

## RESEARCH SUMMARY

# Is starter phosphorus necessary for silage corn in manured soils of the Fraser Valley?

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## KEY TAKEAWAYS

- Applying starter phosphorus (P) fertilizer at rates between 5 to 20 kg P/ha\* did not increase yield or early growth of silage corn compared to not using any starter P.
- This research was conducted on fields with soils that already have **high P levels** and where dairy manure is added every spring.

## HOW CAN THIS RESEARCH BE USED?

- In **high P soils\*\***, and where manure is applied during plowing, starter P fertilizer can be **reduced or eliminated** without impacting silage corn yields. This can save money (by not having to purchase additional fertilizer) and reduces the risk of P pollution to local waterbodies.
- In **low P soils**, we recommend a **“build up and maintain”** P management strategy to raise soil P and corn yield to optimal levels of the region. If manure is applied at plowing at typical rates of the region (around 50 kg P/ha), mineral starter P fertilizer should not exceed 5 kg P/ha.

### \*Note on P and P2O5 application rates

Commercial fertilizer labels show phosphorus concentration in terms of P2O5, and most phosphorus application rate recommendations for B.C. crops are provided in P2O5. To convert from P to P2O5, multiply by 2.29. For example, 5 kg P/ha = 11.5 kg P2O5/ha.


### \*\*Note on high P and low P soils

"High P" refers to fields in this study with more than 140 ppm Mehlich-3 available P (more than 100 ppm Kelowna P). "Low P" refers to fields in this study with less than 50 ppm Mehlich-3 available P (less than 35 ppm Kelowna P).

### Production Type

- Forage

### Practice Benefit(s)

-  Improved nutrient management

### Research Location

- Fraser Valley, BC



**Figure 1.** Silage corn in between the 3-leaf and 6-leaf stage in Chilliwack, BC. Photo by Sylvia Nyamaizi.

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### WHY WAS THIS RESEARCH DONE?

**This research studied how different rates of mineral starter P fertilizer (0, 5, 10, 15, 20 kg P/ha) affect silage corn dry matter (DM) yield, plant P uptake, root growth, and available soil P during the growing season.** These five application rates were chosen based on previous research that found starter P application rates typically used by farmers in this region (30-40 kg P/ha) could be reduced without negatively affecting yield.

In some regions of BC, the amount of P in agricultural soils has reached levels that are concerning for the environment. Surveys have found that many of British Columbia's (BC) agricultural soils are considered to have "high" to "excess" levels of P – meaning that there is more than the amount needed for crop growth. When crops don't use all this extra P during the growing season, it can wash away through surface runoff into nearby water bodies, causing harmful algal blooms that affect both human and aquatic life.

In BC's Fraser Valley, silage corn is typically managed by applying dairy manure at a rate that provides 50 kg P/ha at the beginning of the growing season (at plowing) plus 40 kg P/ha of mineral starter P fertilizer at the time of corn seeding. The mineral P fertilizer applied at seeding is called starter fertilizer and is intended to increase the amount of P available for early plant growth. Because agricultural soils in this area are already high in P and manure is added every year (supplying more P) we wanted to see if mineral starter P fertilizer application rates could be reduced without negatively affecting yield or early plant growth.



**Figure 2.** Harvesting silage corn at the V6 stage. Photo by Sylvia Nyamaizi.

### WHAT WAS THE OUTCOME?

#### *Silage corn yield*

**Corn DM yield was not affected by starter P application rate – even when no starter P fertilizer was applied.** Average corn yield across all starter P rates were within the optimum range for this region (20-25 Mg/ha), with only two exceptions where yield was less than optimal: one site was waterlogged, and another site had lower soil P and also did not have manure applied (due to local restrictions). **These results indicate that when soil P is already high and manure is added every year, optimum corn yield can be maintained without starter P fertilizer.**

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### *Early plant growth*

Early silage corn growth was not affected by starter P application rate. There was likely already enough soil P available for plants from pre-existing high soil P concentrations and annual dairy manure application, so additional P did not improve growth rates.

### *Root growth*

Root length and diameter were not affected by starter P application rates. A sufficient supply of available P early in the growing season (from manure application) likely meant that plant roots could reach P easily and did not need to invest energy into growing long roots.

## WHAT'S NEXT?

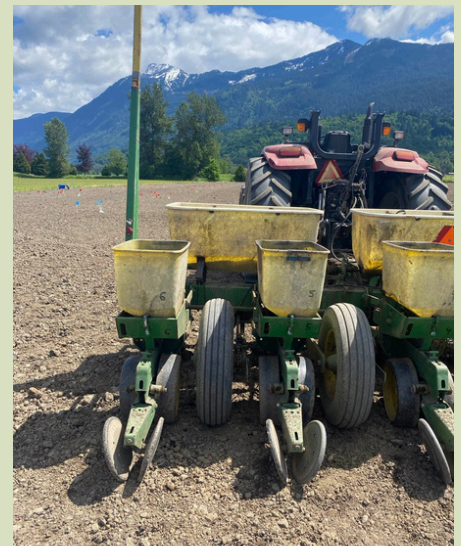
**Our research shows that it is possible to use less or even no starter mineral P fertilizer for growing silage corn in the Fraser Valley.** Using less mineral P fertilizer can save money and reduce the risk of water pollution due to P runoff. Future research should evaluate the effects of not applying starter P fertilizer on plant growth and root activity over a longer period.

## HOW WAS THE RESEARCH DONE?

This study was conducted in Agassiz, Chilliwack, and Rosedale, BC at 4 farms in 2020 and another 4 farms in 2021. To measure soil properties before the start of the study, we collected soil samples (0-30 cm depth) before seeding. The Mehlich-3 extraction method was used to measure available soil P.

At each farm, dairy manure was applied in the spring at 50 kg P/ha (standard practice of farmers in the region) and incorporated mechanically in the soil down to 30-cm depth. The soil was then disked and harrowed to 10-cm depth. Total P content of the dairy manure used ranged from 7.6-11.1 g P/kg dry weight (0.76-1.1% P). One site did not receive any manure due to local restrictions.

Silage corn was planted in late May to early June at a rate of 86,000 plants/ha, with six 75-cm spaced rows in each plot.



**Figure 3.** Six-row corn planter used for seeding. Photo by Sylvia Nyamaizi.

On the same day of planting, we band-applied the five starter P rates (using triple super phosphate) by hand, 5 cm from the seeding row, and then buried it 5 cm deep with a rake to mimic mechanized applications. We side-dressed nitrogen (N) fertilizer (urea) at the V6 stage at a rate of 150 kg N/ha (includes manure N). Post-emergence herbicides were sprayed twice between V3 and V6 stages using Round-up at 1000 g/ha. All other management practices were carried out according to each farmers' typical practices. Each treatment (the five application rates of starter P fertilizer) was replicated four times on each farm.

For plant and root assessment, we harvested plants at the V3, V6, and harvest stages. We recorded fresh weight and then chopped the plants using a shredder. Corn DM yield was calculated using fresh weight, dry weight, and planting density. We took root samples at the V3 (July) and V6 (early August 2020, and mid-July 2021) stages using a shovel around the full diameter of the corn stump. Roots were transported to Agassiz Research and Development Centre, cleaned with water, disentangled, and scanned. We used image analysis software to quantify average root diameter, length, projected area, surface area, and volume.

## ABOUT THIS BRIEF

### This brief is based on the following scientific journal article:

Nyamaizi, S., Messiga, A. J., Cornelis, J.-T., Smukler, S. M., & Cade-Menun, B. J. (2024). Mineral phosphorus fertilization for silage corn in manured soils in the Fraser Valley, Canada. *Agronomy Journal*, 116, 362–379. <https://doi.org/10.1002/agj2.21517>

### Want to learn more?

- For any questions regarding this research, contact Sylvia Nyamaizi at [snyamaizi@gmail.com](mailto:snyamaizi@gmail.com)
- Find resources on nutrient management and soil sampling at [gov.bc.ca/nutrientmanagement](http://gov.bc.ca/nutrientmanagement)

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Funding for this research was provided by Agriculture and Agri-Food Canada through the A-Base program (Project ID: J-002266, Solutions for carryover of legacy P in the Fraser Valley and Hullcar Valley). This research was conducted by Agriculture and Agri-Food Canada (Agassiz Research and Development Centre) and the University of British Columbia (Vancouver).



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Funding for this research brief was provided in part by the governments of Canada and British Columbia under the Sustainable Canadian Agricultural Partnership, a federal-provincial-territorial initiative; additional funding provided by CleanBC.



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