E-1232 (Revised)

SOYBEAN INSECTS

Soybean Aphid, *Aphis glycines*, Management in North Dakota

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Soybean aphid, *Aphis glycines,* was found in the eastern counties of North Dakota in August 2001, one year after the original discovery in Wisconsin. Since then, soybean aphid has been found on soybean plants in North Dakota as far west as the Missouri River, though their overwintering survival may be limited to areas in the more eastern counties of the state. Though no economic infestations were found during the 2001 season, fields that had significant infestations warranting treatment to limit yield losses were treated in 2002 and 2003. Further, each of those seasons had different infestation patterns, illustrating the unpredictability of this insect pest from season to season. Field scouting to monitor for aphids is strongly recommended. Failure to do so could result in significant yield losses.

Description

Soybean aphids are small (approximately 1/16 inch long) soft-bodied insects and may be winged or wingless (Figures 2 and 3). Nymphs can be much smaller than adults. The soybean aphid is light yellow with black cornicles ("tail-pipes") and a pale colored cauda (tail projection). Winged adults will have a black head and thorax. Nymphs that will be winged as adults develop visible wing pads on their thorax (Figure 5). In mid August the aphids are often lighter in color.

Life Cycle (Figure 6)

The soybean aphid can survive winter only in the egg stage, as is true of other aphids in temperate zones. Buckthorn (*Rhamnus* spp.) is the only known overwintering host (Figure 7). Aphid eggs are very winter hardy and can survive extended periods of very cold temperatures. It appears that

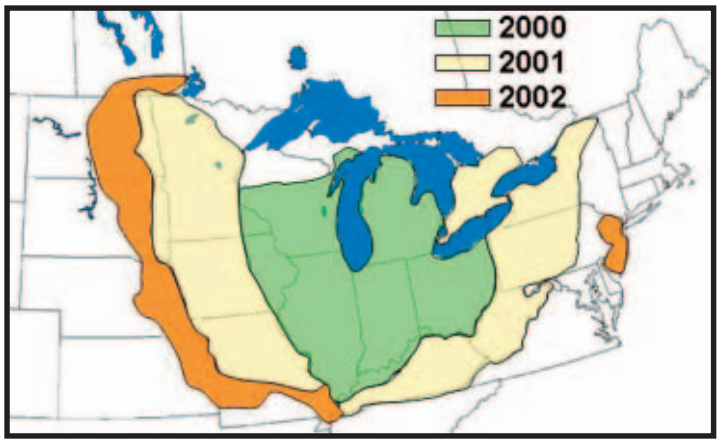

Figure 1. Soybean aphid distribution in the central United States and areas of Canada from the years 2000 and 2003.

Figure 2. Soybean aphid adults and nymphs.

Figure 3. Close-up of soybean aphids.

Figure 4. Winged soybean aphid adult.

Figure 5. Soybean aphid nymph with wing pads visible.

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NOVEMBER 2004

soybean aphid eggs may have some difficulty surviving the colder winter temperatures in the region, though survival levels have yet to be determined. Soybean aphids hatch in the spring and are expected to have two to four generations on buckthorn, with winged females developing during each generation and leaving the overwintering host in search of soybean. Numerous generations of wingless females will develop on soybeans before a winged generation of females and males migrate back to buckthorn in late-summer/early fall to mate and lay eggs.

Damage

Aphids suck sap from plants. When infestations are large, infested leaves are wilted or curled. Other symptoms of direct feeding damage may include plant stunting, reduced pod and seed counts, puckering and yellowing of leaves. The aphids excrete honeydew, a sweet substance that accumulates on surfaces of lower leaves and promotes the growth of sooty mold. This aphid colonizes tender leaves and branches from seedling to blooming. Later, as the growing point slows, the aphids move down to the middle and lower part of the plant, feeding on the undersides of leaves, stems and pods. In early August, aphid colonies begin to rapidly increase in number again. These increases are followed by the migration back to buckthorn.

During the feeding process, soybean aphids are capable of transmitting viruses including alfalfa mosaic, soybean mosaic and bean yellow mosaic. These viruses commonly occur together and form a complex. Symptoms are frequently associated with specific fields and not all fields in a region. General symptoms of soybean viruses include plant stunting, leaf distortion and mottling, reduced pod numbers and seed discoloration. Forage legumes are important sources of inoculum for alfalfa mosaic virus. Infected seed is the most important means for introducing soybean mosaic virus into a field. These viruses occur at a very low incidence in North Dakota. They may become more important in the future with the establishment of the soybean aphid.

Management Recommendations

Treatment Threshold and Spray Timing

1. Scout once or twice a week beginning in early July. Fields near buckthorn, the overwintering host, may be colonized at emergence and require earlier scouting. In areas without buckthorn, winged aphids migrate from other areas in mid-season. August infestations in North Dakota have been strongly influenced by migrating aphids from soybeans south and east of the region.
2. Check 30 to 40 plants per field. Examine the entire plant, particularly new growth. Scout late-planted fields closely.
3. **Use an action threshold of 250 aphids per plant if populations are actively increasing.** In replicated research trials, this threshold has worked well in late vegetative, R1 to R4 soybeans (Figure 8). Treatments made in mid-August, which often coincide with the R5 growth stage, have lower potential for protecting yield with the possibility of little return for the investment depending on value of the beans, general plant health, plant stress and other growth factors. Spraying after R6 has not been documented to increase yield, especially if the crop has grown well through the vegetative stages.
   - To determine if an aphid population is actively increasing, check fields over several visits. Conditions that favor aphid population growth are cool temperatures, plant stress, particularly drought stress, and a lack of aphid predators.
   - Check for mummies (parasitized aphids) and for winged females. Do not spray if mummies are numerous, or if a majority of the aphids are winged or developing wings (Figure 5), an indication that the aphids will soon leave the field.
   - Plants are likely to be considerably above threshold if stems or pods are covered with aphids and honeydew, sooty mold covers the bottom leaves and plants are stunted. Insecticide treatment is probably still of value,

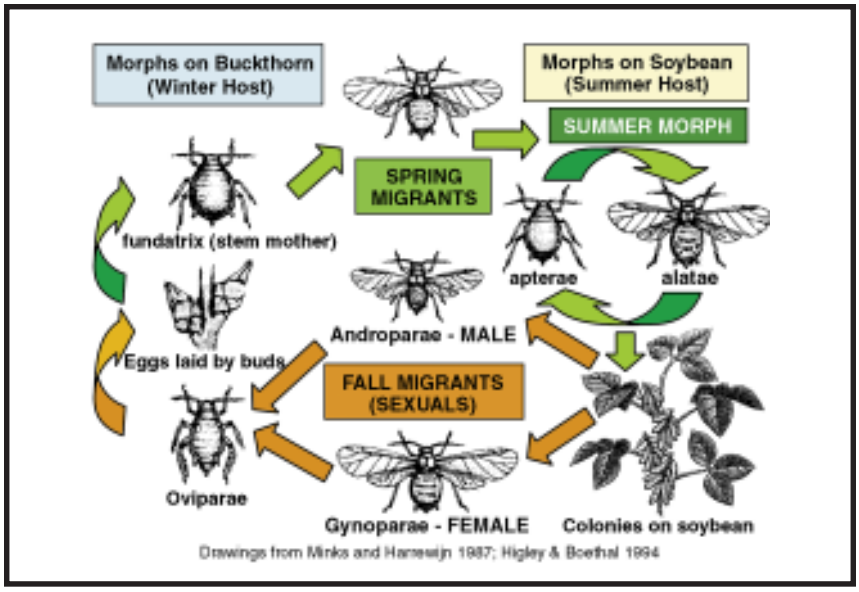

Figure 6. Life cycle of soybean aphid, *Aphis glycines.*

Figure 7. Common buckthorn (*Rhamnus cathartica*). Leaves are dark green and glossy with three to four pairs of upturned veins. Green leaves often remain on trees well into the fall. Small, yellow-green flowers are clustered at the base of leaves in spring.

Figure 8. Beginning Bloom (R1), Full Pod (R4), and Beginning Seed (R5). R1 is when at least one flower is found on the plant at any node, usually the third to sixth, on the main stem. R4 is when there is a pod at least 3/4 inch long on at least one of the four upper nodes of the main stem. R5 is when the plant has seed at least 1/8 inch long in one of the pods on one of the four upper nodes of the main stem. (For more information see NDSU circular A-1174, Soybean Growth and Management Quick Guide)

but the optimal time for treatment (greatest economic return) is past.

- Currently, it is recognized that a population which reaches 4,000 aphid days results in approximately 4% economic losses (yield or quality losses equivalent to the cost of implementing a management strategy) when the population is reached from the R1 to R4 growth stages. The recommended treatment threshold, based on aphids per plant, incorporates an approximately seven-day lead-time between scouting and treatment, helping to make spray arrangements or handle weather delays to prevent a population from increasing and accumulating the critical number of aphid days (Figure 9).

When treating, consider the insecticide choices for your situation. Aphid kill, residual, and yield gains are not consistent among individual insecticides.

- Pyrethroids (Warrior, Mustang, Asana, Baythroid) have a long residual, and work best at temperatures below 90°F. Organophosphate products have a fuming action, and may work well in heavy canopies or at higher temperatures under all circumstances.

Registered Soybean Aphid Insecticides

Insecticide	Dosage in Lb Ai/acre	Product Per Acre	Post Harvest Interval (PHI)	Restrictions on Use
Asana XL *RUP*	0.03 to 0.05	5.8 to 9.6 fl oz	21 days	Do not feed or graze livestock on treated plants.
Baythroid *RUP*	0.013 to 0.025	0.8 to 1.6 fl oz	45 days	Maximum number of applications of 4 per season.
Furadan 4F *RUP*	0.25 to 0.5	4 to 8 fl oz	21 days	Apply in sufficient water for thorough coverage (minimum gallons: air - 2 gal/acre, ground - 20 gal/acre).
Lorsban 4E *RUP*	0.5 to 1.0	1 to 2 pts	28 days	Do not graze or feed forage to dairy or meat animals within 14 days after application. Do not feed straw from treated soybeans to meat or dairy animals within 28 days after application.
Mustang Max *RUP*	0.0175 to 0.025	2.8 to 4.0 fl oz	21 days	Do not graze or harvest treated soybean forage, straw or hay for livestock feed. Use a minimum of 2 gal finished spray by air or 10 gal finished spray by ground.
Penncap-M *RUP*	0.25 to 0.75	1 to 3 pts	20 days	Do not make more than two applications per season.
Pounce *RUP*	0.1 to 0.2	4 to 8 fl oz	60 days	Do not feed or graze livestock on treated plants.
Warrior *RUP*	0.015 to 0.025	1.92 to 3.2 fl oz	45 days	Do not graze or harvest treated soybean forage, straw or hay for livestock feed. When applying by air, apply in a minimum of 2 gallons of water per acre.

RUP - Restricted use pesticide

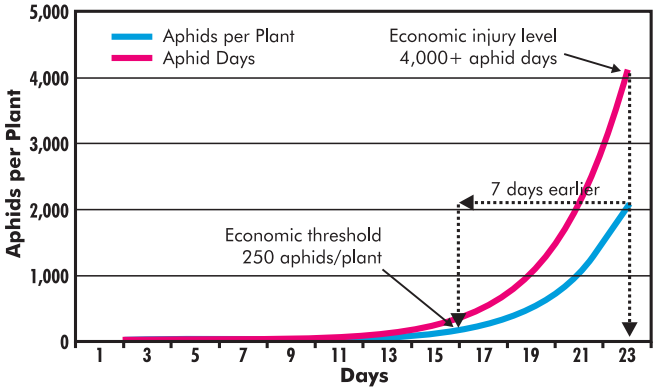

Figure 9. Soybean aphid population growth comparing observations of aphids per plant with the cumulative aphid population growth over time.

Figure 10. Clockwise from upper left: lady beetle larva, lacewing larva, aphid mummy and fungus-killed aphid.

- Tank mixes of fungicides, herbicides or foliar feedants, with an insecticide targeted for the soybean aphid, are generally compatible, but a jar test is always recommended. Crop damage has been reported where organophosphate insecticides have been added to herbicides, so caution should be used. Consider the optimal timing and method (GPA, pressure, nozzle type) for all the components in the tank mix.
- Good coverage is important, particularly with aerial application. High spray volumes and high pressure help to move the insecticide down into the canopy.
- Adding insecticide to early-season glyphosate applications as "insurance" is not recommended. Insecticides should only be used when aphid populations are at threshold levels and actively increasing.
- It is suggested to leave an unsprayed check strip for comparing against sprayed areas to determine the performance of the insecticide and the value of the treatment.
- Spraying at early reproductive stages poses a threat to bees. Communicate treatment plans to beekeepers and follow precautions to minimize bee kills. In areas with concern about honey bees, pyrethroids are a better choice for application than other formulations.

These recommendations are the cooperative effort of researchers throughout the North Central states, funded with soybean checkoff dollars through the North Central Soybean Research Program.

Natural Management

Intense rainfall may kill many aphids by dislodging them from the plant. High humidity that follows rains should increase the potential for aphid fungal infections.

Numerous predators and parasites attack aphids. Important predators of the soybean aphid are lady beetle larvae, lacewing larvae and predatory bugs. Evidence of parasitic wasp activity is the presence of aphid mummies on leaves scattered through the aphid colonies.

Aphid populations may decline rapidly in response to other factors. Crowding and declining quality of food resources often stimulate the development of winged adult aphids. There were numerous cases reported since August 2001 where aphid populations declined rapidly as the aphids developed wings and migrated from those fields.

Additional References

Fischer, D. W. and J. Fanta. 2004. Reproductive Soybean Development Stages and Soybean Aphid Thresholds. U of Wisconsin Extension Circular X-1134.

Photo Credits

Figures 2, 3, and 4 courtesy of Dr. David J. Voegtlin, Center for Biodiversity, Illinois Natural History Survey.

Figure 10 lacewing larva courtesy of Texas Forest Service Archives, Texas Forest Service. Image 3227003. ForestryImages.org. http://www.forestryimages.org/ .May 31, 2002.

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E-1232