A five-year laboratory and field study was conducted to evaluate seed treatments for control of crucifer flea beetles (CFB) and striped flea beetles (SFB) on hybrid canola. Lab bioassays focused on identifying seed treatments that provide the most effective control and protection against CFB and SFB in dry and wet soil 10, 20 and 30°C. Field trials were conducted on three canola types in 2013-2015 to identify seed treatments that provide the best protection against flea beetle feeding damage and greatest improvement in stand establishment and seed yield. Results from laboratory and field tests showed that seed treatments differ greatly in their efficacy against CFB and SFB. Treatments that are effective against one species may not be effective against the other species. Canola producers are encouraged to monitor populations of CFB and SFB to select the most appropriate seed treatment.

Flea beetles are a serious early season pest of canola, *Brassica napus* L., in many regions of western Canada. Until recently, the crucifer flea beetle (CFB), *Phyllotreta cruciferae*, was the predominant species in southern and central regions of canola production whereas the striped flea beetle (SFB), *Phyllotreta striolata*, was most common in northern Parkland and Peace River regions. Both species have one generation per year and overwinter in non-crop areas. Beetles migrate into emerging canola fields when temperatures exceed 14°C. Depending on beetle numbers and weather conditions, feeding damage may lower plant stands, reduce growth, delay maturity and lower seed yield or grade. Since 2001, seed treatments containing a neonicotinoid insecticide and several fungicides have been used to control flea beetles and seedling pathogens in canola.

However, in recent years, canola producers have experienced so-called ‘seed treatment failures’ against flea beetles. To address these concerns, laboratory experiments were initiated to evaluate the effect of moisture conditions and temperature on the efficacy of neonicotinoid seed treatments against CFB and SFB. In lab bioassays on CFB, neonicotinoid seed treatments provided better control and better protection against feeding damage in dry soil than in wet soil and better control at 20°C and 30°C than at 10°C. The results suggested that ‘seed treatment failures’ against CFB are unlikely to occur over the range of conditions tested. In contrast, neonicotinoid seed treatments provided poor control and protection against SFB at most conditions tested. Results indicated that more effective seed treatments are needed for SFB.
Lab Bioassys

Lab bioassays were conducted in 2011 and 2012 to evaluate the efficacy of neonicotinoid seed treatments and new insecticide chemistries against CFB and SFB. In 2011, treatments included untreated seed, a fungicide check (Tribune), four neonicotinoid seed treatments (Gaucho CS FL, Prosper FX, Helix and Helix XTra), two diamide seed treatments (Lumiderm and Fortenza), a sulfoximide seed treatment (Rascendo) and diamide/neonicotinoid mixture (Lumiderm/Prosper). In 2012, the Lumiderm and Lumiderm/Prosper mixture were replaced by mixtures containing Helix XTra and Fortenza or Rascendo (Visivio). Treatments were applied at rates recommended by the manufacturer and replicated four times. Untreated and treated seeds were grown individually in dry soil (20-30% moisture content) and wet soil (>70% moisture content) until the cotyledon stage. Ten seedlings from each treatment and moisture regime were transferred into separate cages in a growth chamber and exposed to 20 CFB or SFB for 72 hours at 10, 20 or 30°C. Flea beetle mortality and feeding damage to the cotyledons was assessed after 72 hours. Results were submitted to chemical companies and forwarded to PMRA to support registration of the treatments. All seed treatments evaluated in the tests are now registered for control of flea beetles in canola in Canada.

In lab bioassays on CFB in 2011 and 2012, feeding damage in check treatments increased rapidly as temperature increased. Damage in check treatments in dry and wet soil after 72 hours averaged 5-6% at 10°C, 11-15% at 20°C and 22-50% at 30°C. Damage at 30°C was 7-25% higher in dry soil than in wet soil. In 2011, Helix XTra, Prosper FX and Lumiderm/Prosper mixture provided the best control and protection against CFB in wet soil at 10, 20 and 30°C. The same treatments and Helix provided the best control and protection in dry soil at 10, 20 and 30°C. In 2012, Prosper FX, Helix XTra and mixtures containing Helix XTra and Fortenza or Rascendo provided the best control and protection in wet soil at 10, 20 and 30°C. The same treatments and Helix provided the best control and protection in dry soil at 10, 20 and 30°C. In 2011 and 2012, the most efficacious treatments reduced damage in dry and wet soil to 3-5% at 20°C and 4-7% at 30°C. The results suggest there are several seed treatment options for producers in regions where CFB are the predominant species. Mixtures containing Lumiderm/Prosper, Fortenza/ Helix XTra or Rascendo/Helix XTra (Visivio) were effective against CFB over the range of conditions tested. For producers wishing to reduce chemical rates and costs without sacrificing efficacy, Prosper FX, Helix XTra or Helix would be an appropriate seed treatment in dry years whereas Prosper FX or Helix XTra would be more appropriate in wetter years.

In lab bioassays on SFB in 2011 and 2012, feeding damage in check treatments in dry and wet soil after 72 hours averaged 5-8% at 10°C, 12-27% at 20°C and 30-75% at 30°C. Damage at 30°C was 20-30% higher in dry soil than in wet soil. In 2011 and 2012, most seed treatments provided poor control and protection against SFB in wet soil at 10, 20 and 30°C. In 2011, Fortenza and the Lumiderm/Prosper mixture provided the most effective protection in wet soil at 20°C and 30°C. Rascendo provided the best control and protection in dry soil at 20°C and 30°C. In 2012, Fortenza, Fortenza/Helix XTra mixture and Rascendo/Helix XTra mixture provided the best protection in wet soil at 20°C and 30°C. Rascendo and the latter two mixtures provided the best control and protection in dry soil
at 20°C and 30°C. In 2011 and 2012, the most efficacious treatments in dry soil reduced damage to 5-8% at 20°C and 7-8% at 30°C. The most efficacious treatments in wet soil reduced damage to 7-13% at 20°C and 14-28% at 30°C. Results suggest that in fields where SFB are the most common species, Rascendo and mixtures containing Helix XTra and Rascendo or Fortenza would be appropriate in dry years. In wetter years, Fortenza or mixtures containing Lumiderm/Prosper, Fortenza/Helix XTra or Rascendo/Helix XTra would be more appropriate.

**Field Trials**

Replicated field trials were conducted in 2013-2015 to evaluate the efficacy of seed treatments against flea beetles in Roundup Ready (RR) hybrid canola, Clearfield (CL) hybrid canola and canola mustard. Moisture conditions were above average in 2013 and 2014 and below average in 2015. Yellow sticky cards were used to monitor populations of SFB and CFB throughout the growing season. Efficacy assessments focused on feeding damage to the cotyledons after 21 days, stand establishment after 21 days and seed yield.

In 2013, tests were conducted on 13 seed treatments in three canola types. Low to moderate populations of SFB and CFB were present during seedling emergence. Feeding damage in check treatments was higher in canola mustard (40-45%) than in RR canola (18-19%) and CL canola (15-19%). Gaucho CS FL, Helix, Prosper Evergol, Helix XTra and four mixtures (Lumiderm/Prosper Evergol, Lumiderm/Helix XTra, Fortenza/Helix XTra and Rascendo/Helix XTra) provided the best protection against flea beetle damage in each canola type. Treatments reduced damage by 23-30% in canola mustard, by 13-15% in RR canola and by 3-4% in CL canola. In most instances, seed treatments that provided the best flea beetle protection in each canola type also provided the greatest improvement in stand establishment and seed yield. Treatments improved stand establishment in canola mustard, RR canola and CL canola by 15-20%, 7-12% and 10-16%, respectively, and seed yield by 10-18%, 4-8% and 0%, respectively.

In 2014, tests were done on 10 seed treatments in RR canola and canola mustard. Three treatments containing Lumiderm were not assessed. SFB were more common than CFB during seedling emergence. Damage in check treatments reached 45-50% in RR canola and 40-45% in canola mustard. Gaucho CS FL, Prosper Evergol, Helix XTra, Fortenza and two mixtures (Fortenza/Helix XTra and Rascendo/Helix XTra) provided the best flea beetle protection in each canola type. Treatments reduced damage by 33-36% in RR canola and by 11-16% in canola mustard. Treatments improved stand establishment and seed yield by 36-42% and 23-29%, respectively, in RR canola and by 16-23% and 5-11%, respectively, in canola mustard.

In 2015, tests were done on 11 seed treatments in RR canola and CL canola. An unregistered mixture containing Fortenza and Helix (200g rate) was also evaluated. Populations of SFB were extremely high. Damage in check treatments exceeded 60% in RR canola and 40% in CL canola. Prosper Evergol, Helix XTra, Fortenza, Fortenza/Helix mixture and Fortenza/Helix XTra mixture provided the best flea beetle protection in RR canola, reducing damage by 7-21%. Gaucho CS FL, Prosper Evergol, Fortenza and three mixtures (Fortenza/Helix, Fortenza/Helix XTra, and Rascendo/Helix XTra) provided the
best protection in CL canola, reducing damage by 9-15%. Damage exceeded the economic threshold (25% damage) in all treatments in each canola type. Treatments that provided the best protection against feeding damage improved stand establishment and seed yield by 21-35% and 27-36%, respectively, in RR canola and by 13-26% and 12-16%, respectively, in CL canola. It is noteworthy that in each canola type, an unregistered mixture containing Fortenza and Helix (200g rate) was as efficacious as the registered mixture containing Fortenza and Helix XTra (400g rate). If pesticide load, residues and production costs are a concern, chemical companies should be encouraged to evaluate the efficacy of lower rates of neonicotinoid insecticide in seed treatment mixtures against SFB and CFB.

Results from laboratory and field tests showed that seed treatments differ in their efficacy against CFB and SFB. Treatments that are effective against one species may not be effective against the other species. Since 2010, the geographic range of SFB in Saskatchewan has expanded south. At AAFC-Saskatoon, CFB were the most abundant species before 2010 when they comprised 90-95% of the total flea beetle population. Since 2010 populations of SFB have increased annually until 2015 when they comprised over 90% of the total flea beetle population. If a similar shift in flea beetle populations has occurred in commercial fields, it is imperative that canola producers monitor their fields to ascertain what species are present and select the most appropriate seed treatment.