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Research Brief

Limited Potential for Milk to Control Soybean Aphid

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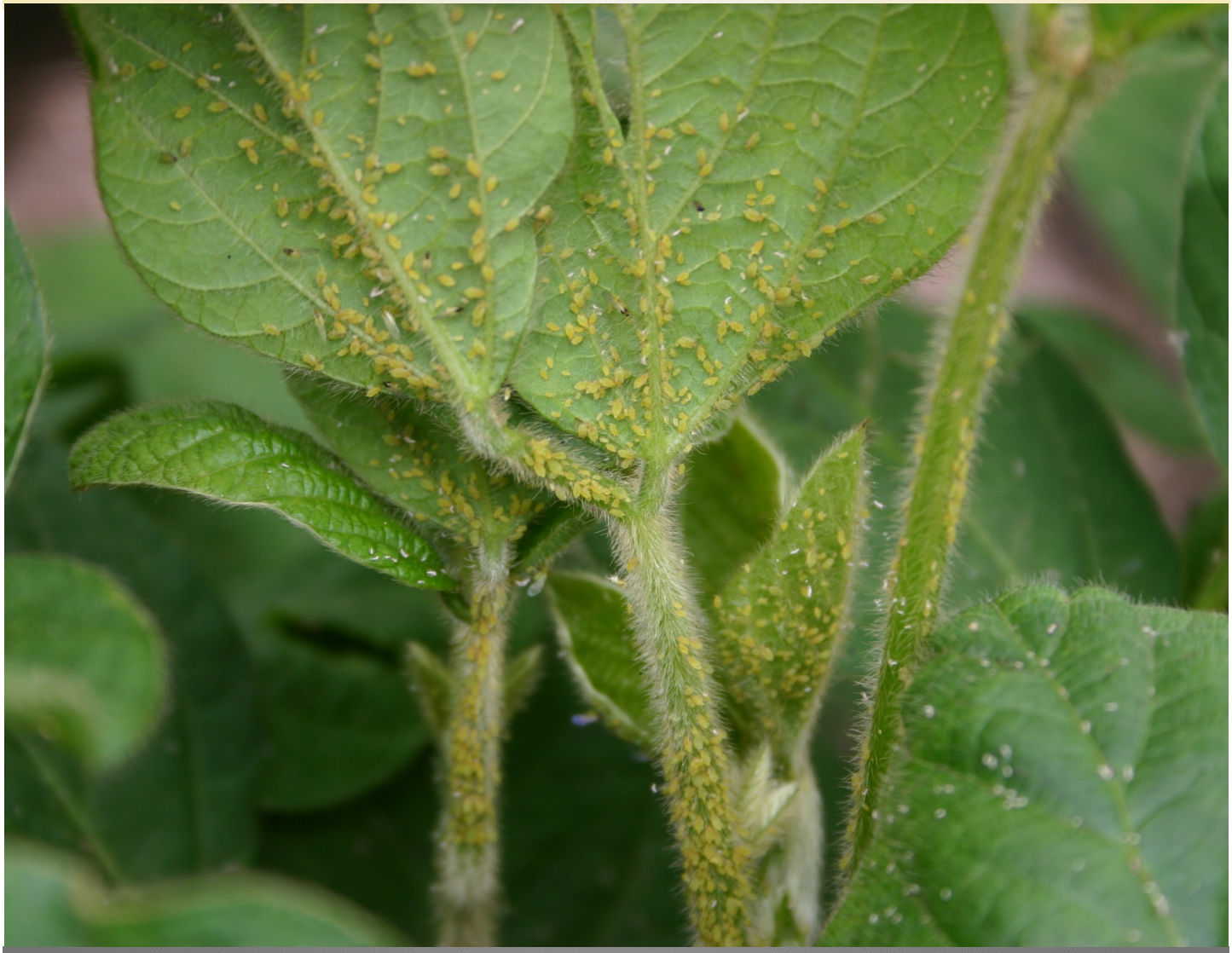


Key Findings:

- There is interest in finding alternatives to chemical insecticides for pest management in field crops.
- Some have reported that milk may be effective against some pests.
- We found that a milk treatment, including milk containing high concentrations of antibiotics, is not effective against soybean aphids.

Background

There is interest in finding alternatives to insecticides for pest management in field crops. A stakeholder presented anecdotal evidence that out-of-condition milk may have some effectiveness against some pests. Soybean aphid (*Aphis glycines*) is a major pest of soybean throughout the U.S. Soybean aphids reproduce asexually on soybean, resulting in rapid population growth in which populations can double in as little as 6 days. This pest feeds on the stems and undersides of leaves, which can damage plants and decrease grain yield up to 40%.

Objective

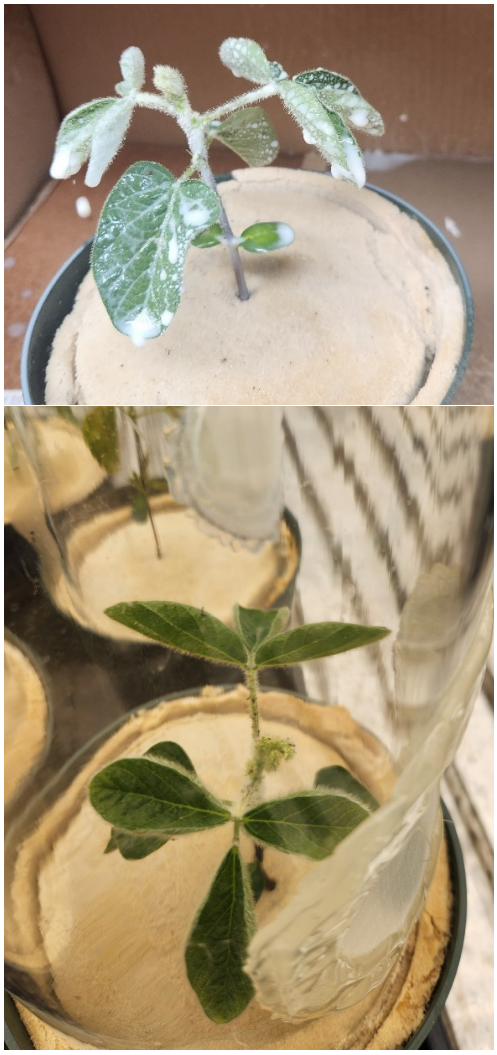
To evaluate the potential for whole milk to kill soybean aphids on soybean plants, and to provide preliminary information regarding milk's potential as an aphid-management strategy.

Methods

1. A colony of soybean aphids was increased from a single aphid collected from an agricultural field in Brookings County.
2. Susceptible soybean plants were grown in a greenhouse to the first trifoliate stage.
3. Soybean plants were infested with 10 adult soybean aphids per plant. Plants were caged to prevent plant-to-plant movement of aphids and transferred to a growth chamber to permit aphid increase for 10 days, after which the aphid counts were about 200 aphids per plant.
4. Whole, raw milk was procured from a local dairy. From the same lot of milk, one 1-gallon portion was treated with 300,000 units of penicillin G (as Norocillin) and 300 mg of oxytetracycline (as Noromycin 300 LA), antibiotics commonly used to treat dairy cows for mastitis and other conditions; this rate produced a concentration of antibiotics in milk higher than expected from treated cows. One portion was stored at room temperatures ranging from 65-68 F for 43 hours to simulate milk that would be out-of-condition because of improper storage conditions. One portion was stored at approximately 37 F. Milk was agitated and strained through paper coffee filters prior to application.

Soybean plant immediately before treatment. Live aphids are green; exosleletons of molted aphids are white. Plants had approximately 200 live aphids per plant at treatment.

5. Plants were treated liberally 10 days after infestation using a hand sprayer. All leaf surfaces, including the underside (where aphids typically reside) were treated. Six replicate plants were treated with
   - Water (control)
   - Milk = whole raw milk stored under refrigerated conditions
   - TempMilk = whole raw milk stored at 65-68 F for 43 hours before application
   - MedMilk = whole raw milk fortified with high concentrations of antibiotics
   - Insecticide = Ridgeback formulated insecticide containing sulfoxaflor and bifenthrin
6. Each plant was isolated and placed in a growth chamber for 7 days.
7. Plants were harvested and live aphids were counted 7 days after application



Top: soybean plant immediately after milk treatment.
Bottom: Isolated soybean plant in growth chamber 28 hours after milk application. Live (green) and dead (dark) aphids are visible.

Results

No aphids survived treatment with commercial insecticide. Milk significantly reduced soybean aphids, i.e., up to 81.5% relative to treatment with water. The particular milk treatment did not make a difference in effectiveness. Aphids that were observed on all milk treatments were located primarily on the new emerging trifoliate leaves and petioles. Very few aphids were counted on lower unifoliate and older trifoliate leaves. In contrast, aphids found on water-treated plants were covering the entire plant (all leaves, stem, and petiole).

We expect that aphids that survived on all milk treatments were protected within leaf hair clusters. Because their populations had rebounded to pre-treatment numbers within 7 days after treatment, and would continue to increase exponentially, a milk treatment is considered ineffective for soybean aphids.

Treatment	Soybean aphids per plant 7 days after treatment	Standard error	Mean comparisons (same letter = not different)	Reduction relative to water
Insecticide	0	0	A	100%
Milk	196	29.2	B	81.5
TempMilk	205	49.3	B	80.6
MedMilk	256	54.6	B	75.9
Water	1060	79.1	C	0

Next Steps

Because milk was not effective under the conditions of this study, which maximized contact with the pest, we do not plan follow-up studies with milk for soybean aphid. However, biological control and other non-chemical options will continue to be evaluated.

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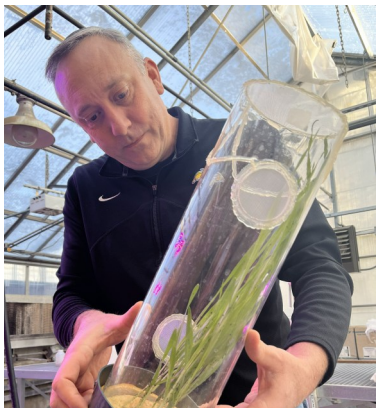

Questions or comments?
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About NCARL

The North Central Agricultural Research Laboratory (NCARL) is a USDA-Agricultural Research Service laboratory located in Brookings, SD. The goal of NCARL is to develop, document, and promote soil, crop, and pest management practices that are ecologically sustainable while maintaining producer profitability.