

Activity 17 Factsheet Crop Rotation with Potatoes (Quebec)

Objectives

The overall objectives of this activity are to 1) evaluate the integration of canola in a potato cropping system and measure the benefits and/or negative impacts during the potato year; 2) compare rotation systems including canola with conventional and new potato cropping systems; 3) determine the best temporal position in the cropping system for the canola and evaluate the impact on other crops included in the rotation; 4) evaluate the influence of canola crop on potato soil-borne disease evolution; and 5) measure nutrient balance and economic impact.

Methodology

The trial took place in Ste-Croix near Quebec City, with plots established in a sandy soil. This trial is established to take place over five years. Each year, a rotation pattern is set up on the same place in the field. For the first year, all plots were planted with potatoes and for the second year (2015) and third year (2016), plots were planted with buckwheat, barley, canola, potatoes, soybean or corn. The experiment was conducted in a randomized complete block design with four replicates. The plots have an area of 28 m². All agricultural operations performed on experimental plots were conducted similarly to what is done by commercial growers.

Measured parameters for cereals are:

1. Fresh weight of 1 m² of grain;
2. Weight of 1 m² of shoot biomass;
3. Fresh weight of 500 grains; and
4. Fresh weight of 500 ml of grain. Test weight was calculated from those data using the “Test Weight Conversion Chart” from the Canadian Grain Commission.

Measured parameters for potatoes are:

1. Yield of the different size categories;
2. External quality (growth crack, misshapen, common scab, rhizoctonia, etc.);
3. Internal quality (hollow heart, brown center, vascular discoloration, etc.); and
4. Specific gravity.

Results

The project is in the late stages of the 5-year cropping experiment and it's too soon to reveal any real impact of the different rotation systems on the crops. At first, it should be reminded that in 2014, potatoes were planted in every plot. With that said, it's important to specify that each one of the crops planted in 2015, i.e. buckwheat, barley, canola, potato, soybean and corn, received the same amount of crop residue (potato). At this stage (2015) of this 5-year experiment, we shouldn't expect to see any difference or at least very few between the different treatments, since the previous crop was the same for every plot. In 2016, the third crop year, the preliminary results show no significant difference amongst the treatments. The exception to this is potato crops planted in monoculture during the three years, which resulted in an increase in soil-born disease (e.g. rhizoctonia), suggesting rotation could decrease soil-born pathogens.

Also, it is relevant to note that yields for all crops were high and this may be justified by "the plot effect." Because we used a commercial-type drill in really small plots, it was more difficult to achieve a constant and fairly fast speed to allow a plant density similar to producers. This led to a seeding rate slightly higher than what is conducted in fields. Furthermore, as compared to what is observed in commercial crops, when we harvest the one square meter plot, there was no shortage and all the grains were collected. This "plot effect" is also observed every year in potato plots, since yields are often quite high. In 2016, some modifications were made and more uniform plots were obtained; however, the plant density was still quite high.

Aside from the potatoes, no disease and no insects (except for a few flea beetle in soybean) were observed in the different crops. As the fields have never grown canola, barley or buckwheat, it is not surprising to see these results.

Results interpretation

1. Results obtained for most of the crops implanted in the second and third year of the 5-year experiment show that there is no significant difference amongst the treatments. With potato plots established in 2014 for all treatments, these results are what was expected.
2. Most of the crops (except the potatoes and soybean) were free of diseases and insects. This could be explained by the fact that canola, barley and buckwheat were never grown in these fields, at least not in the last 10 years.
3. The treatment with potato plots (monoculture) generated reduced yields in 2015 compared to 2014. Since potatoes were grown in this field last year, and also several times in the past years, it was possible to see common diseases (late blight) related to this crops. This data could be the result of negative effects of potato monoculture. Upcoming tests (2017, etc.) will allow us to further analyze the results.
4. In 2015 the soybean crop yield was higher for one treatment, i.e. T7, compared to the other treatments, regarding the shoot biomass as well as the weight of 500 grains. At first sight, nothing could justify those differences, but when we analysed the results, it appears that only one replicate of the T7 treatment shows significantly higher results. Since fertilization was made by broadcast application, it may be possible that this particularly plot received more fertilizer.

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