EASTERN CANADA
OILSEEDS DEVELOPMENT ALLIANCE

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Activity 16 Factsheet

Assessment of the Impact and Interactions of Emerging Crops on potato-Based Cropping Systems

Objectives

The primary objective of this activity is to generate local data and an understanding of the impact of oilseed production in a region that has traditionally been focused on potatoes. Oilseeds are a relatively new addition to the potato rotation. This activity will be implemented through four sub-activities: 1) Evaluate the different temporal positions in the cropping system where oilseeds could potentially fit; 2) Measure any carry-over benefits realized during the potato year, as well as any other carry-over effects from oilseeds realized in other crops in the rotation; 3) Build on the previous AAFC-funded research under DIAP, as well as work done in both Maine and Manitoba; and 4) Evaluate the most effective management options for eliminating canola volunteers during the potato year.

Methodology

Ten different rotations were evaluated **(Table 1)** to look specifically at the effects of different emerging crops on potato yield and quality, with a focus on canola and soybean. The experiment used a staggered start design where every crop from each rotation was grown every year. This design method buffers against the seasonal year-to-year variability. Soil nutrients, soil microorganisms, and nematodes were tracked through all rotations in all years. All crops were managed using conventional management practices and using the most common crop varieties. Canola was consistently L150 and soybean was DH420 during the first year, and DH863 for the rest of the study. The forage mix was a commercial blend from Bishop Seeds which consisted of tillage radish, sunn hemp, and sorghum sudangrass. Whenever possible, pre-emergent weed control was used; both fungicides and herbicides were applied as needed. Soil fertility was adjusted according to the results of soil tests taken on an annual basis. The yields of all non-potato crops were within industry standards.

Table 1: ECODA rotations 2014-2016.

Year 1	Year 2	Year 3
Buckwheat	Buckwheat	Potato
Corn	Forage mix	Potato
Barley	Clover	Potato
Canola	Spring Wheat	Potato
Corn	Canola	Potato
Canola	Canola	Potato
Soybean	Soybean	Potato
Corn	Soybean	Potato
Soybean	Forage mix	Potato
Canola	Forage mix	Potato

Results

Soil microorganisms

Soil microbes were evaluated using a phospholipid fatty acid profiling (PLFA). This technique gives us a snapshot of what is happening biologically in the soil. One useful indicator of soil health is the bacterial to fungal biomass ratio (F:B). This number gives us an idea of the decomposition pathway in the soil. If the decomposition pathway is dominated by bacteria, the soil tends to be more susceptible to stress; the opposite is true for a soil decomposition pathway dominated by fungi. For example, a pasture soil which is not plowed on a regular basis, is mowed, and receives nutrients as manure, would have a higher F:B ratio than a more intensively managed agricultural field. Lower F:B ratio numbers indicate that there is not much organic matter or there is a high nutrient load in the soil. In our results, all of the rotations containing corn had lower F:B numbers. This makes sense as the corn crops that we grew received the full level of fertility, but the crop did not grow properly to use up those nutrients. Fertility in those plots was not efficiently used and went more into bacterially based microbial processes rather than into crop growth. The higher F:B numbers on average tended to be in rotations that had either crops that used up most of the fertility that we put down, or they contained forage crops which took up all of the residual fertility that was put down.

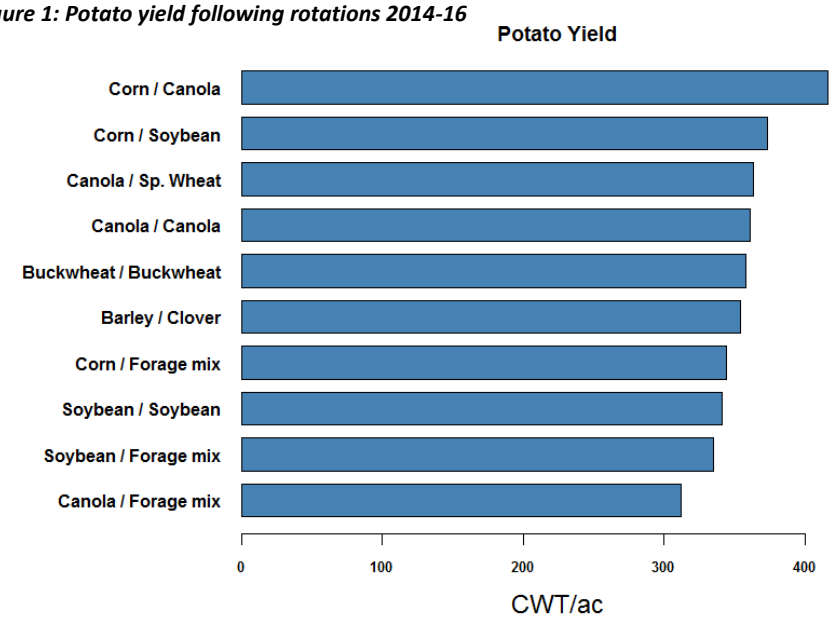
Higher mycorrhizae numbers were in most of the rotations which contained a forage species or forage mixes. Red clover is a highly mycorrhizal species and has previously been shown to increase mycorrhizae in potato rotations. Canola is not a mycorrhizal species, however a single species forage, forage mixes, and grains are all highly mycorrhizal and will increase mycorrhizae in the rotation.

Nematodes

Not all nematodes are bad for agriculture. They are an essential part of the soil food web and are the biggest contributor to nitrogen turnover in the soil system. All nematodes were identified to the family level and included all free-living and plant parasitic nematodes. Plant parasitic nematodes showed slightly higher numbers in the corn-canola rotation and were lowest in the corn soybean rotation when averaged over the three years. When broken down by year, it is clear that certain rotations resulted in an increase in plant parasitic nematode numbers such as canola-canola, barley-forage, and canola-wheat.

Potato yield and quality

Figure 1: Potato yield following rotations 2014-16



There were no significant effects of rotation on potato yield and quality in the study. Potato size and weight classes showed a few small differences, but overall, each rotation was similar. Yield was highest in the corn/canola rotation on average, however but the total yield numbers were not statistically significantly different **(Figure 1)**. It is important to note that the corn crops were in a crop failure situation for two out of the three years of the study. There were higher incidences of rhizoctonia in rotations that contained canola; however, there were no significant differences between the rotations with regard to scab, hollow heart incidence, internal browning, specific gravity or wireworm damage. There was a significant difference in the number of marketable tubers in rotations that contained two years of soybean vs. one year of soybean (with one year being significantly higher than two years). This was also the case for rotations that contained two years of canola vs. one year of canola.

The data presented from this study clearly show the need for diversity within a potato based cropping system. Growing the same crop for two years previous to potato, regardless of the crop, is detrimental to both yield and quality on the subsequent potato crop. A diversity of crops in rotations serves to break weed, pest and disease cycles and helps to buffer producers from both environmental and economic year-to-year variability.

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