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Effects of Combining Potato Pesticides

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Each year potato producers are faced with numerous pests—weeds, insects, diseases, and nematodes—that can potentially reduce potato crop yield and/or quality. Many products used to control these pests can be applied at planting in-furrow near the seed piece, or pre-emergent to potatoes. Many of these products also have systemic activity, which means they are taken up by the plant and remain active for many days after application. It has become so convenient to apply products during the planting operation that it is not uncommon to see tank mixes that contain several pesticides, fertilizers, and humic acid. It has been circumstantially reported that some chemicals or combination of products have resulted in better plant growth and health than what would be expected from controlling pests listed on the label. However, it has also been reported in crops such as corn and soybeans that certain pesticide combinations may cause plant injury.

In an attempt to shed some light on this complicated issue, a two-year study was conducted at University of Idaho Research and Extension Centers located in Parma and Aberdeen in 2005 and 2006 using Russet Burbank potatoes. A range of insecticides, fungicides and herbicides were evaluated from within the following chemical classes: organophosphates (Thimet®), carbamates (Temik®, Vydate®), neonicotinoids (Admire®, Platinum®), stobilurins (Amistar®) and triazolinones (Spartan®). These products were all used at the maximum labeled rate in order to create a "worst case" scenario that would allow identification of potential interactions or non-target impacts on plant growth, disease development, or herbicide injury. The good news is that there were very few interactions among the products tested. However, there were some significant non-target impacts from using these products in which growers should be aware.

Disease Response

One of the most surprising results of this research was the occasional increase in seed decay and Rhizoctonia incidence when organophosphate and carbamate insecticides were applied in-furrow at planting. For example, Temik® and Thimet® increased Rhizoctonia stem canker by 69 and 37% respectively, compared to the no insecticide control. Using Amistar® in-furrow at planting completely removed this effect and brought the Rhizoctonia levels down to low levels in all plots. These results emphasize the importance of using fungicides to control Rhizoctonia when organophosphate or carbamate insecticides are applied near the potato seed piece at planting. We have also shown in separate trials during 2007 that moving the insecticide placement slightly away from the seed piece is also effective in reducing the impact on disease development.

White mold was only present at significant levels in Parma, and none of the treatments significantly affected the incidence of white mold compared with the control. In contrast, early blight was more prominent at Aberdeen than Parma, and disease incidence was significantly reduced by the in-furrow Amistar® application. Although Amistar® is labeled to control early blight when applied to the foliage, it is unknown why in-furrow applications would lessen disease severity. One possible explanation is that Amistar®-treated plots had lower levels of stems infected with Verticillim wilt, resulting in less senescent plant tissue that was susceptible to infection by early-blight spores. Also unknown, is whether Amistar® may move upward in plants and may directly reduce early blight infection. Be cautioned, however, that what is reported here is for research purposes only. Do not apply Amistar® as an in-furrow treatment for control of early blight as this is not a labeled application.

Herbicide Injury

Pre-emergence application of Spartan® herbicide caused visual plant injury and stunting at both locations and during both years of these trials. Spartan®-treated plants exhibited 9 fold higher plant injury ratings than plants in the no Spartan® control plots. Plants treated with Vydate® and Thimet® along with Spartan® also tended to exhibit more plant injury than the non-insecticide control. The insecticide/herbicide interaction was significant in one of the four site-years, indicating that in-furrow application of Thimet® may cause plants to be more susceptible to Spartan® injury. These results emphasize the role that carbamate and orga-

Table 1. Influence of in-furrow insecticides, fungicides and pre-emergence herbicides on total and marketable potato yield at two locations in Idaho during 2005 and 2006.

Treatment	Total Yield (cwt/acre)	U.S. No. 1 (%)[w]
Insecticide means[x]		
Non-treated	530	73
Temik	532	68
Vydate	518	64
Admire	533	69
Platinum	538	70
Thimet	532	69
Fungicide means[y]		
Amistar	565	73
Non-treated	552	67
Herbicide means[z]		
Spartan	495	69
Non-Spartan control	514	68

[w] Percentage by weight of tubers over 4 oz that meet US #1 grade standard.

[x] Insecticide means are averages of two fungicide treatments or two herbicide treatments over 8 trials.

[y] Fungicide means are averages of 5 insecticide treatments over 4 trials.

[z] Herbicide means are averages of 5 insecticide treatments over 4 trials.

nophosphate insecticides can play in increasing plant susceptibility to herbicide injury.

Yield and Grade

Even though systemic pesticides significantly influenced disease development and crop injury, there were relatively few differences in total tuber yield or grade (Table 1). Apparently the insect and/or nematode control provided by these insecticides outweighs the non-target impacts on disease development. Amistar® significantly increased the percentage of U.S. No.1 potatoes compared to the no-fungicide control in two of the four site-years. Rhizoctonia is known to impact tuber shape more than total yield, and the measured response was probably due to the effectiveness of Amistar® in controlling this disease. Despite the fact that Spartan® significantly increased plant injury in all trials, it had only a slight impact on total yield (-4% compared to the non-treated control) and no impact on tuber grade. Potato plants appear to have the ability to tolerate injury due to herbicides, especially early in the season when plants are rapidly growing.

Conclusions

This study demonstrates the unique ability of some systemic pesticides to impact disease development, plant growth and herbicide injury. Although we did not test all possible tank mixes or combinations of products, it is reasonable to state that growers should be cautious when first evaluating new products and combinations of products to be applied in-furrow at planting.

This article discusses chemicals that are labeled for potatoes, but not for purposes discussed. These chemicals were used only for experimental purposes. A chemical can be used only as indicated on the label. The label is the law. Always read and follow all label directions. Where trade names are used, no discrimination and no endorsement by University of Idaho Extension are implied.

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Did You Know?

In the last 75 years, in Idaho the average yield per acre of potatoes has increased 221 percent from 120 to 386 cwt/acre.

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