

PROGRESS REPORT

Compatibility of Insecticides with Crop Oils for Aphid Control

Name and Address of Applicant:

Principal Investigator: Andrei Alyokhin
 School of Biology and Ecology
 5722 Deering Hall
 University of Maine
 Orono, ME 04469

Co-Principal Investigators: Aaron Buzza
 Aroostook Research Farm
 University of Maine
 Presque Isle, ME 04769

Executive Summary:

The main objective of the present study was developing a better understanding of the reasons for the recent increase in potato virus Y (PVY) infections in Maine. PVY is capable of infecting approximately 120 plant species in five different taxonomic families. It is also transmitted by a wide variety of aphids, including both colonizing species living on potato plants and transient species passing through potato fields in search of hosts.

We tested compatibility of foliar aphicides (Admire®, Fulfill®, and Movento®) with crop oils. Movento applied alone, and Movento applied with JMS Stylet oil provided the best aphid control. Unexpectedly, applications of Admire Pro resulted in poor aphid control. Oil applied alone or in combination with Admire or Movento reduced the amount of PVY in harvested tubers. To the contrary, mixing oil with Fulfill resulted in higher incidence of this disease, suggesting the interference between the two compounds.

Background

Potato virus Y (PVY) is transmitted by at least 50 different aphid species. In relation to potato plants, aphids can be divided into colonizing and non-colonizing species. Potato aphid (*Macrosiphum euphorbiae* (Thomas)), buckthorn aphid (*Aphis nasturtii* Kaltenbach), and green peach aphid (*Myzus persicae* (Sulzer)) commonly colonize potato plants (*Solanum tuberosum* L.) in Northeastern U.S. and Canada. Foxglove aphid (*Aulacorthum solani* (Kaltenbach)) is also capable of developing on potato, but it is by far less common than the other three species, and is virtually absent from potato crops in Maine.

Other North American aphids do not colonize potato plants because they are unsuitable hosts for their development. However, rejection of non-host plants does not take place until aphids probe them with their mouthparts. As a result, dispersing winged adults of non-colonizing species commonly land on potato plants, insert their stylets into plant tissue, and then leave in search of a

more appropriate host. Direct damage caused by probing is negligible. However, probing may result in the transmission of certain viruses to healthy plants.

PVY transmission is non-persistent, i.e., the mouthparts of the aphid may get contaminated with viral inoculum in the brief process of probing the epidermal tissues of infected plants. There is no latent period between acquisition and inoculation, and the entire transmission process may take only a few seconds. However, infectivity is lost after several probes. Although non-colonizing aphid species are often held responsible for most PVY transmission, colonizing aphids also contribute to spreading this disease.

Crop oils have been repeatedly shown to interfere with the acquisition and transmission of PVY by aphid vectors. Unfortunately, there is a possibility that translaminar and/or systemic activity of oil films on treated leaves may compromise aphicidal activity of commonly used insecticides. In particular, our last year's investigations revealed an apparent aphid outbreak following tank-mixing Fulfill® with crop oil. Understanding compatibility of insecticides with crop oils is essential for successful chemical control of PVY spread.

Accomplishments

Experiment was conducted on 30-foot long and 4 row wide plots set up on Aroostook Research Farm. Plots were planted with certified seed potatoes and arranged in a randomized complete block design (six plots per treatment). To prevent virus transmission between the plots, they were separated from each other by strips of small grain (20-foot wide between the blocks, and six-foot wide between the plots within each block). The plots were sprayed with spinosad as needed to prevent potato defoliation by the Colorado potato beetles.

Before furrow closure, one certified seed piece in each row of each plot was manually replaced with seed pieces deliberately infected with PVY. Infected pieces were marked at planting, so that the tubers produced by infected plants would not be sampled at harvest.

Twenty potato plants were randomly selected from the middle two rows of each plot at weekly intervals and visually examined for the presence of potato-colonizing aphids. Chemicals were applied at high label rates. Insecticide / oil tank mixes were applied twice during the season (Table 1). Fungicides were applied following the schedule recommended by the UMaine Cooperative Extension for late blight control. Movento applied alone, and Movento applied with JMS Stylet oil provided the best aphid control, followed by Fulfill and Sivanto. Unexpectedly, applications of Admire Pro resulted in poor aphid control. No interference between insecticides and JMS Stylet oil in reducing aphid numbers was observed.

To evaluate virus transmission, a subsample of 52 tubers (26 tubers selected at random from the two middle rows of each plot) was harvested, immediately dipped in gibberellic acid, and stored 18°C to encourage sprouting. In late December, the sprouts were checked with ELISA for the presence of PVY. Oil applied alone or in combination with Admire or Movento reduced the amount of PVY in sampled tubers. To the contrary, mixing oil with Fulfill resulted in higher incidence of this disease (Fig. 1), suggesting the interference between the two compounds.

Table 1. Mean aphid numbers on experimental plots. Means in a column followed by the same letter are not significantly different (LSD, P>0.05).

Product/Formulation	Rate amt/acre	Applied	29-Jul	6-Aug	14-Aug	18-Aug	24-Aug
1 Untreated Check	-----	-----	9.6 a	12.3 a	5.1 ab	0.6 a	0.2 a
2 JMS Stylet oil	3.0% v/v	29 Jul, 10 Aug	6.0 a	8.2 ab	6.6 a	1.7 a	0.1 a
3 Fulfill DF	5.5 oz	29 Jul, 10 Aug	2.7 a	2.8 bc	1.5 bc	0.8 a	0.1 a
JMS Stylet oil	3.0 % v/v						
4 Fulfill DF	5.5 oz	29 Jul, 10 Aug	5.1 a	5.2 abc	4.4 abc	0.6 a	0.1 a
5 Admire Pro SC	1.3 fl oz	29 Jul, 10 Aug	5.4 a	5.9 abc	7.7 a	0.8 a	0.3 a
6 Admire Pro SC	1.3 fl oz	29 Jul, 10 Aug	9.3 a	8.6 ab	5.1 ab	0.4 a	0.0 a
JMS Stylet oil	3.0 % v/v						
7 Movento SC	5.0 fl oz	29 Jul, 10 Aug	11.6 a	1.2 c	1.1 c	0.3 a	0.1 a
8 Movento SC	5.0 fl oz	29 Jul, 10 Aug	6.9 a	1.8 c	1.3 bc	0.3 a	0.0 a
JMS Stylet oil	3.0 % v/v						
9 Sivanto SL	7 fl oz	29 Jul, 10 Aug	8.6 a	4.0 bc	2.3 abc	0.8 a	0.5 a

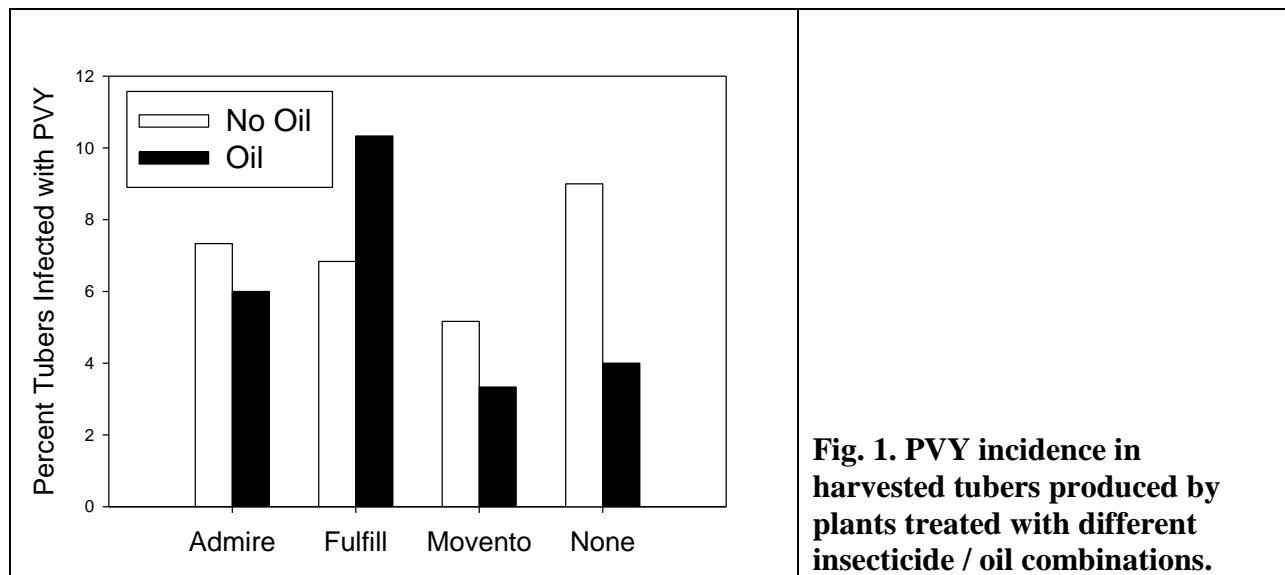


Fig. 1. PVY incidence in harvested tubers produced by plants treated with different insecticide / oil combinations.