Preliminary report

Project Title: Aphid Predictive Model
Optimizing on Farm Aphid Management

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Background:

Potato Virus Y has become a significant issue for all of North America including Maine. PVY is a non-persistent virus that can be transmitted by four species of colonizing aphids and over forty species of non-colonizing aphids. The speed of PVY transmission is measured in seconds and the current systemic and translaminar insecticide materials for aphids are largely ineffective in preventing virus transmission from non-colonizing aphids. Oil spray materials called stylet oils can be effective at reducing PVY transmission; however, timing of application is critical. Stylet oil materials are prophylactic and must be applied prior to the aphid probing the plant with its stylet.

Potato producers deal with two major issues with managing risk from aphid populations and PVY transmission. When do the aphid flights begin, when do the peak aphid flights occur. Aphid trapping information while important, allows a grower to react to what has or is happening rather than being pro-active. Predicting aphid flights could provide potato seed growers with information that would allow growers to be proactive in the application of more traditional insecticides for colonizing aphids and prophylatic stylet oil applications for non-colonizing aphids.

Methods:

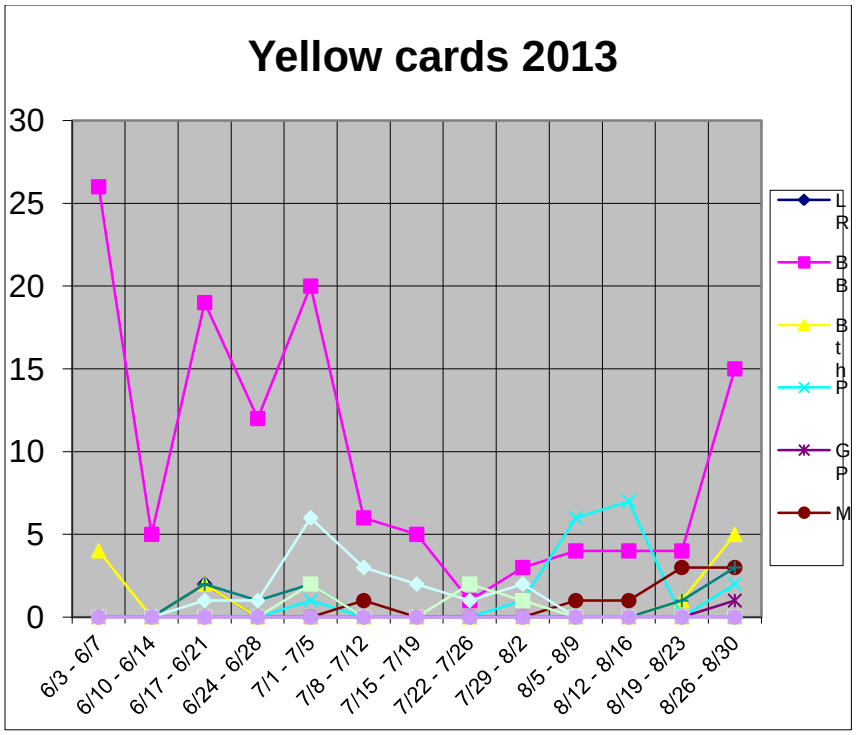
Aphid trapping in Maine has traditionally been done utilizing yellow water pan type traps and more recently, yellow sticky cards. It is proposed to initiate trapping in mid-May, which is earlier than traditionally done. This is to insure the detection of the initial “trivial” flight as aphids move from the over-wintering host in search of summer host plants. Both colonizing and non-colonizing aphid flights will be monitored. Aphid data from Maine indicates that some aphid species may be active in late May and early June.

Aphids collected by the two different types of traps, water pan and sticky card were identified to species. The initial detections will be compared to a growing degree-day based model which is being developed by Dr. Russell Groves, Entomologist, and University of Wisconsin. The 2014 aphid trapping data has been sent to Dr. Groves in Wisconsin. The result of integrating the Maine data into the Groves model has not been completed as of this date.

In discussions with Dr. Groves, his model seems to be effective in predicting the initial flight of four different species of aphids in the Wisconsin area. The Groves Model is based upon growing degree days. Growing degree days can be calculated as the maximum temperature plus the minimum temperature divided by 2 minus a base temperature.

$$GDD = \frac{\text{max temp.} + \text{min temp}}{2} - \text{base temp.}$$

In 2013 and 2014 ten locations were selected with cooperating seed growers to trap aphids using both water pan and sticky card traps. It is interesting to note that there is a consistent trend with the trapping that the sticky cards collect aphids earlier in the growing season than water pan traps, usually the timing is at least a week.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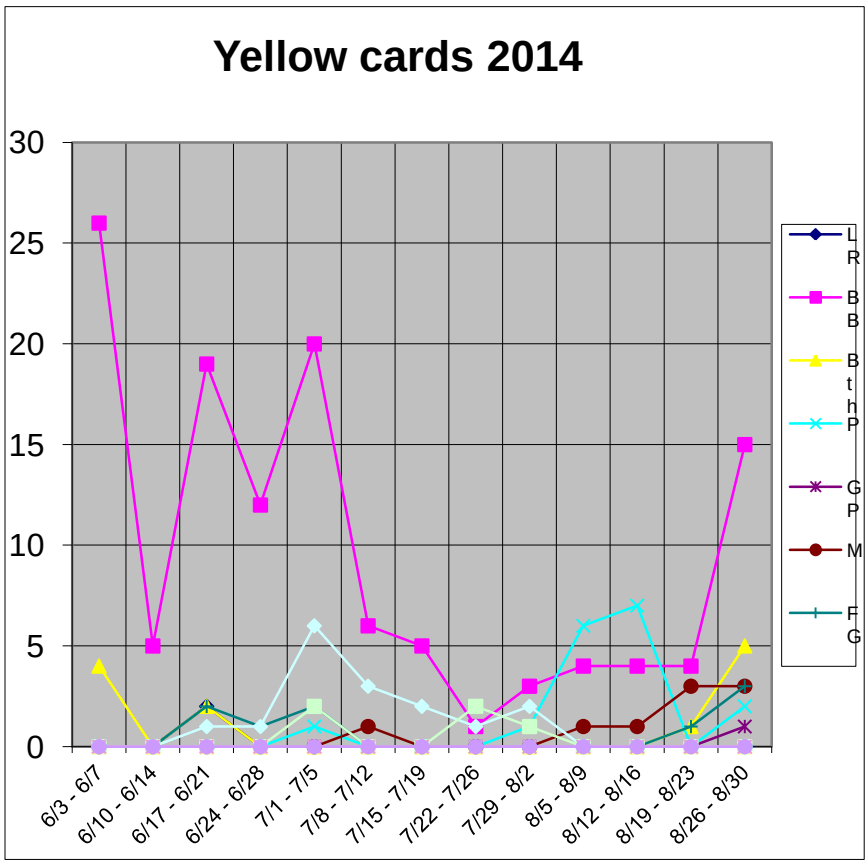
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2013 data

Date of first collection	**std 32 degree**	**std 40 degree**	**std 50 degree**	**modified 50 degree**
6/3 to 6/7 Black bean aphid collected Buckthorn aphid collected	1076 to 1168	580 to 640	213 to 232	355 to 387
6/24 to 6/28 Potato aphid collected	1622 to 1732	958 to 1036	381 to 419	566 to 605

2014 Data

Date of first collection	**std 32 degree**	**std 40 degree**	**std 50 degree**	**modified 50 degree**
6/2 to 6/6 Black bean aphid	847 to 963	421 to 505	125 to 169	229 to 273
6/9 to 6/13 Buckthorn aphid Potato aphid	1033 to 1157	571 to 643	204 to 236	312 to 352

Even though the results are not back from the aphid collection data being entered into the Groves model, if one compares the collection dates for two years of data, the first buckthorn aphid collections correspond almost perfectly with a standard 40 degree growing degree calculation as well as a standard 50 degree day calculation.

2013 first Buckthorn aphids were collected on 6/3 to 6/7 at 580 to 640 gdd base 40
2014 first Buckthorn aphids were collected on 6/9 to 6/13 at 571 to 643 gdd base 40

2013 first Buckthorn aphids were collected on 6/3 to 6/7 at 213 to 232 gdd base 50
2014 first Buckthorn aphids were collected on 6/9 to 6/13 at 204 to 236 gdd base 50

Base upon only two years of data it appears that we may be able to forecast the initial flight of buckthorn aphids. This is only two years of data and will have to be tested for accuracy, but it is interesting how close these numbers match. This data will also be examined using the Groves model.

2013 first Black bean aphids were collected on 6/3 to 6/7 at 580 to 640 gdd base 40
2014 first Black bean aphids were collected on 6/2 to 6/6 at 421 to 505 gdd base 40

Based upon these two years of data and a 40-degree base temperature, the initial collections of Black bean aphids were made within 159 growing degree-days of each year. Assuming a

growing degree-day accumulation of an average of 18 gdd per day, these were collected within approximately eight calculated days from each other.

The potato aphid data for the two years seems to be separated rather significantly and more investigation will be required.

Further investigation, modification and refinements will be required in order to create a working aphid prediction model, but this beginning effort is promising. We look forward to seeing the results of the integration of the Maine data with Dr. Groves's model.