Production management strategies to improve field pea root health in aphanomyces contaminated soils

Aphanomyces euteiches is an important disease of field peas that is caused by a complex of root pathogens. Cultural and chemical controls are available to reduce the adverse impact of this disease on root development, growth and yield, but none of these practices when used individually are highly effective. Utilizing multiple control strategies to limit the effects of aphanomyces may prove the most effective to improve pea root health. This study will help producers identify which management strategies will result in the greatest increase in plant health, crop yield and net profits. This trial was initiated in the spring of 2019 at four facilities throughout Saskatchewan- WARC (Scott), ICDC (Outlook), NARF (Melfort) and WCA (Swift Current). The factors evaluated were herbicide (glyphosate vs. trifluralin), seed treatment (none vs. Vibrance Maxx vs. Vibrance Maxx + Intego), fertility (20 P_2O5 vs. 50 P_2O5, 20 K, 10S) and foliar nutrient application for a total of 10 treatments.

Disease ratings 3 WAP were relatively low across all sites. Disease ratings were highest at Scott and increased by 63% at 7 WAP compared to 3 WAP. The most diseased plants occurred when low fertilizer (20 P) + Gly was used compared to the higher fertilizer applications (50 P, 20 K, 10 S). Disease ratings at the remaining sites (Melfort, Swift Current and Outlook) ranged from very low (0-1) to moderate (2-4) and the trends observed varied across location. In general, it is difficult to confirm a treatment effect based on the disease ratings alone.

Yield was not significantly influenced by any of the inputs applied, except at Scott (P =0.0132). **The highest yields at Scott were achieved by adding higher rates of fertilizer (50 P, 20 K, 10 S) to result in a 9 bu/ac yield gain compared to when low fertilizer (20 P) was applied.** The yield at the three non-responsive sites were combined and compared to the response site (Scott, SK). Yield gains were compared to the lowest yielding combination of Gly + low fertility (20P). The high fertility treatments on average resulted in a 26% increase in yield compared to the low fertility treatments.

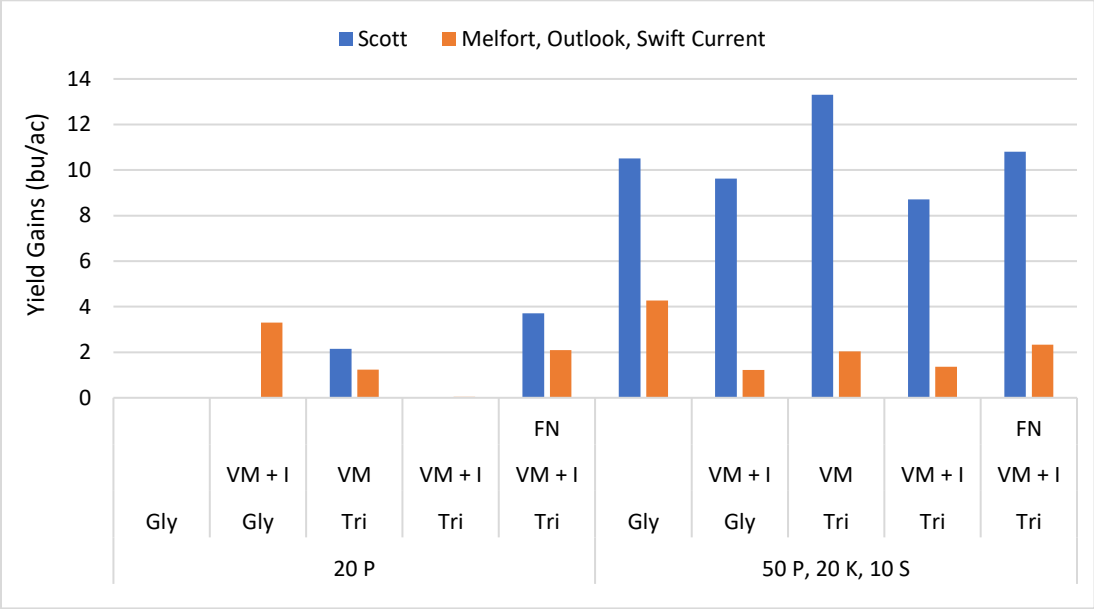

Figure 1. Comparison of the lowest yielding input combination of Glyphosate (Gly) + low fertility (20 P) with no seed treatment (ST) and no foliar nutrient (Fn) to the yields recorded at Scott and the three non-responsive sites (Melfort, Outlook and Swift Current SK) under aphanomyces infected soils.

The effects of fertilizer, particularly inorganic phosphate, and arbuscular mycorrhizal fungi (AMF) on aphanomyces in pea roots has been studied in previous research (Bodker et al. 1998; Thygesen et al. 2004). Arbuscular mycorrhizas are known to enhance plant uptake of phosphate and improve overall plant vigor (Linderman 1994). This enhanced plant development may increase the buffering or tolerance capacity of field pea roots against soil-borne pathogens (Dehne 1982).

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A chemical management strategy of applying a dinitroaniline herbicide such as trifluralin was also found to be an effective strategy. A study by Teasdale et al. (1997) reported that an application of a dinitroaniline herbicide would inhibit the production of motile zoospores and as a result infection would be 2-weeks delayed. This delay resulted in additional plant growth that allowed the peas to better withstand the effects of subsequent disease development. The effects of trifluralin in the current study was less effective than previous studies reported but overall trends indicate that infection may have been slightly delayed. The combination of higher fertility with trifluralin was anticipated to provide the greatest yield and crop tolerance to aphanomyces. This combination resulted in the two highest yields at Scott, the highest at Swift Current and the third and fourth highest yields at Outlook.

In contrast, the use of seed treatment and foliar nutrients were quite variable and do not appear to have a consistent effect on yield, particularly when averaged across all three non-responsive sites as Gly + high fertility resulted in the greatest yield gains. **All sites were combined to determine the most profitable combination: glyphosate + high fertility (50 P, 20 K, 10 S) followed by trifluralin + high fertility (50 P, 20 K, 10 S) + Vibrance Maxx.**

When looking at disease management options in terms of effectiveness and profitability the three most important strategies should include (1) proper fertilization (higher than the current standard of 20 lb/ac of P_2O_5), (2) applications of trifluralin to reduce disease and weed pressure and (3) the application of seed treatments in a wet, cold spring. As this was a dry spring with little disease in the early growing season the effects of seed treatment may not have been reported to its fullest potential. Combining multiple techniques may prove useful as the combination of delayed infection and improved disease tolerance may result in more robust plants. Additional research is required to confirm the most effective and profitable combination of field peas grown under aphanomyces infected soils.

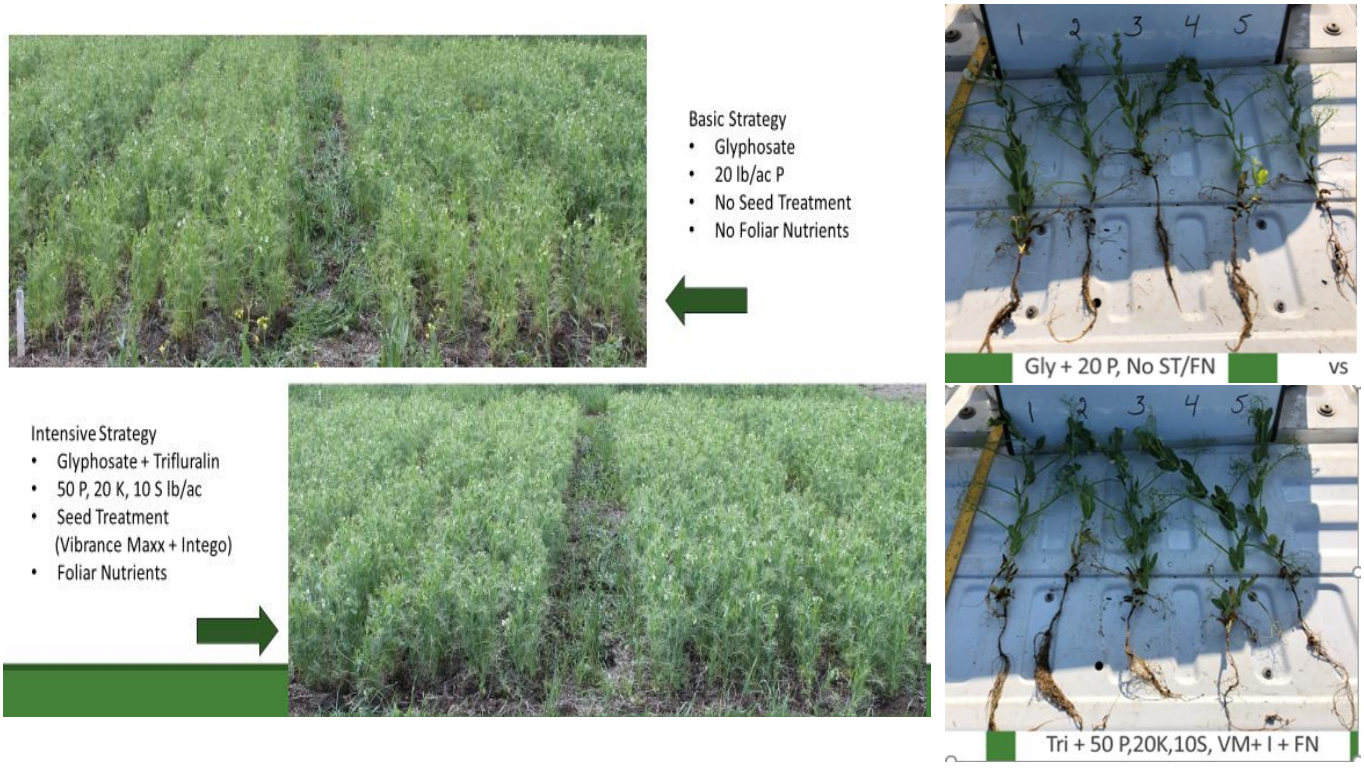

Figure 2. Comparison at 8 WAP of field peas grown on aphanomyces infected soils treated with Glyphosate and 20 lb/ac of P_20_5 (left) compared to trifluralin, high fertility application rates (50 P, 20K, 10S), Vibrance Maxx + Intego and foliar nutrients (right).

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