Identification, Monitoring, & Management Of Asiatic Garden Beetle in Field Crops

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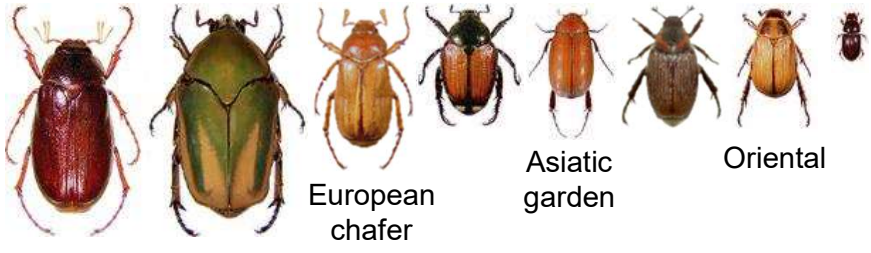
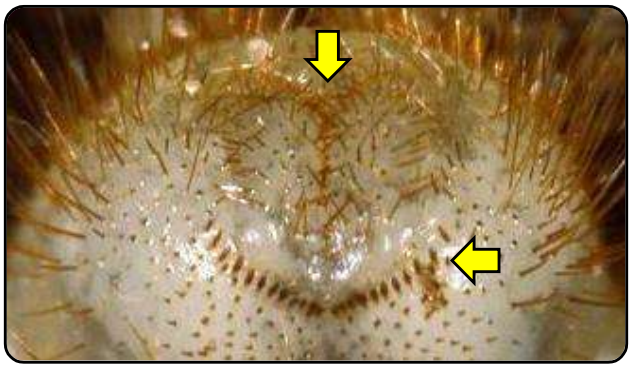


Adults of common white grub species found in field crops. Beetles are sized relative to each other.

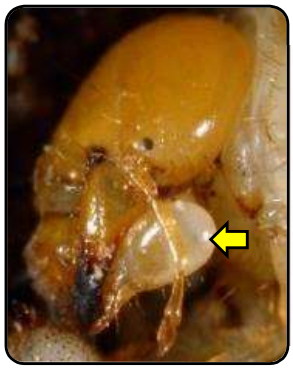
The Asiatic garden beetle (AGB), is an annual white grub species (i.e., a single generation per year) that was introduced to the United States in 1921 and has since spread to 24 states and 2 Canadian provinces. AGB is a sporadic pest of turf, ornamentals, weeds, and (more recently) field crops like corn and soybean in the Great Lakes region.

AGB identification

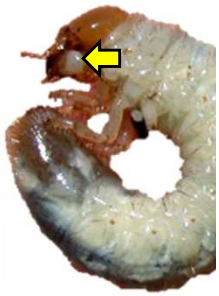
Aggressive *and 'bitey'; does not retain C-shape.*



Rear end has strongly ***Y-shaped anal slit*** *+ crescent-shaped row of spines.*



Face of AGB grub has characteristic ***white bulb****.*



Seasonal distribution of life stages in field crops (based on sampling in MI & OH)

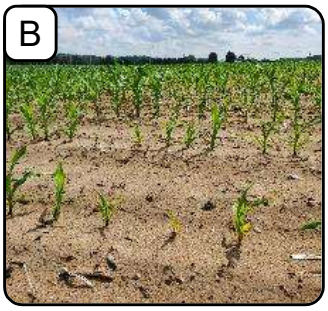
« 2nd (bottom) and 3rd (top) instar grubs. These stages hibernate through the winter and infest crops the following spring.

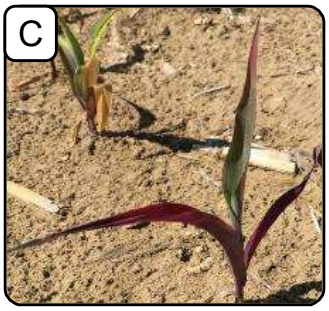
« Pupae and barrel-shaped, chestnut-brown adults (paperclip for size). 3rd instar grubs stop feeding and pupate in late-May to June.

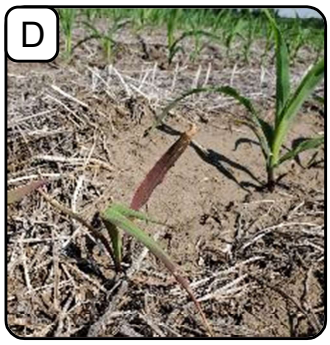
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

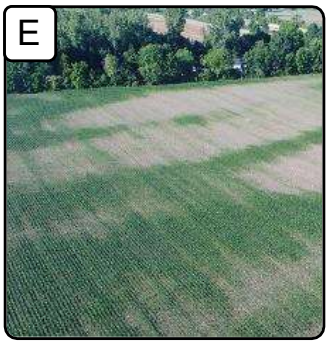
Signs and symptoms of AGB infestations

Feeding by 2nd and 3rd instar AGB grubs (A) in the spring (May-June) can result in extensive root loss which causes plants to stunt and remain "stuck" in early growth stages (B), turn yellow and/or purple (C), wilt from reduced water uptake (D), and ultimately die. Heavy infestations can cause extensive plant stand reduction (E) and necessitate replanting when losses are too great. Crops planted in early May are more susceptible to grub feeding damage.

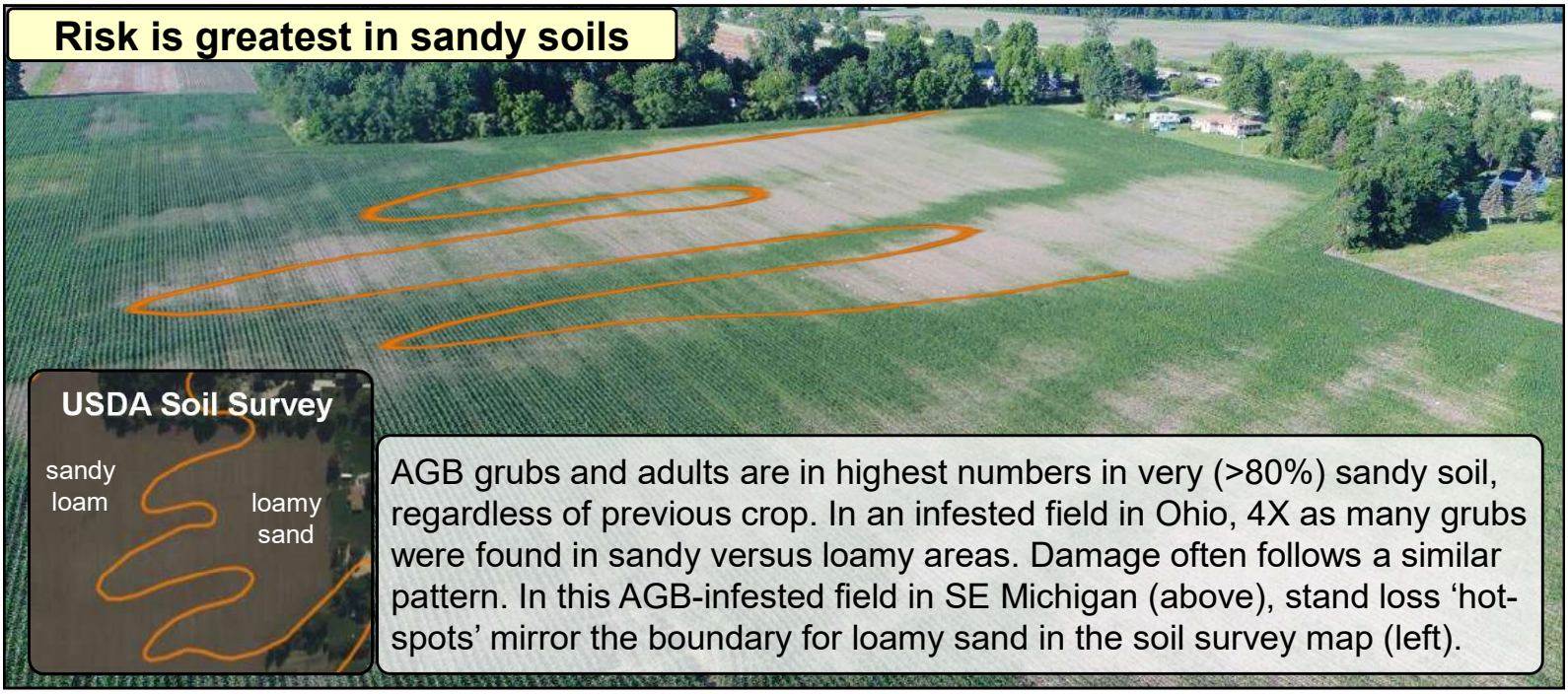








Risk is greatest in sandy soils



AGB grubs and adults are in highest numbers in very (>80%) sandy soil, regardless of previous crop. In an infested field in Ohio, 4X as many grubs were found in sandy versus loamy areas. Damage often follows a similar pattern. In this AGB-infested field in SE Michigan (above), stand loss 'hot-spots' mirror the boundary for loamy sand in the soil survey map (left).

Adult biology and behavior

Nocturnal adults feed on the foliage and flowers of over 100 plant species. In contrast to skeletonizing injury typical of Japanese beetle (F), AGB consumes entire leaves including veins (G). Hosts include many weed such as palmer amaranth, giant ragweed, and marestail (H). Both adults and grubs can be scouted by pulling these species up in fields and on field margins. Beetles also feed on numerous ornamental plants. Since they are attracted in high numbers to lights on warm summer evenings, ornamentals under lights (such as hostas) often show feeding damage.

Adult populations generally peak in the last week of June through mid-July, and egg laying begins soon after. Adults prefer cool moist areas under a dense plant canopy for egg-laying and can move easily into sand soil where they reside during daytime.

AGB management in field crops

The biggest challenge of AGB is its control, because infestations are spotty and difficult to predict, and replicated studies on management tactics are limited. Below we provide our observations and recommendations to help deal with this insect, as of the time of publication.

Impact of environmental conditions

TOO WET
flooding

Flooding kills AGB grubs directly or forces them to the soil surface, where they are exposed to predators.

This field in SW Michigan 'lost' its AGB population after heavy flooding in spring 2018.

JUST RIGHT
cool, moist, canopied + well drained soil

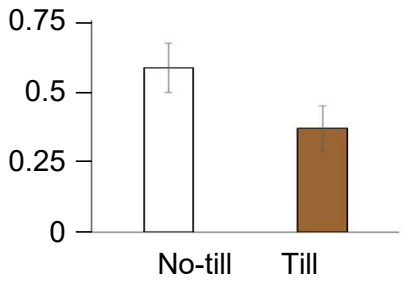
AGB prefers moist conditions for egg-laying at night, especially in > 80% sand content. This often means that sandy knolls or light textured portions of fields are most heavily infested, creating hot spots across a field. This makes AGB management even more complicated.

TOO DRY
drought

- A dry spring could present a worst-case scenario, where AGB grub feeding is combined with poor root development.
- In contrast, a dry summer could reduce areas attractive for egg laying, since females prefer moist, shaded soils.
- In both scenarios, grubs might be found lower down on slopes, where moisture is still present, rather than on top of sandy knolls.

Impact of tillage

Average # AGB per sample. (Split field in Wauseon, OH).



- Damaging AGB infestations have been found in both no-till and conventionally tilled fields, although no-till fields may be at greater risk for egg-laying if crop residue keeps the soil moist and cool. Grubs can be found in corn roots from previous crop.
- Tillage may provide some reduction in AGB by directly injuring grubs, reducing protective residue, or bringing AGB to the surface where they are exposed to the elements and predators. The graph to the left shows an apparent reduction in the number of grubs in the tilled half of an Ohio field However, tillage does not reduce populations to '0'.

Grub actively feeding on decaying corn roots during springtime.

Timely weed control

- In season: Weed control in wheat stubble after harvest and in fields left fallow from the spring should reduce attractiveness for egg laying by AGB females and reduce food for hatched grubs.
- Fall: Weed control after harvest would remove hosts for AGB grubs in the current year and in the following spring.

Preferred weed species

- Chickweed
- Giant ragweed
- Lambsquarters
- Marestail
- Palmer amaranth
- Pokeweed
- Queen Anne's lace
- Tree-of-heaven

Planting date

Fields with a history of AGB infestation should be planted last, to reduce the time of crop exposure to grub feeding (grubs stop feeding after pupation). This recommendation is based on our knowledge of AGB biology and observations from crop consultants.

Insecticides and AGB

The biggest gap in AGB management is effective insecticides. To date, there are laboratory-based studies that document actual reduction in grub numbers with the use of soil insecticides. The information below is based on the impression of growers and consultants, our lab studies, and our knowledge of the efficacy of insecticides to control other grub species.

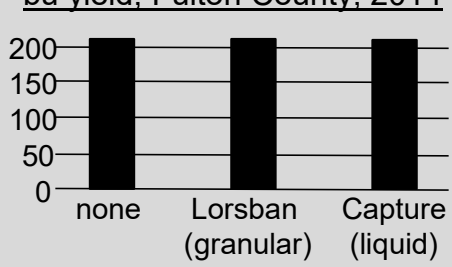
Insecticides applied at planting

Chlorethoxyfos in-furrow or granular soil insecticide:

- **Advantages**: prescription, IPM-based solution compared to seed treatments, because the system can be shut off/on to treat only hotspots in the field; low rates yield high mortality.
- ***2ee Recommendation*** *is in place for Index® on AGB grubs at a rate of 0.65-0.72 fl. oz/1000 ft of row. The 2ee is for use only in Indiana, Michigan, Ohio, & Pennsylvania.*
- **Limitations**: this product requires a closed application system and can only be applied in-furrow (no banding) with an injection system for liquids. Calibration is critical.

Bifenthrin-only products are largely ineffective.

Note: Where insecticides have been used against grubs, reductions in beetle emergence and increases in yield are hard to document.



In a replicated, field-length strip trial in NW Ohio, under "very high' AGB pressure, there was no yield difference in treated & untreated plots. (*trial done by A. Michel & E. Richer, OSU).*

Neonicotinoid seed treatments: *inconsistent*

250 rate **No impact**	• **Evidence:** Corn fields heavily damaged by AGB all had at least a 250 rate of insecticidal seed treatment.
500 rate **Limited protection** *under low AGB populations*	• **Evidence:** anecdotal observations from producers and consultants. • **Advantages:** most corn hybrids can be sourced with a 500 rate of insecticide; easy to handle & plant; use with any equipment. • **Limitations:** limited efficacy; entire field must be planted with the moderate rate (more $) when infestations are typically patchy.
1250 rate **Good protection** *but not bullet-proof under high AGB populations*	• **Evidence:** anecdotal observations from producers and consultants. • **Advantages:** will also provide some corn rootworm larval control; easy to handle & plant; use with any equipment. • **Limitations:** an expensive 'non-IPM' type solution because the entire field must be planted with high-rate seed when infestations are typically patchy; not all seed sources provide a 1250 rate.

Insecticides sprayed to kill egg-laying beetles: *May or may not work*

Evidence: (i) Multiple, weekly sprays in potato fields failed to reduce AGB grub damage to tubers, while (ii) a single Warrior spray in R3 soybeans caused many dead beetles 24 hours post spray.

Problem: It is difficult to predict exactly when peak adult emergence will occur and whether the beetles stay in the same field to lay eggs or leave to colonize others.