

Crop Disease Update 2012

IHARF

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What is disease?

- Plant diseases are caused by:
 - Pathogens
 - Fungi
 - Bacteria
 - Viruses
 - Phytoplasmas
 - Nematodes
 - Environmental stress
- Leads to signs and symptoms of disease





What impacts do diseases have?

- Ultimately affect crop quality & yield
 - Reduce root growth/uptake
 - Restrict stem flow





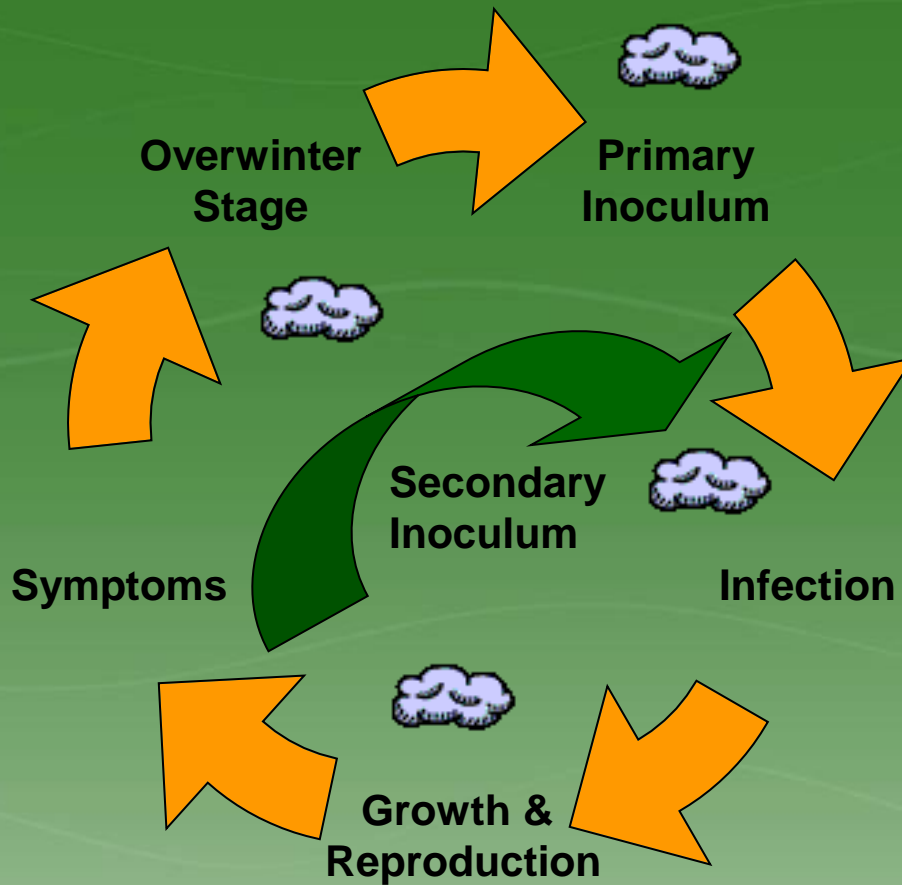
What impacts do diseases have?

- **Ultimately affect crop quality & yield**
 - Reduce photosynthesis
 - Result in flower and head infections





Fungal Facts: why do we see more disease in wet years?



- Most plant diseases occurring in western Canada are caused by fungal organisms.
- Fungi may live as saprophytes (break down dead material) or pathogens (infect/feed on living hosts) or both (opportunistic).
- Various parts of life cycle are favoured by moisture.



Seedling Issues

Yellowing of Various Crops

- Roots need oxygen. When soil is saturated, air pores in the soil fill with water causing roots to function poorly.
- Cool, cloudy growing conditions slow seedling metabolism / photosynthesis.
- When plants are stressed by adverse conditions, they are more susceptible to seedling diseases caused by fungal pathogens that like moisture.
- Yellowing can also be a symptom of other diseases such as Wheat Streak Mosaic Virus or Bacterial Mosaic.





Seedling Diseases

- Root Rots
 - May include damping-off, root rot and seedling blight diseases.
 - Symptoms often involve yellowing, wilting, stunting or death.
- Seed treatments can help depending on the pathogen and growing conditions.
 - But only for 2-3 weeks





Pea Diseases

- *Mycosphaerella* blight is the most common disease on peas in SK.
- *Ascochyta* complex includes:
 - *Mycosphaerella* blight
 - *Ascochyta* leaf and pod spot
 - *Ascochyta* foot rot
- Other diseases include root rots, powdery and downy mildew.





Lentil Diseases





Stemphylium Blight

- Fungus, *Stemphylium botryosum*, survives as a saprophyte.
- Prefer warm temp (above 25) but will germinate in cool temp (produce multiple germ tubes).
- Min 8 hrs leaf wetness (but retains infectious ability in 6- to 24-hr dry).
- Fungus feeds on water and nutrients, killing the plant cells (blighting).
- Leaves may drop off early and cause the plant to ripen earlier.





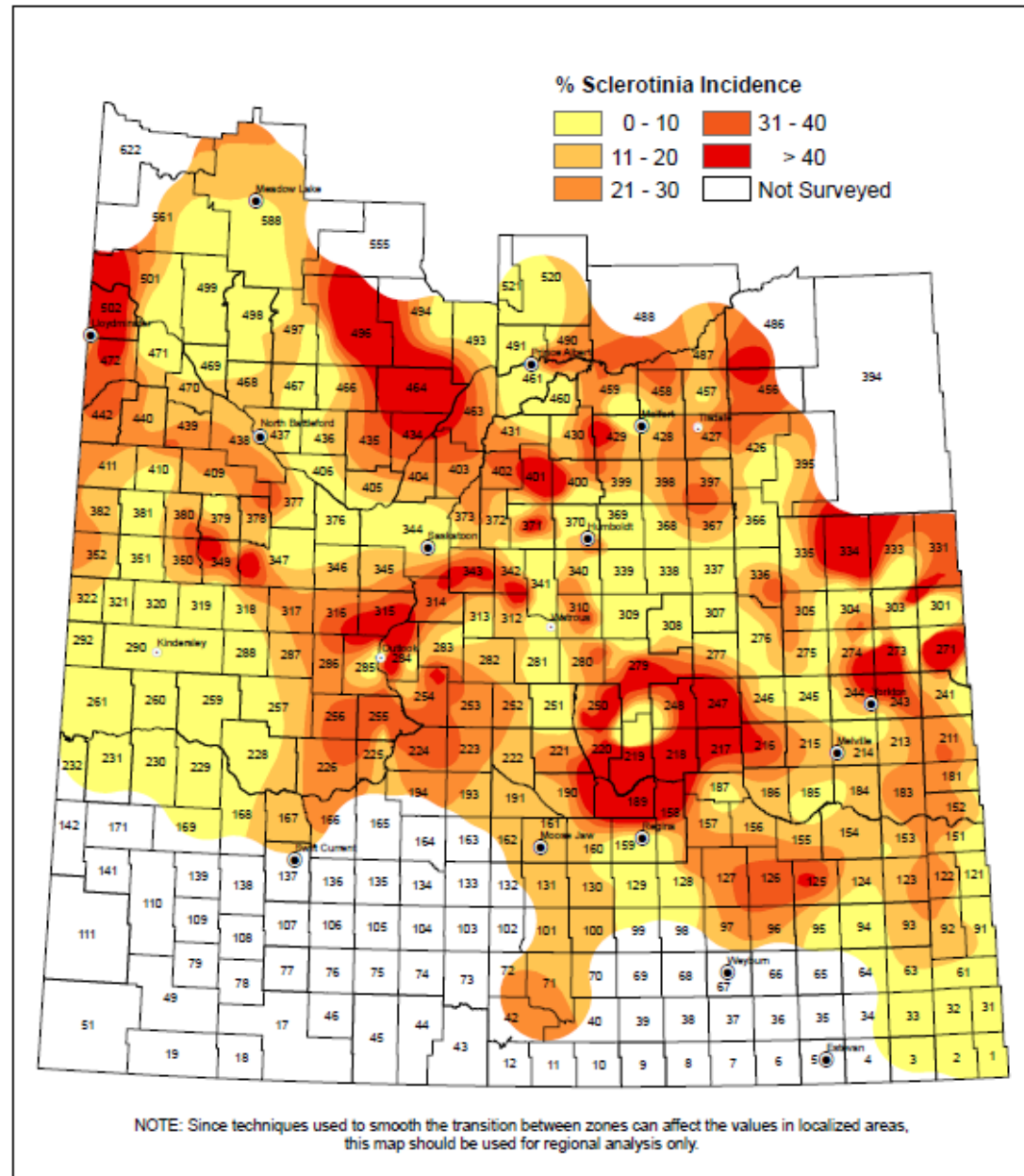
Sclerotinia

- Sclerotinia affects various broadleaf crops in SK.
- For canola, pathogen must infect the petals first in order to cause disease.
- For lentils, mould can grow from sclerotia in soil and plant-to-plant contact.
- Infection leads to a soft rot, and eventually bleaching, shredding, molding, and sclerotia formation.



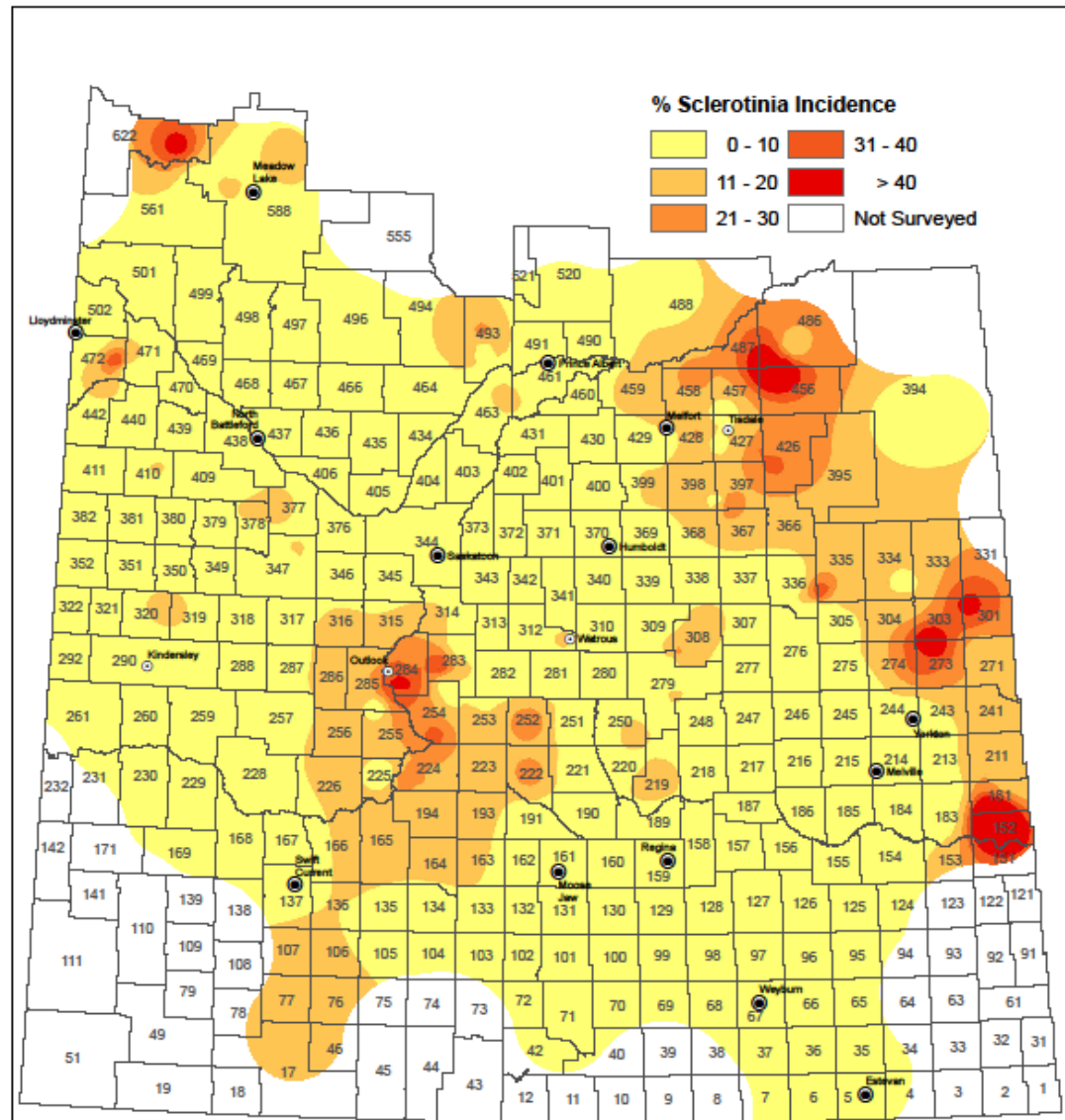


Average Per Cent Sclerotinia Incidence in Canola - 2010





Average Percent Sclerotinia Incidence in Canola - 2011





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Canola Diseases: Blackleg



Blackleg has been decreasing in western Canada with use of resistant varieties. However, the disease is still out there and is often associated with hail damage. It is important to ensure good resistance stewardship (crop rotation).

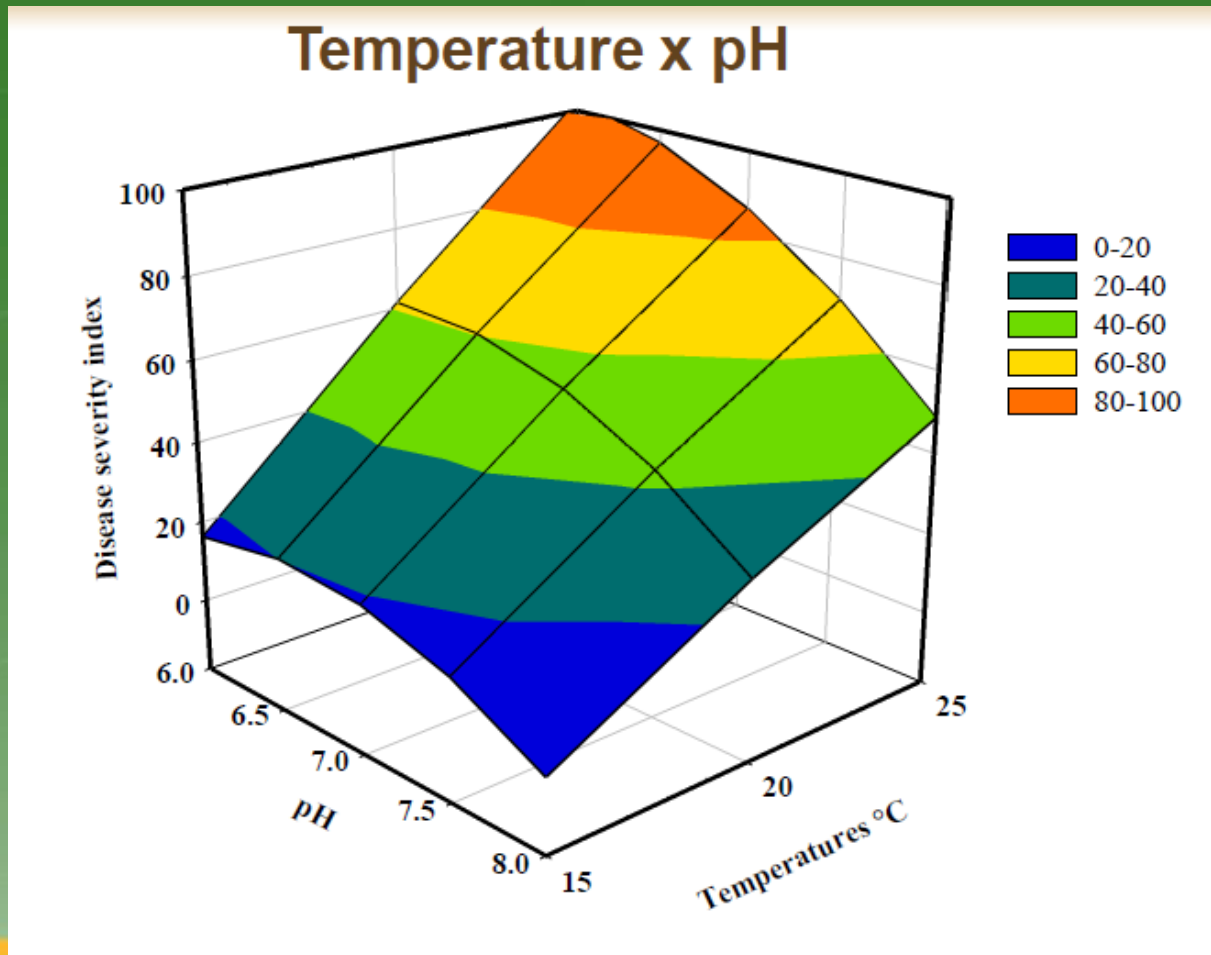


Clubroot Risk

		Level of Risk for Clubroot		
		Low		High
Importance of Risk Factor	↑ Very Important ↑ Important	Good crop rotation with canola no more than once every 4 years.	Sometimes grow canola every 2 to 3 years.	Have grown canola 2 or more years in a row.
		Sanitation procedures are regularly followed.	Some sanitation procedures in place.	No sanitation procedures.
		You scout crops regularly for disease and have not seen clubroot symptoms.	You sometimes scout crops and investigate unusual symptoms.	You rarely scout crops or investigate unusual symptoms.
		Regardless of soil conditions, clubroot risk will be lowered with sanitation and good crop rotations.	Dry years may reduce disease High soil pH will not prevent clubroot.	Wet years may increase disease Low soil pH may increase clubroot.



Environment for Clubroot





Clubroot Detection

Wilting, Stunting, Yellowing

- Visible at late rosette to early podding stages - wilting more noticeable on hot days
- May also cause seed shrivelling

Premature Ripening

- Patches are most likely the first thing we would notice at high disease levels

Root Galls

- Dig up plants, check the roots

DNA Testing

- Soil or plant roots can be tested for clubroot DNA using a PCR test

Clubroot Confirmation

- Must observe disease symptoms in a susceptible crop (either in the field or through bioassay) and detect the pathogen's DNA in a plant or soil sample, in a laboratory.



Clubroot symptoms in Alberta



Clubroot in SK?

- Above-ground symptoms:
 - The Ministry coordinates annual canola disease surveys for the province. We have surveyed over 800 fields in the last 5 years and have not observed any clubroot-related symptoms on canola crops in SK during any of these surveys.



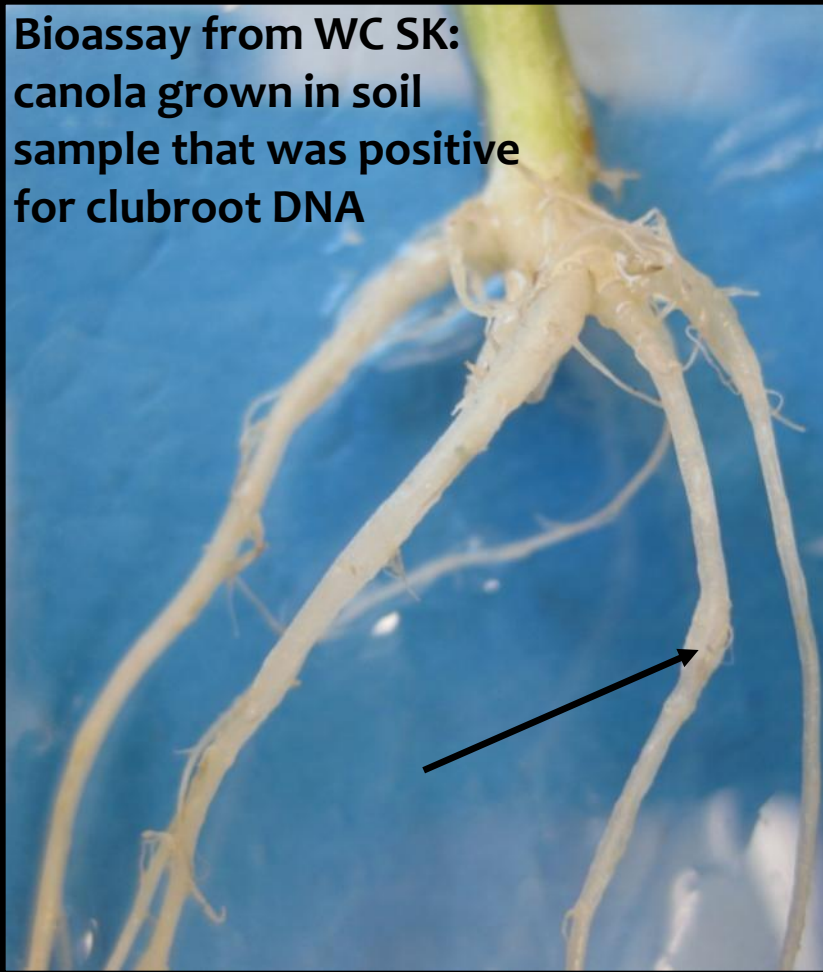


Clubroot in SK?

- Pathogen in soil:

- The Ministry also provides leadership and legwork for the clubroot soil surveys (AAFC Clubroot Risk Mitigation Initiative), sampling over 250 fields so far.
- *Plasmodiophora brassicae* was detected in a soil sample from one field surveyed in west central SK in 2008. Was not a declared pest at that time.
- We continue to collect soil samples in our survey and have had no confirmed positives since 2008.

Bioassay from WC SK:
canola grown in soil
sample that was positive
for clubroot DNA





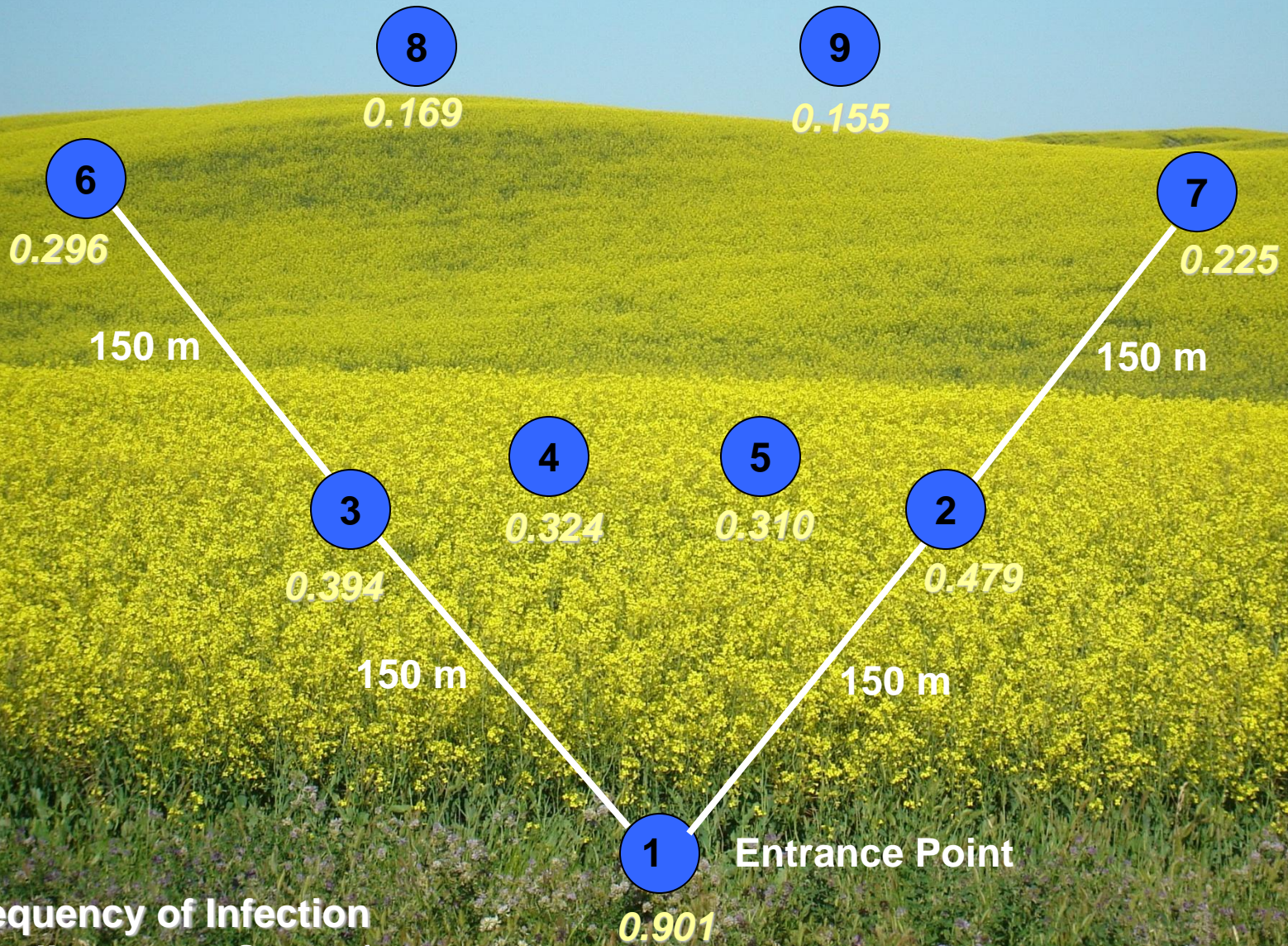
Clubroot in SK?

- Root symptoms:

- While evaluating plants at two locations in north central SK in 2011, Cargill researchers observed bumps on canola roots that tested positive for the clubroot pathogen, *P. brassicae*.
- We also check random plant roots (100 per field) in our canola disease survey but have not found any clubroot symptoms (yet).



The importance of soil as a transport for disease:



Frequency of Infection
(Strelkov, 2006 Survey)



Aster Yellows

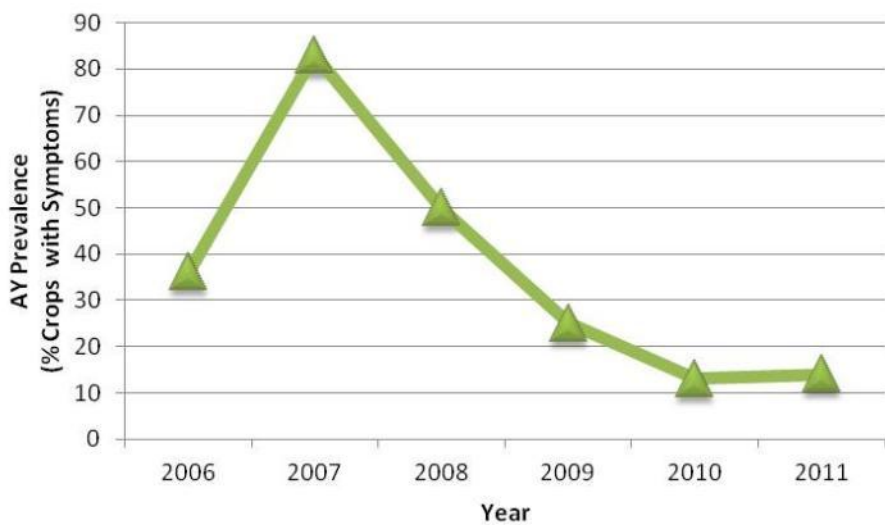
- Not a new disease
 - Highest incidence since 2000 was in 2007 – province 2%
 - Northeast had incidence of 3% aster yellows in 2007
 - Provincial average was 2% with fields up to 15% and pockets within fields $\geq 40\%$ disease incidence in 2007
 - Worse if near shelterbelts or alfalfa stands



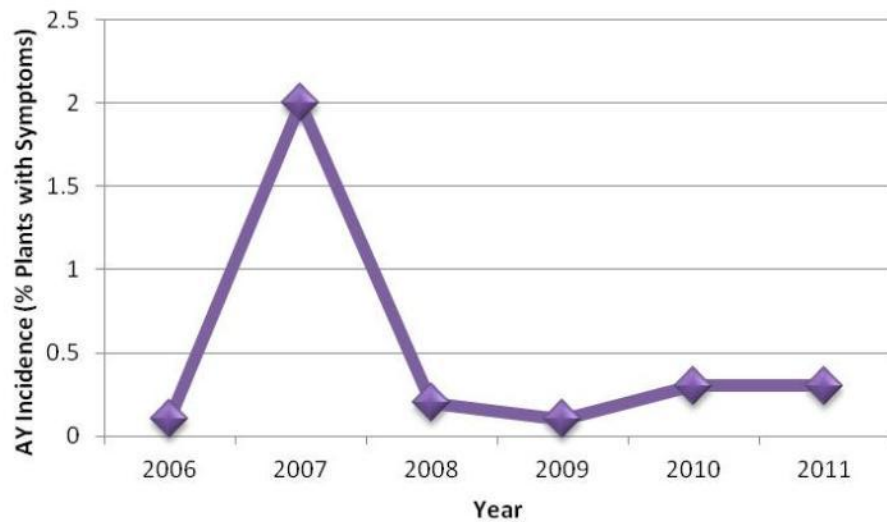
Aster Yellows in SK



Prevalence 2006-2011



Incidence 2006-2011





- Caused by a phytoplasma
 - Between a virus and a bacteria
- Spread by insect vector
 - Main vector is the aster leafhopper
 - Leafhopper can over-winter in SK or blown in from USA
 - There was an increase in leafhoppers this spring (2007) as well as an increase in the number that were carrying the phytoplasma (correlation?)





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Information provided by:
C. Olivier, B. Galka
~ AAFC-Saskatoon

- Most common on canola in SK
- Can also infect cereals \Rightarrow don't usually develop symptoms
- Carrot, potato, coriander, various garden vegetables and weeds can also be affected

Photos: MAFRI



Carrot and Echinacea



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Aster Yellows on Canola



Photos: C. Olivier, AAFC



- Pathogen has been found in canola seeds
 - 1 infected plant
⇒ 30-70% misshapen seeds ⇒ 30-70% yield loss
 - Seeds that are harvested are not a concern if sold into for oil
 - But if keeping seed for planting:
 - 0% of the misshapen seeds germinated
 - 50-90% of the normal looking seeds germinated BUT seedlings were malformed ...





Aster Yellows Management

- Not economical to control leafhoppers
 - Leafhoppers are active flyers
 - Takes about 3 weeks for symptoms to develop in plants
 - Takes 2-4 weeks for leafhopper to be able to transfer phytoplasma
... too late to spray leafhoppers once see symptoms
- No “fungicides” available
- Varietal resistance?
 - Doesn’t appear to be variability between canola lines
 - Differences in severity between fields more likely due to planting date, moisture, leaf hoppers



Cereals: Leaf Spots



- In provincial cereal surveys, Leaf spots are generally observed in all common and durum wheat crops sampled.
- Pathogens in order of most prevalent isolations:
 - *Pyrenophora tritici-repentis* (tan spot)
 - *Stagonospora nodorum* (septoria leaf complex)
 - *Cochliobolus sativus* (spot blotch)
 - *Septoria tritici* (septoria leaf complex)
- Spraying can be most beneficial if applied at flag leaf stage (to protect yield).
- If you miss the ideal application stage, only spray if disease pressure is high and good crop value (adjust expectations of disease control vs economic impact), and no later than end of flowering.



Cereals: Rusts

- Leaf and stripe rust were at higher levels in 2011 than in previous years.
- Stripe rust likely overwintered here last year resulting in earlier infection and greater severity. Possible in 2012.
- Generally prefers cool wet conditions, but new strains may be better suited to warmer temperatures.
- Usually the pathogen must travel here from the Pacific Northwest United States. We can monitor their disease situation and prevailing winds to determine rust risk.



Can also impact grain quality:
pustules form behind glumes; may
be mistaken for other issues



Photo by: K. Turkington, AAFC-Lacombe



Stripe Rust

- Potential to be more damaging than leaf spots. However, if infections occur later (either early seeding or if the disease does not overwinter here but arrives late from the USA), stripe rust will not be as damaging.
- Fungicide application is generally appropriate for stripe rust under the following conditions (Tom Fetch, 2002):
 - When you grow susceptible or very susceptible varieties (refer to preliminary ratings in Seed Guide).
 - When high yield (45 bu/ac or more) is expected.
 - When rust is present before heading and/or is at high levels.
 - When weather conditions are expected to be favourable for rust (18-24°C at night) – will know more with research on the rust population in Sask.
 - Like with any fungicide, spray only if expected net return per acre is positive.

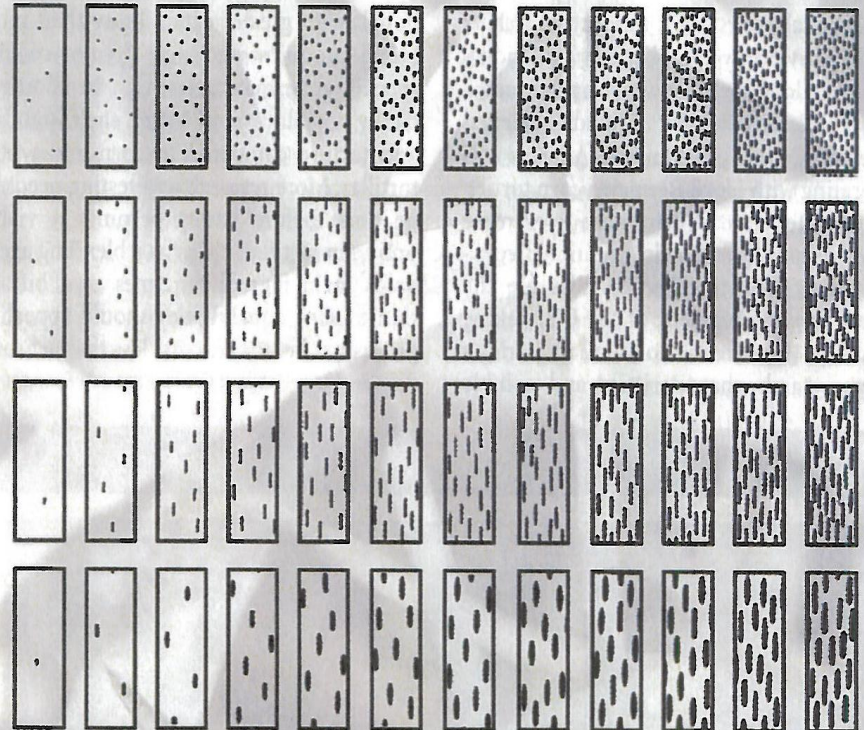


Stripe Rust

- Incidence = % of plants affected
- Severity = % tissue affected
- General rule of thumb: every of 1% rust severity has the potential to cause 0.25 to 0.5 bu/ac yield loss.
- Assess the crop and focus on FLAG leaf:
 - At the jointing to boot stage, spray if at least 5% incidence and 3% severity.
 - At the heading to flowering stage, spray if at least 10% incidence and 5% severity.
 - At the milk stage, and only if fungicide PHI allows, spray if at least 20% incidence and 10% severity.
- If NO pustules are observed, spraying is not necessary.
- If rust appears late (dough or later), it is unlikely to cause economic losses.
- If rust is TOO severe to control (80% incidence and 70% severity), spraying is not recommended.

USE THIS CHART TO ESTIMATE RUST SEVERITY

Match these diagrams to the rust infection in your cereal crop to estimate rust severity. Rust pustules are represented by the dark spots in each diagram. The top 2 rows, with smaller pustules, correspond more to leaf rust and crown rust infections. The bottom 2 rows, with larger, longer pustules, are typical of stem rust. Numbers in row A indicate the actual percent of leaf coverage by rust pustules. Numbers in row B, which pathologists use to estimate severity, should also be used by growers to estimate rust severity during the growing season.



A	0.37	1.85	3.7	7.4	11.1	14.8	18.5	22.2	25.9	29.6	33.3	37.0
B	1	5	10	20	30	40	50	60	70	80	90	100



Fusarium Head Blight

- Cereal head infection by fungal spores is favoured by moist, warm conditions during flowering.
- Symptoms may occur on the entire head or on just a few spikelets and can result in the formation of fusarium damaged kernels.
 - FDK are typically shrivelled, light in weight, and white or pink in colour. It is because of these attributes they are named "tombstone kernels".





Fusarium on Seed -> FHB?

- Infected seed does not cause FHB in that crop, but can decrease emergence and cause seedling blight and introduce the pathogen for future FHB infections.
- Fusarium Head Blight (FHB) is caused by spores blowing and splashing off crop residue.





Cereal Diseases: Ergot

- Conditions have been favourable for ergot since 2008 in some areas
 - Uneven crops with extended period of susceptibility (open florets, self-sterile plants)
 - Adequate moisture for germination of sclerotia causing initial infections
 - Secondary spread through ‘honey-dew’ stage (rain splash, insects)
 - 2009 and 2010 not as many reports of ergot but 2008 and 2011 widespread concerns
 - No seed treatments, fungicides, or other foliar applications are effective (copper only on deficient soils)





Integrated Disease Management Tools

- Crop rotation & disease tolerant cultivars
- Prevention & sanitation measures
- Seedling health & seed treatments
- Crop scouting & foliar fungicides
- Good record keeping & planning





Disease ID Resources

- Diseases of Field Crops in Canada
 - Information on all crop diseases and photos
- Ministry of Agriculture fact sheets
 - Various crops/diseases/photos online
 - Crop Production News during the field season
- Canola Council of Canada – Canola Watch and website; Saskatchewan Pulse Growers' updated Pulse Grower Manuals
 - Guidelines on all aspects of pulse agronomy including disease scouting and photos



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Weyburn- (306) 848-2857

Watrous- (306) 946-3220

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Swift Current- (306) 778-8285

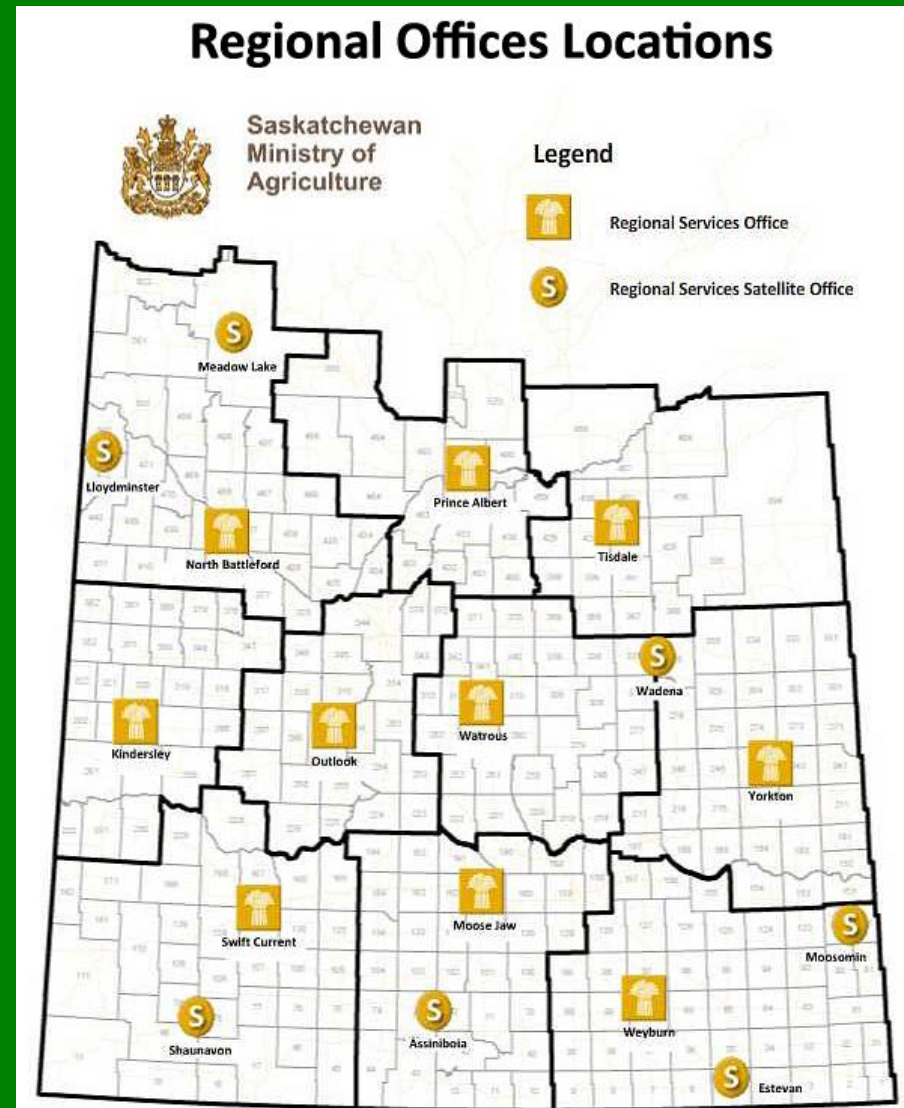
Moose Jaw- 1-866-457-2377

- Agriculture Knowledge Centre:

1-866-457-2377

- Ministry Website: www.agriculture.gov.sk.ca

- Clubroot.ca website



Thank you!

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