

Agronomy Initiative for Marketable yield (AIM) Annual Report

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It has been another successful year for the Agronomy Initiative for Marketable yield (AIM) program. This ongoing collaboration between the potato producers of Prince Edward Island, Cavendish Farms, the Province of Prince Edward Island, and Agriculture & Agri-Food Canada continues to deliver a comprehensive program of research and agronomy projects on a wide range of important topics. These projects have the goal of improving marketable yields while prioritizing both economic and environmental sustainability. The AIM Steering Committee, with representatives from all of these partners as well as from the Dalhousie Faculty of Agriculture, continues to oversee AIM activities and financial performance. The three AIM Working Groups (Seed & Tuber Quality, Soil Improvement, and Science & Technology) continue to discuss and recommend projects in their respective areas of interest that respond to the needs of producers growing potatoes for French fry production.

This initiative continues to bring the key industry stakeholders together in collaboration while engaging producers directly in understanding their needs. The success of AIM continues to be rooted in the initiative being grower-directed.

Yields in 2021 and 2022 were the two highest average yields in provincial history. While advantageous weather and use of new varieties are undoubtedly big parts of this strong performance, it is also very likely that improvements in production practices stemming from AIM projects and extension are also contributing to these strong yields.

2022-2023 Research Projects:

1. Cover Crops in the year before potatoes (Living Labs BMP1)

- 2022 was the final crop year of this project, with 9 fields included in the project. These fields were planted with a variety of fall cover crops in 2021 and then were assessed for soil health, soil nitrate concentrations, pest and disease levels, and marketable potato yield when comparing no cover crop control strips with cover crop treatments.
- Across all three cropping cycles in this project, an **average of 32 cwt/acre of increased marketable yield was observed when comparing all cover crop treatments with all no cover control strips**. This yield increase (11%) was larger than observed in other comparable studies in other regions (6.5% increase in the UK, 7% yield increase in Ontario field tomatoes)
- Assuming an average cost of establishment of approximately \$50 per acre, the **ROI on this BMP is approximately 10 to 1** in the short-term. In addition, there are a lot of long-term benefits (reduced soil erosion, improved soil health) that are hard to quantify in the short-term.
- Soil nitrate concentrations were reduced ~40% across all dates following cover crop establishment. **After October 25th, nitrate concentrations were reduced up to 65%** in the cover

crop treatments. This is very good news, as this indicates that a significant amount of nitrates were taken up by the cover crop and will be carried over to the next crop system in crop residue rather than being leached to groundwater or lost as nitrous oxide.

2. Cover Crops following potato harvest (Living Labs BMP2)

- Only one new trial field was established for BMP2 in the fall of 2022, due to operational challenges following Hurricane Fiona and a lack of human resources.
- Data from the last four years (2019-2022) were analyzed.
- **Erosion potential** (measured using splash pans) **was decreased by 22%** in cover crop treatments. There was significant difference from year to year in this data, due to climatic conditions.
- **Nitrate concentrations were reduced by between 25 and 33%** in soil samples taken more than 16 days following planting (after the cover crop had established). This again is encouraging that even a small amount of cover crop growth can help sequester nitrates and prevent them from being lost to the environment.
- The percentage of green cover was greatest for the winter cereals (fall rye, winter barley, winter wheat) compared to the spring cereals (oats, barley). Winter cereals are particularly recommended following potatoes harvested after early October.
- While winter barley established well as a fall cover, it only survived as a commercial crop in 1 of 8 trials. Further research would be required to see if winter barley would survive with earlier establishment (early to mid-Sept).
- **Higher seeding rates of cover crops did not appear to improve the percent cover.** Moderate rates in the 80 to 100 lbs/ac (depending on species) are recommended.

3. Full-Season Soil-Building Crops in the year before potatoes (Living Labs BMP3)

- Eight fields had sampling completed in 2022 that were established in either 2020 or 2021 with a variety of crops and mixtures. These crops included sorghum sudangrass, pearl millet, brown mustard, oilseed radish and tillage radish (among others). Check crops were ryegrass or clover/grass hay mixtures.
- Over three crop cycles and more than 20 fields with yield data obtained, there was a **25 cwt/acre improvement in marketable yield when comparing these alternative crops as a group compared with annual ryegrass.** These crops tended to show reductions in root lesion nematodes compared to ryegrass. When comparing these alternative crops to legume/grass mixtures, no difference was observed. It is felt that this can be explained by a difference in tillage frequency between the treatments as well as the lack of legumes (fixing nitrogen) in the alternative crops.
- No significant differences were observed for soil health metrics when comparing these crops; however, the number of replications per crop and the number of samples per field may have made it difficult to observe any real differences.
- The most encouraging treatments from these trials were forage pearl millet and 2 or 3 species mixtures of C4 grasses (sudangrass and pearl millet) with brassica species (radish, mustard). Trends toward higher yields (> 30 cwt/ac) were observed in these trials.

4. Mustard Biofumigation

- Across 8 fields over 2 years, **we did not see a significant improvement to marketable yield or crop value when comparing Caliente Rojo mustard/arugula mix** compared to a ryegrass or barley check crop. Only one field showed indications of a benefit from mustard biofumigation, and this was the field with the highest level of Verticillium and nematodes as well as the most susceptible variety (Russet Burbank).
- Mustard biofumigation is tricky in PEI, as it requires adequate soil moisture to be effective. Getting the right timing and having the right equipment for incorporation is key.
- Use of newer varieties that are more resistant to potato early dying may be of larger value in battling the disease. In addition, avoiding rotation crops that further multiply nematodes (like red clover) may also be an effective strategy in PEI.
- For very high inoculum fields or when using PED susceptible varieties, mustard biofumigation may still be a good tool.

5. Manure Management

- Two farm trials were initiated in 2021 to compare applying manure in the late summer/early fall with no incorporation compared with manure application in late fall followed by ploughing (grower standard practice)
- **Manure addition consistently improved concentrations of nutrients** such as potassium, magnesium and sulfur to the soil.
- Results were inconsistent between the two fields. However, there was no yield loss from incorporating manure earlier.
- In one field, there was a **trend toward higher organic matter and active carbon when manure was applied earlier**. More research on this topic could be warranted.

6. Rotational Grazing

- Two trials were initiated in 2022 where forage crops were grown in comparison with the grower standard practice rotation and were then grazed by beef cattle. Pre-treatment soil samples were taken in 2022 and will be taken again in spring 2023.
- One field will be in potatoes in 2023, while the other will also be grazed in 2023 before being in potatoes in 2024.
- More rotational grazing trials are proposed for 2023.

7. Corn before potatoes

- A split field farm trial was conducted comparing a corn – potato – wheat – corn – potato rotation with a sudangrass – potato – wheat – sudangrass – potato rotation.
- There was **no significant difference in marketable yield** between the two treatments. However, this was an irrigated field with generally adequate rainfall, so crop stress in 2022 would be relatively minor.
- Organic matter percentage was 0.2% higher on the sorghum sudangrass side of the field, but more sampling would be required to confirm this difference.

8. Reduced Nitrogen on Seed

- Across four trials, **no difference was observed in yield when reducing nitrogen rates by 20%** in three varieties (Dakota Russet, Alverstone Russet, Mountain Gem).
- In one of the four trials, the number of tubers was increased without reducing yield (Dakota Russet). This is advantageous for seed production.
- There is room to explore this further in future years, with even greater decreased in nitrogen rates

9. Variable Rate Seeding

- Across six fields over two years, there was between a **\$200-\$300 per acre increase in crop value** by increasing seed spacing in lower yield potential zones of the field and decreasing seed spacing in higher yield potential zones of the field compared to standard seed spacing.
- Management zones were determined used SWAT mapping. Previous AIM research has shown that soil electroconductivity mapping (including SWAT) is highly correlated with yield potential.
- A number of growers are already purchasing or adapting planters to be able to do variable rate seeding.
- A follow-up research project with UPEI and Evan MacDonald is planned for 2023 to compare both VR seed spacing and VR fertility using newly available planting equipment.

10. Measuring Compaction with Soil Electroconductivity

- Preliminary study with UPEI completed in 2022.
- Use of soil EC sensors shows potential for identifying soil compaction in fields and producing a compaction map
- Work is proposed for 2023/2024 to further refine this scanning technology and correlate it with soil tests, penetrometer readings, and potato yields.
- New software has been obtained to visualize compaction at different depths in the soil, with the hope of being able to tell producers how deep a plow pan is and what depth to do subsoil tillage at.
- In four field trials comparing subsoil tillage versus no subsoil tillage, **there is a trend toward yield improvement in favour of the subsoil tillage**. Timing of tillage (late summer/early fall under dry soil conditions) is imperative.

Extension Projects:

1. Value of Hay/Straw Calculator

- Ryan developed an Excel calculator that was shared with producers to quantify the value of hay, silage and straw in terms of their nutrient concentrations as a tool to help producers with better understanding the need to get value for these products in order to replace their value with fertilizer. This was shared via email and the Agronomy site.

2. Seed Handling

- Videos and photos were collected on proper seed handling and cutting techniques. These were incorporated into presentations and will be used to update a seed handling and cutting guide this spring.

3. Summer Field Tours

- Three summer field tours were conducted in August 2022 with growers and industry partners, followed by BBQs hosted by 3 growers. Turnout was strong at all three locations, with approximately 100 people in attendance across the 3 tours.
- Field trials included nitrogen management, cover crops, mustard biofumigation, and compaction. Included trials in partnership with UPEI, PEI Department of Agriculture & Land, Dalhousie University and Genesis Crop Systems.

4. Winter Workshops/Conferences

- Two winter workshop series were organized in winter 2023
 - February – Potato Early Dying, Compaction and Nitrogen Management with Dr Mario Tenuta (University of Manitoba), Dr Aitazaz Farooque (UPEI) and Ryan Barrett
 - March – Seed Management with Newton Yorinori (Cavendish Farms), Dr. Rick Peters (AAFC) and Ryan Barrett
- February workshops were lightly attended due to many people being out of province in late February (Canada Games). However, video was recorded and posted on YouTube and linked on Agronomy site.
- March meetings were well attended
- Ryan also presented on cover crops in November 2022 as part of PEIFA-OFCAF local workshop series. These meetings were well attended.
- Ryan helped to organize and moderate discussion at January 2023 PEIFA-OFCAF local workshops on nitrogen management, including David Burton from Dal AC.
- AIM sponsored speakers on soil health, including a grower panel, at the PEI Potato Conference in February 2023.
- Evan MacDonald presented AIM-supported research results on variable rate seeding at the PEI Potato Conference
- A group of Working Group members was organized to attend Manitoba Potato Production Days in January 2023; however, poor weather and travel interruptions required this trip to be cancelled.
- Ryan presented on cover crop research at online webinars sponsored by Ontario Soil & Crop and Perennia in 2022.
- Ryan presented in-person on cover crop research at NB Potato Conference, Ontario Potato Conference, and NB Soil & Crop Conference in 2023, raising the profile of the AIM program in other provinces.
- Weekly agronomy updates were provided to producers and industry partners, sharing highlights from research projects, providing crop, disease and pest updates through the growing season, and promoting extension opportunities.

Moving Forward:

- Working Groups met in December 2022 and March 2023 to finalize project plans for 2023. There will be many newer projects proposed for 2023, as a number of projects outlined in this report were completed in 2022.
- Proposed research partners for 2023 include UPEI, the new ACS Living Labs program, the National Fruit and Vegetable Cluster (Soil Health), and the PEI Department of Agriculture.
- March 2023 marks the end of a one-year extension to the collaborative funding agreement between the project partners. A new agreement will be worked on following launch of the PEIDAL's new S-CAP program announcement in April 2023.
- The Seed Working Group is now the Seed and Tuber Quality Working Group, reflecting the fact that there are additional research opportunities in tube quality that need to be addressed as well as recognizing that the Cavendish Farms Research Division is doing a lot more work on seed management and variety management than at the start of the AIM program. This should allow for projects to be well-aligned between the Cavendish Farms team and AIM.
- According to a December 2022 producer survey, cover crop adoption is close to 50% before and after potatoes. This has grown considerably over the years and is a very good demonstration of producers embracing sustainable production practices that are also associated with improved yields and quality.

Respectfully submitted,

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