AGRONOMY

Soybean Aphid Control by Natural Enemies in Manitoba

Soybean fields adjacent to cereal fields were positively associated with lacewings, the aphid predators most associated with soybean aphid suppression.

Dr. Costamagna and a malaise trap used to assess predator movement in field experiments.

UNABLE TO OVERWINTER in Manitoba, soybean aphids migrate from the U.S. every summer and, on occasion, populations reach levels that cause economic yield loss. Although aphid control can be satisfactorily achieved by using registered, non-selective insecticide, a number of natural enemies (or predators), including species of ladybeetles, minute pirate bugs, damsel bugs, hoverflies and lacewings commonly found in Manitoba, also play an important role in controlling aphid populations. The action threshold (250 aphids per plant and populations increasing) accounts for aphid suppression by predators; however, a lack of understanding of the dynamics of predator movement reduces our ability to predict this component of the threshold. This study investigated the dispersal capacity and effectiveness of natural enemies in suppressing soybean aphids, and identified vegetation surrounding soybean crops that can be a source of predators in Manitoba.

A preliminary study assessed the effectiveness of predators on aphid suppression by infesting plants within soybean and alfalfa fields with soybean aphids that were: 1) open to predation; 2) protected from ground predators; or 3) completely protected from predation. Despite larger numbers of predators in alfalfa, aphids were significantly reduced in both crops. Foliar predators also contributed more than ground predators to aphid suppression.

A mark-release-recapture study investigated ladybeetle movement between soybean and alfalfa. Although most movement was away from soybeans, likely due to the low natural aphid levels, ladybeetles moved rapidly between both crops suggesting that alfalfa may act as a source of predators for soybean when infested with aphids.

Following up on these results, 27 field experiments were set up in the Interlake, Central and Eastman regions in 2013 and 2014 to determine the source and track the movement of aphid predators. Soybean plants within commercial soybean fields were infested with aphids and were: 1) left open or 2) protected from foliar predators to determine the level of aphid suppression by predators. Sweep nets and visual plant counts were used to quantify natural aphid populations and predators. Bi-directional malaise traps (see photo) were placed parallel to the edge of the soybean field to monitor movement of predators from outside sources. Overall, naturally occurring soybean aphids were very low; however, protection from predation resulted in a 3.6 fold increase in aphid populations. Predator populations were dominated by minute pirate bugs and hoverflies, and, to a lesser extent, green lacewings, damsel bugs, ladybeetles and brown lacewings.

Although aphid populations were significantly lower in the presence of predators compared with predator exclusion controls, results indicated that the strength of aphid suppression also varied by landscape. Land-cover types within a two kilometre radius of each soybean field were quantified and were dominated by cereals (wheat, oats, and barley), canola, corn and soybeans and to a lesser extent, natural vegetation. The proportion of cereals in the landscape showed a consistent negative association with soybean aphid abundance under predation at multiple spatial scales. Cereals were positively associated with green lacewings, which was the predator most associated with aphid suppression. By mid- to late-July, when soybean is still susceptible to aphid damage, most cereal crops are senescing, meaning that predators move from cereals to other habitats searching for prey; thus cereal crops can act as sources of natural enemies.

By contrast, the positive association of aphids with a percentage of canola and native vegetation in the landscape suggests that these habitats interfere with aphid suppression. The inverse mechanism as with cereals may be operating here, i.e. canola and native vegetation may compete for predators with soybeans, as they will have prey populations developing at similar times.

These results support previous studies in North America and confirm the role of generalist predators in controlling pest populations. Further research is required to identify the mechanisms of aphid suppression associated with cereal and alfalfa crops, i.e. understand how time during the growing season and the proportion of habitat and distances between habitat and soybeans affect effective predator populations.

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MPSG INVESTMENT $36,950

CO-FUNDER $43,050 – Growing Forward 2 Growing Innovation: Agri-Food Research and Development Initiative

DURATION 3.5 years