PHREC 97-05c

NEBRASKA

POTATO EYES

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Updates

Bravo Section 24c

The Section 24c request to increase the seasonal limitation of the active ingredient in Bravo Zn and Bravo Ultrex from 12 to 16 lb ai/acre was completed and submitted on June 17. The Nebraska Pesticide Advisory Board will be considering it for approval at their next meeting, July 24. Approval is expected. All of the State's requirements have been fulfilled and questions answered. I'll send a fax to everyone when the decision comes down that day.

Potato Leafhopper

Potato leafhoppers have come to Nebraska much earlier than normal due to unusual wind activity from the South. Their population is usually kept below threshold levels by insecticides used for the Colorado potato beetle. But, nearly all of these, also kill beneficial insects. One suggested insecticide to use on leafhoppers that is more selective is **malathion**, an organophosphate. Malathion 57EC (UAP) at 1-1½ pint/acre is effective on leafhoppers and aphids (not on the Col. potato beetle). It is short-lived so it doesn't disrupt populations of natural predators such as ladybugs that are building. Pyrethroids such as ... are very harsh to beneficial insects and should be avoided.

If beneficial insect populations build up, they are established when aphids appear. These predatory populations then can inhibit a flare-up of aphid populations. Some of the beneficial insects to look for are ladybugs (ladybird beetles), damsel bugs, stink bugs, and spiders.

Alexander D. Pavlista

Inside this Issue...

Insect Life Cycles

Colorado Potato Beetle

Adults overwinter in soil. Nebraska may have less of a problem with this pest than other states due to the usual cold winter with little to no snow cover. Adults will overwinter in potato fields.

Emerge in the spring.

Fly several miles in search of hosts that include nightshades and buffalobur.

Mate on the host and eggs may be layed for as long as a month.

Eggs hatch in 4 to 10 days depending on temperature (cooler the longer).

Larvae feed for 2 to 4 weeks then pupate in the soil (4-10 inches deep).

Pupa last for about a week.

Adults emerge and eggs begin to be layed 7-10 days later.

The cycle takes 5 to 8 weeks per generation. Usually, there are two generations per season in Nebraska – early to mid June, and early to mid August.

Most systemic insecticides applied at planting will kill the Colorado potato beetle's first generation. Most foliar insecticides will take care of the second generation population. The key is not to let the population de-synchronize. If this happens, weekly applications of foliar insecticides could be needed.

The economic threshold for defoliation is 10% during the first half of tuber bulking (about 4 weeks) and 25% at other potato stages.

European Corn Borer

Adults will not overwinter in potato fields.

Adults fly, mate, lay eggs for about 3 weeks (early June).

Eggs are layed in the evening and hatch after about a week depending on air temperature.

The larval stage feeds for about 30 days depending on air temperature during which time they will first feed on foliage and then bore into the stem.

In the stem, they will pupate for about two weeks and emerge as adults to start over again.

One cycle takes about 9-10 weeks. The borer undergoes two generations per potato season in Nebraska. The first flight and egg laying of the European corn borer is in the first half of June, and the damaging larvae emerge about mid to end of the month. The second flight and egg laying is usually in the last week of July and the beginning of August. The second generation of larvae will be about the second week of August (10th or so). Usually the second generation does little damage to the potato crop. The time to get them is when the eggs first hatch before they bore into the vine. Hatching varies with years and weather but the usual time is the second half of June.

The economic threshold is 15% of plant stems are infestated.

Note since the borer attacks the pith (center) of the vine, it does little damage except make the stem weak and later fall over. Damage doesn't really occur until they start eating the vascular tissue thereby wilting the plant.

No systemic including Phorate/Thimet is labelled for control of ECB in potato. Phorate 20G, however, is labelled in field corn for control ECB. Most foliar insecticides will take care of the second generation population. The key is not to let the population de-synchronize. If this happens, weekly applications of foliar insecticides could be needed.

Wilting Diseases

Rhizoctonia-Fusarium-Verticillium-Erwinia

Several growers on my trip around the State asked me how I distinguish between the various wilts. What do I look for and how are they different? Growers have also asked how these wilts affect tubers in storage. What are their symptoms; what to look for? The following are rough descriptions for the identification of the four major wilts – *Rhizoctonia solani* (stem canker and black scurf), *Fusarium* spp. (wilt and dry rot), *Verticillium dahliae* (early dying and vascular discoloration), and *Erwinia carotovora* (blackleg and bacterial soft rot). I have not included the blights here. I'd recommend getting a copy of the "Compendium of Potato Diseases" ($35) and "Potato Health Management" ($45), both published by the American Phytopathological Society; call 1-800-328-7560 to order.

These are the symptoms that I look for as I look at vines in the field and tubers in storage.

I. *Rhizoctonia solani*

– on vines = stem canker:

a) early symptoms = reddish-brownish usually rectangular blotches on stem near ground level (slightly above, at and/or slightly below). These blotches can also be seen in severe cases on the stolons which will result in pinching off the stolon and loss of tuber (stolon pruning).

b) later symptoms = wilting of vine and blotches become darker to black, enter stem and stem decays. Root pruning also may occur. As the disease progressed, a cross-cut of the lower stem will reveal that the vascular ring is brown to black and with further disease progress the whole inside decays. In the last stages, it's impossible to discern this wilt from other wilts. Microbiological plating and growth of organism in culture is needed for identification.

– on tubers = black scurf: This disease does not rot tubers. It's appearance is on the surface as black hard spots that do not wash off. These fungal colonies give rise to the vine symptoms noted above when the tuber is planted. The colonies are formed through contamination by the disease in the soil. Tuber misformation is often associated with this disease; the cause is not known.

II. *Fusarium* spp.

– on vines = Fusarium wilt (several species):

symptoms = The first indication is a general wilting of the plant. A rosetting of the vine top and leaf discoloration can occur in severe cases. Upon cutting a cross-section of the stem, the whole vascular ring (unlike the early symptom of Verticillium wilt, see III) would be discolored, brown to black. At the base of the vine, the stem is brown to black but not in blotches as with stem canker (see I). Stem decay at base is from the vascular tissue out and in while stem canker is from the outside (epidermis) through the vascular tissue and further in. At later stages these two diseases cannot be told apart based on stem appearance.

– on tubers = Fusarium decay (several species): There are surface discoloration which grow deeper into the tuber. The stem-end discolors. Starting at the stem-end of the tuber, peel thin (eighth of an inch at a time) layers. A dark ring (infected vascular ring) may appear; this is the disease in the vascular tissue. But, note this alone may not indicate Fusarium decay since this symptom can appear due to a too rapid vine kill, Verticillium wilt (see III), bacterial ring rot, and other causes.

– on tubers = dry rot (*Fusarium solani*): Organism enters through wounds on the tuber surface. It spreads from the point of entry leaving a cavern of dried dead tissue. Under high humidity, bacterial soft rot (see IV) will also attack cavern causing a liquid/dry mix. There is an odor from the soft rot (see IV) but not a stench like in *Pythium* leak (Smells like "dead mackeral" is my description for leak).

III. *Verticillium dahliae* and *V. albo-atrum*

– on vines = early dying / Verticillium wilt:

a) early symptoms = Wilting first appears on one side of the plant. This can be one or two stems out of several or leaves on one side of a stem and not the other side. When the stem is cross-sectioned, the vascular ring appears dark on one side, semi-circle, as opposed to all the way around as with Fusarium wilt (see II). This is best observed with a slanting or diagonal stem cut near the soil surface.

b) later symptoms = The whole plant wilts and the vascular ring is discolored all the way around. Stem decays. At this point, this disease cannot be discerned from Fusarium wilt without microbiological culturing of diseased tissue for fungal growth and identification.

– on tubers - vascular discoloration: The key symptom is the discoloration of the vascular ring starting from the stem end. This may not appear on all tubers from a plant but only on those from the side of the plant first infected. The tuber surface may also show discoloration especially around the eyes. This symptom may be confused with other diseases such as pink eye which does not have vascular discoloration as a symptom.

IV. *Erwinia carotovora*

– on vines = blackleg:

a) early symptoms = Unlike the three diseases described above, this is caused by a bacteria not a fungus. This bacteria eats out the center of the stem (pith) at the base near ground level. It decays from the inside out, first hollowing the stem. Unlike the others, the stem becomes black and slimy, and oozes. Stunting and delayed emergence is common.

b) later symptoms = The stem is destroyed and the plant wilts. At this point, it becomes difficult to distinguish it from the fungal diseases unless the hard vascular tissue is still somewhat intact and the hollow pith can still be seen.

– on tubers = bacterial soft rot: Symptoms range from vascular discoloration to a soft rot, both starting at the stem-end of tubers. The soft rot goes from the stem-end through the center of the tuber extending further in, hollowing out the tuber much like what happens to the stem as blackleg. The rot is wet and creamy in color with sometimes black margins. I find that the smell of the rot at early stages, before other organisms invade, is the slight odor of frozen meat. Pythium leak, a fungal disease with similar symptoms, has a strong nasty smell of rotting fish. Pythium leak has no vine symptoms and is a harvest and storage disease. Both soft rot and leak are promoted by the same harvest and storage conditions – heat, wet and lack of air.

VINE SYMPTOMS for WILT DISEASES

	vine and stem	stem decay	stolon	vascular ring	other
Stem Canker	rectangular stem patches	outer skin to inside	blotches pinching	discolors with decay	roots pruned delayed emergence
Fusarium Wilt	rosetting wilting	from ring to outside and in	growth slowed	discolored in stems	leaf yellowing and drying
Early Dying	one side wilts first	from ring to outside and in	growth slowed one side first	discolors one side first	leaf yellowing and drying
Blackleg	hollow and black stem	from the center out	black areas pinching	decayed slimy	stunting delayed emergence

TUBER SYMPTOMS for WILT DISEASES

	tuber core	vascular ring	tuber surface
Black Scurf	none	none	black, unwashable spots
Dry Rot	dry cavity extending from surface wounds	discoloration and decaying	dry decay around wounds
Vascular Discolor	none	discolored	discoloration around eyes
Bacterial Soft Rot	soft, wet cavity from lenticels, wound or stem end	discoloration and rotting	sweating, decay at wounds or lenticels

Late Blight Notes

Copper: "Fixed" copper compounds have soil activity, killing spores on the ground. Fixed copper compounds include Kocide 2000 and Basicop. These two products are most recommended. Application of fixed coppers is not recommended during the season, but is recommended for end-of-season application. Recommendation is to vine kill to open canopy and three days later apply a fixed copper such as Kocide 2000. The copper can act as a soil barrier against the spread of late blight spore downward to the tuber zone. Bravo can work like fixed coppers but has a seven day pre-harvest interval (7 day PHI). Maneb will not work. Last winter, lab tests conducted at North Dakota showed that copper sulfate alone is not good for killing spores after vine kill. Basicop (tribasic copper sulfate) is a good mix; it contains both copper hydroxide and copper sulfate. The copper sulfate "shoots quickly" while the copper hydroxide is a "slow release" activity. Basicop and Kocide 2000 are about equal. However, more Basicop may be applied per acre in a single shot than Kocide 2000. Kocide 2000 gives 35% copper and can be used at a maximum rate of 3 lb product/acre; therefore, at most 1 lb copper will be applied per pass per acre. Basicop gives 30% copper and can be used at 6 lb product/acre resulting in 1.8 lb copper per pass per acre. Either of these products can be applied right in front of the harvester since they have no pre-harvest interval. North Dakota's recommended rate for copper is 1½ lb/acre, higher than a single pass of Kocide 2000.

Tin: Super Tin helps against late blight and does great on early blight. It can be mixed with all late blight products and in some cases will enhance activity. For instance, Polyram alone is poor against late blight but, when mixed with SuperTin, the combination works very well. The best application of SuperTin mixes for the fall crop is in early to mid August, not before. Also, note that it has a 21 days before harvest limitation (21 day PHI).

Varietal Sensitivity: There are no North American variety that is resistant or tolerant to late blight. The following groupings of No. Amer. potato varieties is based on relative susceptibility. The most suseptible will go down (100% dead) in less than a week versus less susceptible which will go down in less than two weeks. The following is from a paper published in Plant Disease (1996) by Inglis et al.

MOST Susceptible:
russets – Frontier Rus., Goldrush, HiLite Rus., Norgold Rus., Norking Rus., Rus. Norkotah;
whites – Atlantic, Gemchip, Monona, Norchip, Superior;
reds – Chieftan, Norland(s), Red LaSoda.

Susceptible:
russets – Ranger Rus., Rus. Burbank;
whites – Allegany, Castille, Katahdin, Norwis, Shepody, Snowden;
yellows – Yukon Gold.

LESS Susceptible:
russets – Krantz;
whites – Elba, Kennebec, Sebago.

Dr. David Douches (Michigan St. Univ.) shared the following rankings based on greenhouse tests done in 1995 and 1996. He expects to publish this in the Amer. Potato Jour. in the near future, so we got a preview.
Rating Scale: 0 = no infection; 1 = 0.1 - 5% infection; 2 = 6 - 15% infection, 3 = 16 - 30% infection; 4 = 31 - 49% infection; 5 = 50 - 100% infection

North American Varieties:	rating	Other (mostly European) Varieties:	rating
Atlantic	5.0	Dorita	5.0
Chaleur	5.0	Ofelia	5.0
Goldrush	5.0	Agria	4.7
Onaway	5.0	Alpha	4.7
Prestile	5.0	Penta	4.7
Rus. Burbank	5.0	Desiree	4.0
St. Johns	5.0	Estima	4.0
Superior	5.0	Libertas	3.7
Lemhi Rus.	4.7	Matilda	3.7
Yukon Gold	4.7	Island Sunshine	3.3
Crestone	4.3	Lily	3.3
Saginaw Gold	4.3	Brodick	3.0
Spartan Pearl	4.3	Sante	2.7
Frontier Rus.	4.0	Zarevo *	1.3
Krantz	3.7		
Portage	3.7		
Mainestay	3.0		
Shepody	3.0		
Snowden	3.0		
Pike	2.3		

* This is a Ukranian variety which he noted was the only entry with acceptable resistance to late blight.

David also shared the results of his field trials in 1996. He inoculated leaves with late blight and recorded the amount of infection 24 days later.

Variety	% foliar infection	Variety	% foliar infection
Atlantic	92	Pike	80
Century Rus.	87	Rus. Burbank	96
Delta	49	Rus. Norkotah	84
Goldrush	90	Saginaw Gold	98
Island Sunshine	48	Shepody	95
Mainestay	99	Snowden	92
Matilda	48	St. Johns	68
Morning Gold	83	Superior	93
Norchip	96	Zarevo	17
Onaway	99		

COOPERATIVE EXTENSION
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UNIVERSITY OF NEBRASKA-LINCOLN
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National Late Blight Fungicide Trial

General Conclusions from 1996 Trial

1 - No treatment sequence achieved 100% control of foliar symptoms.
2 - All sequences reduced foliar late blight and increased yield over control.
3 - The Section 18 systemic treatments did not significantly outperform the registered protectant treatments in foliar disease or tuber yield.
4 - Across the 10 locations, the Kocide 2000 (copper hydroxide) + Manex (mancozeb) sequence was least effective for controlling foliar late blight.
5 - Foliar infection by late blight was suppressed with 6-8 fungicide applications regardless of location or program.
6 - When and how fungicides are applied is probably more important than differences among effective products.

The locations of the Trial last year were Florida, Maine, Michigan, New York, North Dakota, Oregon, Pennsylvania, Prince Edward Island, and two sites in Washington.

This trial is being repeated in 1997. The treatments are similar to last year's. All treatment sequences begin when plants are 8-10 inches tall.

1) Bravo WS 6F every week (ISK BioScience);
2) Kocide 2000 weekly + Manex weekly up to the last 2-3 applications (Griffin);
3) Polyram 80DF + SuperTin 80DF every week (UAP);
4) Dithane DF every week (Rohm & Haas);
5) Bravo WS 6F weekly until disease is forecasted or appears in control then Curzate 60DF + Manzate 200 weekly for 5-7 weeks then end with Bravo (DuPont);
6) Bravo WS 6F weekly, Acrobat MZ applied three times with Bravo WS 6F: 7 days prior to row closure, at row closure, and at vine kill (Amer. Cyanamid);
7) Bravo WS 6F weekly until disease is forecasted or appears in control then Tattoo C applied three times alternating weekly with Bravo then end with Bravo through vine kill (AgrEvo).

The first four sequences cost between $50 and $100 approx. per acre and the last three cost between $130 and $170 approx. per acre in 1996.