Benefits of Pyrethroids to Potatoes

PYRETHROID WORKING GROUP

PYRETHROIDS BENEFITS PROJECT

The Pyrethroid Working Group contracted an extensive analysis of the benefits of pyrethroids to agriculture. A multitude of data was analyzed with different methodologies to determine the value of pyrethroids, and the costs to farmers if they were no longer available. These analyses determined: (1) costs to the farmer of key insect pest management practices with and without pyrethroids, (2) Yield benefits of pyrethroids, (3) monetary and non-monetary value of pyrethroids based on a farmer survey, and (4) a multi-market analysis to project the aggregate economic benefits of pyrethroids to the U.S. economy. Below are the primary benefits of pyrethroids from these analyses.

BENEFITS TO POTATOES

1. Costs with and without pyrethroids

- The total market value of potatoes in the U.S. for 2015 was $3.9 billion according to USDA-NASS.
- Pyrethroids make up 28% of the total number of insecticide applications to potato, indicating they are a preferred low-cost method for effective pest control and resistance management.
- There is a $13 per acre cost advantage for using foliar-applied pyrethroids in potato.
- Costs for soil-applied insecticides on potato increases by $9.1 million for the industry without pyrethroids.
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- Farmer costs for foliar and soil-applied insecticides increase more than $13 and $7 per treated acre, respectively, without pyrethroids.
- Based on 2012-2014 average expenditures per insecticide product acre, pyrethroids provide a cost advantage of 78% and 40% for foliar and soil-applied insecticides, respectively, when compared to non-pyrethroid alternatives.

2. Yield Benefits

- Pyrethroids have clear advantages for reducing pest abundance and crop damage relative to other insecticides. The pest abundance advantage of pyrethroids is 14.4% (280 observations), while the crop damage reduction advantage was 9.5% (116 observations).
- An estimated yield loss of 10% would occur if pyrethroids were not available for use on potato.
- Small plot data indicates pyrethroids provide an average yield increase of 80% for potato compared to an untreated control.
- Pyrethroids reduce aphid populations in potato by an average of 33.3%.
- Pyrethroids reduce crop damage by an average of 82% for potato.

3. Monetary and Non-Monetary Value to Farmers (Case Study)

Case studies were conducted to determine the value of pyrethroids in potato productions systems across the United States.

Washington State and the Pacific Northwest:

- Pyrethroids are essential for early-season management of beet leafhopper to prevent early establishment of BLTVA (beet leafhopper-transmitted virescence agent). There are no alternatives for early beet leafhopper control. Applications also control psyllids when systemic neonicotinoids are no longer effective and consequently, reduce zebra chip transmission.
- Due to their short PHIs and established MRLs to meet export requirements, pyrethroids are the only effective materials for late-season control of potato tuberworm.
- Pyrethroids are needed for use in rotation with active ingredients with different MoAs to manage resistance in multiple pests — including Colorado potato beetle, psyllids and thrips.
- Pyrethroids are an effective alternative to manage emerging pest threats, such as lygus bugs and the brown marmorated stink bug.

Wisconsin and the Midwest:

- Pyrethroids are the most cost effective options to manage potato leafhopper, which annually migrates into the Midwest and can build to damaging levels that require a rapid control response.
- Colorado potato beetle resistance to neonicotinoids is now widespread in the Midwest, and pyrethroids are needed as rotation active ingredients with other MoA groups to manage resistance in foliar spray programs.
- Pyrethroids are good pest management tools that control sporadic lepidopteran infestations and emerging hemipteran pests.

4. Direct and Indirect impacts

- Among specialty crops, the largest impacts of the loss of pyrethroids are for sweet corn, potato, tomato and citrus, which combined generate $703 million of benefits for the American farmer.
- On a per cropped acre basis, the value of pyrethroids to potato is almost $248/A.
- On a treated acre basis, the value of pyrethroids to potato is $377/A.
- Without pyrethroids, the costs per treated acre increase to $12.67 for potato.
- Potatoes constitute $271 million of the $784 million in overall economic benefit of pyrethroids to specialty crops; benefits generated on far fewer acres than commodity crops.
- Pyrethroids have a 28% share of all insecticide product acres, which is relatively large for a crop in which farmers use 11 insecticide classes. These values imply that though pyrethroids are popular among potato farmers, alternatives are available. However, pyrethroids serve as a relatively low cost, broad spectrum insecticide class that farmers use in rotation with more expensive and selective insecticide classes to manage insect resistance. The resistance management benefits of pyrethroids are emphasized by the potato case studies, as well as the need for pyrethroids to manage key insect pests at key times of the season.

Insect Pests of Washington Potatoes

Pests	When controls are applied	Importance of pyrethroids	Resistance concerns	Alternative management strategies	**Potential impacts of pyrethroid loss**
Key Pests					
Potato psyllid, vector of zebra chip	Season long with pyrethroids early (June) and late (August) to avoid disruption of mites	Essential early and late to manage psyllids	Multiple psyllid controls used with rotation of MoA, AIs to manage resistance to all classes	Systemic neonicotinoid at planting	Greater use of alternatives, faster resistance, more zebra chip
Beet leafhopper, vector of BLTVA	Early season (May-June)	Only effective option to control adult leafhopper immigration and establishment of BLTVA	None	None	Increase in virescence, yield and quality loss
Thrips	Mid season (July-August)	Essential in thrip control	Resistance common and rotation of AIs with different MoAs essential to management	None	Faster resistance in alternative MoAs, reduced efficacy and yield
Potato tuberworm	Late season, close to harvest (September-October)	Only option to provide control with short PHIs and established MRLs for export	None if limited to late season	Cultural (partial)	Increased tuber damage, processing plant rejection, failure to meet MRLs for export
Colorado potato beetle	Early season (May-June)	Used in conjunction with neonicotinoids or where no systemic used	Resistance widespread in U.S. to all MoAs but not in WA,pyrethroids used in rotation with other MoAs	None	Increased resistance, more sprays, increased costs, declining efficacy
Sporadic Pests					
Foliage feeding lepidoptera	Mid-season (July-August)	Used for fast response to damage when over threshold	Resistance not an issue, alternative MoAs available	None	Slower response, increased damage, reduced yields
Hemipteran complex	Mid-season (June- August)	Only effective option to reduce damage	None	None	Reduced yields

Insect Pests of Wisconsin Potatoes

Pests	When controls are applied	Importance of pyrethroids	Resistance concerns	Alternative management strategies	**Potential impacts of pyrethroid loss**
Key Pests					
Colorado potato beetle	Early season where no neonicotinoid was used (May-June)	No longer critical	Resistance common to all MoAs, pyrethroids needed in resistance management programs	Cultural (partial), other AIs with various MoAs	Increased resistance to alternatives
Potato leafhopper	Mid-season (June- August)	Most effective and economical for rapid response to influxes that exceed thresholds	None	None	Increased use of alternatives, reduced worker safety
Sporadic Pests					
Foliage feeding lepidoptera	Mid-season (July-August)	Rapid response to damage over threshold	None and alternative MoAs available	None	Increased use of alternatives, reduced worker safety
Fleabeetles	Early season (June-July) where no systemic neonicotinoid used	No longer critical	None	Systemic neonicotinoids, other AIs (organophosphates)	Minor
Hemipteran complex	Early season-mid season (June-July)	Only effective option available	None	None	Reduced yield