of adult beetles emerge after corn silking and cause leaf wilting symptoms, which are commonly seen in many hybrids. Seed transmission is rare. Most often, late infections after silking are associated with high beetle populations. Sweet corn is often more susceptible than field corn and can serve as a reservoir for the bacteria.

The disease is often found in the best Susceptibility to the disease increases in fields that have high nitrogen and phosphorous levels.

The ability to accurately predict Stewart's wilt of corn allows for better management of the disease and the corn flea beetle. If you have a recent history of Stewart's wilt in your field, arrange for resistant hybrids or seed corn inbreds, if possible. Most field corn hybrids are resistant but there are few susceptible ones out there. The use of Gaucho, Poncho (low rate) or Cruiser seed treatment will control the flea beetles and potentially reduce the transmission of stewart's wilt this spring. Keep in mind that Gaucho is only available for use on **seed corn**. And do not graze or feed livestock on fields and fertility seems to play a part. Cruiser treated areas for 45 days after planting. If a susceptible hybrid or inbred is planted, plan to scout early for flea beetle damage.

This survey and prediction model was supported by the Seed Corn Growers of Ontario which obtained funding through contributions by Canada and the Province of Ontario under the Canada-Ontario Research and Development (CORD) Program, an initiative of the federal-provincial-territorial Agricultural Policy Framework designed to position Canada's agri-food sector as a world leader. The Agricultural Adaptation Council administers the CORD program on behalf of the province.

Table 1. The Stevens-Boewe disease forecasting system for Stewart's wilt disease of corn (Model 1).

Air Temperature Index	Disease Severity Prediction
-3.3 to 2.2 °C (90 to 100 °F) and above	Severe
-6.2 to -3.3 °C (85 to 90 °F)	Moderate to severe
-8.8 to -6.2 °C (80 to 85 °F)	Light to moderate
Below -8.8 °C (<80 °F)	Trace amounts

Table 2. The Iowa State Method (Model 2) for disease forecasting for Stewart's disease of corn (Nutter et al).

Number of Months ≥ -4.4 °C (24°F)	Predicted Risk
0	Negligible
1	Low
2	Moderate to High
3	High

Table 3. Comparison of the Two Models and Stewarts wilt predictions in 2007

Stations	Stevens-Boewe	Iowa State Model
Ridgetown	Trace	Moderate to High
London	Trace	Moderate to High
Sarnia	Light - Moderate	Moderate to High
Hamilton	Trace	Moderate to High
Leamington	Moderate - Severe	Moderate to High
Windsor	Moderate - Severe	Moderate to High

Assess Those Winter Wheat Stands

Peter Johnson, OMAFRA Cereal Specialist, Stratford

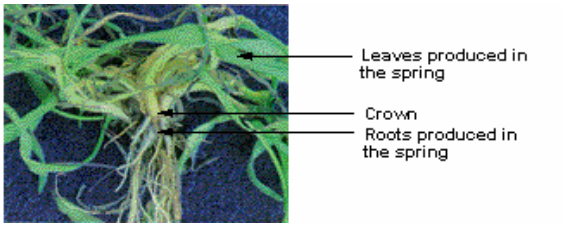
Trying to make the decision on whether to keep that wheat stand or replant is never easy. Stands are rarely uniform, with holes and gaps of various sizes which is related entirely to drainage patterns in the field. So as you walk those fields and wonder, here are some things to look for.

1. Plant Stands: While stands are rarely uniform, poor fields often have less than perfect stands even in the better areas. The table below (from University of Guelph – Ridgetown Campus) can be used to help assess the yield potential of your stand. Columns 3 and 4 give yield estimates for fields with different yield potentials. For late planted wheat or heavier soil types, use column 4 (75 bu/ac). Fields that would normally have excellent yield potential should use column 3 (90 bu/ac). (NOTE: If you are assessing a volunteer wheat stand, take into consideration the yield potential is often 35-40 bu/ac.)

Plants per Foot of Row	Percent Yield	Yield* Potential (bu/ac)	Yield ** Potential (bu/ac)
20	**100**	**90**	**75**
10	**95**	**86**	**71**
7	**90**	**81**	**68**
6	**85**	**77**	**64**
5	**80**	**72**	**60**

* Late planted wheat or heavy soil types; ** Field with traditional high yield potential

2. Plant Health: While stand counts are a good place to start, plant health is just as important. 5 or 6 healthy plants are likely better than 10 poor plants. If assessing heaved plants, look for new white root growth, the amount of this growth, and if these new roots are in the soil or still above ground. Plants with good root growth are healthy and will do well. Plants with little or no root growth will not make it, and should not be counted.



Tillering is another good measure of plant health. Look for tillers coming from the crown of the plant (plants with less than three leaves will not have started tillering yet). Evidence of tillers is another sign of health, while lack of tillers will reduce the yield potential of those plants.

3. Holes and gaps: Holes are by far the hardest thing to assess in these fields. It takes a tremendous amount of walking to get an accurate idea of the amount of the field affected. Count paces as you walk across the field. For each 100 paces, record the number of paces with no or very poor wheat. After a "W" or "Z" walking pattern, you can use these numbers to calculate the percentage of the field gone. DO NOT just stand at the side of the field and try to assess the stand. Invariably, your eyes will be drawn to the poor spots, and you will estimate far too high.

Aerial Assessments Can Help!: One easy way to assess the holes and gaps in the field is from the air. A quick flight over the field can tell you far more than hours of walking. The pictures below will give you an idea of the benefit of an aerial view. Talk to your neighbour the pilot!!

Figure 1
4.5% Damaged Areas

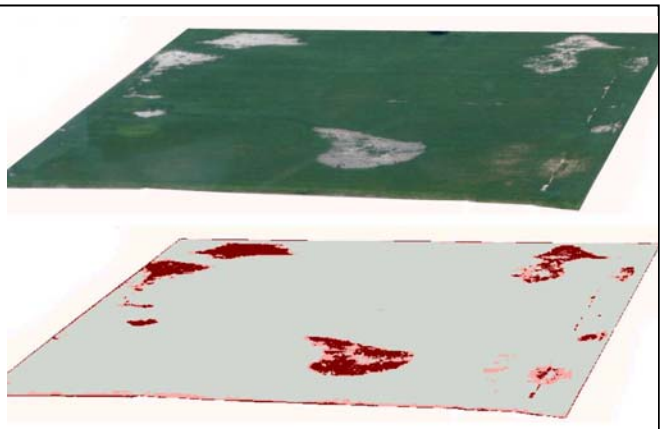


Figure 2
11.5% Damaged Areas

Figure 3
20.4% Damaged Areas

Low Winter Killed Wheat

Moderate Winter Killed Wheat

Severe Winter Killed Wheat

No Damage

Other Tips to Consider: Always look at your wheat stands ACROSS the rows. Stands of 2 or 3 plants per foot of row will look like a row of wheat if you look down the rows, but virtually disappear if you look across the rows. And have patience, as much as possible. The closer to corn planting time you can make the decision, the better chance you will have to make the best call.

Being the first issue, now would be an excellent time to assist us in updating our mailing list. If you have other outlets, dealers or growers that would like a copy, please contact Mirjam Hall at 519-674-1698 (Mirjam.hall@ontario.ca) or you can also be alerted to when new issues are posted by joining our on-line subscription service at: www.omafra.gov.on.ca/croppest.