# Effects of Soil Nitrogen Rates & Neighboring Crops on Onion Thrips (Thysanoptera: Thripidae) Populations

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## Abstract:

Onion thrips is the insect vector of a severe virus in onion, *Iris yellow spot virus*. The thrips and virus are primary Threats to the economic stability of onion production worldwide. Overuse of insecticides to suppress onion thrips has resulted in the development of resistance, reduced performance of insecticides, and reduced onion yields. There is a compelling desire to find Alternatives to better manage these pests. In this study, we assessed onion thrips populations on onions with low (120 lb. N per acre) and high (350 lb. N per acre) nitrogen rates, and near and far from corn and wheat, two common neighboring crops in the onion farm-scape. We found a strong effect of growing corn next to onions: onion thrips were more abundant on onions near corn, and the thrips laid more eggs, than in the center of onion plots or near wheat. Onion plants and bulbs near field edges with corn and wheat than in the center of plots, suggesting that thrips injury reduced onion productivity. Onion Plants and bulbs treated with the higher rate of nitrogen fertilizer were larger than those with less nitrogen; however, there were no effects of nitrogen rates on onion thrips abundance. Integrated pest management, as a sustainable approach to manage onion pests, is discussed.

Thrips in the neck of an onion plant

Severe injury to onion crop due to high onion thrips population

Close-up of adult onion thrips

## Onion Farm-scape:

Onions growing next to wheat (right )and corn (left) in June. Corn plants were in the seedling stage while wheat was nearly mature.

Onions growing next to wheat (left) and corn (right) in August. Wheat plants were fully mature and corn was still in the vegetative stage.

## Acknowledgments:

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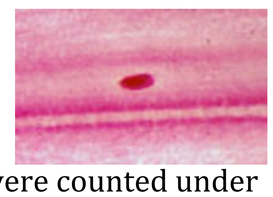
## Methods:

The research was conducted at the Utah Agricultural Experiment Station in Kaysville, UT in the summer of 2015. The onion, corn, and wheat plots were established as part of a long-term crop rotation and nitrogen rate study. This study included three plots of each onion, corn, and wheat (25 ft x 50 ft); each was split in half and treated with either a high rate (350 lb. N per acre) or low rate (120 lb. N per acre) of nitrogen fertilizer. Each onion plot was next to a wheat plot on one side and a corn plot on the other side. No insecticides were applied to any of the crops.

Collecting a corn plant sample

Samples were collected on five dates (June 16 and 24, July 8 and 21, and August 4) from the center and border of each onion, corn, and wheat plot. In onion, border samples were collected in the rows adjacent to corn and wheat. In corn and wheat, border samples were collected in the row next to onion. Samples consisted of three whole onion plants cut just above the bulb, three whole wheat plants cut at the soil line, and the upper one-third of three corn plants. Samples were placed into gallon-size press-seal plastic bags. When onion bulbs were sizing, bulb diameter were measured for three plants in the center and border of plots on July 29, August 4 and 12.

In the lab, samples were processed by washing them in a small bucket of soapy water and pouring the solution through a 230 mesh sieve to collect the thrips into a 20 ml glass vial with 70% ethanol. The third youngest leaf from each plant was removed and stained with acid fuchsin stain dye. Thrips adults, larvae, and eggs were counted under the dissecting microscope at 10-30x magnification.



Thrips egg stained with acid fuchsin dye.

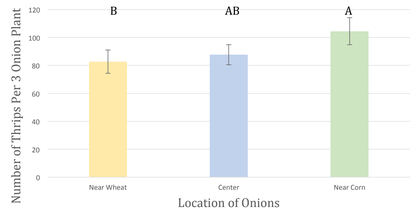
| | |
|---|---|
| **Corn** High Nitrogen | **Corn** Low Nitrogen |
| **Onion** High Nitrogen | **Corn** Low Nitrogen |
| **Wheat** High Nitrogen | **Corn** Low Nitrogen |

Plot map for the study . The plots were 50 ft by 25 ft; there were three replications resulting in 6 plots for each crop.

Washing plants in soapy water through a fine sieve to collect the thrips

## Results:

Fig. 1-Total Number of Thrips by Plot Location




Nearly Significant; $p = 0.07$

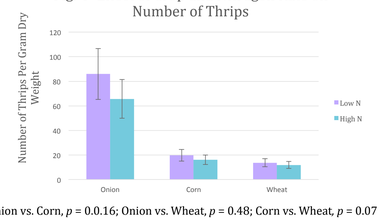
Fig. 2- Number of Eggs in Onion Leaves by Plot Location


Significant; $p = 0.02$

Fig. 3- Onion Bulb Diameter by Plot Location


Significant; $p = 0.007$

Fig. 4- Effect of Crop and Nitrogen Rate on Number of Thrips



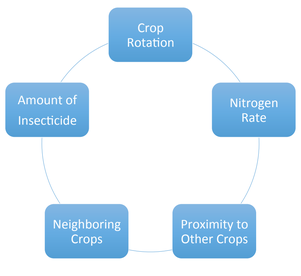

Onion vs. Corn, $p = 0.0.16$; Onion vs. Wheat, $p = 0.48$; Corn vs. Wheat, $p = 0.07$

- Onions growing next to corn had more onion thrips eggs, and nearly more adults and larvae, than those in the center of the plot (Fig. 2). Onions growing near wheat had an intermediate number of thrips eggs and fewer adults and larvae than in the center of the plot (Fig. 1).
- Onions growing next to corn and wheat had smaller bulbs than those in the center of the plot (Fig. 3).
- There was no effect of high and low nitrogen levels on thrips numbers in comparing onion to corn and wheat; however, it was nearly significant for comparison of corn and wheat (Fig. 4).

## Conclusion:

We found that growing onions next to corn increased the number of onion thrips infesting onion and reduced the size of onion bulbs. Wheat as a neighboring crop did not influence thrips populations as much as corn. Next to wheat, thrips numbers were similar, but bulb size smaller. We conclude that corn is attractive to thrips, and increases their populations on onion when it is grown nearby. Corn is also a high user of nitrogen and water; onions next to corn may be more stressed and susceptible to thrips infestation. In contrast, we did not see an effect of higher nitrogen fertilizer rate on thrips numbers, although we have observed this in previous studies. A reason may be that alfalfa was grown previously in these onion plots, and may have "washed out" the effects of the higher nitrogen rate due to its nitrogen fixing ability.

## Onion Integrated Pest Management:




Integrated pest management (IPM) is an approach that emphasizes multiple techniques to manage pests. IPM is focused on long-term pest suppression, and reduces the use of pesticides and other non-sustainable inputs.

**References:**

Alston, D., & Drost, D. (2008). Onion Thrips *(Thrips tabaci*). Retrieved February 11, 2015, from https://extension.usu.edu/files/publications/factsheet/ENT-117-08PR.pdf

Buckland, K., Reeve, J., Alston, D., Nischwitz, C., & Drost, D. (2013). Effects of Nitrogen Fertility and Crop Rotation on Onion Growth and Yield, Thrips Densities, Iris Yellow Spot Virus and Soil Properties. *Agriculture, Ecosystems and Environment, 177*, 36-74.