Prairie Crop Disease Monitoring Network
Sclerotinia Stem Rot Assessment Protocols
Summer 2021

1. General

During late June and July, crop scouting in canola is critical for assessing sclerotinia stem rot risk and gauging the need for and timing of an in-crop fungicide application. However, late season crop scouting is also important as it can be used to assess the prevalence, severity and impact of this disease issue. Where unsprayed check strips or areas have been left in the field, late season assessments can be used to assess the impact and benefit of spraying in relation to sclerotinia stem rot management and crop productivity. When assessing sclerotinia stem rot incidence and severity, **it is critical** to correctly identify symptoms of stem rot and differentiate these from normal or premature canola crop ripening due to a range of abiotic and biotic factors.

2. Timing

It is critical to assess end-of-season stem rot levels at the correct growth stage. Assessment of stem rot becomes very difficult if plants have started to ripen. Table 1 outlines the recommended stage to assess end-of-season sclerotinia stem rot levels. For sclerotinia stem rot just prior to swathing, i.e. GS 5.3 or just prior to when you have ~60% seed colour change (Harper and Berkenkanp 1976; CCC 2012), is ideal to assess the final level of disease. If the canola canopy and stem and branch tissue are starting to turn colour then assessment of sclerotinia stem rot is problematic as it may be difficult to differentiate sclerotinia infections from healthy, but senesced plant tissue.

Table 1. Growth stage information for assessment of sclerotinia stem rot of canola.

Growth stage for collection/assessment	Description of growth stage
Harper and Berkenkamp (1975) – growth stage 5.3, or just prior to 60% seed colour change. Depending on the seeding date this stage will typically occur in early to mid-August and usually just prior to the crop being swathed.	GS 5.3 is typically when seeds in the lower pods are starting to turn colour, i.e. "5.3 Seeds in lower pods green-brown mottled". More recent information indicates that swathing is recommended when you have an average of 60% seed colour change (CCC 2012). Thus, assessments should be done within 7 days prior to 60% seed colour change.

3. Sclerotinia stem rot assessment sampling sites

When assessing late season sclerotinia stem rot disease levels, one should look at a representative sample of plants throughout the field. For example, **a minimum of 4-6 sites** should be looked at in a quarter section field; with a minimum of 25-50 plants assessed at each site. Half or full section fields will require more sites. If the field is quite variable then separate assessments in specific areas may be needed, e.g. lodged versus non-lodged. Assessments can also be made in sprayed versus unsprayed areas to determine the usefulness and benefit of in-crop fungicide applications. Leaving unsprayed checks, even small areas, can be quite useful to assess the impact and role of in-crop fungicide applications.

There are a variety of recommended patterns that one can follow for the assessment of sclerotinia stem rot. One of the most common ones to follow is a "w-shaped" pattern in a field starting from one side and moving towards the opposite side of the field (Figure 2a). Along this "w-shaped" pattern one can assess plants at several points along the path. Ideally you should avoid the headlands of the field as these areas may have somewhat different crop development due to double seeding and fertilization, compaction, or impacts due to tree lines along field edges. Individual sites along the "w-shaped path can be spaced according to the purposes of the assessments. If it is just to get a general idea of sclerotinia stem rot levels then the total length of the path should be at least 400-500 feet long with approximately 50-100 feet between sampling points (Figure 2a). In contrast, if one is interested in a more thorough assessment over the entire field, then more sampling points and time may be needed. Here the "w-shaped" pattern should cover most of the field going north to south and east to west (Figure 2b). If your field has an unusual shape due to water courses and/or bodies, etc., then modify your sampling pattern accordingly (Figure 2c). At each sampling point, randomly assess a minimum of 25-50 plants for sclerotinia stem rot level.

An alternative pattern that can be used to get a general idea of stem rot levels is to follow a "diamond-shaped" path starting past the field headlands (Figure 3). The main reason for a "diamond-shaped" path is that it ensures that you exit the field at the same location where you entered the field. This will help to shorten the time it takes to sample a field and avoid any unnecessary walking. Along the "diamond-shaped" path randomly assess a minimum of 25-50 plants at a minimum of 4-6 locations. Make sure the total sampling path is at least 400-500 feet in length. If you are interested in a more thorough assessment for the entire field, the size of the "diamond-shaped" pattern can be increased to cover a larger area.

4. Assessment of sclerotinia stem rot incidence and severity

Overall, the concern is in relation to the incidence and severity of sclerotinia stem rot on individual plants. Typical symptoms of stem rot can be found in the PCDMN disease info cards or other PCDMN information on differentiating stem rot from other issues in a canola crop (see

links below). For farmers and consultants assessment of the incidence of main stem and branch infections may be sufficient. However, it may be useful to also assess severity, from which incidence values can be derived. Individual canola plants may be comprised of a single main stem, while some varieties may have several main branches originating from the plant base and thus comprise a single plant. For these multi-branched standing plants any one single infected branch would mean the entire plant is infected.

Links to information to assist in the identification of sclerotinia stem rot symptoms and differentiating those from other plant symptoms due to various biotic and abiotic factors or healthy canola plants.

1. PCDMN sclerotinia stem rot disease info card: https://drive.google.com/file/d/1049a-UAekFLxRxxlDFiEIH90hSZXFPWN/view?usp=sharing;
2. PCDMN sclerotinia stem rot scouting tweet, August 2019: https://twitter.com/pcdmn/status/1160706605391859712;
3. PCDMN sclerotinia stem rot risk assessment and identification tweet, June 2019: https://twitter.com/pcdmn/status/1143545235789811712;
4. PCDMN sclerotinia stem rot identification guides, August 2021: https://drive.google.com/file/d/1IdWH9Wgc1alQBVs146jC_48F-wNmjFbT/view?usp=sharing.

When evaluating sclerotinia levels it is important to ensure that plants are assessed at random. Unfortunately, there is a natural tendency to gravitate and focus on plants with symptoms. Try to avoid this by assessing plants non-selectively along the sampling path. One way to do this is when you reach a sampling point you can pick a spot in the canopy at random. At this point one can move along a single row or along 2-3 rows assessing individual plants along the individual rows. If the field lacks distinct rows due to the type of seeding system and openers used, then one can follow a 12-18 inch wide path and assess the plants along this path at each sampling site. It is usually helpful to hold the plant at the top and scan all sides of the canola plant from the soil surface to the pods and note any symptoms. A rating based on the Kutcher and Wolf (2006) scale can then be recorded for the plant and then one can move onto the next plant to be assessed. Sometimes it helps to have two people doing the ratings; one individual examines and rates the plants, while the other person records the ratings and keeps track of the number of plants assessed. Alternatively, one can pull individual plants, examine them from stem base to the pods, and then put individual plants into piles for each rating category. Note when pulling plants the farmer must be willing to permit destructive sampling in their field(s). Once all plants are rated for a site then you can count the number of plants in each pile and record these values.

One suggested alternative for producers and consultants would be to examine the plants and note how many are infected regardless if they have a rating of 2, 3, 4, or 5, while one can ignore pod symptoms. To facilitate this, especially with one person doing the ratings, the assessor can mentally count the number of plants, but then use a mechanical clicker counter to tally the

number of plants with symptoms that range from 2-5 on the Kutcher Wolf (2006) scale. Here the clicker counter is engaged each time an infected plant is encountered. Once the desired number of plants are counted, the assessor can record the number of infected plants using the number displayed by the clicker counter. One word of caution, **always reset the clicker counter to zero before starting assessments at a new individual sampling site**! Clicker or tally counters are available from a number of retail locations either in their stores or online (e.g. https://www.staples.ca/products/12367-en-staples-tally-counter; https://www.grainger.ca/en/category/Mechanical-and-Hand-Tally-Counters/Counters-and-Hour-Meters/c/28871, https://www.princessauto.com/en/detail/tally-counter/A-p8654741e). **Note mention of a particular retailer does not imply an endorsement of the retailer.**

Assessments can be done in the field and data recorded using a small notepad and pencil or alternatively recorded onto a smart phone using a note app or a mini spreadsheet app. Make sure to label the assessments according to date, growth stage, field, and sampling point. Moreover, it may be a good idea to draw a small map to show the approximate areas where the sampling was performed. One can also use a GPS mapping app to identify the sampling point and this GPS value can be noted or copied and recorded electronically.

Once all plants been examined and assigned a rating, one can calculate an average incidence value by taking the number of plants with any symptoms, dividing this value by the total number of plants assessed, and multiplying the resulting value by 100 to get the incidence of stem rot infected plants. Average percentage severity values can be calculated by using severity ratings for individual plants and the formula as follows:

> =(sum of the number of plants rated as a "1" multiplied by 1 + sum of the number of plants rated as a "2" multiplied by 2 + sum of the number of plants rated as a "3" multiplied by 3 + sum of the number of plants rated as a "4" multiplied by 4 + sum of the number of plants rated as a "5" multiplied by 5). The resulting value can then be divided by the total number of plants assessed to give % stem rot severity.

Calculations for incidence and severity can be done for each individual site or the area of the field sampled or for the entire field, or for sprayed versus non-sprayed areas.

Rules of thumb have been developed to estimate potential yield loss from sclerotinia stem rot. Note that lower stem or branch lesions will have the largest impact on individual plants and the greatest potential to reduce total plant yield. Yield losses from upper canopy pod or inflorescence infections have much less impact. To estimate potential yield loss from stem rot focus on the main stem and branch symptoms, i.e. rating categories 2-5 on the Kutcher and Wolf (2006) scale (Table 2). Note one should only take the number of plants rated as being in categories 2-5 and divide by the total number of plants assessed and multiple this by 100 to get the incidence of stem rot infected plants (main stem or branch infections only). This value allows one to focus on infections that have the largest impact on yield. You can then estimate %

yield loss by multiplying the percentage of infected plants (using only rating categories 2-5, Kutcher and Wolf [2006]) by 0.5 to derive the potential % yield loss that is expected based on rules of thumbs from Morrall et al. (1984) and Davies (1986). For example, if 20% of the plants have a rating of 2-5 on the Kutcher and Wolf (2006) scale, then you can expect a 10% yield loss, i.e. 20% infected plants (only those rating a 2-5) x 0.5 = an estimated yield loss of 10%.

Please note that the conversion factors for % yield loss due to sclerotinia stem rot in canola focus primarily on infections of the main stems and branches and should be viewed as a general rule of thumb, which can be used to derive a rough estimate of potential yield loss.

References

CCC. 2012. Canola swathing guide. CCC 042 (15-10-12), Canola Council of Canada, Winnipeg, MB. Available online: https://www.canolacouncil.org/media/530966/canola_swathing_guide.pdf.

Davies, J. M. L. 1986. Diseases of oilseed rape. Pages 195-236 *in* D. H. Scarisbrick and R. W. Daniels (Eds.) Oilseed rape. Collins, London. 309 pp.

Harper, F.R., and Berkenkamp, B. 1976. Revised growth-stage key for *Brassica campestris* and *B. napus*. Can. J. Plant Sci. 55: 657-658.

Morrall, R. A. A., Dueck, J., and Verma, P.R. 1984. Yield losses due to sclerotinia stem rot in western Canadian rapeseed. Can. J. Plant. Pathol. 6: 265 (Abstr.).

Table 2. Rating scale for sclerotinia stem rot assessments (Kutcher and Wolf 2006).		
Individual plant disease rating	**Location of lesion on the plant**	**Symptoms**
5	Lower	Main stem lesion with potential effects on seed formation and filling of entire plant
4	Upper	Lesion situated on main stem or on a number of branches with potential to affect up to 3/4 of seed formation and filling on plant
3	Upper	Lesion situated on main stem or on a number of branches with potential to affect up to ½ of seed formation and filling on plant
2	Upper	Lesion situated on main stem or branch(es) with potential to affect up to 1/4 of seed formation and filling on plant
1	Pod	Infection of pods only
0	None	No symptoms
Rating scale for assessing the incidence and severity of sclerotinia stem rot of canola for each individual plant. Taken from Kutcher, H.R. and T.M. Wolf. 2006. Low-drift fungicide application technology for sclerotinia stem rot control in canola. Crop Protection 25: 640-646.		

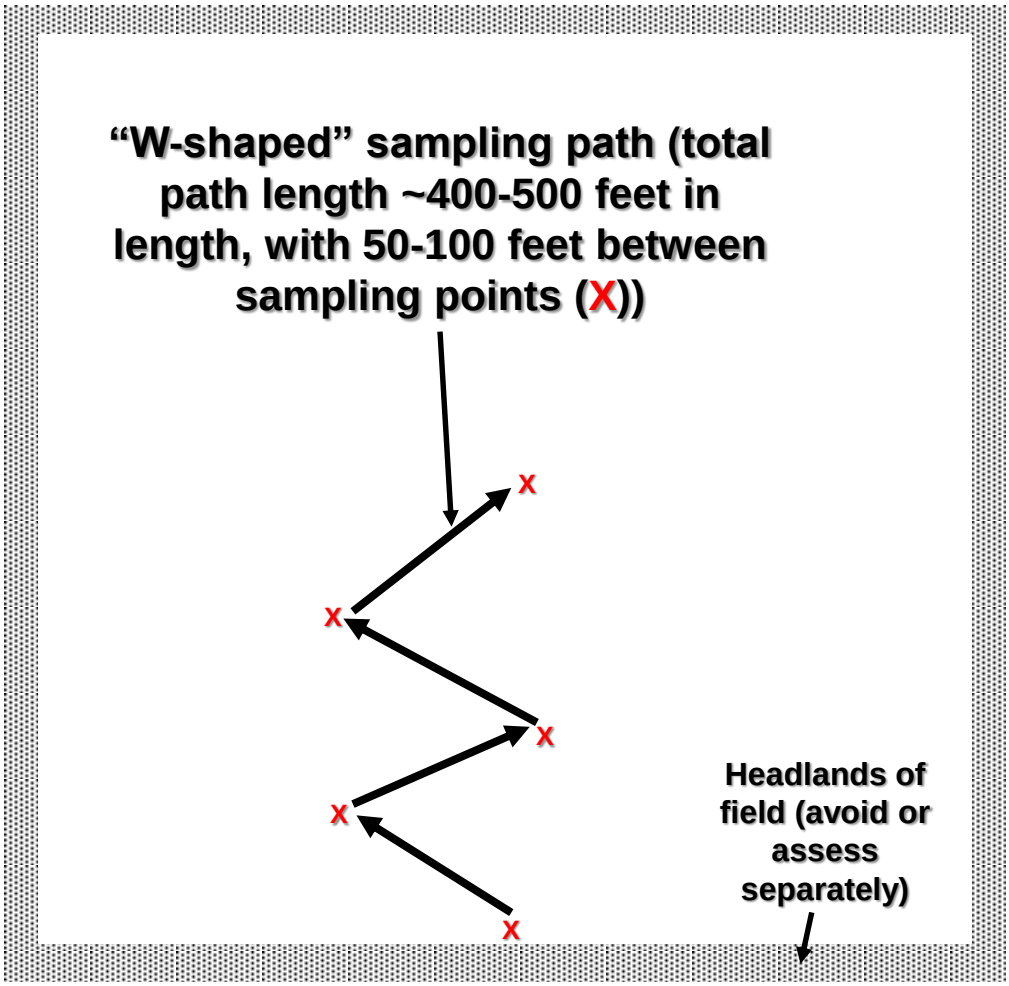

Figure 2a. Suggested "W-shaped" sampling pattern for a quick general assessment of canola plants.

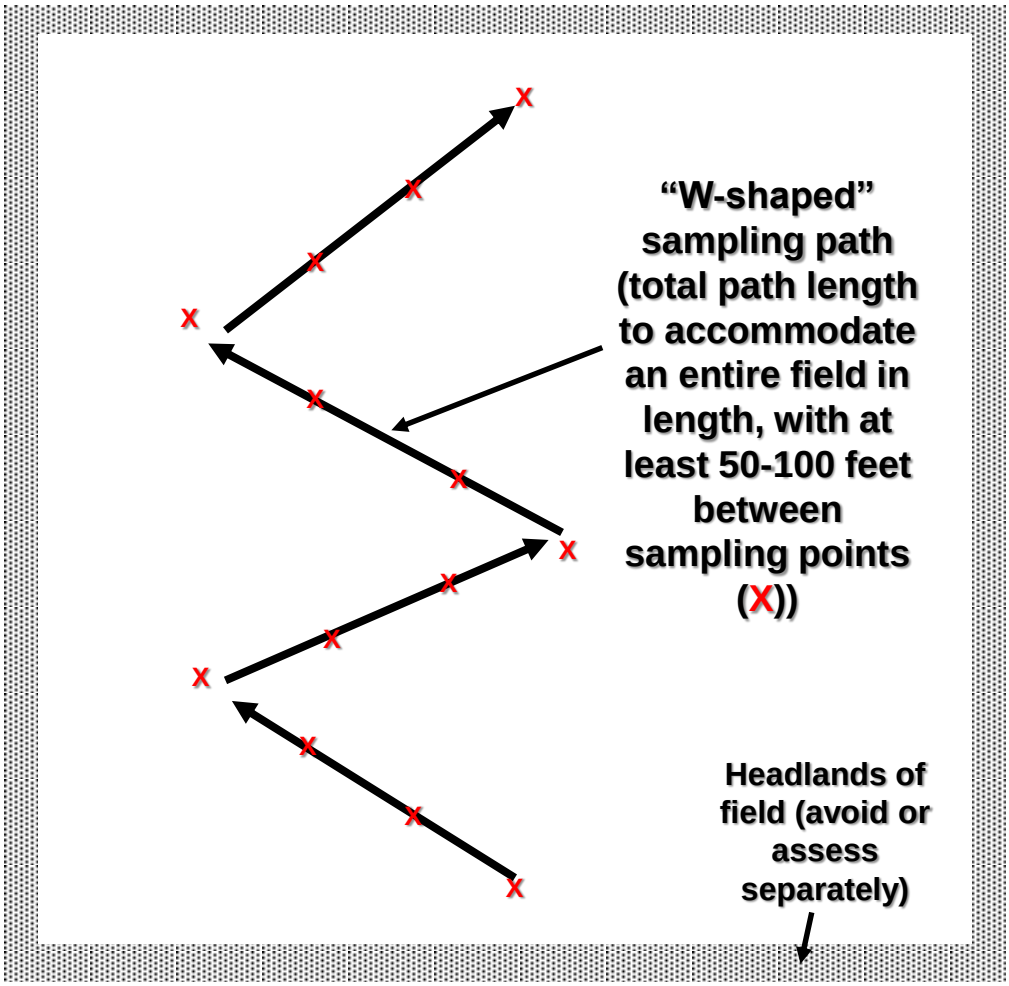

Figure 2b. Suggested "W-shaped" sampling pattern for more thorough entire field assessment of canola plants.

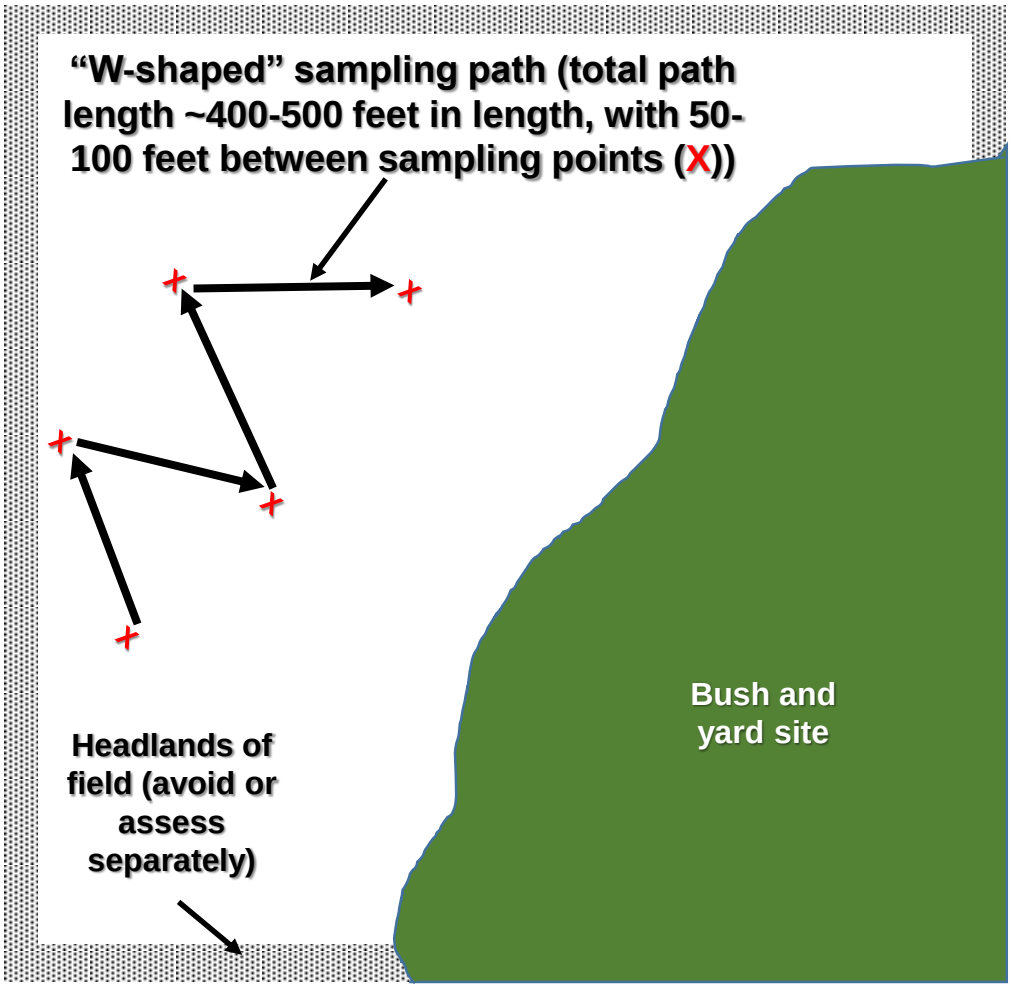

Figure 2c. Suggested "W-shaped" sampling pattern for a quick general assessment of canola plants. Pattern modified to accommodate an irregularly shaped field.

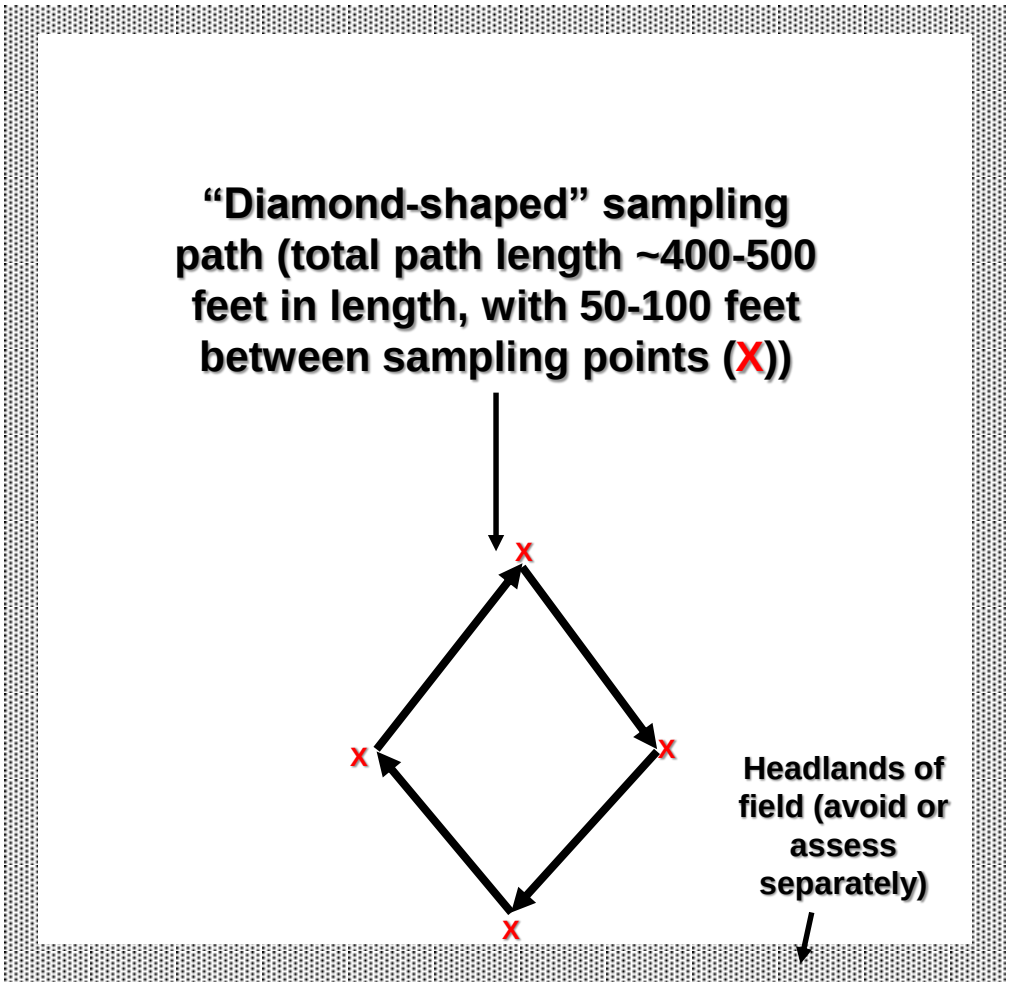

Figure 3. Suggested "diamond-shaped" sampling pattern for quick general assessment of canola plants.