Using Canola Seed Vigour Tests

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High yielding and good quality canola crops require rapid establishment of uniform plant stands under variable environmental conditions. Factors such as crop rotation, trash management, seedbed preparation, seeding date, seeding rate, fertility and weed control can have a significant impact on the establishment of uniform crop stands. Seed quality, germination, seed and seedling vigour are also important factors in the establishment of canola stands under the wide range of growing conditions that can occur.

The purpose of germination and seedling vigour tests is to identify seed lots that can provide uniform stand establishment under variable conditions. Use seed testing, along with other seed quality factors to select superior seed lots.

Why is Seed Vigour Important?
Many growers are seeding earlier to maximize yield and quality. With early planting, seeds are often planted in cool and wet soils, especially under minimum tillage or direct seeding. Because soil conditions may not be optimal, the seed must have good germination and vigour to establish uniform stands.

Predicting Seed and Seedling Vigour
When field conditions are near optimum, the standard germination test may accurately predict seed emergence and seedling establishment. However, when environmental conditions are less than favourable, seed vigour tests can provide additional information on potential crop establishment.

Seed Testing Requirements
Seed sold in Canada must meet minimum standards for physical purity and germination as set out under the Canada Seeds Act. Samples of seed that have received the Canadian Seed Growers Association pedigree classification must be analyzed by a government accredited seed laboratory for germination, presence of weed seeds and seeds of other crops, and general quality before the seed can be sold. The most widely used pedigreed seed is Canada Certified No. 1.

Definitions
Seed germination, seed vigour and seedling vigour describe different aspects of a seed’s ability to germinate and produce seedlings.

Seed Germination is the ability of a seed to produce a normal seedling under favourable conditions.

Seed Vigour is the ability of a seed to germinate and grow rapidly to establish a normal seedling. Good seed vigour means rapid uniform emergence and development of normal seedlings under a wide range of field conditions.

Seedling Vigour is the rapid growth of seedlings during cotyledon and early true leaf stages.

What’s on a Seed Tag?
The blue certified seed tag contains valuable information. The top line names the crop, the next line indicates the variety and the grade of canola (Certified No. 1 or Certified No. 2 depending on
purity and germination). On the third line of the tag there is a crop certificate number which is usually 12 digits. The first two digits indicate the year the crop was grown, the third digit is the province and the next six digits the grower who grew the seed. The tenth digit indicates the seed class and the last two digits the number that the Canadian Seed Growers assigned to the crop.

On the fourth line of the tag is the lot number that identifies the seed establishment processing the seed. The authorized seed establishment assigns the lot number for the pedigreed seed.

A tag may read the year and then have the word “blend” which means there have been two or more seed lots blended together. Most blends are seed lots that have been mixed together. A sample of the mixed blended seed must have been sent to an accredited lab for analysis and it must meet the standards of the labeled lot. Some lots may be stacked or pancaked blends where one lot is placed on top of another in a bin. The reading of the lowest germination of the stacked lots is considered the germination of the stacked blend.

**Seed Buyer’s Rights and Seller’s Responsibilities**
A germination test doesn’t have to be done every year for seed lots or blends but it is the seller’s responsibility that the seed must meet the germination standards complying with the grade stated on the tag at the time of sale.

A buyer has the right to ask for a purity analysis and germination on a seed lot up to one year after purchase of the seed. The seller must provide this information within 30 days. Keep copies of blue tags and also keep a 2 lb representative sample of the seed in case problems are encountered with crop establishment. Store the seed sample in a clean residue-free container under cool, dry conditions.

**Germination Test Requirements**
Canada Certified No. 1 must have a minimum germination of 90% and Canada Certified No. 2 a minimum germination of 80%. The germination test is conducted according to protocols described in the Canadian Methods and Procedures for Testing Seeds put out by the Canadian Food Inspection Agency (CFIA).

The percent germination is usually recorded on day seven of the germination test. However, if after seven days ungerminated seeds remain (indicating a late wave of germination) or small seedlings are difficult to assess, the test may be extended up to a total of 11 days. The extension should be noted on the report of analysis for the seed lot. When purchasing seed, ask when the germination was recorded. Good quality Certified No. 1 seed should have a minimum 90% germination within seven days.

**Seed Vigour Tests**
The purpose of conducting vigour tests is to provide additional information on the ability of the seed to germinate and produce normal seedlings under variable soil and climactic conditions. Various different seed vigour tests can be used to evaluate seed lots. The tests most commonly used to evaluate vigour measure germination at cooler temperatures.

Standard testing procedures have not been adopted for conducting vigour tests. Tests are done using blotter paper or soil mixes and different temperatures, photoperiods and incubation times. With the variation in procedures, vigour ratings often vary from test to test. It is important to understand the procedures used to conduct the test to interpret the results.
Dr. Bob Elliott, with Agriculture and Agri-Food Canada at the Saskatoon Research Centre, conducted an extensive research project on “Factors limiting germination, emergence and vigour of canola” from 1998-2001. Vigour ratings from different laboratory tests were correlated with data from field plantings to determine which tests provided the best indication of emergence and seedling growth.

Some general conclusions from this study are as follows:

**Germination Test**
Germination counts at four to seven days generally provide a good indication of seedling emergence and seedling establishment in both early and late May plantings. Germination counts at four and five days provide a good indication of seedling emergence. Germination counts at seven days provide the best indication of seedling establishment. Germination counts at seven days are the most precise, repeatable and reproducible method of evaluating seed viability.

Seed lots that do not meet the germination requirement for No. 1 Certified seed within seven days have reduced vigour at low temperatures, poor emergence and poor seedling establishment. Generally, the higher the germination count at seven days, the better the crop establishment. Seed lots that meet germination standards within four and five days also tend to have better seedling establishment and higher seedling weights. High germination seed with higher seed weight generally produce the best establishment and seedling growth.

**Seedling Assay**
The seedling assay is conducted in the laboratory at 20°C. Seedling establishment, seedling fresh weight and total seedling weight are determined after seven days. The seedling assay generally provides the best indication of seedling growth in both early and late May plantings. However, many factors can affect yield from the time plants are seedlings until maturity so correlations between vigour tests, the seedling assay and yield can be extremely variable. Procedures to conduct a seedling assay test are currently being evaluated by seed test labs and a recommended test will be available in the near future.

**Prechill Tests for Treated Seed**
Prechill tests use a potting soil and sand mixture to evaluate the vigour of treated seed. Germination of treated seed is consistently higher in prechill tests than in the germination test conducted on a blotter. Vigour ratings are also more reproducible in the prechill tests than in the germination test. Conduct a prechill test within three months of seeding to detect any decline in seed quality during storage.

**Summary**
Growers can obtain information regarding seed quality by talking to their seed suppliers. The Seed Regulations set minimum standards for seed quality. However, the more information that can be obtained on a seed lot, the better the ability to evaluate the seed. Obtain the following information from your seed supplier to improve the probability of obtaining high quality seed:

1. The seed grade, variety and seed lot number. This information is on the blue seed tag for bagged seed and on the bulk pedigreed seed certificate for bulk seed.
2. The year the seed was grown and when it was treated. The year the seed was grown is part of the crop certificate number except for blended seed. The longer the seed is stored and the longer it is treated the greater the potential for reduced seed vigour.
3. The germination percentage on day seven of the test and a four- or five-day reading if it is available. The germination percent will be on the analysis report from an
accredited seed testing laboratory. High vigour seed lots of Argentine or *B. napus* canola often obtain 90% germination in five days and Polish or *B. rapa* canola in four days. Larger seed may take slightly longer to germinate on a blotter than smaller seed but can have excellent seedling vigour and growth.

4. The date the last germination test was conducted. A test conducted within three to four months of the seeding date is preferred. Also determine if the germination test was conducted on treated or untreated seed.

5. If a vigour test was conducted, ask what test was done and the results. A prechill test can provide information on the vigour of treated seed. The seedling assay test can provide information on potential seedling growth.

6. A chlorophyll or green seed count should be done on the seed. Ask to see a sample of untreated seed. High quality seed is usually mature, well filled and has a low chlorophyll or green seed count. Research has also shown that larger seed provides quicker and more uniform seedling growth especially under higher stress conditions. The 1000 seed weight of a seed lot provides an indication of seed size.

7. For blended lots ask when the individual lots were grown and treated and for the results from the most recent germination test. The germination of the lots prior to blending can also provide an indication of the quality of the individual lots. Ask if the seed lots were blended by mixing or were stack blends. Mixed blends require a germination test to be done on the blended seed. For stack blended lots, the lowest germination of the combined lots is recorded as the germination percent of the blend.

Growers and seed suppliers both benefit from information to identify superior quality seed lots that provide uniform and quick crop establishment under variable growing conditions. The germination test along with vigour tests provides information to assist with selecting superior seed lots.

**Test Procedures**

**Germination Test**

Seeds are placed on a germination blotter paper, moistened and transferred to germinators for seven days. Germinators are maintained at alternating 25°C and 15°C daily temperatures that correspond to eight hours of light and 16 hours of dark respectively. Numbers of normal seedlings, abnormal seedlings and dead or ungerminated seeds are assessed at four and seven days after incubation. The final germination count is most commonly taken at seven days.

However, if after seven days ungerminated seeds remain (indicating a late wave of germination) or seedlings are difficult to assess, the test may be extended up to 11 days. If counts fall on public holidays or weekends it is acceptable to read the test on the first working day.

**Seedling Assay**

Seed lots are planted in wooden flats containing a potting mix and placed in a growth chamber at 20°C and 50-75% relative humidity for 16 hours of light and eight hours of dark. The seedling assay is conducted under a uniform light intensity. The number of seedlings per row, seedling fresh weight and total seedling weight are measured after seven days. The surface area of cotyledons and leaves can also be measured using computer imaging. Procedures to conduct a seedling vigour assay will be evaluated by seed testing laboratories and a recommended test should be available in the near future.
**Prechill Tests**

Seeds are incubated in the dark at 5°C for seven days in a potting soil/sand mixture. Samples are transferred to germinators for five additional days and maintained at alternating 25°C and 15°C daily temperatures corresponding to eight hours of light and 16 hours of dark. Vigour ratings are based on the number of normal seedlings after 12 days.

**Table 1.** Incubation medium, temperature, photoperiod and time of rating for germination and vigour tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>Incubation Medium</th>
<th>Temperature - Photoperiod</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germination</td>
<td>blotter paper</td>
<td>25°C for eight hours light, 15°C for 16 hours dark for seven days</td>
<td>Number of normal seedlings is determined at four and seven days</td>
</tr>
<tr>
<td>Seedling assay</td>
<td>potting mixture in wooden flats</td>
<td>growth chamber at 20°C at 50-75% relative humidity for 16 hours of light and eight hours of dark and under a uniform light intensity</td>
<td>Number of seedlings per row, seedling fresh weight and total seedling weight are determined after seven days</td>
</tr>
<tr>
<td>Prechill tests</td>
<td>potting soil/sand mixture</td>
<td>5°C and 24 hours dark for seven days, 25°C eight hours light and 15°C for 16 hours dark for five days</td>
<td>Number of normal for seedlings is determined after 12 days</td>
</tr>
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