PROJECT REPORT

This is a final project report submitted
to the Organic Farming Research Foundation.

Project Title:

Organic certified seed potato production in the Midwest

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Organic Certified Seed Potato Production in the Midwest

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1. Project Summary

Certified seed potatoes are tested to ensure that they meet low tolerances for disease. Use of certified seed potatoes by organic growers is likely to increase the yield, quality and profitability of their potato crops. However, organic potato growers in the United States face a shortage of organically produced certified seed potatoes. Our project aimed to assess the feasibility of certified seed potato production on organic farms in Wisconsin and to assess strategies to limit the spread of Potato Virus Y (PVY), which causes the majority of seedlot rejections from certification in Wisconsin. In 2007 and 2008 field trials at organic sites, we saw that the majority of potato lots met certification standards for PVY: 121 of 135 lots in 2007 and 100 of 118 lots in 2008. Two strategies for limiting the spread of PVY - use of border crops and intercrops - did not affect PVY incidence in our 2008 trials. We conclude that organic production of seed potatoes is feasible in the Midwest but further research is needed both into PVY control strategies useful for organic farmers and to understand the landing behavior of the aphid vector of PVY.

2. Introduction

Unlike many crops, potatoes are propagated vegetatively from seed potatoes rather than from true seed. Most pathogens are excluded from true seed but infected potato plants transmit many pathogens to progeny plants through seed tubers, posing a significant disease management problem. Use of certified seed potatoes, which meet low tolerances for disease, significantly reduces tuber-borne diseases in potato and has measurable economic benefits for growers. For example, in 1981, Maine implemented a law requiring commercial potato growers to plant certified seed. Economic analysis of this law a decade later demonstrated that potato grower profit increased by $14,700 per year due to the requirement to use certified seed potatoes (7). Seed potato certification programs and production of early generation potato plantlets in tissue culture have significantly reduced tuber-borne diseases in potato (1, 3, 6, 13). Up until the mid-1970s, on average 10% or more of seed potato lots were infected with bacterial ring rot each year. After changes in seed potato certification and the introduction of tissue culture and pathogen testing methods, bacterial ring rot, which can cause devastating losses, has fallen to nearly zero in seed potato lots in the United States. Other important diseases, such as mosaic and leafroll diseases, are kept at very low levels through seed potato certification.

Use of certified seed potatoes by organic growers is likely to increase the yield, quality and profitability of their potato crops. However, access to certified seed potatoes can be problematic for organic farmers. National Organic Program (NOP) rules require organic growers to attempt to source organically-produced seed, but there are few organic producers of certified seed potatoes. Only one organic farm in the Midwest produces certified seed potatoes and demand far exceeds supply, such that Midwest organic potato growers consistently face a local shortage of organic certified seed potatoes. Many organic farmers grow specialty potato varieties due to market demands and, for many of these varieties, seed potatoes (organic or conventional) are locally unavailable. Consequently, many Wisconsin organic growers import organic seed potatoes (certified or non-certified) from regions of North America. The high cost of shipping potatoes reduces profits, and growers also risk importing plant pathogens not currently present in their region. Importantly, the lack of disease-free planting material places all growers in a region at risk since if one grower plants non-certified seed, they may bring high levels of unusual or quarantine pathogens into a growing region and these pathogens may spread to other farms and remain in the soil for years. Additionally, part of the philosophy of organic production includes local production. Bringing in seed from hundreds or thousands of miles away is counter to this value.

At present, there is a lack of effective strategies to reduce the incidence of problematic pathogens in organically-certified seed, and there is a need to improve methods of generating disease-free, organically produced potato seed for this developing industry. We propose to research organic production of certified seed potatoes in Wisconsin through on-farm trials. In Wisconsin, most rejections of conventionally-grown seed potatoes are due to late-season infections with the aphid-borne Potato virus Y (PVY). We will monitor this and other diseases in our field trials. Additionally, we will develop literature for organic potato growers on how to become certified seed potato growers and on how to use disease testing to monitor seed potato quality and potato health throughout the growing season.

The overall goal of our research is to support the growth of the organic certified seed potato industry in Wisconsin and the Midwest through on-farm collaborative research and extension. Increased local production of organic certified seed potatoes will benefit all Midwest potato growers by reducing the risk of pest and pathogen invasion and will specifically benefit organic farmers by reducing seed shipping costs and losses caused by disease. In addition, production of organic certified seed potatoes is a new niche industry for organic potato growers.

3. Objectives Statement

Our overall goal is to support the growth of an organic certified seed potato industry in Wisconsin. We have addressed this goal by conducting field trials on participating Wisconsin organic farms in order to test organic production methods for seed potatoes that meet certification standards. We used information from our field trials and from published literature to develop educational resources for organic growers on becoming certified seed potato growers using disease testing to monitor potato health and organic management strategies to control common potato diseases. We also hope to encourage development of an organic potato growers association that will sustain these goals after the funding for this project has ended.

The objectives of this project were to:

1. Conduct on-farm trials of organic seed potato production testing strategies to control aphid-borne viral diseases and other limiting potato diseases and determine the feasibility and best methods of organic certified seed potato production in the Midwest.

2. Develop educational materials for organic growers on how to become certified seed potato growers, on organic methods for potato disease control, and on the uses of pathogen indexing in seed potato production.

One change in our field trial approach was made to overcome a lack of disease. In our first field year (2007) we supplied participating organic farmers with foundation-class seed potatoes (early generation seed potatoes that must meet more stringent disease thresholds than certified seed potatoes and that must be planted by certified seed potato producers). Farmers tested strategies predicted to limit spread of PVY by aphid vectors including establishing borders around test plots and spraying with mineral oil. We sampled the harvested potatoes and tested them for PVY. Samples from most farms showed an extremely low level of PVY, such that the effectiveness of PVY-limiting strategies could not be assessed. To overcome this issue, in our second field year we conducted field trials at the Hancock Agricultural Research Station instead of at the Malek farm which is in the same geographic region. At the research station, we inoculated “spreader rows” - rows of potatoes flanking our test plots - with PVY to provide a source of inoculum. Spreader rows were not used on the two organic farms which hosted field trials in 2008 as, naturally, we did not wish to introduce pathogens onto working farms.

4. Materials and Methods

2007 field trials. We conducted field trials on six Wisconsin organic farms located in several geographic regions of Wisconsin. Farmers were provided with foundation class seed which has extremely low disease incidence (see Table 1 for varieties grown and planting dates). Since the major cause for rejection of certified seed lots is infection with Potato Virus Y (PVY), an aphid-transmitted virus that is also carried in seed potatoes, we trialed two strategies aimed at reducing aphid landing and transmission of virus.

(1) Surround seed potato plots with a border of winter wheat. Aphids preferentially alight at the edges of fields using the contrast between soil and plant foliage as a target (4, 8, 10). PVY is carried on the aphid's mouthparts and is lost when the aphid probes an uninfected plant. Use of a border crop around potato plots has previously been shown to reduce PVY incidence in conventional production, presumably due to discharge of PVY from the aphid's stylet as it probes for feeding sites in the border plants. This strategy was trialed at all sites.

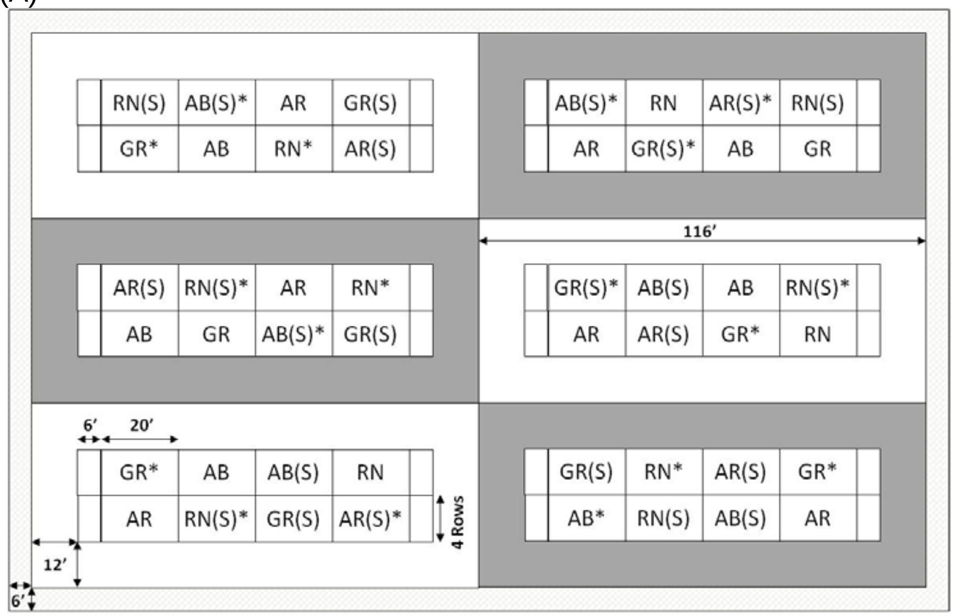
(2) Spray potato plots with mineral oil. Mineral oil on leaf surfaces has been previously shown to interfere with transmission of PVY by green peach aphid (12). This treatment was trialed at one site (Igl farm). An OMRI-approved mineral oil was used (Organic Stylet-Oil, donated by JMS Flower Farms).

<u>Table 1</u>: Varieties, planting date and treatments for field trials of certified seed potato production on six Wisconsin organic farms

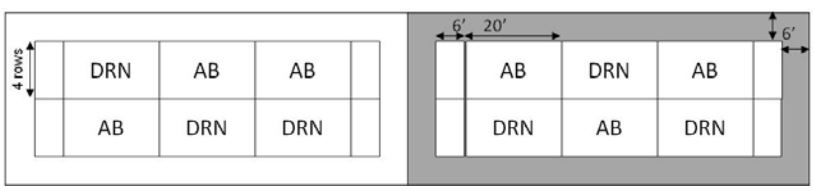
Farm	Aue	Engel	Igl	Kincaid	Malek	Rouse
Planting date	07.11.07†	6.01.07	05.21.07	07.05.07†	05.11.07	05.31.07
Varieties*	AB MM YG DRN	AB MM RN DRN	AB AR GR RN	AB DRN	AB DRN	AB AR YG DRN
Harvest date	11.23.07	9.24.07	9.27.07	10.10.07	9.22.07 10.13.07	10.11.07

*AB: Adirondack Blue; AR: Adirondack Red; MM: Magic Molly; YG: Yukon Gold; DRN: Dark Red Norland; RN: Red Norland; GR: Goldrush
†Late planting is farmer's preferred strategy to avoid potato leafhopper

(A)



(B)



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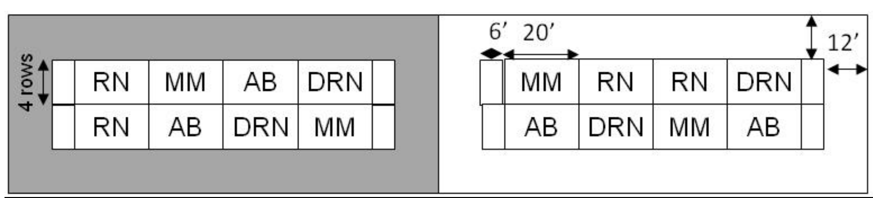


Figure 1: Layout of seed potato production trials on six organic Wisconsin farms. Six foot potato buffers were planted at the ends of plot areas. (A) Plot layout at Igl farm. Shaded areas represent spring-planted winter wheat borders. Varieties are Adirondack Blue (AB), Adirondack Red (AR), Red Norland (RN) and Goldrush (GR). Subplots marked with an asterisk (*) contained an aphid trap in the center of the subplot. (S) indicates plots sprayed with mineral oil. A similar layout was used at the Aue and Rouse farms; however, aphid data were not collected and no spray treatments were applied. (B) Plot layout at Kincaid farm. Shaded areas represent spring-planted winter wheat borders. Varieties are Adirondack Blue (AB), and Dark Red Norland (DRN). A similar layout was used at the Malek farm. (C) Plot layout at Engel farm. Varieties are Adirondack Blue (AB), Red Norland (RN), Dark Red Norland (DRN) and Magic Molly (MM).

Treatments were applied in a split-plot randomized block design (Figure 1). Border treatments (winter wheat or bare earth) were applied at the whole plot level, while varieties and mineral oil treatments were tested at the sub-plot level. At the Aue, Rouse and Igl farms, three replicates of the border treatment were planted. Within each replicated plot, four replicate subplots were planted for each variety. At the Igl farm, two of these subplots for each variety were sprayed with mineral oil on a weekly basis from late June to early August. Due to space constraints, only one replicate was planted at each of the Engel, Kincaid and Malek farms. Although this did not enable statistical analysis of the effect of the border treatment at these farms, variety comparisons were possible: four replicate subplots were planted for each variety at the Engel farm, and six replicate subplots for each variety at the Kincaid and Malek farms. Subplots were 20 feet by 4 rows.

Two to three weeks after emergence, leaves were collected from 200 plants from each seedlot. These leaves were tested for PVY infection by ELISA. No evidence of PVY infection was found, confirming the disease-free status of the seed tubers planted. Plots at all sites were inspected for viral disease symptoms approximately two months after planting and no symptoms were seen.

Since PVY is vectored by aphid hosts, aphid populations in seed potato plots were monitored. The number of alate (winged) aphids landing in seed potato plots was monitored at the Igl farm. Green tile traps painted with Tanglefoot™ (Figure 2) were placed within potato plots at canopy height and collected weekly. At all sites, populations of colonizing aphids within potato plots were monitored by scouting during the growing season. Aphids were counted on five leaves at six locations within each replicated whole plot: three locations each in wheat- and bare earth-bordered split-plots.

Figure 2: Green tile traps painted with Tanglefoot™ were placed within potato rows at canopy height.

Harvest dates are shown in Table 1. For each subplot, 100 tubers were sampled. Ten tubers from each sample were assessed for surface defects including scab lesions, silver scurf, black scurf, and growth cracks. Tubers were then treated to break dormancy and planted in Florida test site (Igl farm samples) or in the greenhouse (all other sites). None of the grow-out sites are certified organic. One leaf from each plant was tested for PVY by ELISA (Agdia) assay. The PVY incidence (percentage of plants positive for PVY) was calculated from the number of plants positive for PVY divided by the number of plants tested. As not all plants emerged, in some cases the number of plants tested is less than 100.

2008 field trials. Field trials were established at three sites in Wisconsin, including one research station and two organic farms. At each site, foundation class seed potatoes were planted for two varieties, Red Norland (resistant to PVY) and Yukon Gold (susceptible to PVY). Planned trials at a fourth site, the Kincaid organic farm, could not go ahead due to the extreme floods in June 2008.

At the two organic farms (Rouse and Igl) and the Hancock Agricultural Research Station (HARS), we trialed two strategies for control of PVY spread by aphids: winter wheat borders (as described above) and interplanting red clover or winter wheat between potato rows. Intercrops have been shown to reduce spread of stylet-borne viruses (2, 5, 9, 11), a group that includes PVY. Trial layout is shown in Figure 3. Treatments were applied in a split-plot randomized block design. Border treatments (winter wheat or bare earth) were applied at the whole plot level. Borders were six feet wide at the two farms (Figure 3A), and twelve feet wide at HARS (Figure 3B); plots were surrounded by a further six-foot bare earth border. Three replicates of each whole plot were planted at each site. Intercrop treatments were tested at the sub-plot level. Within each replicated plot, three replicate subplots were planted for each intercrop treatment: no intercrop, red clover intercrop, and winter wheat intercrop. Subplots were 40 feet by 4 rows. In order to simplify planting, and because we did not anticipate differences between Yukon Gold and Red Norland beyond the known differences in susceptibility to PVY, we did not allocate varieties randomly to subplots. The Hancock site was in transition to organic in 2008.

Single rows of Silverton, a highly susceptible potato variety, were planted to flank the plots at HARS (Figure 3B). Four weeks after emergence, these potatoes were inoculated with filtered suspensions of macerated PVY-infected tobacco leaves using an airbrush (Paasche).

Aphid populations in potato plots were monitored using methods similar to those used in 2007. The number of alate (winged) aphids landing in seed potato plots was monitored at the Igl farm and at the HARS location. Green sticky tile traps were placed within potato plots at canopy height and collected weekly. Different trapping strategies were used at each location to answer particular questions. It was not possible to use all strategies at all locations due to the number of traps that would have been required. At the Igl farm, traps were placed in each Yukon Gold plot in order to compare the effect of inter-row planting on aphid alightment. Additional traps were placed at the edge of each Yukon Gold plot that did not have inter-row planting to compare the aphid alightment in plots that did or did not have a winter wheat border. At the HARS location, traps were placed at the edge of each Yukon Gold plot that did not have inter-row planting and at the edge of the adjacent border region to determine aphid alightment at the field edge, comparing a potato edge to a wheat edge. In the final week of aphid trapping at HARS, during a peak aphid flight, three traps were placed at the edge of each of the Yukon Gold plots that did not have inter-row planting to compare aphid alightment in plots that did or did not have a winter wheat border.

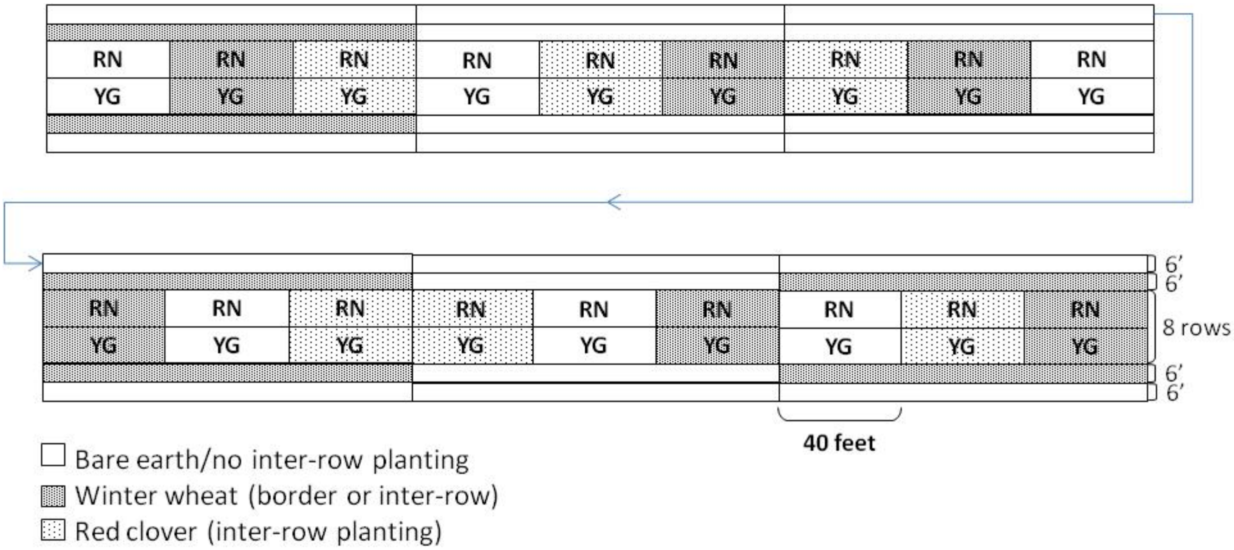
At the HARS location, populations of colonizing aphids within potato plots were monitored by scouting during the growing season. Aphids were counted on five leaves at six locations within each replicated whole plot: three locations each in wheat- and bare earth-bordered split-plots.

Harvest dates are shown in Table 2. For all subplots, 100 tubers were sampled. Also, 100 tubers were sampled from the six areas of the spreader rows adjacent to plots. Tubers were allowed to sprout naturally and sprouts were tested for PVY by ELISA (Agdia). A subset of tubers were tested for PVY using tissue from the stem end of the tuber.

5. Project Results

2007 field trials. Extreme weather conditions impacted trials at three locations. Southern Wisconsin experienced severe drought conditions in early summer. Due to extremely low soil moisture at planting at the Aue farm, which does not have access to irrigation, emergence was poor. It was only possible to harvest from Dark Red Norland subplots, and no yield data was recorded. Very low yields were seen at the Rouse farm due to drought conditions, and no yield data was recorded, although sufficient tubers were harvested from all plots to allow virus testing. In August, severe storms led to flooding throughout southern Wisconsin. At the Kincaid farm, waterlogging of the muck soils resulted in complete loss of tubers in the winter wheat-bordered plot due to rot. Limited numbers of tubers were harvested from the bare-earth bordered plot, and no yield data was recorded.

(A)



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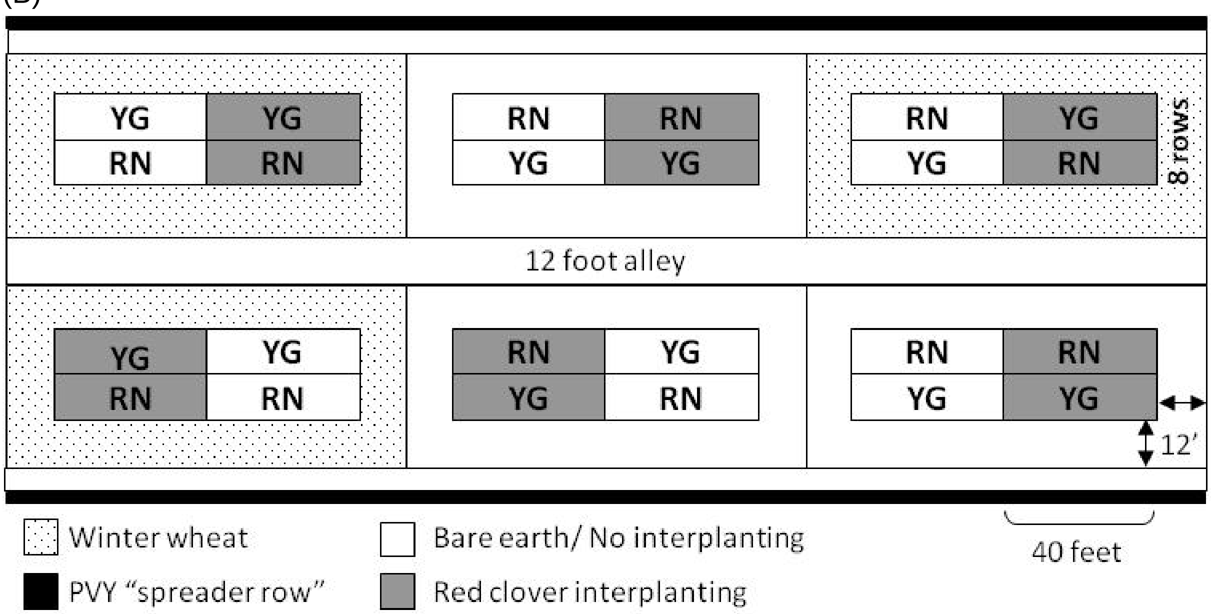


Figure 3: (A) Plot layout at Igl farm. Plots were laid out in a long strip - the two strips shown represent a continuous area as indicated by the arrows. A similar layout was used at the Rouse farm. (B) Plot layout at Hancock Agricultural Research Station. Varieties are Red Norland (RN) and Yukon Gold (YG).

Table 2: Planting and harvest dates for organic field trials of certified seed potato production at three Wisconsin locations.

Location	Igl	HARS	Rouse
Planting date (potatoes)	5.30.08	5.16.08	early June
Planting date (border)	5.30.08	5.16.08	7.10.08
Planting date (intercrop)	7.8.08	6.19.08	mid July
Harvest date	10.2.08	8.29.08	10.14.08

Aphid incidence in potato plots. Alightment of aphids in potato plots was monitored using green sticky tile traps within potato plots at the Igl farm (Figures 1A, 2). Numbers of aphids seen on traps within potato plots with bare earth borders or winter wheat borders is shown in Figure 4. No significant differences were seen, but a trend towards higher numbers of aphids landing in bare earth bordered plots was noted.

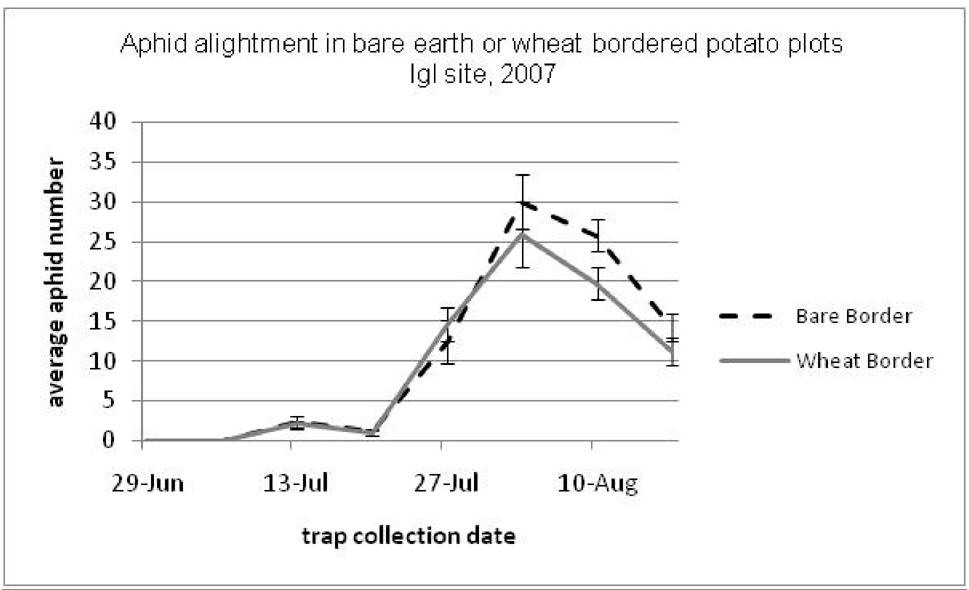


Figure 4: Average number of aphids trapped in potato plots bordered by bare earth or winter wheat in 2007 season at Igl site. Each data point is the average aphid number from nine traps.

Scouting for colonizing aphids was performed at all sites. At the northernmost site (Igl farm) colonizing aphids were not seen until July 27 and numbers remained low (5 on July 27, 3 on August 10). In the central sands site (Malek farm), colonizing aphids were seen sooner, on July 12 (1 aphid), and numbers expanded rapidly (32 aphids on July 27). Scouting on single dates in early July at the Aue and Engel sites found no aphids, while 3 aphids were seen in potato plots at the Rouse farm. At the Kincaid farm, 32 aphids were found on August 1 (note that planting occurred on July 5). No differences were seen between bare-bordered and winter wheat-bordered plots for numbers of colonizing aphids.

Yields. For the three sites for which yield data was recorded, differences were seen between varieties and locations (Figure 5). Assessment of the impact of mineral oil sprays and borders on yields was only possible at the Igl farm where border treatments were replicated. No effect on yield was seen for either treatment. Adirondack Red performed poorly in comparison to other varieties at the Igl farm; while no yield data is available from the Rouse farm, Adirondack Red plots showed very poor emergence and low yields at this location. Adirondack Blue and Magic Molly performed poorly at the Engel farm. As Magic Molly is a fingerling variety, however, low yields are to be expected.

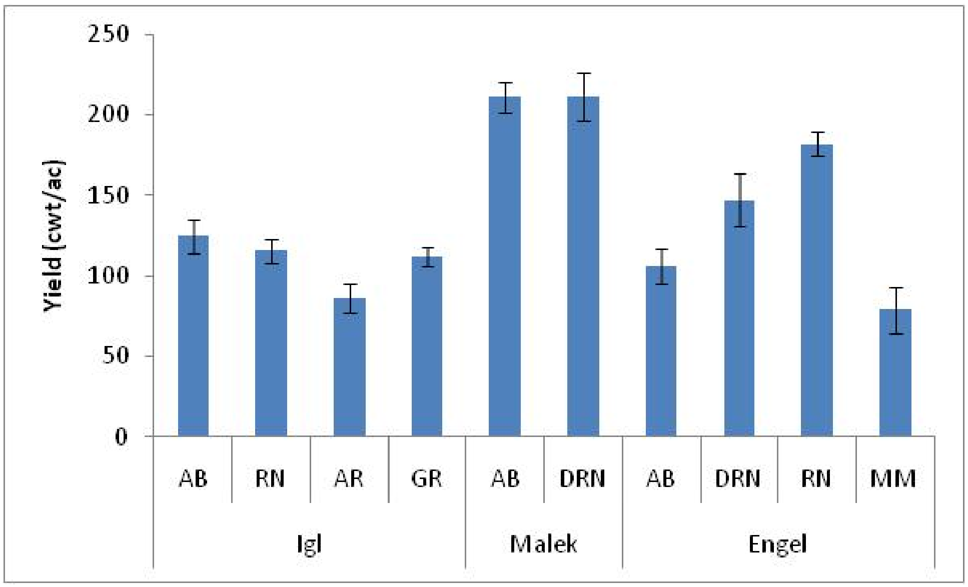


Figure 5: Yields (in hundred-weight per acre) of potatoes at the Igl, Malek and Engel farms from 2007 trials. Varieties are Adirondack Blue (AB), Red Norland (RN), Adirondack Red (AR), Goldrush (GR), Dark Red Norland (DRN) and Magic Molly (MM).

Surface defects. At all sites we observed common scab and silver scurf on harvested tubers (although ratings were not done for tubers harvested from the Aue farm due to the poor season described above). For some sites and varieties, common scab levels were high enough (<5% surface area) to affect the certification grade. At the Rouse and Igl farms, Adirondack Red had the highest levels of common scab lesion coverage (Figure 6), and showed particularly bad pitting due to common scab at the Igl farm. At the Engel farm, Adirondack Blue had high levels of scab damage not seen at other farms. At Kincaid and Malek farms, average coverage of common scab on harvested tubers ranged between 2 and 4 percent for varieties Dark Red Norland and Adirondack Blue.

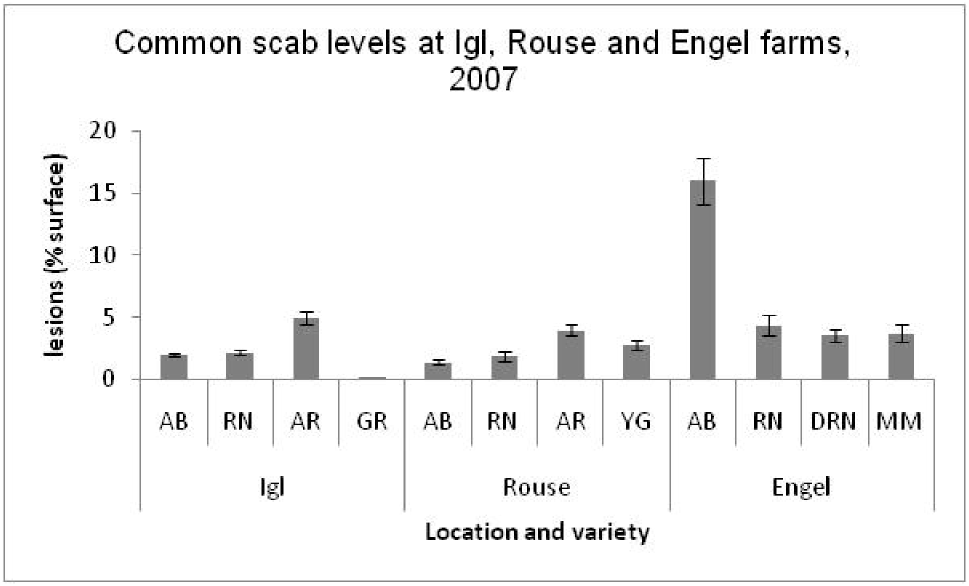


Figure 6: Common scab on harvested tubers from 2007 Igl, Rouse and Engel field trials. Varieties are Adirondack Blue (AB), Red Norland (RN), Adirondack Red (AR), Goldrush (GR), Yukon Gold (YG), Dark Red Norland (DRN) and Magic Molly (MM).

PVY incidence. Incidence of Potato Virus Y (PVY) was very low at most locations with most lots having no detectable PVY (Figure 7). At two southern Wisconsin farms (Kincaid and Engel) no PVY was detected. At the Aue and Rouse farms, also in southern Wisconsin, PVY was detected but the majority of potato lots met certification standards for virus incidence (5%). By contrast, at the Malek farm, which is in the Wisconsin central sands surrounded by conventional tablestock potato production, the majority of potato lots exceeded 5% PVY. At the Igl farm, in northern Wisconsin surrounded by conventional seed potato production, PVY was detected in a minority of lots, with 44 of 48 lots showing no PVY and none exceeding certification standards for PVY.

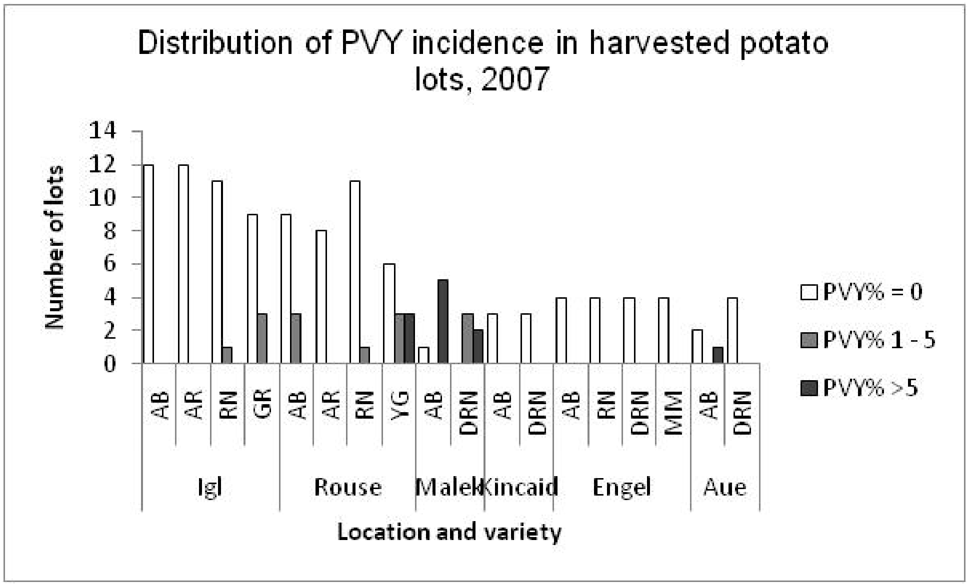


Figure 7: Incidence of *Potato Virus Y* (PVY) in lots of potatoes harvested from six Wisconsin organic farms in 2007. Varieties are Adirondack Blue (AB), Red Norland (RN), Adirondack Red (AR), Goldrush (GR), Yukon Gold (YG), Dark Red Norland (DRN) and Magic Molly (MM).

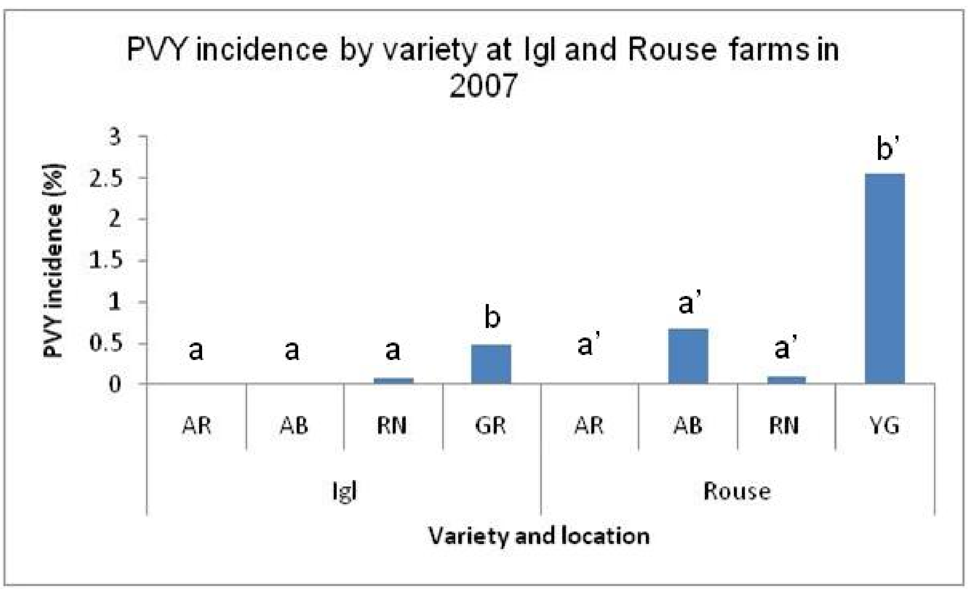


Figure 8: Incidence of PVY in varieties grown at Igl and Rouse farms in 2007. Varieties are Adirondack Red (AR), Adirondack Blue (AB), Red Norland (RN), Goldrush (Igl only, GR) and Yukon Gold (Rouse only, YG). Significant differences between varieties are shown by different letters (note that Igl and Rouse data sets were analyzed separately).

At the Rouse and Igl farms, treatments (mineral oil sprays and/or borders) had no impact on PVY incidence; the very low incidence of PVY made it impossible to assess these treatments. However, the low incidence was encouraging in terms of the feasibility of seed potato production on organic farms. The only significant effect on PVY incidence was due to variety (Figure 8). Yukon Gold had significantly higher PVY incidence than other varieties grown at the Rouse farm ($p=0.056$), and at the Igl farm, variety Goldrush had significantly higher PVY incidence than other varieties ($p = 0.001$).

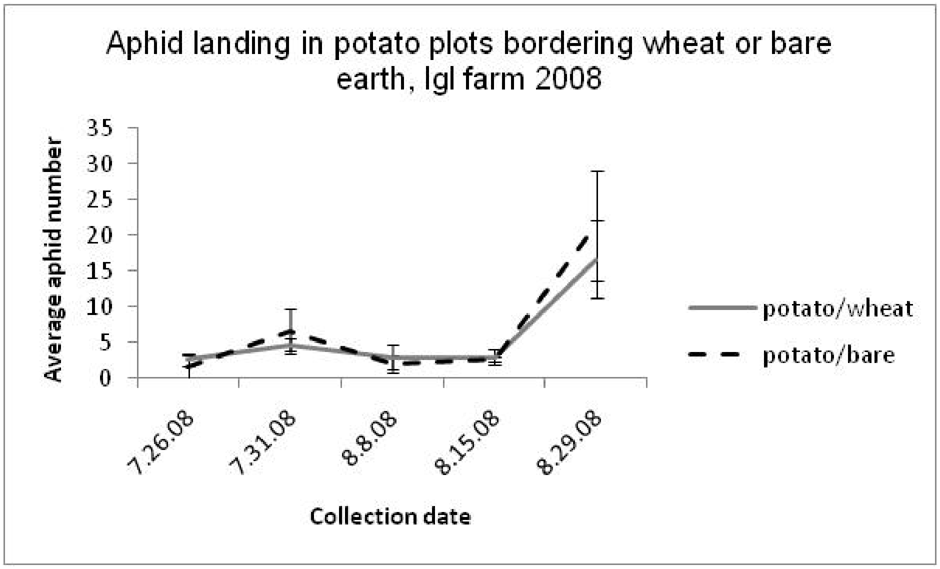
2008 field trials.

Aphid incidence in potato plots. Counts of aphids from traps at the Igl farm were analyzed by ANOVA; no effect of border or intercrop was seen on aphid landing patterns (Figure 9A). However, at HARS, significantly more aphids landed in plots bordered by bare earth compared to plots bordered by winter wheat ($p=0.008$, Figure 9B). The border treatment had no significant impact on numbers of colonizing aphids in plots at HARS, suggesting that the landing difference may have been due to aphid species that do not colonize potato.

Yield. At the Igl farm, decreased yields were seen when potato plots were bordered by winter wheat compared to bare earth ($P=0.019$, Figure 10A); this effect was not seen at HARS (Figure 10B). Intercrops did not significantly affect yield at either location, although a trend for higher yields in plots with red clover intercropping was seen at the Igl farm. Yield was not recorded for plots from the Rouse farm because rodent damage in storage led to loss of some harvested tubers.

PVY incidence. PVY incidence was not affected by the presence of a winter wheat border or an intercrop at any site - Igl, Rouse or HARS (Figure 11 A, B, C). As anticipated due to differences in susceptibility, Red Norland showed lower PVY incidence than Yukon Gold at all sites. PVY incidence was higher in 2008 than 2007 (Figure 12; compare Figure 7), with a much higher frequency of lots that did not meet certification standards for PVY, especially for the susceptible variety Yukon Gold.

(A)



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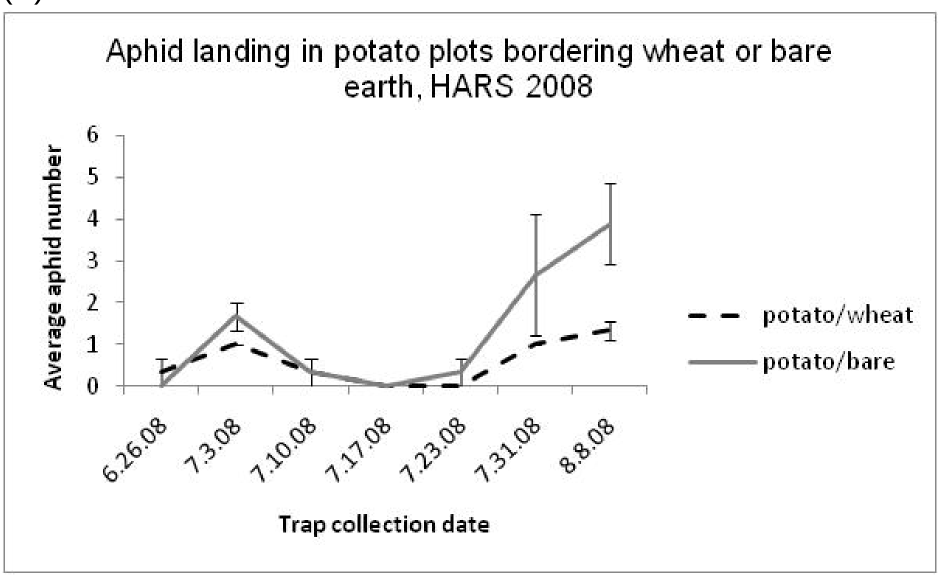
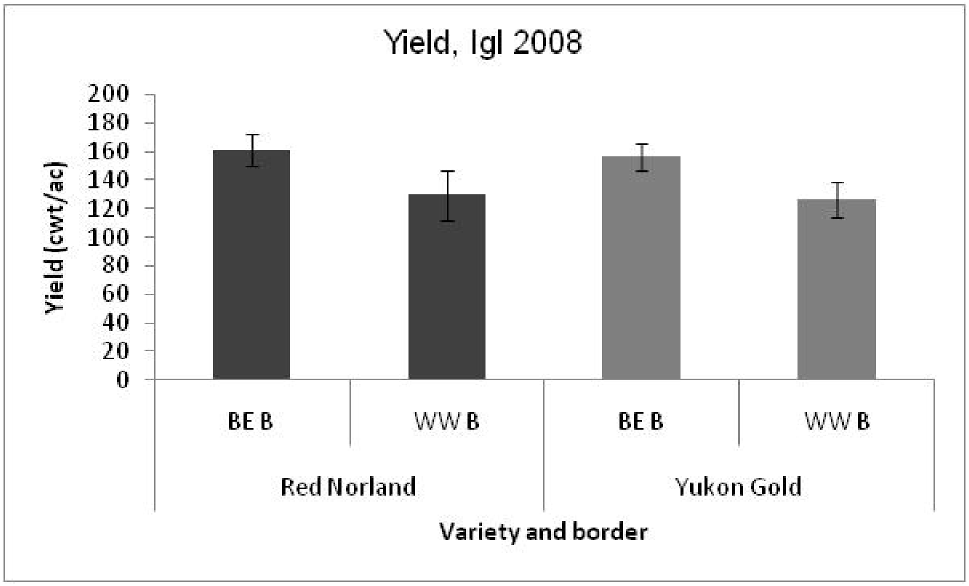


Figure 9: Numbers of aphids trapped in potato plots adjacent to wheat or bare earth borders. Data points represent average aphid numbers from three traps. (A) Aphid landing numbers from Igl farm. (B) Aphid landing numbers from HARS.

(A)



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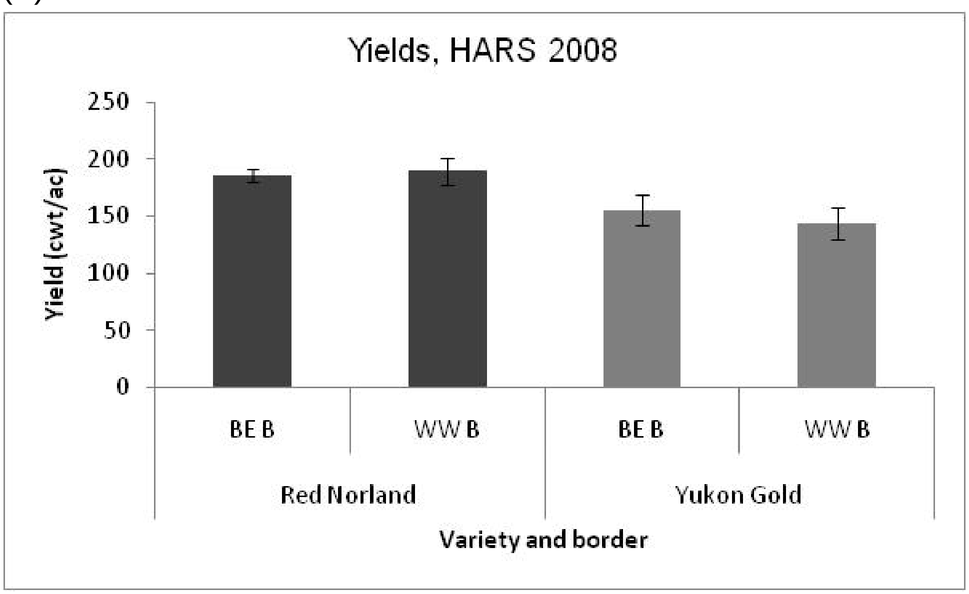
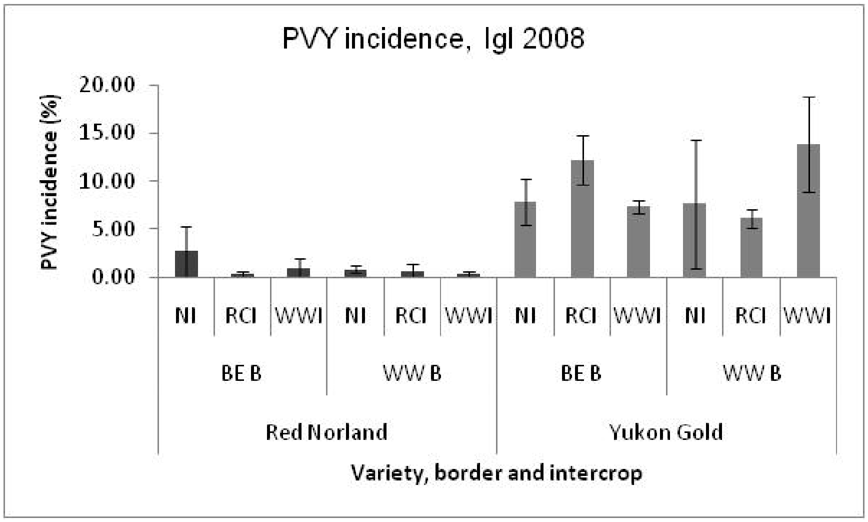
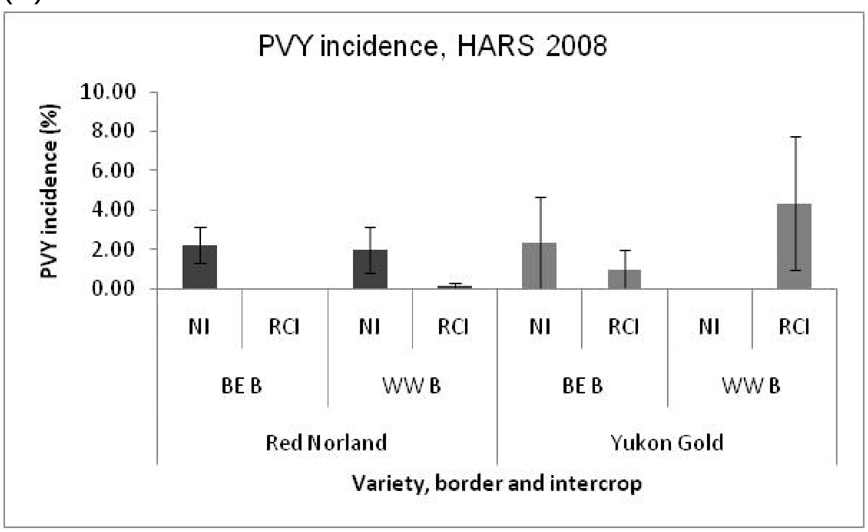


Figure 10: Yields of harvested grade A tubers at Igl farm (A) and HARS (B) from 2008 trials. Yields are shown for Red Norland and Yukon Gold plots that were bordered by bare earth (BE B) or winter wheat (WW B).

(A)


PVY incidence, Igl 2008
PVY incidence (%)
20.00
15.00
10.00
5.00
0.00
NI
RCI
WWI
BE B
WW B
Red Norland
Yukon Gold
Variety, border and intercrop

(B)


PVY incidence, HARS 2008
PVY incidence (%)
10.00
8.00
6.00
4.00
2.00
0.00
NI
RCI
BE B
WW B
Red Norland
Yukon Gold
Variety, border and intercrop

(C)

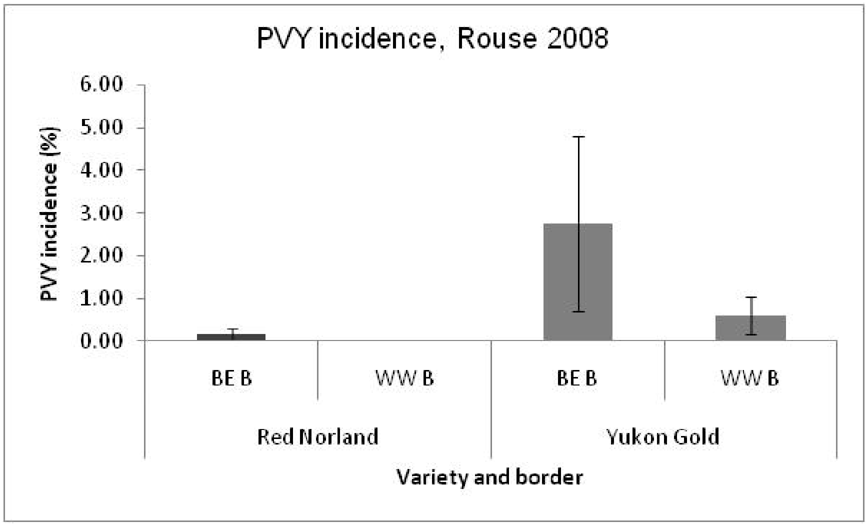


Figure 11: PVY incidence for varieties Yukon Gold and Red Norland from field trials at the Igl farm (A), HARS (B) and Rouse farm (C) in 2008. PVY incidence is shown for plots with no intercrop (NI), a red clover intercrop (RCI), or a winter wheat intercrop (WWI, Igl 2008 only), with either a bare earth border (BE B) or a winter wheat border (WW B).

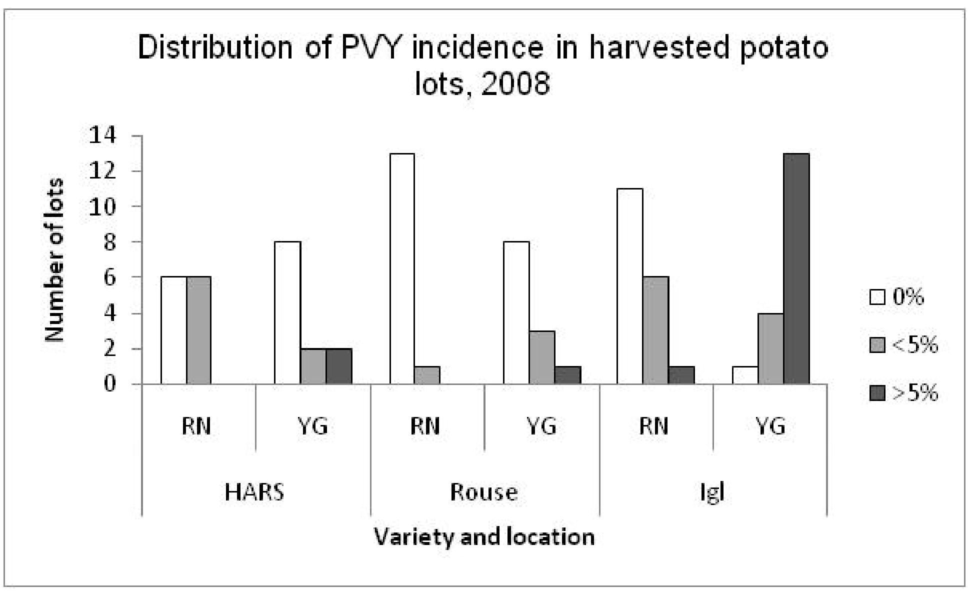


Figure 12: Incidence of *Potato Virus Y* (PVY) in lots of potatoes harvested from HARS, Rouse and Igl sites in 2008. Varieties are Red Norland (RN) and Yukon Gold (YG).

6. Conclusions and Discussion

The field trials we conducted in 2007 and 2008 confirmed that certified seed potato production is feasible for Wisconsin organic potato growers. In 2007, of 135 potato lots from six organic farms, 121 lots (89.6%) met certification standards for PVY. In 2008, of 118 potato lots from 3 organic sites, 100 lots (84.7%) met certification standards for PVY. PVY incidence was higher in 2008 than in 2007, and at both the Igl farm and HARS, high PVY incidence was seen for some lots of the susceptible variety Yukon Gold. This contrasts with the very low incidence of PVY in 2007, too low to assess the strategies trialed to control PVY (borders and mineral oil). The year to year variation in PVY incidence and thus in the risk that seed lots may not meet certification standards underlines the need for field trials over multiple years, allowing a more comprehensive evaluation of the feasibility and economics of seed potato production on organic farms in Wisconsin. We intend to continue our research into organic seed potato production and will include an economic analysis in our assessment of its feasibility.

PVY, an aphid-transmitted virus, is the most common cause for seed potato lots to be rejected from certification in Wisconsin. Use of crop borders around potato seed lots was previously shown to limit spread of PVY (4). We trialed this strategy using 6 foot or 12 foot borders of spring-planted winter wheat. Although slightly lower aphid landing rates were seen for potato plots surrounded by a winter wheat border at the Igl farm in 2007 and at HARS in 2008, this effect was not always observed. The presence of a winter wheat border did not affect the incidence of PVY in the harvested potatoes. It is possible that the scale of the borders used in our trials was too small, as Difonzo et al. (4) used 12 and 30 foot borders. To gain a better understanding of aphid landing distribution in fields, we have initiated studies to monitor aphid landing at differing distances from field edges. As different aphid species vary in their ability to transmit PVY and may vary in their landing behavior, we will identify the major species trapped in our studies. These studies are hoped to lead to a better recommendation for placement of valuable seed potato lots within larger fields in order to avoid aphid landing and PVY infection.

Winter wheat borders did not affect yield in 2007 trials at the Igl farm or 2008 trials at HARS but had a negative effect on yield in 2008 trials at the Igl farm. It is possible that field conditions at the Igl farm in 2008 allowed the wheat border to out-compete the neighboring potato plants. Yield estimates from these trials were taken from the two rows immediately adjacent to the wheat border. In any future field experiments involving border crops, we will assess yield in rows immediately adjacent to borders as well as rows further from borders, to determine how far into the field any effect on yield may extend.

Intercrops have been shown to reduce spread of stylet-borne viruses (2, 5, 9, 11), a group that includes PVY. In 2008 we trialed winter wheat and red clover as intercrops, planting between potato rows after the final hilling. No effect on PVY incidence or aphid landing was seen for these treatments. However, a trend for higher yield was seen in plots with red clover intercropping at the Igl farm, and we will repeat trials to determine whether this effect can be reproduced.

Variety selection makes a clear impact on successful production of seed potatoes that meet certification standards for PVY, with PVY resistant varieties such as Red Norland performing better than PVY susceptible varieties such as Yukon Gold. Our 2007 trials included varieties for which PVY resistance was not known - Adirondack Blue, Adirondack Red and Magic Molly. PVY incidence was low in our 2007 trials, but the high PVY incidence in some Adirondack Blue lots (from the Malek farm) may indicate that this variety is PVY susceptible. Lack of PVY detection in Adirondack Red and Magic Molly lots may have been due to lack of inoculum. We plan to extend our variety trials of specialty and heirloom potato varieties on organic farms and will assess PVY resistance of these varieties in separate trials.

7. Outreach

At the 2007, 2008 and 2009 Organic Farming Conferences in La Crosse, Wisconsin, we met with farmers involved in the organic seed potato project to report progress and plan future work. At these meetings, we distributed handouts describing the seed potato certification process and guidelines for purchasing high quality seed potatoes. At the 2008 conference, Ruth Genger gave a short presentation followed by a round table discussion of the project with farmers as part of the Organic Symposium. In 2007, Ruth attended the annual field day at the Malek farm and spoke with attending farmers about the organic seed potato project. A publication describing the project's findings is in draft form and will be submitted to a peer-reviewed journal.

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9. Addenda

Planting day at Aue farm, 2007 - cut seed tubers

Winter wheat and bare earth borders at Igl farm, 2007


Harvest day at Malek farm, 2007


Harvest day at Engel farm, 2007