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Japanese Beetles in South Dakota

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Biology of Japanese Beetles

The Japanese beetle, *Popillia japonica* Newman, (Coleoptera: Scarabaeidae) was first reported in South Dakota in 2007, when a small infestation was observed in Union County. Although relatively new to our state, this beetle has been a major pest throughout the eastern United States since approximately 1916, when it was first reported in New Jersey. This beetle is capable of feeding on over 300 plant species and is referred to as a polyphagous (able to feed in several plant species) pest. The larvae of the Japanese beetle feed exclusively on the roots of grasses, making them a nuisance pest of lawns, parks and golf courses. In South Dakota, adult Japanese beetles are the primary concern as they defoliate leaves and fruits of trees, shrubs and variety of ornamental and horticultural plants. Another concern is that in other states the adults have been documented as pests of field crops, including corn and soybean. Although the Japanese beetle has not yet caused significant economic injury to South Dakota field crops, its presence in the state increases the potential for it to become a major defoliating pest of corn and soybean, as it already has in some states where it has been established longer. However, through an integrated pest management approach it can be managed in both urban and agricultural settings.

Description

The adult Japanese beetle is a striking beetle that is approximately ½" long, with a boxy, bulky shape (Figure 1). It is a scarab beetle like the common June beetles that are seen at night around lights in the summer. However, the Japanese beetle has a distinctive metallic coloration that is green on the foreparts and bronze on the elytra (wing covers). The underside of the body is

Figure 1. Adult Japanese beetle
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black and lined with several bands of fluffy, white hairs. These bands of hairs protrude from the sides of the beetle, giving the appearance of a "checker" pattern along the edges of the abdomen when viewed from above. Although there are several species of beetles that resemble the Japanese beetle in size as well as coloration, none of them have the combination of color as well as distinct bands of white hair on the sides of the abdomen. Japanese beetles are often found on

Figure 2. Adult Japanese beetles in aggregation or clusters.
Photo by Adam Varenhorst, SDSU Extension

Figure 3. White grub curled in "C" shape
USDA Agricultural Research Service , USDA Agricultural Research Service, Bugwood.org

plants in aggregations or clusters (Figure 2).

The larvae of Japanese beetles can be difficult to distinguish from the many other species of soil-dwelling grub larvae that feed on grass roots. In general, these larvae are referred to as "white grubs" due to their general white or tan-white coloration and brown head capsule. White grubs typically curl their bodies into a "C" shape when disturbed (Figure 3). These species do not emerge from the soil until they become adult beetles. Japanese beetle grubs can be distinguished from other white grubs by carefully examining the "raster," which is a collection of hairs or spines near the posterior (rear) end of a grub. For the Japanese beetle, the hairs of the raster are arranged in two diverging rows that resemble a faint "V" shape.

Life Cycle

Japanese beetles typically complete one generation per year, although in colder climates, they may require more than one year (Figure 4). Adult beetles begin emerging in late June to early July, and are active for approximately two months, during which time each female can lay several dozen eggs (up to 60 in one season). Adults are powerful flyers, and can disperse over long distances easily, feeding on many different host plants and spreading their eggs over a large area. Eggs are deposited in the soil, 2 or more inches deep.

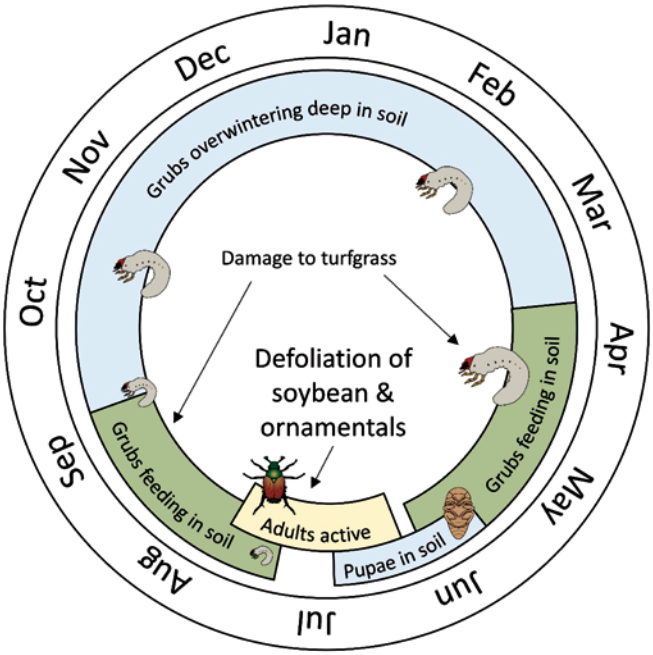

Figure 4. Japanese beetle life cycle

After two weeks, the eggs hatch into grubs, which remain in the soil and feed on grass roots until winter. During the fall the larvae will burrow deeper into the soil to avoid cold temperatures and overwinter in a dormant state. The grubs move back towards the soil surface in the spring to continue feeding on grass roots for another 4-6 weeks. Once the grubs mature they pupate in the soil for one week and then emerge as adults.

Feeding and Plant Damage

White grubs mainly feed on grass roots and this damage prevents the plant from taking up enough water for the grass to survive. The result of extensive white grub feeding are large patches of dried, brown grass, especially in areas with inadequate irrigation. In these dead patches, the turf can often be rolled back easily, like a carpet, because there are no roots left to hold the turf together. Rolling back the grass may reveal the larvae, which are most likely to be found at the edges of nearby green areas. These dead areas may also be excavated by local animals (e.g., raccoons, birds) as the white grubs are a suitable food source.

Perhaps the most dramatic injury caused by Japanese beetle is caused by the adult form. Adults feed extensively on greenery, "skeletonizing" leaves by consuming all the leaf tissue between the veins, which reduces the leaves to a frail, lacey or skeletal appearance

(Figure 1). Entire plants can be skeletonized in this way. These plants suffer from the lack of photosynthetic tissue, and are also more susceptible to pathogens and diseases. After a plant is initially attacked, the chemicals it exudes into the air attract additional beetles to the feeding site, causing mass aggregations (Figure 2) that can quickly skeletonize an entire plant. Although the primary targets of skeletonizing attacks are trees and ornamentals, soybean plants may also be defoliated in this way, with occasionally severe results. In corn, Japanese beetles may also feed on leaves, but this is unlikely to be of economic importance. However, feeding that occurs on the silks by adult beetles is of greater concern. If the beetles clip the silks during pollination it will result in reduced kernel set and yield.

Management

As of now, Japanese beetles have not caused significant economic injury to field crops in South Dakota. Japanese beetles have been found in nine counties in South Dakota, and are considered established in four counties (Codington, Brookings, Minnehaha, and Union). Japanese beetles in South Dakota have in general been associated with lawns and horticultural crops. However, the beetle is known to have caused damage to field crops in neighboring states, and farmers are advised to be aware what their treatment options are in case of field infestations.

Scouting and Economic Threshold

The basic scouting technique for Japanese beetles is the same as for any other defoliator. It is recommended to scout at least ten plants that are spread across the field. To ensure different parts of the field are scouted, walk a W or Z pattern in the field, and select 2 or 3 plants spread out along each "leg" of the W or Z. Sample a leaf from the top, middle and bottom of each plant. For soybean, estimate the percent defoliation using Box 1 as a guide. Treatment may be justified if the average defoliation across all plants and all leaves is above the stage-dependent economic threshold. Consider spraying pre-bloom (vegetative stages) soybean if average defoliation is 30% or more, and consider spraying post-bloom (reproductive stages) soybean if average defoliation is 20% or more. Yield losses of 3-7% are associated with pre-bloom defoliation of 30% or more, with similar yield reductions if post-bloom defoliation is 20% or more. For corn, leaf feeding by Japanese beetles is generally not an issue but feeding on the silks can cause yield losses. The economic threshold for corn is three or more beetles per ear or silks that have been clipped to ½ inch when pollination is only 50% complete.

However, because there are many different insects that can defoliate soybean it is important to identify the insects before applying insecticide. This can be done by a spreading a white sheet on the ground between soybean rows, bending one row-foot of plants over the sheet and carefully shaking to knock insects onto the sheet. As before, sample a minimum of 10 locations spread across the field. Sweep net sampling can also be used to effectively determine the identity of Japanese beetles present in the field.

Management

Registered Insecticides

Please refer to the current edition of the South Dakota Pest Management Guide: Soybean and also South Dakota Pest Management Guide: Corn for a complete list of insecticides available for Japanese beetle management.

Trapping

There are some products that are designed to lure and trap Japanese beetles using floral chemicals and pheromones that are attractive to the beetles, or by planting flowers such as geraniums near the crop to be protected. While these techniques can trap Japanese beetles, there are concerns that they may simply lure additional beetles into an area and increase their populations; resulting in more severe defoliation. Trapping is also not thought to be effective or economical for use in large-scale farming operations, but may be effective for small gardens.

Biological Control

The Japanese beetle has no shortage of natural enemies (predators, parasites and pathogens that attack it). Many birds will root out and eat white grubs, and large numbers of these birds congregating in a field may be an early indicator of a white grub infestation. Mammals, such as skunks and raccoons, may also consume large numbers of white grubs. However, these animals usually cause considerable damage to the

turf while digging out grubs, so they may be no more desirable than the grubs themselves. There are many types of soil-dwelling insects that can be important predators of Japanese beetle eggs and small white grub larvae, including ground beetles and ants. Some research indicates that grub-management regimes that do not harm these natural enemies may improve overall management of the pest.

Some of the most promising biological control agents for white grubs are parasitoids and pathogens. Examples of parasitoids include *Tiphia* wasps, whose larvae attack white grubs, and the winsome fly, whose larvae attack adult Japanese beetles. These parasitoids may be able to reduce Japanese beetle populations in some cases, but their ability to persist in South Dakota and provide consistent management of Japanese beetle populations is currently unknown. Several pathogens have been used for managing Japanese beetle larvae, including the nematode worms *Steinernema* and *Heterorhabditis* (Figure 5), and a bacterial pathogen called "milky spore". These are soil-dwelling organisms that attack Japanese beetle larvae upon contact (or upon being accidentally consumed by the larvae). They can provide lasting management, but often take a long time (several years) to fully establish. These pathogens may be available commercially, but careful consideration must be given to specific recommendations for application and use.

Figure 5. Nematode worms Steinernema and Heterorhabditis.
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It is important to remember that most chemical insecticides that will kill pest insects will also kill many beneficial insects, including natural enemies that may help manage pest populations. Insecticide applications should be based on scouting and populations that have reached economic thresholds to reduce the impact of these management tactics on beneficial insects.

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