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No Effects of an Autumn Mustard Crop on Wireworm Densities or Damage to Potatoes in the Following Growing Season

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Potato growers in the Pacific Northwest have few options for chemical control of wireworms. Soil fumigants are used by potato growers to control soil-dwelling fungal pathogens and nematode pests of potatoes, and these products may also be effective against wireworms if applied in late summer or early autumn. There has been interest in using plant-generated fumigants to control soil-dwelling pests, by incorporating mustard crops (Brassica and related genera) into the soil. Macerated tissues of mustards release chemicals that are known to have pesticidal effects, and these products have been shown to negatively affect soil-dwelling nematodes, insects, fungal pathogens, and germinating weed seed. The effects of mustard biofumigants on field populations of wireworms are unknown. Objectives of this study were to assess whether a late-season cover crop of mustard, tilled into the soil, led to increased protection of a potato crop in the season following the mustard crop.

Methods

The study was done at the USDA-ARS experimental farm located east of Yakima, Washington. Eighteen plots (each 75 x 75 ft, with 25 ft buffers between plots) were set out in spring 2006 within an irrigated field known to be infested with wireworms. Soil type is a sandy loam. After plots had been established in spring 2006, each was baited using moistened rolled oats to determine pre-treatment densities of wireworms (see timeline of research in Table 1). Soft spring wheat was then sown in a solid planting to include all 18 plots as well as the interplot buffer zones. In early August, the wheat was mowed and then disked into the soil (Table 1). Mustard ('Caliente 199') was planted 17 August 2006 in 9 of the 18 plots at 20 lbs of seed per acre. "Arrow" herbicide was applied to the entire field on 26 August and 9 September to kill recovering wheat. The mustard was flail-mowed 24 October and immediately tilled into the soil to 6 inches deep. Control plots and interplot areas were also tilled at that time.

The 18 plots were then re-baited in April of 2007, to determine post-treatment counts of wireworms (Table 1). Potatoes ('Russet Burbank') were planted 15 May 2007 in all plots and interplot areas at 34 inch row spacing and with 1 foot between adjacent seed pieces. Potato vines were killed with "Reglone" in September (Table 1). Tubers were harvested on 25 September, sorted to size, and weighed for yield. A random subsample of 200 tubers for each size class in each plot was then examined for wireworm feeding.

Results

Wireworm counts. Wireworm numbers in baits declined between years (Figure 1). The magnitude of the decline was the same in mustard and control plots, indicating that the mustard had no effect on wireworm numbers.

Tuber damage. Over 12,000 tubers were examined for wireworm damage. Approximately 25% of tubers had at least one entry hole, if data are averaged over tuber size class (Figure 2A: pooled). Percent damage was statistically the same in mustard and control plots. Damage increased with increasing tuber size (Figure 2A). The feeding damage averaged about 0.7 entry holes per tuber across all tuber size classes (Figure 2B: pooled), with no differences between control and mustard plots. Damage increased from 0.3-0.4 holes per tuber in the smallest tubers to 1.0-1.2 holes per tuber in the largest tubers (Figure 2B).

Tuber yield. Yields were slightly but significantly lower in the mustard plots than the control plots (Figure 3). With the row spacing used in this study, the pooled yields shown in Figure 3 translate into approximately 400 cwt of tubers per acre.

Conclusions

- ➢ A mustard green manure tilled into the soil in autumn preceding a potato crop had no effect on wireworm counts in baits.
- ➢ Wireworm damage to tubers was of similar magnitude in mustard and control plots.
- ➢ Wireworm damage increased in severity as tuber size increased.
- ➢ There was a slight but statistically significant drop in tuber yield in the mustard plots.

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Table 1. Timeline of study.

April 10 2006	Eighteen plots measured out and flagged
April-May	Wireworms baited
April 30	Wheat planted
August 4	Wheat mowed, disked
August 17	Mustard planted in 9 of the 18 plots
August 25	All plots treated with "Arrow" herbicide to kill wheat regrowth
September 7	Re-treatment with "Arrow"
October 24	Mustard flail mowed, entire field tilled
April-May 2007	Plots re-baited
May 10	Potatoes planted
September 8	Vine kill
September 25	Tubers harvested
September 25-October 5	Tubers sorted, weighed, and examined for damage

Figure 1. Number of wireworms per 15 baits in control plots and plots that were to receive (pre-treatment) or had received (post-treatment) a mustard green manure.

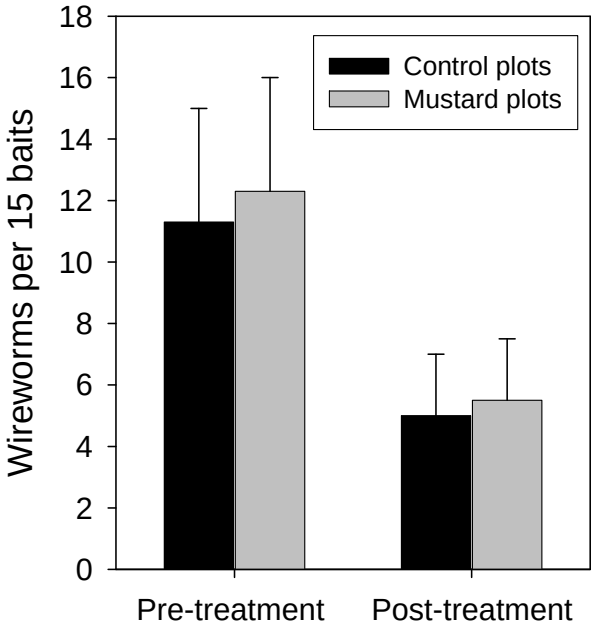


Figure 2. Tuber damage caused by wireworm feeding expressed as percentage of tubers having at least one entry hole (panel A) or number of holes per tuber (panel B).

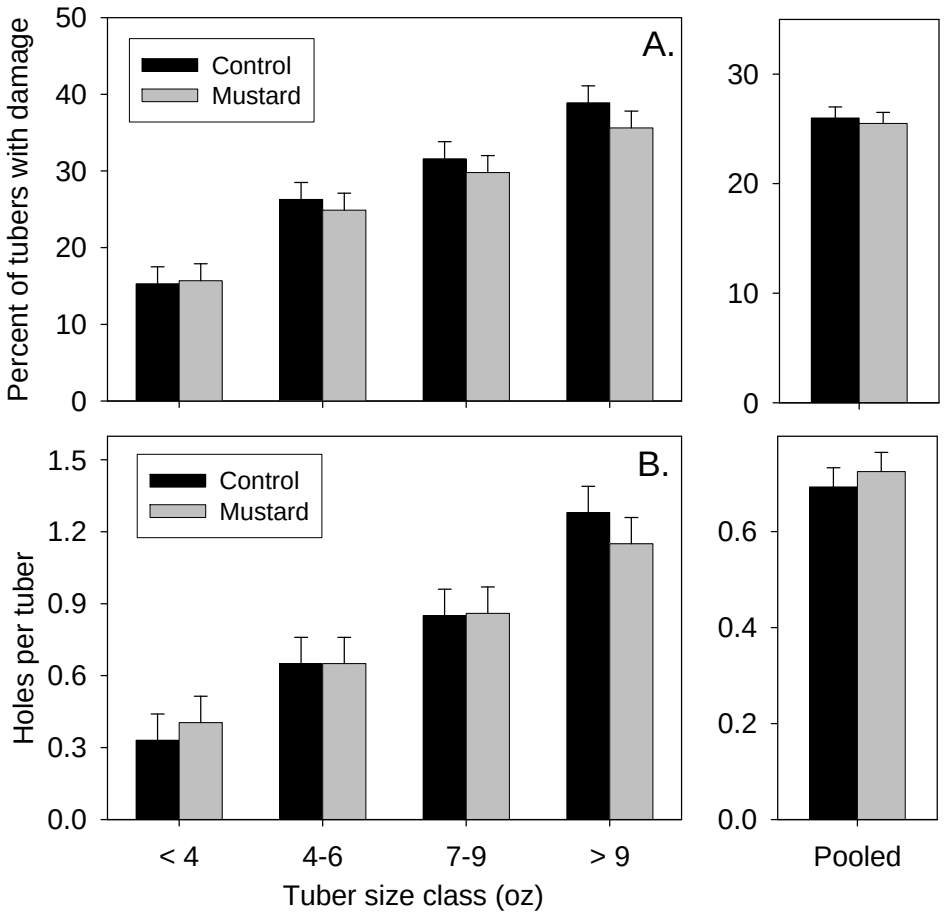
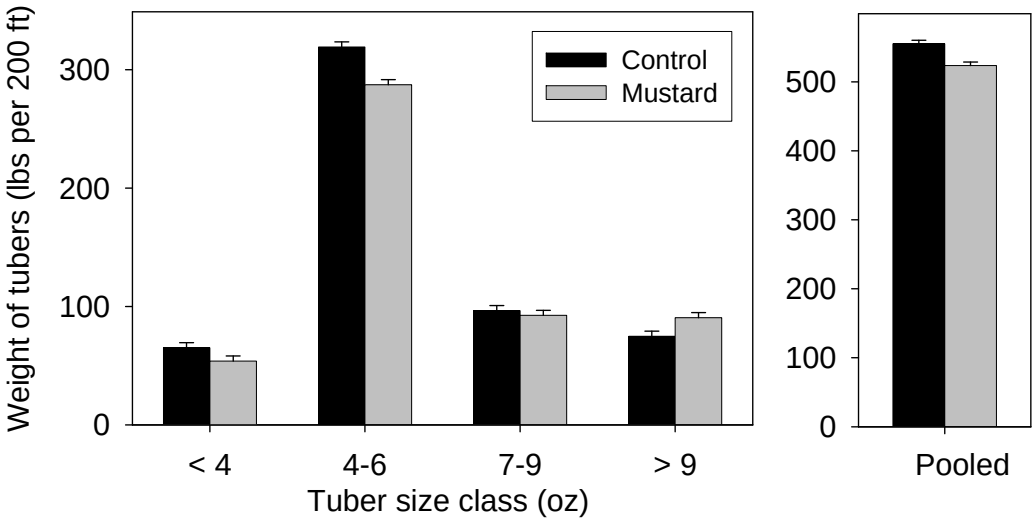


Figure 3. Tuber yields in mustard and control plots, expressed as pounds of tubers per 200 row feet harvested per plot.



Caterpillars (a.k.a. 'worms') on Potatoes

This year the potato commission is funding a new research project on the identification, biology, and pest status of the suite of caterpillars that feed on potato foliage (excluding tuberworm). Some background information follows:

1. Potential caterpillar pests in potato fields include the bertha armyworm, western yellowstriped armyworm, spotted cutworm, variegated cutworm, red backed cutworm, Lacanobia subjuncta, alfalfa looper, and cabbage looper.
2. These moths all are highly mobile, and can arrive in potato fields following flights of miles to hundreds of miles.
3. Regional populations vary significantly from year to year. Also, species have varied phenologies, with adult flight, egg laying, and feeding by larvae occurring at different times of the potato-growing season.
4. Larvae of these species vary in their ability to develop on potato. Some do extremely well on potato, while others fare poorly.
5. Most people, including most entomologists, have difficulty separating the different species, whether worms or adult moths. This is further confounded by the fact that over 850 species of moths in this group occur in the state, and about 250 are present in the irrigated areas of central Washington.

We are asking for your help!

As a part of this project, we want to find many infestations of foliage-feeding caterpillars in potatoes. Each outbreak will be studied in the field, and samples will be collected and studied in the laboratory. If you detect a caterpillar outbreak, please contact Andy Jensen at 509-760-4859 or Alan Schreiber at 509-266-4348.