DIGGING INTO RESEARCH

Canola dormancy investigated

CATEGORY **weeds** | *October 22, 2024*

In addition to genetic, physiological, and environmental factors, farming practices such as harvest timing, and tillage regimes can influence secondary dormancy of volunteer canola seed. Given the documented high heritability of secondary dormancy, it is feasible to reduce secondary dormancy in canola cultivars through plant breeding.

Canola dormancy resembles the case of Dr. Jekyll and Mr. Hyde. On the one hand, primary dormancy is good because it keeps canola seed from sprouting in the seed pod prior to harvest. Primary dormancy is the result of high levels of a hormone called abscisic acid (ABA), which prevents seed germination in the pod known as precocious germination or vivipary.

On the other hand, canola lost during harvest contributes to the weed seedbank and secondary dormancy can mean it persists for up to seven years. Secondary dormancy is induced when environmental conditions are not favourable for germination.

Secondary dormancy and the persistence of volunteer canola in the soil seedbank bring several concerns. Glyphosate-tolerant volunteer canola can be difficult to control in glyphosate-tolerant soybean or corn crops. Additionally, volunteer canola can be a host for clubroot disease, and there are issues with oil profile contamination from outcrossing of volunteers.

A literature review was conducted to look at the interaction of genetic, physiological, environmental, and agronomic factors on secondary dormancy in *Brassica napus*, the predominant species of canola currently grown in Canada. The interaction of dormancy with seed germination and vigour were also investigated.

Highly dormant genotypes were found to have increased ABA concentration in the seed, while another hormone, gibberellic acid, and its interaction with ABA was also found to be important. Additional factors affecting absolute dormancy include seed sugars, seed storage proteins, and glucosinolate content.

Secondary dormancy in *B. napus* is highly heritable and is a quantitative trait that is controlled by multiple genes. Secondary dormancy ranges from 0 to 90 per cent, but typically is about 50 per cent. Because secondary dormancy is highly heritable, reducing secondary dormancy could be a breeding objective for plant breeders, although primary dormancy, current seed vigour and germination standards must also be retained.

Soil and environmental conditions affect dormancy. Greenhouse studies found that seed produced on high nitrogen soils were weakly correlated to having lower secondary dormancy, although this did not occur in field studies. Cooler seed maturation conditions contribute to greater secondary seed dormancy, and contribute to dormancy more than soil nitrate. There were very few studies on nitrate and dormancy.

Abiotic stresses such as light, temperature, oxygen levels and osmotic stress can affect secondary induction. Osmotic stress impacts canola seed when soil conditions are dry and moisture does not move into the canola seed to encourage germination.

Flooding did not induce dormancy and the seed either rotted or germinated immediately after flooding conditions were removed.

These abiotic stresses are major contributors in western Canada because soil conditions in the fall can be dry and warm, creating ideal conditions for secondary dormancy in harvest seed losses.

Agronomic practices contribute to secondary dormancy

Reducing harvest losses is the biggest factor on reducing canola seed adding to the soil seedbank. Harvest seed losses can reach up to 300 seeds per square foot (3,000 viable seeds/m^2) or 5.8 per cent of total yield. Not all of these will survive, but this research highlights the need to minimize harvest losses, whether swathing or direct combining.

Other research found that agronomic practices that increased yield such as timely fungicide application and proper harvest management including optimum swath timing and lower combine harvesting speed reduced harvest losses.

The recent introduction of pod shatter resistant varieties helps to reduce harvest seed losses and make direct combining more viable. While eliminating harvest losses is not practical, the goal should be to reduce harvest losses as much as is practical.

Research in western Canada on *B. napus* found that tillage with either a tine harrow or tandem disc immediately following harvest effectively reduced volunteer canola populations. This post-harvest tillage signals volunteer to germinate, which are subsequently winterkilled. Post-harvest tillage reduced seed persistence by one-half compared to zero-till or spring tillage. Fall harrowing or discing were similar in their effect on volunteer germination.

One research project found no relationship between seed germination and vigor with secondary seed dormancy levels. There were weak relationships with seed quality parameters like protein and fibre that are currently being investigated. The relationship between secondary dormancy and seed germination, vigour and quality traits need to be further evaluated to ensure that reducing secondary dormancy does not impact these important traits.

Overall, the development of low secondary dormancy genotypes combined with agronomic management could help decrease volunteer canola populations in the soil seedbank. Research is now aiming to reduce secondary seed dormancy by identifying genetic markers that are associated with the trait, and eventually developing markers to quickly screen germplasm to select against higher secondary seed dormancy.

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