2021 Premiere Pulse Virtual Series: Pea Questions for Panelists

Ivan Izgagin

- Fertility in Peas: Should we just apply inoculant and not anything else?
  - Yes, inoculant can be only applied and nothing else if fields have a good residual level of nitrates, phosphates, and other nutrients in the sufficient levels. And soil is warm with soil temperatures increasing. But in most of the cases peas are being planted early in the spring with soil temperatures around +3 to +5C. That's why like starter phosphate, starter calcium will help to develop a quicker root system earlier on for the stronger start. It is so important now days that plants have a strong start which will help to fight diseases in all growing stages.

    We always have to remember and look at the removal chart of the crops. Peas can be fertilized like canola or wheat without applying inoculant. But I would suggest doing a farm trial first. Regular soil tests will help to see the variation of nutrients in the soil. Pea average yields on the farm along with soil tests will help to set more realistic yield goals in terms of the fertilization on peas.

    We have seen a decline of nutrient levels more where peas been in frequent rotation with only inoculant application versus canola/wheat/barley as an example.

- What advice do you have for growers on field selection when considering growing peas?
  - Crop field history with average yields along with crop rotation. Yearly accumulation of rainfall not only per farm but for the field areas. History or reports of disease in crops. Herbicide history. Soil test history. Important as well to look at NDVI history. Elevation maps from air seeder, sprayer, combine etc. can be used for the field selection. Google historical images can be helpful. Topography maps with slope, depression, salinity areas can be useful for the pea field selection. Site specific or grid soil sampling nutrient layers can be very useful to see the nutrient levels across the whole field. Especially Calcium/Magnesium Ratio layer map. Calcium is the element which causes the soil particles to move apart for good aeration and drainage. Magnesium makes the particles stick together and infiltration is decreased. With peas being a nitrogen fixer it is important that the soil has good infiltration and porosity. With a composite soil sampling it is harder to see these nutrients distribution across the whole field versus site specific / grid soil testing. If some of those layers are unavailable the Engine Load (%) layer/map from air seeder can be used to see across entire farm where it is harder to pull and where is not. Compaction and higher accumulation of Magnesium and Silt will have a negative impact on pea yields with developing pressure from Aphanomyces.

- What is the main barrier to having agronomists and farmers using agronomic tools tool like disease testing on a regular basis each season?
  - I see that it is a main barrier. To overcome that barrier both parties need to cooperate better together. It is not only about agronomists/farmers doing it for their own knowledge but for both. They have to have an idea together and implement idea as well. Sometimes it is hard just an example to set a trial or so but it needs to be done that both parties can learn from it and move in the right direction. Every growing season is different and that's why we need to learn from it by collection and analyzing data on the farm every season by using different agronomic tools. The more consistent data that is collected the more precise recommendation will be given which will help farm to be more profitable at the end.

Jeff Schoenau

- Is there any research done on the role of sulfur and Molybdenum (Mo) in nitrogen (N) fixation in pulses for rhizobial metabolism?
    - Not specifically for N fixation such as nitrogen derived from the atmosphere (%ndfa) in Western Canada. Trials about six years ago at three sites across SK showed limited response of peas to S fertilization. Responses were greatest for canola, much less for wheat and pea. Difficult to find highly S deficient soil anymore due to widespread use of S fertilizer for canola in past few years, which has built up soil S supply power. Very little work on Mo in Western Canada. We are starting some work this year to look at influence of micros including Mo on pea yield and protein.

- We talk a lot about Phosphorus (P) for pulses but what has been done with Potassium (K) and Sulfur (S)? How important is sufficient supply of these nutrients for optimizing yield and preventing stress? Can K be important for standability?
    - High yielding peas do have high requirements and uptake of K and S but are rather good scavengers for these nutrients. See answer above for sulfur, not much recent work with K but old work typically showed limited grain yield response of peas to K fertilization. Could be some other benefits depending on conditions related to drought tolerance, lodging. Has not been evaluated in recent years. High sensitivity of pea to KCl in seedrow.

- Micros and disease. Can micros (Boron, Zinc, Manganese, and others) influence flower fertility and pod set? Can they impact disease?
    - Some important impacts of micros are their relation to disease incidence (e.g. Copper deficiency and ergot in cereals). Copper (Cu) is the one I think we might have observed a positive effect on yield due to reducing root disease in pea grown in rotation with Cu fertilized wheat, but not verified. Zinc (Zn) deficiency and disease in pea has not been linked nor is Boron (Bo) deficiency something I would anticipate a specific link to a pea disease.

- Calcium and root rots, do you have any thoughts?
    - Direct nutritional limitation of Calcium (Ca) in pea physiology seems unlikely in most SK agricultural soils. Link to disease suppression is not known.

- Why are people promoting Zinc (Zn) with Phosphorous (P) fertilizers if they could work against each other?
    - Because of potential antagonism between P and Zn in uptake and movement in plant. If applying large amounts of P fertilizer to a soil that is even marginal in Zn, should especially consider some application of Zn as well. Also, if applying copper or zinc, need to make sure your P fertility is good.

- Do you think impregnating micronutrients product containing Zinc (Zn) and Copper (Cu) and other nutrients on dry starter fertilizers will help crops roots to access them efficiently or not? Is there any research done on that in our region?
    - Impregnating micros on macro fertilizer granules may help to access due to better distribution of the microelement throughout soil volume for root feeding. This is compared to a granule of a concentrated micronutrient fertilizer that when applied at a rate of one or two pounds per acre results in variable and large distances between granules. Not a lot of research on impregnated micros, mainly soil and foliar applied salts and chelates.

- What is your opinion on in-crop Nitrogen (N) fertility? Say spread-on after herbicide timing or later?
    - I don't think there has been a great deal of benefit shown from post emergent applications of N on peas.
- What do you recommend as a good balanced fertility package for peas, and what is best method of Phosphorus (P)?
    - Start with a soil nutrient availability assessment to see where you stand. Make sure you have conditions for biological Nitrogen (N) fixation optimized (inoculate with rhizobium, grow on stubble low in available N), have some P close to where roots of seedling will be able to access. Pay attention to maximum safe rates for seed-row placed fertilizer. May split: some with seed, rest in band for high rates such as replacement or building. Mobile nutrients like N and Sulfur (S) don't need to be close to seed, best in separate band.

<u>Scott Anderson</u>

- What could I grow instead of peas/lentils for a pulse crop that will work here?
    - I always tell growers that it is best to look into markets for alternative crops first, you want to be sure to have a market for your crop before you decide to grow it. It somewhat depends on your area for this question. Faba beans have been adopted in many areas but they do require quite a bit of moisture for best results so are better suited for areas that are more moist but they are also late maturing so there is a balance of where they will work. Soybean is another crop that needs moisture especially later in the season but has potential depending on your area and typical rainfall patterns. As with anything the weather in any given year has a huge effect on what will and won't be an effective alternative pulse crop but be sure to consult with your local agronomist and grain buyers before jumping in too far.

- My crop looks sick, should I still spray fungicide? Will it help?
    - This is not an easy answer. With respect to root rots in pulses this isn't a cut and dried answer as we don't always know how the crop is going to progress. Certain weather patterns and field considerations could worsen the situation but sometimes the crop actually may push through early stress. Foliar fungicide will not cure root rot so the decision needs to be based on current condition of the crop and future forecast, field history and current foliar disease pressure in the field.

- What is the main barrier to having agronomists and farmers using agronomic tools tool like disease testing on a regular basis each season?
    - I think more and more are doing disease screens on their seed to get an understanding of seed-borne diseases present. Testing for root rots is happening and for presence of Aphanomyces however as with any test the sample is crucial, perhaps the fear of false negatives may deter some testing. Many growers are going off past field history and crop performance when making decisions.

<u>Shaun Sharpe</u>

- Is there seasonal air temp, relative humidity (RH) % rainfall in June & July has any impact on germination & vigour % and its dormancy breakdown in next season?
    - The major drivers for weed emergence are warmer temperatures and adequate moisture. Limited moisture through June/July could result in delayed emergence, particularly for later emerging weeds. If it's a small seeded annual, this could result in increased seed predation or reduced vigor the next season if the seed is short-lived. The impacts of the mother plant on seed dormancy in weeds isn't well studied. Wild oat has demonstrated that drought stress during seed formation can lead to increased dormancy.

- Do you think combining five modes of action (MoA) of herbicides likewise G2+G4+G9+G14+G15 at recommended rate prior to seeding field peas is good practice to combat herbicide resistant (HR) weed spectrum in field or not?
    - Yes, I think this is a good mixture of MoA. The G9 has widespread control (minus kochia), the G4 and G14 will have good activity on broadleaves and exploit pre- and post-emergence control, while the G15 will help with grasses. The G2, while there are more HR than other MoA, is good to include as resistance may not be 100% and will clean up other weedy vegetation as well.

- When applying in crop herbicides in peas what are some recommendations to minimize the yellowing or slight injury that can occur? Is there actual yield loss associated with the injury or is it just visual and an added stress to the crop?
    - For Group 2, timing is fairly critical and narrow. For Imazamox (Davai 80SL) and Odyssey the timing is only 1 to 6 leaf stage. Avoiding hot and humid weather, if possible, should help reduce yellowing. This is likely due to hot and humid conditions helping more herbicide move into the plant when sprayed. The crop should outgrow this initial yellowing but yes, it is an added stress.

<u>Syama Chatterton</u>

- Does rainfall received in September have any impact on Aphanomyces?
    - This is not an important factor, unless it stays wet throughout winter and contributes to high soil moisture in the spring.

- Could Syama please recap the graph on slide 12 explaining oospores and soil texture again?
    - These graphs follow a sigmoidal-type response curve. Generally, very little disease develops at oospore concentrations from 1 – 50 oospores/ g soil. Disease severity starts to increase at this point, until it plateaus at a maximum disease severity level. Maximum disease severity occurs at around 1,000 oospores/g soil. The threshold (to cause visible symptoms) falls between this minimum and maximum number, and on average is at 100 oospores/g soil. However, the minimum, threshold and maximum numbers doses vary by soil type. For example, in a sandy loam soil the number of oospores to reach the threshold is higher than in a clay loam soil. However, we tested soils from 12 locations and each one had a slightly different oospore dose to disease response curve, meaning there are site-specific soil factors that influence disease severity. The reason why the oospore threshold is quite low (e.g. average across all soil types is 100 oospores/g soil) is because one oospore can germinate to produce 100's of zoospores, which then infect the roots.

- Regarding Redvers study do you feel in season rainfall is a major influencer on severity or incidence?
    - Yes, this was the biggest factor for the differences observed at the Redvers site compared to the Taber site. The Taber site also had a longer history of growing peas so inoculum concentration in the soil is higher.

- How does soil pH affect development of root rot?
    - pH is not a big factor in root rot. However, calcium and potassium levels appear to be negatively correlated with disease severity in some studies, e.g. lower disease severity when soil concentrations of these elements are higher.

- We tested a field that was potentially going into peas. It tested double positive and hasn't ever had peas. We checked the rotations and it had alfalfa in 2008. Could that be the problem?
    - This is an interesting and difficult question to answer! Alfalfa is a host of *Aphanomyces euteiches*, and if the field had a long history of alfalfa production, then this would contribute to inoculum levels increasing. It is surprising that the field still tested positive after 12 years! If it was cropped to lentil or had other susceptible host crops or weeds in the interim, this would contribute to maintaining inoculum.

- Do any products that claim suppression of Aphanomyces as seed treatment show benefits throughout the season?
    - Seed treatments provide early-season suppression of seedling root rot, but generally, we are seeing Aphanomyces root rot start to develop ~6 weeks after planting.

- Can any comments be provided on using potassium chloride to help reduce root rots? I think a comment was made in a previous webinar about its effect on Aphanomyces.
    - I can't provide references to any studies that have tested this specifically, but there is some evidence from correlation studies where high potassium levels in the soil were negatively correlated with disease severity. But there have been no published field studies to verify this correlation.

- What is the general risk of Aphanomyces for SW Saskatchewan based on soil type and moisture?
    - The risk is somewhat lower in SW SK because of generally lower precipitation levels, and lower clay soils in some areas. But risk will be field specific, and is really dependent on how many times a field has had a previous pea or lentil crop.

- Field selection has been talked about a lot for minimising root rot risk. In areas where heavy clays cannot be avoided is there anything else that can be considered, other than the fertility, rotation, and field history that has been discussed?
    - At this point, there is not a lot of other recommendations. We are actively researching the potential for using specific crops in a rotation (e.g. mustards, oats) that have been cited in the literature as having an inhibitory effect on oospores, however, I don't have any concrete evidence from those field trials yet. We are also studying whether intercropping with mustards or canola contributes to reducing disease severity and/or improving yields, but early results suggest this won't fix a problem in already-infested fields.

- What is the main barrier to having agronomists and farmers using agronomic tools tool like disease testing on a regular basis each season?
    - I think the largest barrier is a reliable and fast soil test that provides quantitative results! DNA quantification holds the most promise, but it is challenging due to the nature of the oospores in a complex soil matrix. We are also actively working on this problem, and new technologies are changing quickly, so hopefully some new methods that we will be testing will solve this problem.

Tom Warkentin

- Did you consider Zinc uptake acquisition efficiency and its biofortification in seeds of new varieties that will come in future years?
    - We have developed pea lines that are low in phytate and thus which show greater iron bioavailability when consumed by human cell lines and chickens. We are currently testing these in humans. We expect they will likely also show greater zinc bioavailability. We have also recently developed DNA based markers for iron and zinc concentration in pea seeds. Presumably, these are accessions that take up more of these minerals from the soil. We will use these in future breeding activities.

- Where do you see yields going in the future with pea breeding? Is there room for improvement and what is needed to get to higher yields?
    - Independent data showed that pea yields have increased by approx. 2% per year in Western Canada over the past two decades. This is partly due to improvements in breeding and partly due to improvements in agronomic practices. Yes, there is room for further yield increases but it will take concerted breeding efforts.