Research on lygus bugs and other plant bugs in beans

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The Manitoba Pulse Grower's Association has funded a study on the effects of plant bugs on yield quantity and quality of dry edible beans. The study has three components: field surveys of commercial crops to determine what plant bugs occur on beans and when, laboratory studies of how plant bugs of different ages affect beans at different growth stages, and field studies of how plant bug infestations affect yield quality and quantity.

We surveyed a total of 17 navy bean, 10 pinto bean and 9 soybean commercial fields between 2008 and 2010. Each field was sampled weekly from crop emergence to harvest, with 20 sweep net samples taken at each of five locations. We hand harvested at each sample location to relate insect numbers to yield. In all years and crops, 83-92% of the plant bugs were tarnished plant bugs, 3-4 % were alfalfa plant bugs, and several other species made up the remainder. Plant bug numbers were highest in 2010. Seasonal patterns of tarnished plant bugs were similar in all years: adults enter bean crops in late July (R1-2 stage in dry edible beans), and females lay eggs in the stems of the plants. From these hatch nymphs, which are most numerous at the R4-5 stage but persist into the R6-7 stage. The nymphs moult to adults, but adult numbers are greatly augmented late in the season by immigration from early-maturing crops. In none of the three seasons were we able to detect any negative effects on yield quality or quantity that could be linked to the plant bugs in the fields.

In the laboratory, we have studied the effect of feeding by tarnished plant bug nymphs and adults on navy beans at growth stages R1-2, R4-5 and R6-7. For each stage, we caged insects on individual inflorescences and recorded the type of injury and the effect on seed weight. At R1-2, one insect per inflorescence significantly reduced total seed weight from the inflorescence. The major effect of feeding was the abortion of pods, and nymphs were more harmful than adults. At R4-5, three insects per inflorescence were sufficient to cause seed weight loss, and many harvested seeds were shrivelled; again, nymphs were more damaging than adults. At R4-5, most feeding occurs on the placental and funiculus regions of pods and injures the vessels conducting photosynthates to the filling seeds, resulting in them being shrivelled at harvest. At R6-7, even five insects per inflorescence did not significantly reduce total seed weight. However, direct feeding on the seed reduced seed quality through surface pitting. We also caged tarnished plant bugs on whole plants in the laboratory so that insects had more choice of their site of attack. Exposure of whole plants at the R6-7 stage for 5 days to 15 or 30 nymphs or adults did not reduce the weight of seed yield but seed coat pitting reduced seed quality. We have just finished a similar experiment at the R4-5 stage, but the results have not yet been analysed.

From 2009 to 2011, we conducted field plot studies of yield loss of navy beans caused by plant bugs. The numbers of bugs were too low to allow manipulation of populations using insecticides, so we placed one

square metre (m^2) cages over growing crops, introduced bugs at a specific time, and left the insects in the cages until the time of harvest. In 2009, in a trial where 30 or 60 adult tarnished plant bugs were introduced at the R2-3 stage, the loss in seed yield was about 0.30 g/m^2 per bug, and this weight loss was mostly responsible for significant reductions in the value of the yield/m^2. In 2010, our plots were attacked by deer, and only one complete trial was possible. In this trial, up to 120 tarnished plant bug or alfalfa plant adults or 60 tarnished plant bug nymphs were introduced into each cage at the R6-7 stage. Value of the yield was reduced with 60 or 120 alfalfa plant bugs adults or 60 tarnished plant bug nymphs: lower seed quality and lower weight of marketable seed were responsible for the decline in value. In 2011, four field cage experiments have been carried out, with up to 180 insects per cage: one experiment at the R2-3 stage, two experiments at the R4-5 stage, and one experiment at the R6-7 stage. Harvesting has recently been completed, and seed weighing and grading are in progress.

Because our cage results measure insects in numbers /m^2 and producers normally sample for plant bugs by sweep netting, we have began work to link the two measures of insect abundance. In 2011, at 10 locations in each of three commercial fields, 20 sweep samples were taken, and then, adjacent to the sweep net location, a 1 m length of two rows was enclosed and all the plant bugs removed with a vacuum sampler. Data from the 30 locations will be analysed to develop a relationship between the two measures. This study will be repeated in 2012 so that we are able to express thresholds developed from our cage studies in terms of insects per sweep.