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

Highlights

- **At the NPARA research farm in North Star**
  - **Emergence and maturity**
    - **Greater number of stands at**
      - **"late" seeding dates (third week of May to first week of June)**
      - **highest seeding rate (168 plants ft-2)**
      - **There is no effect in florescence**
    - **Less number of stands at 56 plants ft-2 regardless of seeding date**
  - **Leaf damage remains fairly constant in the first four days where repeated measures were taken with a decline occurring in the fifth**
  - **Number of flea beetles was found to be increasing through time**
    - **increasing as leaf damage decreased**
    - **possibly due to development of leaves from cotyledon to true**
  - **Flea beetle species numbers analyzed did not show impacts from seeding date, seeding rate or seed size.**
    - **Except crucifer flea beetles where greater numbers were found in canola stands emerged from small seeds compared to those stands that emerged from unsorted canola seed**
  - **Seeding date, seeding rate and seed size did not impact yield**

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.

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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). The seeding date for all these trials had to be pushed further due to weather constraints. Therefore, “early seeding dates correspond to canola sown from the second to the third week of May and “Late” dates correspond to canola sown from the fourth week of May to the first week of June.

As the third year of this experiment concluded, data compiled from all three years showed an effect of seeding date and seeding rate on emergence and maturity but nor florescence. More plants emerged at the “late” seeding date as well as canola sown in plots with the greatest seeding rate (168 plants ft-2) . Seeding date and seeding rate interactions impacted maturity. Canola found in plots seeded “late” at 168 plants ft-2 had greater number of matured stands than canola seeded “early” under the same seeding rate.

P-values obtained from ANOVA and repeated measures statistical analysis in parameters measured to assess Flea beetle hervibory in canola. Canola was sown “early” on (May 18, 2020 May 12, 2021 and 24, 2022 and “late” (June 3, 2020, May 17, 2021 and June 3, 2022)

Parameter	Stand count			Leaf damage	Number of Flea beetles			
Effect	Emergence	Florescence	Maturity		Crucifer (Phyllotetra cruciferae)	Striped (Phyllotetra striolata)	Hop (Psylloides punctulata)	Total
Day				**0.0024**				**0.0001**
Seeding rate	**0.0001**	0.1206	**0.0001**	**0.0109**	0.9475	0.3712	0.8758	0.0524
Seeding date	**0.0001**	0.9566	**0.0006**	0.3386	0.2470	0.4038	0.6433	**0.0001**
Seeding size	0.9886	0.5567	0.6472	0.9384	0.0327	0.9748	0.6104	0.9422
*Seeding rate*Day*				0.2356				0.8016
*Seeding date*Day*				**0.0001**				**0.0001**
*Seed size*Day*				0.8915				0.8637
*Seeding date*Seeding rate*	0.9272	0.9545	0.0246		0.1540	0.8674	0.8722	
*Seeding date*Seed size*	0.2719	0.4888	0.6572		0.4664	0.9994	0.9667	0.8637
*Seeding rate*Seed size*	0.4496	0.5456	0.9205		0.6863	0.8748	0.5094	
*Seeding date*Seeding rate*Day*				0.5801				0.5307
*Seeding date*Seed size*Day*				0.0936				0.7409
*Seeding rate*Seed size*Day*				0.9621				0.9568
*Seeding date*Seeding rate*Seed size*	0.4904	0.9641	0.6342		0.5619	0.2548	0.0867	
*Seeding date*Seeding rate*Seed size*Day*				0.3422				0.8547

Moreover, data compiled from Manning, Fahler and Fort Vermillion in 2020 to 2022 showed that number of matured canola stands seeded “late” at 112 plants ft-2 was greater than that found in canola seeded “early” at the same seeding rate and canola seeded at 56 plants ft-2 despite seeding date. Data is coincidental to compiled data from 2020 and 2021. Seeding dates from the third week of May to the first week of June showed more emergent individuals than canola planted in from the second to third week of May. As for maturity, 2020-2021 compiled data showed that the greatest seeding rate was more likely to ensure a greater number of mature canola stands. Florescence was the same under different seeding dates, rates and seed sizes. The results demonstrated that emergence and maturity are likely to be greater at later dates likely due to warmer temperatures and less probability of frosting overnight. As intuitively expected, more stands can be a possibility if seeding rates are increased.

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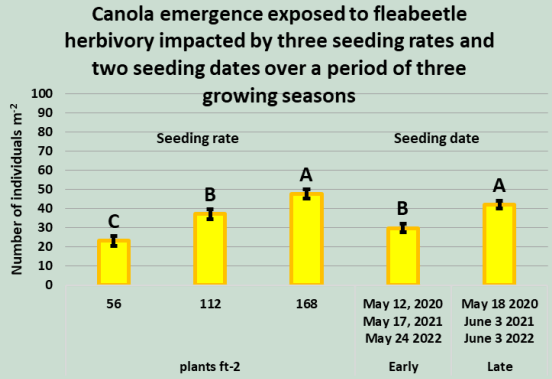
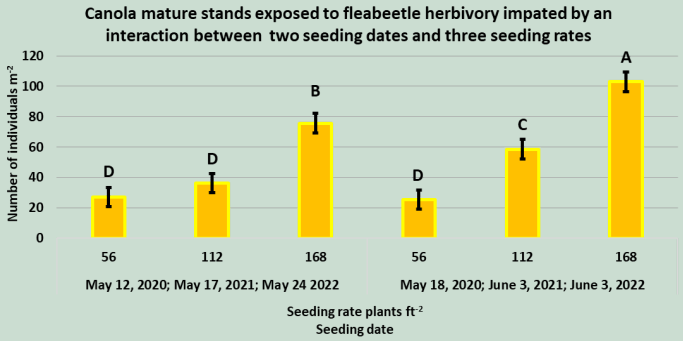
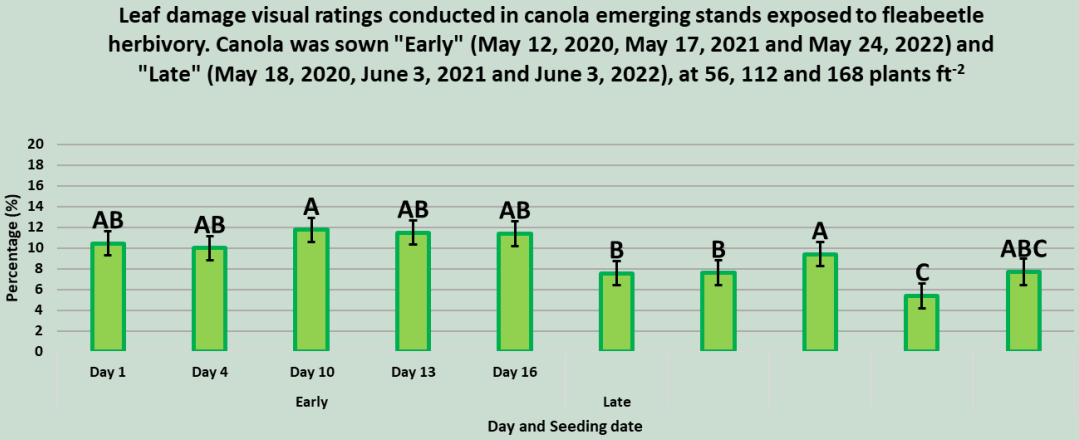




Leaf damage and total number of flea beetles data was analyzed as repeated measures. Damage was monitored by looking at 10 plants in a 25 by 25 cm quadrat and assess visual percentage of herbivory in canola up to the four-leaf cotyledon stage. There were three quadrants per plot and assessment was performed every three days. Leaf damage was affected by the interaction between the repeated measured factor (in this case called “day” for repeated measure) and the seeding date. Overall, leaf damage remains the same for the first four days chosen to conduct repeated measures with a decline by the last. Likely meaning a decrease in leaf area due to excessive herbivory. Values exposed here are similar in trend as those in 2020-2021 compiled data.



Because number of flea beetles in some years was too low in comparison to others, number of flea beetles per specie for data compiled between 2020-2022 was analysed as an effect with no repeated measures. In the same quadrat, a yellow sticky card was placed in the middle and used to count the number of flea beetles. Number of flea beetles was averaged for all three quadrats at each plot and converted to number per squared meter. Across all the study years, total number of flea beetles was affected by the repeated measure factor. As such, a greater number of flea beetles was found to be increasing as time went by, which coincides with a decrease in leaf damage. This is probably because as flea beetle number of individuals increased there was less cotyledon leaves left to eat and there were more development of true leaves left. Findings of compiled data in 2020-2021, showed that number of flea beetles tended to decrease through time. It is possible flea beetle counts were continued until canola was transgressing from colyledon to true leaves, and hence such decline was reported.

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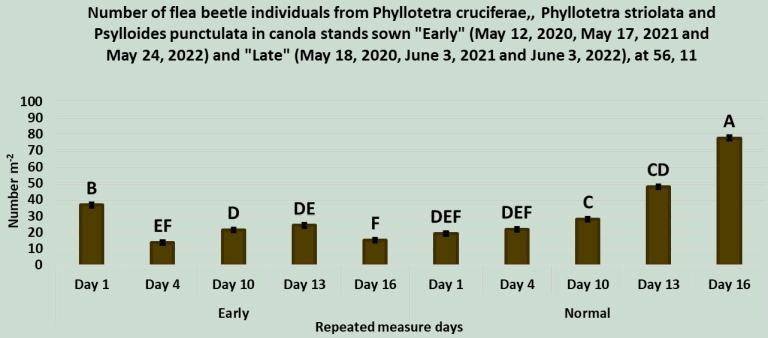

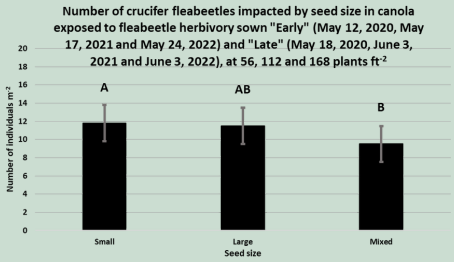

Number of flea beetles were the same under all effects except crucifer Flea beetles (Phyllotetra cruciferae), whose numbers seemed to be affected by seed size. Results showed that more Flea beetles were found in plots sown with small seeds compared to plots seeded with mixed seed (performed conventionally). However, plots sown with large seeds had the same number of crucifer Flea beetles as those seeded with small seed as well as those seeded with mixed seed. Thus, we can conclude that as for the NPARA site, seed size is still a murky predictor of Flea beetle presence.

Yield in 2020 showed to be influenced by the seeding date, seeding rate and seed size but this impact was absent by 2021 and 2022. In 2020, canola seeded at a “late” date and at 168 plants ft-2 would likely return the greatest yields. In addition, mixed size canola seed was more yielding than small canola seed, and yield from large seeds was no different from either small or mixed seed. In 2021 and 2022, there was no difference in yield regardless of when was it seeded, how much seed was planted or how big the seed was. In 2020, canola yields were extremely low due to numerous precipitation events and consequent flooding, in 2021, there was a contrary effect, and canola was exposed to extensive drought periods. The last growing season was the least extreme in comparison to the two years prior but overall data pooled may have masked whatever differences found from the 2022 growing season. These results contrast findings from pooled data across sites in Fort Vermillion and Fahler. Overall results demonstrated that in order to obtain more yield, “late” dates should be considered, as well as a rate of 112 plants ft-2 with mixed canola seed sizes or canola seed greater than 1.8mm of diameter. It can be argued that our site presented problems for canola every year. Our contribution to this results is that having all these effects in check, weather conditions as well as appropriate soil moisture is much more crucial for canola yield.