1. Project name and contact information

Breeding Colorful Disease and Pest Tolerant Potatoes
FNE 06-569

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2. Goals

The goal of this project was to create lines of potatoes that incorporated the potato leafhopper (PLH) resistance of the cultivar 'Prince Hairy' with more interesting appearing and flavorful traits from other potato varieties.

3. Farm Profile

Currently we are on a bit of a farming sabbatical. Since the start of this project we have moved the farm, had two children, I have taken a full time off farm job, and am concurrently working on a Ph.D. at the University of Connecticut. We have plans to resume our farming operation sometime in the next few years. Generally in the past we have farmed 1-2 acres of mixed vegetables and raised broiler chickens. Potatoes are a large part of our vegetable operation and we found colored and fingerling potatoes to be very popular at farmers market. In the summers of 2004-2006 we had significant leafhopper damage with 'Prince Hairy' showing good tolerance.

4. Participants

Dr. Elizabeth Dyck of NOFA/NY trialed potato lines for us.

5. Project Activities

Several varieties of potatoes were grown in 06 with 'Prince Hairy', a variety with glandular hairs that prevents potato leafhoppers (PLH) and to some extent potato beetles from feeding on the plant's leaves. 'Prince Hairy' in our eyes needed improvement, the potatoes were a run of the mill white color, the flavor was severely lacking, and the potatoes were prone to scab. Though 'Prince Hairy' held up very well in the presents of leafhopper when many other varieties suffered severe "hopper burn". We crossed pollinated 'Prince Hairy' and obtained seed of hybrids with 'Purple Peruvian', 'Carola', 'Kueka Gold', and 'Russian Banana'. 'Prince Hairy' was used as the maternal line in all cases with the exception of the pollination with 'Purple Peruvian'. The flowers of the maternal parent were emasculated (anthers removed), and pollen was collected from the flowers of the paternal lines, the pollen was then placed on the stigma of the maternal plant and the flowers were marked. Fruit was harvested approximately 60-80 days later.

Fruits were cut open and the seeds were cleaned, dried, and stored. These seeds were started in a greenhouse in the spring of 07 and planted that June. It was a hot dry summer and several seedlings died, the remaining tubers were harvested in November. Small tubers of 15 crosses with 'Purple Peruvian', 10 crosses with 'Kueka Gold', 4 'Russian Banana' crosses, 21 hybrids with 'Carola', and 10 seedling lines from uncrossed 'Prince Hairy' were recovered and were stored. The tubers of the 'Purple Peruvian' derived lines seem especially interesting, the cross yielded white fingerlings, purple fingerlings, purple round tubers, and white round tubers.

In the spring of 2008 tubers from the above lines were planted in a limed plot. Many of the tubers due to their small size dehydrated in storage we felt we did not have enough material for the randomized block design originally planned. We did not have much better luck getting the tubers to size up in 2008. The year was wet and we were unable to keep up with the severe weed pressure. We lost some lines of the crosses due to weed competition. We did recover several of the Purple Peruvian crosses that we found the most interesting. The lines did not flower and backcrosses to 'Prince Hairy' (BC1) or the newer 'King Hairy' could not be performed. There were no signs of PLH or scab.

In 2009 all surviving lines were planted in a randomized block design in a limed plot. The planting got in late around the first week in July. The plants were growing well until the last week in July when they became infected with late blight. The research plants were plowed under to reduce the spread of the disease. No data was collected. Though in the spring of 2009 tubers were sent to Elizabeth Dyck of NOFA/NY to be included in some of her potato evaluations. There was not enough material to send to other participants or to carry out flavor evaluations.

6. Results

We were able to obtain over 50 F1 crosses of 'Prince Hairy' and 4 other varieties. We found the greatest variation in the crosses of 'Prince Hairy' and 'Purple Peruvian'. All crosses seem relatively scab and leaf hopper resistant but this could not be confirmed, we may have just escaped the pest organisms the past few years.
Elizabeth Dyck planted tubers of the lines below and obtained the following result.

Cross	yield (lb)	tuber count
PP x PH 8	2.7	22
PP x PH 6	1.9	16
PP x PH 12	0.3	5
PH x Ban 2	1	7
PP x PH 3	0.9	21

Results from Elizabeth Dyck of NOFA/NY. 'Purple Peruvian' = PP, 'Prince Hairy' = PH, Banana = Ban

PP x PH8 had the highest yield and the most tolerance to late blight in 2009. (Photo Elizabeth Dyck)

'Purple Peruvian' is cited as highly scab resistant, this cross of 'Prince Hairy' and 'Purple Peruvian' seems to be the most promising result of this SARE grant. Further evaluation will be carried out on its leafhopper resistance and flavor.

PP x PH 6 sister line to PP x PH 8, also shows promise. (Photo Elizabeth Duck)

7. Conditions

It has been a wild ride the last three seasons. The weather and disease did significantly affect this project. One of the major stumbling blocks was to get enough tuber material to assess the lines. Drought one season and then wet weather and weeds the next did not allow the seedlings to bulk up well. Furthermore in 2009 late blight did not allow us to collect data.

8. Economics

The number of tubers produced from this project has been too small to make an economic impact on our farm. In the future once the tubers are up to production levels and we resume vegetable production, they (or their future daughter lines) may increase our marketable yields of potatoes.

9. Assessment

One major event was the release of 'King Hairy' a much better PLH resistant cultivar. We trialed this potato and thought it much better then 'Prince Hairy' its predecessor. We are excited to cross our current lines with this variety in the future. Mostly our steps from here are to bulk up the promising lines and see how they fair for flavor and send them to other growers for trialing. We will continue to collaborate with Cornell and NOFA/NY, and perhaps in the future also FEDCO and Wood Prairie to see if they are interested in any of the material.

10. Adoption

We plan to keep growing PP X PH 6 and PP X PH 8. They seem to be the most productive attractive and disease resistant progeny from the project. We have some reserve tubers of other lines and left over seeds from the original F1 crosses and may continue some work with these.

11. Outreach

The results of our project are very preliminary and we have not done any outreach. In the future the results are likely to be incorporated in talks that I regularly give at NOFA (Northeast Organic Farming Association) events.

12. Report Summary

The purpose of this project was to create lines of attractive, flavorful, leafhopper resistance potato varieties. The leafhopper resistant variety 'Prince Hairy' was crossed with four other potato lines, three yellow fleshed, and one purple. Plants were grown from true seed that resulted from the cross-pollination of the different potato varieties. More then 50 lines were created and grown. Two promising lines stood out, both were crosses of 'Purple Peruvian' and 'Prince Hairy'. These are both fingerlings one white and the other purple, their tubers seem clean and free of scab, they were noted by our collaborator as being somewhat tolerant of late blight. These new lines show good potential as specialty potatoes though more assessment of their production, disease resistance, and flavor is needed.

Bryan Connolly December 24, 2009