PRACTICAL FARMERS OF IOWA
COOPERATORS' PROGRAM Farmer-Led Research

RESEARCH PROTOCOLS

Row Covers for pest management in winter squash

Objective: What is the optimal time to remove row covers from butternut squash to minimize pest pressure and achieve optimum yield?

Hypothesis: The improved plant vigor of plants covered longer will result in decreased pest pressure and increased yield.

Farmer-Cooperator will:

- Follow Research Protocols for study
- Take photos throughout the project
- Keep in contact with PFI with updates and questions
- Turn in all data by November 2020

Practical Farmers of Iowa will:

- Help set up research protocol.
- Monitor progress of project and provide support when needed.
- Publish results in a PFI research report, on PFI website, and potentially other outlets.
- Provide $550 cooperator payment at conclusion of project year.

Project Design:

- Randomized, replicated trial of butternut squash with three row cover treatments.
  Treatment 1: Row cover removed at first female flower.
  Treatment 2: Row cover removed 2 weeks following treatment 1.
  Treatment 3: Row cover removed 2 weeks following treatment 2.
- The trial will run for two successions, with four replications of each treatment (12 plots total) per succession.
- Agribon-19 will be used as row cover.
- Farmers can use other management strategies to control pests once plants are uncovered, but should be consistent across treatments (like spraying Surround, for example).
- Remove plants with bacterial wilt as needed.

Layout example of four replications of three treatments.

T1	T3	T2	T1
T2	T1	T3	T2
T3	T2	T1	T3

Photo List:
- early-season field-shot of trial
- removing row cover (farmer in photo!)
- pests or disease (include treatment info and date in photo)
- mid-season field-shot of trial
- groups of fruit during harvest, in bins, etc.
- harvest-time with farmer in the photo
- bonus for photo of farmer entering data in the field!

- **Data Collected:**
  - Dates of: seeding (and row covers applied), emergence, first true leaf (and thinning), first flower (T1 row cover removal), T2 row cover removal, T3 row cover removal.
  - Weekly scouting information for squash bug, cucumber beetle and bacterial wilt beginning when first row cover is removed.
  - Harvest data by plot: marketable fruit count, weight, number of surviving plants/plot.

Project Timeline

<table>
<tr><td colspan="2">• Review research protocol
• Complete MOU and pre-project survey</td></tr>
<tr><td>Succession 1</td><td>Succession 2</td></tr>
<tr><td>May
• May 10: Prepare field
• May 15: direct seed squash and cover with Agribon-19.
June
• First true leaf: thin squash plants, add direct-seed to any holes w/ no germ.
• Uncover T1 plots at first flower. Scout for cucumber beetle and squash bugs – record data.
• Continue scouting for pests weekly; record data.
July
• Uncover T2 plots (two weeks after T1).
• Continue weekly scouting and data recording.
• Uncover T3 plots (two weeks after T2).
• Continue weekly scouting and data recording.
August – November
• Manage crop normally, scouting each week for squash bugs, cucumber beetle and bacterial wilt.
• Harvest squash; record data in accordance with data collection sheet.</td><td>June
• June 10: prepare field
• June 15: direct seed squash and cover with Agribon-19.
July
• First true leaf: thin squash plants, add direct-seed to any holes w/ no germ.
• Uncover T1 plots at first flower. Scout for cucumber beetle and squash bugs – record data.
• Continue scouting for pests weekly; record data.
August
• Uncover T2 plots (two weeks after T1).
• Continue weekly scouting and data recording.
• Uncover T3 plots (two weeks after T2).
• Continue weekly scouting and data recording.
September – November
• Manage crop normally, scouting each week for squash bugs, cucumber beetle and bacterial wilt.
• Harvest squash; record data in accordance with data collection sheet.</td></tr>
<tr><td colspan="2">• Enter data and photos (see photo shot list, above), to PFI's google site: https://sites.google.com/practicalfarmers.org/research/home.
• Complete post-project survey.</td></tr>
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Adult squash bug. (photo credit: Jeffrey Hahn, Univ. of Minnesota)

Squash bug egg mass on underside of leaf. (photo credit: Photo by Gerald Holmes, California Polytechnic State University at San Luis Obispo Bugwood.org)

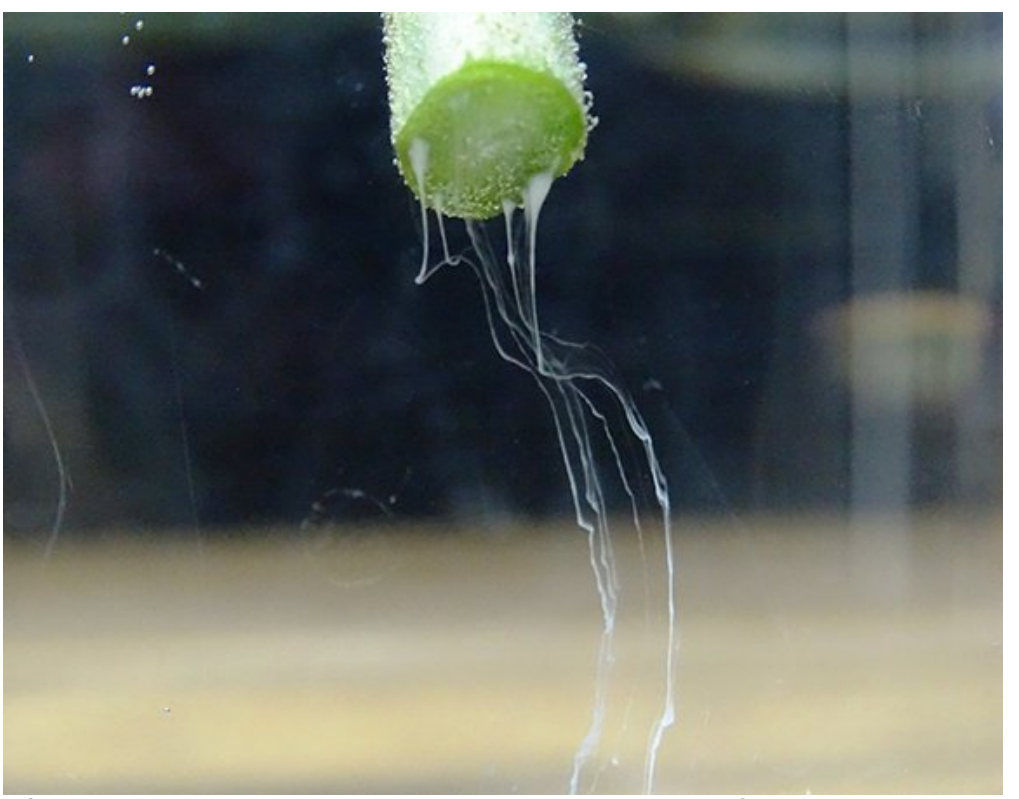
Squash bug nymphs (and eggs) on squash leaf. (Photo credit: UMass Extension, Vegetable Program)

Striped cucumber beetle (Photo credit: Utah State University)

Spotted cucumber beetle (Photo credit: Utah State University)

Cucumber beetle egg mass, yellow to orange. (Photo credit: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org)

Bacterial wilt. Can look similar to vine borer damage (except no stem entry of vine borer!). When stem is cut will ooze bacterial exudate. (Photo credit: Howard F. Schwartz, Colorado State University, Bugwood.org)



Infected stem in water (Photo credit: American Phytopathological Society).