Seed Quality and Guidelines for Seed Borne Diseases of Pulse Crops

Seed quality is very important in pulse production, as the costs of seed and seed treatments are a significant part of overall input costs. Seed generally refers to grain intended for planting, while grain is the term for sale into the marketplace as food, feed or fuel. If the seed is for planting, "quality" refers to seed that has a high germination, is intact, free from foreign materials and weed seeds and has zero or low levels of seed-borne diseases. This article will focus on the importance of seed-borne diseases in quality pulse seed.

Pea seed sample with wild oat seeds and *Sclerotinia sclerotiorum* sclerotia

Planting pulse seed that is free of ascochyta blight and other important seed-borne diseases is the primary means to limit the introduction of pathogens into a field, and prevent early establishment of disease.

Planting infected seed may result in a widespread distribution of disease within the crop, and an increased number of initial infection sites from which the disease can spread. As an example, consider the development of ascochyta blight in a chickpea crop. Since there is a high rate of seed-to-seedling transmission of this disease, even a small percentage of infected seed can result in significant seedling infection in the field. For a seed lot with 0.1 per cent ascochyta infection (one infected seed in 1,000 seeds) and a planting density of three to four plants/ft.^{2}, 175 infected seedlings per acre, could potentially result. This is a substantial amount of early infection for this aggressive disease.

Importance of Seed Testing

It is recommended to have seed tested at an accredited laboratory to assess the levels of seed-borne diseases. Commercial laboratories can test pulse seed to determine the level of seed-borne fungi that cause ascochyta blight, anthracnose, botrytis seedling blight and grey mould, and sclerotinia white mould. A parallel test for germination will indicate whether seed quality has been affected by such factors as immaturity, disease, mechanical injury and chemical damage. Testing for vigour may also be beneficial, as it serves as an indication of how seed will respond in less than ideal growing conditions.
Preferably, buy only certified seed with demonstrated good quality. However, keep in mind that certified seed, according to the *Seeds Act* (federal regulations), has only to meet standards for germination and purity, not for diseases. The motto is "buyer-beware" when purchasing pulse seed. Ask to see the lab certificate before purchasing seed.

For more information about seed testing, refer to the Commercial Seed Analysts Association of Canada Inc. website.

Limitations of Disease Testing

A sample submitted to a lab is only a small representation of the larger seed lot, and its value is dependent on how the sample was collected. Due to the statistical nature of small samples, even a carefully selected representative sample may not quantify the exact disease level. For example, a zero per cent seed test result cannot guarantee that the entire seed lot is free of disease.

The number of seeds tested affects the accuracy of the test. Many pulse seed tests are done with a 400-seed sample, but a 1,000-seed sample is sometimes used for ascochyta blight of chickpea. By increasing the number of seeds to 1,000, the probability of detecting a small amount of infection is increased. For example, a 1,000-seed test can detect 0.1 per cent infection (one in 1,000), whereas a 400-seed sample test may have provided a zero per cent infection result. Thus, the 1,000-seed sample decreases the likelihood of getting a false negative result. The difference between zero per cent and 0.1 per cent infection can be important with a disease like ascochyta blight of chickpea, when weather conditions favour disease spread. The ability to detect low levels of infection and avoid false negative results is more important for chickpea than for lentil or field pea, and more important for seed growers than commercial growers.

Cleaning Seed

Diseased seed is often, but not always, shrunken or discoloured. Severely *Ascochyta*-infected seed may grade as No. 1 and still be carrying the fungus. Botrytis-infected seed is often shrunken. Cleaners and colour sorters can be used to remove some diseased or damaged seed to improve the seed quality for planting. Furthermore, it is recommended that producers have their seed cleaned and sized to allow for consistent flow in seeding equipment.

If requested, seed testing labs will clean seed to a standard level (based on screen size) before testing the lot for germination and disease. If the seed sample is very dirty, a disease test cannot be conducted without cleaning the seed first. As there is usually an extra charge to the client for cleaning to a suitable level, it is important to talk to the lab to confirm your expectations regarding cleaning.

Germination

Seed should be tested for germination to determine its suitability for planting. Germination can decrease in the bin over the winter, especially if the seed was immature or damaged at harvest. It is a good investment to re-test seed for germination in the spring, if quality was questionable in the fall. Increasing the seeding rate will compensate for low germination, but only to a certain extent. If the reduced germination was a result of disease, an increased seeding rate can introduce more disease into the field.

Do not use seed from a pulse crop that was treated with pre-harvest glyphosate. Chemically-damaged seed will show poor root development and may result in some seedlings dying and, in extreme cases, a complete crop failure.

Vigour

Some labs provide vigour testing, but there is still some debate about the best testing protocol and how to interpret results. Vigour is a measure of germination when seed is placed in less than ideal growing conditions, such as low temperatures. Some people believe that a vigour test is a valuable indicator of seed performance, as it mimics natural field conditions. The smaller the gap between per cent germination and per cent vigour, the more sound the seed is believed to be. If there is a significant discrepancy between these two values, it is important to determine why the vigour was reduced, e.g. mechanical damage, a high proportion of green seed, herbicide damage, etc. Knowing the cause of the problem will help in the decision to plant the seed, or to source another seed lot with acceptable vigour.

The Value of Fungicide Seed Treatments

Fungicide seed treatments protect seed viability and inhibit diseases like seed rot and seedling blight. Seed treatments protect the seed in two ways: by controlling fungi present either on the seed surface or carried internally in the seed; and by controlling fungi present in the soil, or on crop residue in the soil.

Treating seed ensures that the crop gets off to a good start. But keep in mind that seed treatments will not "cure" a poor seed lot that has high proportions of dead, damaged or infected seed.

The degree of control with seed treatment depends on five factors: (1) fungicide active ingredients, (2) rate of application, (3) seed- and soil-borne fungal diseases present, (4) environmental conditions, and (5) quality of seed coverage.

The latter point cannot be overlooked, full coverage of the product over the seed coat is essential to ensure protection.

If you are testing seed on-farm, equipment must be carefully calibrated to ensure proper mixing of the seed and chemical to provide adequate coverage. This becomes even more important for fungicides with contact activity. Large-sized pulse seed may be easily damaged during treatment, so reduce velocity within the equipment and during augering if possible. The rate of application listed on the product label must be adhered to, because over-treatment may injure the seed, and under treatment may not provide adequate disease control.

In general, seed treatments may have either systemic or contact modes of action. Controlling fungi that are carried within the seed requires a systemic product (i.e. smut in barley), whereas contact or protectant products are adequate for surface-borne or soil-borne fungi. Systemic seed treatments are diluted quite quickly within the plant once the seed germinates and is actively growing. Some treatments will protect a young seedling against early leaf disease or root rot infection, but in most cases, seed treatments are no longer effective after seedling emergence.

Note: If seed-applied Rhizobium inoculants are being used as well, it is recommended to first apply the fungicide seed treatment, allow it to dry on the seed, then add the inoculant as close to planting as possible. Contact your inoculant and crop protection provider for product-specific compatibility information. Also refer to the Ministry web publication Inoculation of Pulse Crops.

Guidelines for Tolerance Levels for Planting

There are no research-based recommendations for what levels of seed-borne infection in pulse seed are tolerable for planting. The critical level will depend on moisture and temperature conditions after planting and will, therefore, vary from year to year. The decision whether to plant infected seed will also depend on a variety of factors affecting risk management.

Factors to consider when planting infected seed include:

- The cost and availability of disease-free seed with good germination.
- The cost and availability of registered seed treatments.
- The weather conditions and disease pressure typical of the region/soil climatic zone.
- The type of pulse crop.
- The type of disease present in the seed and proximity to other sources of disease inoculum.
- Plans for infield scouting; availability and costs of foliar fungicides.

Despite the above variables, the following guidelines were developed to give pulse producers some assistance when making decisions about seed-borne diseases. These guidelines are based partly on

knowledge of the biology of different diseases, partly on published research, and partly on crop insurance considerations. However, because of the biological, agronomic, environmental and economic variables mentioned, the guidelines should be treated as rules of thumb.

Guidelines for tolerances of seed-borne diseases of chickpea

Ascochyta blight

Pathogen:

Ascochyta rabiei

Guidelines:

Use seed with less than or equal to 0.3 per cent *Ascochyta* infection[3].

Even though a seed test may indicate 0 per cent infection, the seed lot may still contain infected seed, and seed treatment is recommended.

Seed-to-seedling transmission of ascochyta blight is high in chickpea. The disease is very aggressive and can spread quickly in a field once established if weather conditions are favourable.

Seed rots and damping off

Pathogen:

Pythium species

Guidelines:

These are soil-borne diseases and are not tested for at seed testing labs.

The use of seed treatment is strongly recommended for kabuli varieties since they are very susceptible to these diseases.

Seed rots and seedling blights

Pathogens:

Botrytis, Sclerotinia, Rhizoctonia, and Fusarium species

Guidelines:

Sclerotinia, Rhizoctonia and Fusarium are primarily soil-borne. Botrytis and Fusarium are also often seed-borne and can be tested for at seed testing labs.

Up to 10 per cent infection (Sclerotinia + Botrytis) may be tolerable, but will result in significant seedling blight if a seed treatment is not used.

The importance of seed-borne Fusarium in seed rot and seedling blight in pulses is not known. Some labs will notify growers if greater than 5 per cent Fusarium infection occurs. If present, add the Fusarium value to the Sclerotinia + Botrytis value above (not to exceed 10 per cent).

Guidelines for tolerances of seed-borne diseases of lentil

Ascochyta blight

Pathogen:

Ascochyta lentis

Guidelines:

Up to 5 per cent Ascochyta infection may be tolerable in the Brown and Dark Brown soil zones of Saskatchewan, if weather patterns are normal.

A seed treatment should be used if infection levels are close to or exceed 5 per cent.

Seed should be avoided if infection levels exceed 10 per cent. High infection levels are usually indicative of other quality issues.

Use seed with 0 per cent Ascochyta infection if planting in the Black soil zone of Saskatchewan.

Anthracnose

Pathogen:

Colletotrichum truncatum

Guidelines:

Anthracnose is not highly seed-borne and levels are rarely over 1 per cent. Infected lentil stubble serves as a greater inoculum source.

Do not use anthracnose-infected seed if it is being planted in a field where lentil has never been grown. Seed treatments are only registered for suppression of anthracnose in lentil.

Seed rots and damping off

Pathogen:

Pythium species

Guidelines:

Pythium species are soil-borne and not tested for at seed testing labs.

Most lentil varieties contain tannin in the seed coat, which has fungicidal properties against *Pythium*. Seed treatment is recommended only for low tannin lentils.

Seed rots and seedling blights

Pathogens:

Botrytis, *Sclerotinia*, *Rhizoctonia*, and *Fusarium* species

Guidelines:

Sclerotinia, *Rhizoctonia* and *Fusarium* are primarily soil-borne. *Botrytis* and *Fusarium* are also often seed-borne and can be tested for at seed testing labs.

Up to 10 per cent infection (*Sclerotinia* + *Botrytis*) may be tolerable, but will result in significant seedling blight if a seed treatment is not used.

The importance of seed-borne *Fusarium* in seed rot and seedling blight in pulses is not known. Some labs will notify growers if greater than 5 per cent *Fusarium* infection occurs. If present, add the *Fusarium* value to the *Sclerotinia* + *Botrytis* value above (not to exceed 10 per cent).

Aphanomyces root rot

Pathogen:

Aphanomyces euteiches

Guidelines:

Root rots in pulse crops can be caused by a complex of organisms including *Fusarium* species, *Rhizoctoni* species, *Pythium* species and *Aphanomyces euteiches*. For *Fusarium, Rhizoctonia* and *Pythium* species, the thresholds listed above should be followed. However it is important to remember that seed treatments will only protect from these diseases while the seed treatment is still active. *Aphanomyces euteiches* is a soil borne pathogen and as a result, the presence of this pathogen on seed is not tested for by seed testing labs. Susceptible plants are susceptible throughout the entire life span of the plant.

Seed treatments may provide early season **suppression** of this disease but will not provide protection against later infections.

Guidelines for tolerances of seed-borne diseases of field pea

Ascochyta blight

Pathogens:

Mycosphaerella pinodes, *Ascochyta pinodella*, and *Ascochyta pisi*

Guidelines:

Up to 10 per cent *Ascochyta* infection should not significantly affect plant establishment and yield, as long as the seed has good germination, and spring conditions promote quick germination and good seedling vigour.
Seed to seedling transmission of ascochyta blight in pea under field conditions is considered low.
In areas where pea production is common, the primary means of infection is air-borne spores from the over-wintering stage of *Mycosphaerella pinodes* on pea residues.

Seed rots and damping off

Pathogen:

Pythium species

Guidelines:

These are soil-borne diseases and are not tested for at seed testing labs.
Seed treatment in field pea may be beneficial when planting under cool, moist soil conditions, or if using damaged or cracked seed.

Seed rots and seedling blights

Pathogens:

Botrytis, *Sclerotinia*, *Rhizoctonia*, and *Fusarium* species

Guidelines:

Sclerotinia, *Rhizoctonia* and *Fusarium* are primarily soil-borne. *Botrytis* and *Fusarium* are also often seed-borne and can be tested for at seed testing labs.
Up to 10 per cent infection (*Sclerotinia* + *Botrytis*) may be tolerable, but will result in significant seedling blight if a seed treatment is not used.
The importance of seed-borne *Fusarium* in seed rot and seedling blight in pulses is not known. Some labs will notify growers if greater than 5 per cent *Fusarium* infection occurs. If present, add the *Fusarium* value to the *Sclerotinia* + *Botrytis* value above (not to exceed 10 per cent).

Aphanomyces root rot

Pathogen:

Aphanomyces euteiches

Guidelines:

Root rots in pulse crops can be caused by a complex of organisms including *Fusarium* species, *Rhizoctonia* species, *Pythium* species and *Aphanomyces euteiches*. For *Fusarium, Rhizoctonia* and *Pythium* species, the thresholds listed above should be followed. However it is important to remember that seed treatments will only protect from these diseases while the seed treatment is still active.
Aphanomyces euteiches is a soil borne pathogen and as a result, the presence of this pathogen on seed is not tested for by seed testing labs. Susceptible plants are susceptible throughout the entire life span of the plant.
Seed treatments may provide early season **suppression** of this disease but will not provide protection against later infections.

For more information:

Contact the Agriculture Knowledge Centre at 1-866-457-2377
Refer to the Commercial Seed Analysts Association of Canada Inc website.