4-3-2006

Winter temperatures and soybean aphid survival

Marlin E. Rice
Iowa State University, merice@iastate.edu

Winter temperatures and soybean aphid survival

Abstract
What effect will the winter weather have on crop pests? This was one of the most common questions asked by participants during the recent Crop Advantage Series meetings. And no insect, except maybe the corn rootworms, causes greater concern than the soybean aphid. We know that soybean aphids overwinter in the egg stage on common buckthorn and alder-leaf buckthorn. The eggs are laid on or near leaf buds on young plants and are therefore exposed to cold winter air unless they are covered by snow.

Disciplines
Entomology

Insects and Mites

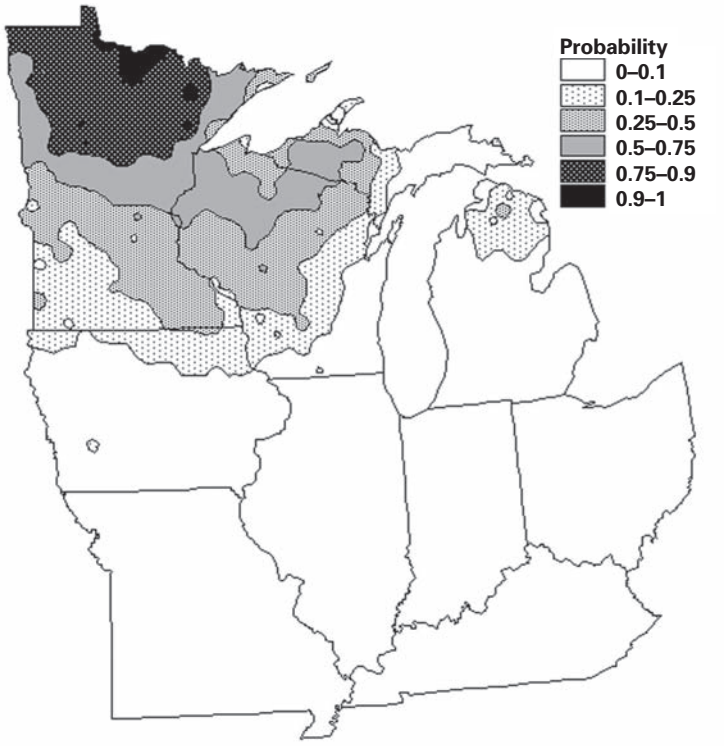
Winter temperatures and soybean aphid survival

by Marlin E. Rice, Department of Entomology

What effect will the winter weather have on crop pests? This was one of the most common questions asked by participants during the recent Crop Advantage Series meetings. And no insect, except maybe the corn rootworms, causes greater concern than the soybean aphid. We know that soybean aphids overwinter in the egg stage on common buckthorn and alder-leaf buckthorn. The eggs are laid on or near leaf buds on young plants and are therefore exposed to cold winter air unless they are covered by snow.

During the last several years, David Ragsdale and his research team at the University of Minnesota have investigated soybean aphid survival during simulated winter conditions. Their findings were recently published in the journal *Environmental Entomology* and will help us understand how well aphids can survive winter temperatures. They stated that the capacity for soybean aphid eggs to survive may depend on their ability to supercool and tolerate winter temperatures. When insects supercool, they lower the freezing point of their body fluids to prevent the formation of ice crystals. This behavior protects them against low temperatures. However, even aphids have their limits as to what they can tolerate. The temperature at which ice crystals will form in an insect and cause instantaneous death is known as the supercooling point.

The researchers found that the average supercooling point of soybean aphid eggs was a very cold –29 °F (that's minus 29!). This is the temperature at which eggs would rupture from ice crystal formation and die. Then they determined the annual probability that winter temperatures would equal or fall below the average supercooling point. The map shows a 10 to 25 percent probability that extreme low air temperatures are likely to reach or exceed the mean supercooling point for soybean aphid eggs in the northern quarter of Iowa. There is one small area in southwestern Iowa near Atlantic that suggests temperatures may get cold enough to kill soybean aphid eggs. Because this area is not topographically unique with respect to surrounding counties, this predicted "cold spot" may be a function of incorrectly reported weather station data and can probably be ignored.



So how do these research findings help us interpret what may have happened to soybean aphids in Iowa? Temperatures in Iowa this past winter were unusual. It was the 27th coldest December in the past 133 years, but the coldest reported temperature was –19 °F at Cedar Rapids and Sheldon. No temperatures were recorded in Iowa at or near the supercooling point of –29 °F. In contrast, January tied with 1933 as the warmest January on record with a high of 65 °F at Onawa. Based on these winter events and the predicted supercooling point of –29 °F, the soybean aphid should have experienced widespread success at overwintering in Iowa during the winter of 2005–2006.

Thanks to David Ragsdale and Brian McCornack, University of Minnesota, for providing the map. Their complete research article can be found at **http://docserver.esa.catchword.org/deliver/cw/pdf/esa/freepdfs/0046225x/v34n2s2.pdf**.

Marlin E. Rice is a professor of entomology with extension and research responsibilities in field and forage crops.