FLEABEETLE HERBIVORY IN CANOLA IMPACTED BY SEED SIZE, SEEDING DATE AND SEEDING RATE

The Canola Council of Canada advises that canola should be sown with high seeding densities and preferably using larger seed size (up to 2.2mm). Moreover, seeding later in the season should be considered rather than seeding on earlier dates. Briefly, greater plant densities produced by high seeding rates compensate for flea beetle leaf damage. More tolerant seedlings to flea beetles have been observed to be affected by seed size and canola sown mid-May to early-June. Late sown less affected by flea beetle damage than canola seeded in late-April to early-May. Currently, there is limited research showing how all these recommendations, acting in conjunction, affect canola production. Therefore, this study aims to evaluate the impact of seeding rate, seed size, and seeding date on flea beetle damage and populations. Furthermore, a split-plot factor analysis will also allow us to examine interaction effects between seeding rate, seed size and seeding date. Further insight on interactions effects will allow us to measure the true flea beetle response to these recommendations, and provide new recommendations based on these possible interactions.

The objective is to evaluate the impact on flea beetle leaf damage and flea beetle population of seeding date (late-April to early-May and second to third week of May), seed size (small, large and unsorted), and seeding rate (112,56 and 168 plant m-2)

Table 1. P-values for canola yield evaluated by seeding date (May 18 and May 12, 2020 and June 3 and May 17, 2021), seeding rate (56, 112 and 168 lb ac^{-1}) and seeding size (1.4-1.7mm, 1.8-2.2mm and unsorted) in canola stands subjected to fleabeetle herbivory

	P-value	
Effect	2020	2021
Seeding date	0.8513	0.3788
Seeding rate	0.9267	0.0837
Seed size	0.6187	0.1105
Seeding date X Seeding rate	0.2478	0.2355
Seeding date X Seed size	0.6448	0.2085
Seeding rate X Seed size	0.7515	0.3324
Seeding date X Seeding rate X Seed size	0.5564	0.3435

Data from the North Peace Applied Research Association farm was compiled for both 2020 and 2021 growing seasons. Yield in canola differed in 2020 and 2021. Differences were expected as yield in 2020 was minimal compared to that obtained in 2021. However, statistical analysis conducted by year showed no difference in seeding date, seeding rate and seed size or any of the interactions (Table 1).
Since there was no significance in treatments by year, Figure 1 shows the yields reported across all treatments for both seasons.

Yield values of canola from stands exposed to flea beetle herbivory sown on early (May 12, 2020 and May 17,2021) and late (May 18, 2020 and June 03, 2021) in the growing season, at 56, 112, and 168 plants m-2, using different seed sizes (1.4-1.7 mm and 1.8-2.2 mm as well as unsorted) *

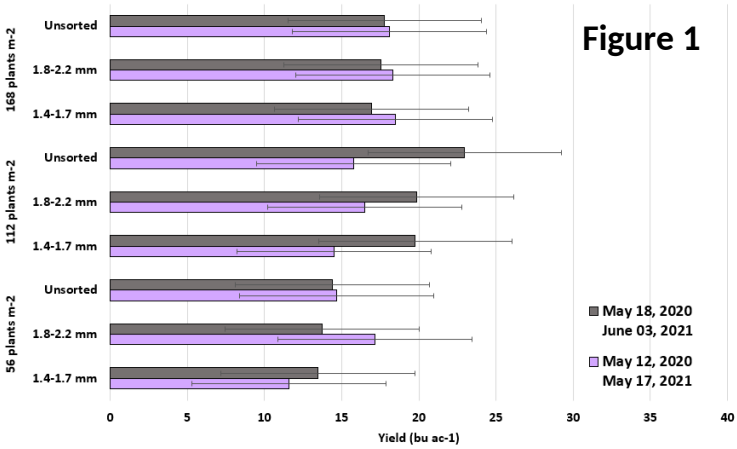

Figure 1

Fleabeetle herbivory was kept isolated within each plot by using buffers seeded with an insecticide treated canola variety. However, this may have done very little to prevent fleabeetle migration to other plots. It can be argued that as a result yield may have been compromised and there is very little impact from seeding date, seeding rate, and seed size. The region where the NPARA farm is located has a very short growing season. This makes it impracticable to seed canola before early May. Even though we had and "early" and a "late" seeding date, all dates are still within the mid-May to early-June ideal seeding window for canola. This may explain why there was no difference in yield despite the date.

***Values with no letters determine no statistical difference across treatments**

Emergence and maturity were affected by seeding date (P=0.0085 and 0.0378 respectively) and by seeding rate (P=0.0005 and P=0.0002) but not by the seeding date X seeding rate interaction (P=0.5669 and 0.0700 respectively). As anticipated, greater seeding rates brought out more emergent and mature individuals (Figure 2). In addition, more emergent individuals and mature individuals were reported in canola stands seeded later in the growing season instead of those sown earlier in the season (Figure 2). Scientific literature on seeding date is still inconclusive. It has been argued that early seeding may provide a head start to canola stands to survive fleabeetle damage whereas late seeding is supported as it prevents uneven maturity and delayed ripening. Two years of data from the NPARA farm support the latter argument. Canola stands seeded early in the season (May 12, 2020 and May 17, 2021) had more uneven maturity and more fleabeetle damage than those seeded later (May 18, 2020 and June 3, 2021).

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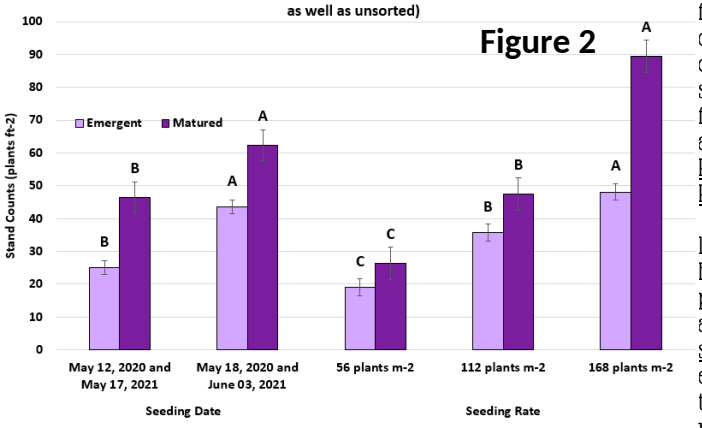
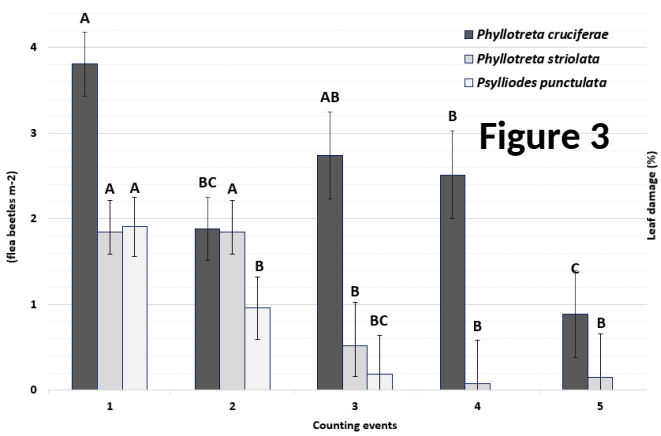
Emergent and matured stand counts of canola exposed to flea beetle herbivory sown "early" (May 12, 2020 and May 17,2021) and "late" (May 18, 2020 and June 03, 2021) in the growing season, at 56, 112, and 168 plants m-2, using different seed sizes (1.4-1.7mm and 1.8-2.2 mm as well as unsorted)

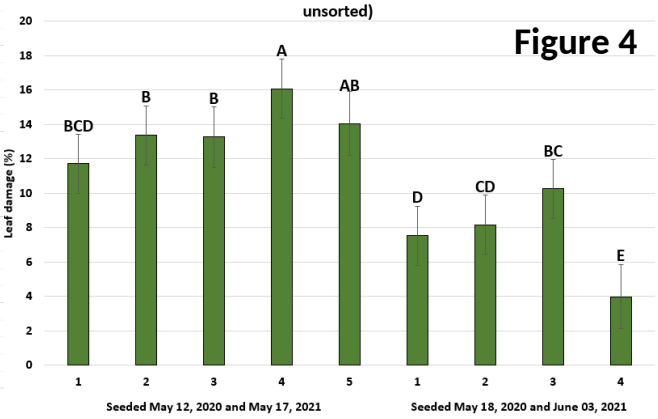


Total number of fleabeetles were different at every single count (P≤0.0001). Highest numbers of fleabeetles were found at the first and second counting events and decreased to the last counting event. This agrees with most of the research reported data, where fleabeetles peak shortly after cotyledon stage and tend to decrease past the four-leaf stage. There were three fleabeetle species counted as they are the most common in agricultural fields: Phyllotetra striolata Fabricius, P. cruciferae Goeze and Psylliodes punctulata Mescheimer. In general, P. striolata Fabricius. and P. punctulata Mescheimer numbers were lower than P. cruciferae Goeze. Moreover, P. striolata Fabricius (P≤0.0001), P. cruciferae Goeze (P≤0.0001) and P. punctulata Melscheimer (P≤0.0001) individuals varied according to counting events. From a total of five events, P. striolata Fabricius numbers were higher in the first two events whereas P. cruciferae Goeze numbers were higher in the first and third. P. punctulata Melscheimer individual numbers slowly decreased over counting events.

Phyllotreta cruciferae, P. striolata and Psylliodes punctulata flea beetle species counts over 5 counting events from seeding to 4-leaf stage in canola stands exposed to flea beetle herbivory sown on May 12, 2020 and May 17,2021 and May 18, 2020 and June 03, 2020



Leaf damage visual rating events conducted from cotyledon to 4-leaf stage on canola stands exposed to flea beetle herbivory sown "early" (May 12, 2020 and May 17,2021) and "late" (May 18, 2020 and June 03, 2021), at 56, 112, and 168 plants m-2, using different seed sizes (1.4-1.7 mm and 1.8-2.2 mm as well as unsorted)



Leaf damage caused by fleabeetles varied according to visual rating events and was impacted by seeding date (P≤0.0001). Leaf damage visual ratings at each event were greater if canola was sown earlier (Figure 4). Regardless of seeding date, greatest damage was found in the penultimate visual rating event. Dry and warm temperatures occurring in June, which is when the first, second and third counting events took place explain why flea beetle populations were greater compared to those populations counted in temperatures from the fourth and fifth events. Damage observed in the penultimate event indicate extensive herbivory by fleabeetles and the last event may indicate potential recovery by the canola stands from leaf loss.

In conclusion, it is still debatable if canola can be high yielding if grown later in the season. However, emergence and maturity are impacted by time of seeding and number of seed sown per square foot. Fleabeetle populations tend to increase in the early cotyledon stages and slowly decrease afterwards and damage seems to be alleviated by the four-leaf stage, simultaneously as fleabeetle populations are dropping. Fleabeetle populations and leaf damage may be influenced by dry, warmer temperatures as greater number of individuals and more leaf damage was observed in early to mid-June, when fleabeetle counting and leaf damage visual ratings were conducted.