

## Onion Variety Trial

### In a Nutshell:

- Cooperators tested a range of onion varieties, measuring yield and storage stability.
- It was hypothesized that varieties that were more resistant or less attractive to thrips might have yield or storage benefits.

### Key Findings:

- No relationship was found between thrips and yield or storage outcomes.
- The Patterson variety performed particularly poorly, with the lowest average bulb sizes and yields at all of the locations.
- Blush, a pink variety, performed and stored well for Alice McGary and Mark Quee.
- The Ailsa Craig variety yielded well, but stored poorly for Kathy Dice and Roxane Mitten.

### BACKGROUND

There are many different varieties of onions, with different characteristics. Growth, yield, taste, and storage and transport hardiness are all commercially important factors to consider when choosing which variety to plant. Resistance to pests, both while growing in field and in storage are also important.

Thrips are small pest insects which pierce plant cell walls and feed on the contents, leaving hollowed-out areas of cell wall remnants which show up as the white patches on leaf tissues that are associated with thrips damage. Thrips damage aboveground tissue, hindering plant productivity. The wounds that they leave on leaves can serve as entry points for infections.

Kathy Dice, Alice McGary, Roxane Mitten, and Mark Quee conducted a trial to assess the performance of six different onion varieties, as well as the varieties' resistance to thrips damage and storage stability. Mitten listed the identification more of more tolerant varieties that could be used in a trap-crop strategy as one of her desired outcomes for the trial.

### METHODS

#### Design

The varieties chosen were diverse. Patterson is a yellow onion billed as very-long-storing [1], [2]. Talon is a white onion that stores well [3], [4]. Redwing is a red onion, also billed as long-storing[5], [6]. Ailsa Craig is a that is recommended for fresh eating, not storage [7], [8]. Rossa di Milano and Blush are pink varieties [9], [10], [11]. Ailsa Craig and Rossa di Milano are heritage, open pollination varieties; the others are F1 hybrids. Each trial tested three or four varieties; all grew Patterson in their set of varieties **Figure A1**. Planting and harvest dates varied

### Cooperators

Kathy Dice, Red Fern Farm –  
Wapello, IA

Alice McGary, Mustard Seed  
Community Farm – Ames, IA

Roxane Mitten – Iowa City, IA

Mark Quee, Scattergood Friends  
School Farm – West Branch, IA

### Funding

IDALS



*Thrips nymphs and adults on Roxane Mitten's onions' leaves. Photo taken July 18, 2024.*

due to local weather and individual preferences and are listed in **Table 1** along with management details. Cooperators randomly assigned four replications of each treatment across their beds for a total of 12 or 16 plots (**Figure A1**).

#### Measurements

At intervals through the growing season, cooperators measured thrips presence, inspecting the growing plants for thrips or signs of thrips damage.

At harvest, cooperators measured the fresh weight of all marketable bulbs, uncured, with the leaves intact (fresh weight) and number of all marketable bulbs (fresh count) from each plot. Average bulb size was determined from this data. After harvest, marketable bulbs were stored in labeled paper bags for several months. Some cooperators stored their entire crop, others took a random selection. The onions that were stored were then evaluated for marketability. Dice, Mitten, and McGary opened up a sampling of the post-storage onions and inspected them for damaged, mushy brown layers, scoring or noting rot. McGary and Quee weighed the onions that remained marketable after storage.

#### Data analysis

We used Fischer’s LSD at a 95% confidence level to determine if there were significant differences between varieties. For each metric, the difference between any two varieties was compared with the LSD. A difference greater than or equal to the LSD indicates a statistically significant treatment effect, meaning one treatment outperformed the other and the farmer can expect the same results to occur 95 out of 100 times under the same conditions. A difference smaller than the LSD indicates the difference is not statistically significant and the treatment had no effect. We can perform this analysis because the cooperators had completely randomized and replicated experimental designs (**Figure A1**).



Roxane Mitten harvesting her onions. Photo taken July 21, 2024.

TABLE 1. Planting and management details for each cooperator's trial in 2024.

	<b>DICE</b>	<b>MCGARY</b>	<b>MITTEN</b>	<b>QUEE</b>
Varieties	Ailsa Craig, Patterson, Redwing	Blush, Patterson, Rossa, Talon	Ailsa Craig, Patterson, Redwing	Blush, Patterson, Talon
Plants per Rep	9	36	35	20
Number of Reps	6	4	4	4
Seeding date	Ordered seedlings	Feb. 7	Feb. 2	Feb. 1
Planting date	March 29	May 7	April 25	Apr. 14
Harvest date	July 18	July 19	July 21	July 21
Post-harvest date sampling	Oct. 4	Oct. 22	Nov. 14	Dec. 5
Bed Prep	Composted sheep manure and hay — light mulch to avoid compaction	Strip-tilled, chicken manure and bedding tilled in pre-transplanting	Top-dressed manure fall 2023	Barn bedding shallowly cultivated, rototilled pre-transplanting
Mulch	Sheep manure and lawn clippings	No mulch	1 in. leaf mulch	No mulch
Irrigation	No	Not needed	Watered manually	Drip irrigation, as needed

TABLE 2. Fresh yields (July 18) and post-storage results (Oct. 4) of onion varieties at Kathy Dice's in 2024.

VARIETY	FRESH BULBS (no./plot)	FRESH WEIGHT (lb/plot)	FRESH BULB WEIGHT (lb/bulb)	POST-STORAGE SAMPLE QUALITY (Score/10)
Ailsa Craig	8.3 a	7.6 a	0.9 a	8.7 b
Patterson	8.7 a	4.6 c	0.5 c	9.8 a
Redwing	8.2 a	5.8 b	0.7 b	10.0 a
LSD (95)	0.7	1.0	0.1	0.5

Within a column, when the difference between any two averages is greater than or equal to the corresponding least significant difference (LSD), the values are considered statistically different at the 95% confidence level. We indicate statistical differences with letter-rankings. Values with an 'a' are greater than those with a 'b' but values with an 'ab' are equal to those with either 'a' or 'b'.

TABLE 3. Fresh yields (July 21) and post-storage results (Nov. 14) of onion varieties at Roxane Mitten's in 2024.

VARIETY	FRESH BULBS (no./plot)	FRESH WEIGHT (lb/plot)	FRESH BULB WEIGHT (lb/bulb)	POST-CURING BULBS (no./plot)	POST-STORAGE BULBS (lb/plot)	POST-STORAGE MARKETABLE BULBS (%)
Ailsa Craig	21.0 a	5.5 a	0.27 a	15.8 a	7.5 b	37% b
Patterson	20.8 a	4.5 a	0.21 a	20.8 a	20.5 a	99% a
Redwing	19.5 a	4.3 a	0.22 a	18.5 a	17.8 a	92% a
LSD (95)	7.2	2.1	0.08	7.7	7.6	25%

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TABLE 4. Fresh yields (July 19) and post-storage results (Oct. 12) of onion varieties at Alice McGary's in 2024.

VARIETY	FRESH BULBS (no./plot)	FRESH WEIGHT (lb/plot)	FRESH BULB WEIGHT (lb/bulb)	POST-STORAGE BULBS (no./plot)	POST-STORAGE WEIGHT (lb/plot)	POST-STORAGE BULB WEIGHT (lb/bulb)	POST-STORAGE SAMPLE QUALITY (% good)
Blush	35.8 a	14.7 a	0.41 a	31.8 b	10.1 a	0.32 a	63% b
Patterson	35.5 a	12.7 b	0.36 b	31.8 b	8.7 b	0.27 b	71% ab
Rossa di Milano	35.8 a	13.1 b	0.37 b	34.5 a	10.3 a	0.30 ab	92% a
Talon	35.8 a	13.6 ab	0.38 ab	32.3 ab	10.2 a	0.32 a	83% ab
LSD(95)	1.0	1.3	0.04	2.6	1.2	0.03	26%

Within a column, when the difference between any two averages is greater than or equal to the corresponding least significant difference (LSD), the values are considered statistically different at the 95% confidence level. We indicate statistical differences with letter-rankings. Values with an 'a' are greater than those with a 'b' but values with an 'ab' are equal to those with either 'a' or 'b'.

TABLE 5. Fresh yields (July 21) and post-storage results (Dec. 5) of onion varieties at Mark Quee's in 2024.

VARIETY	FRESH BULBS (no./plot)	FRESH WEIGHT (lb/plot)	FRESH BULB WEIGHT (lb/bulb)	POST-STORAGE BULBS (no./plot)	POST-STORAGE WEIGHT (lb/plot)	POST-STORAGE BULB WEIGHT (lb/bulb)	POST-STORAGE MARKETABLE BULBS (%)
Blush	17.0 a	11.26 a	0.66 a	15.8 a	7.86 a	0.50 a	93% a
Patterson	16.0 a	9.12 b	0.57 b	15.0 a	6.27 b	0.42 b	94% a
Talon	17.8 a	10.62 ab	0.60 ab	17.0 a	7.60 a	0.45 ab	96% a
LSD(95)	2.5	1.79	0.07	2.7	1.32	0.05	10%

Within a column, when the difference between any two averages is greater than or equal to the corresponding least significant difference (LSD), the values are considered statistically different at the 95% confidence level. We indicate statistical differences with letter-rankings. Values with an 'a' are greater than those with a 'b' but values with an 'ab' are equal to those with either 'a' or 'b'.

## RESULTS AND DISCUSSION

### Onion yield

Onion fresh weight yield differed significantly by variety in three of the four locations. Three of four locations also saw significant differences in average bulb weight. Patterson, the variety that all of the farmers grew as a common comparison and reference point, had the lowest average weight per bulb of the varieties. It had both significantly lower average bulb size and plot yields at three of the four locations — Mitten had no significant differences in yield by variety (**Table 3**). Two varieties, Blush and Ailsa Craig, had particularly high yield in their respective locations. Blush had the largest onions and highest fresh-yielding reps for McGary and Quee (**Tables 4, 5**). Quee commented on how much he liked Blush, that it yielded well, tasted good, and was an attractive pink color. In both locations where it was grown, the Ailsa Craig produced the largest onions by average fresh weight per bulb. Ailsa Craig produced the statistically significantly largest onions at Dice's farm (**Table 2**), although the difference was not significant for Mitten growing the same varieties (**Table 3**).

The other varieties, Talon, Redwing, and Rossa di Milano, were middling, with average bulb weight and yields between the larger Blush and Ailsa Craig and the smaller Patterson.

### Storage Quality

Storage quality varied with variety. The starkest example of this was the Ailsa Craig variety, which is a large, white onion that does not store well. As noted above (**Tables 2, 3**) it produced large onions and high yields, but it rotted quickly in storage at Dice's and Mittens farms. At both locations, only a minority of the onions survived to the end of the storage period. This is not wholly surprising — our data illustrates the 'short-storage' designation given in seed catalogs [7], [8].

Only McGary grew the Rossa di Milano variety. It performed comparably to Patterson in fresh yield but outperformed it in storage weight (**Table 4**). Rossa di Milano had the smallest number of culls of the four varieties McGary grew, and had the highest number of bulbs after storage, significantly more than Blush and Patterson. McGary found that Blush stored poorly, with the highest amount of rot discovered in the post-storage sample evaluated — significantly more rot than Rossa di Milano (**Table 4**). From the post-storage sampling, McGary was surprised overall by how many onions that seemed to have made it through storage had rot inside when cut open. She was pleased with the storage quality of the Rossa di Milano, but disappointed in the others.

The storage conditions varied by location, reflecting each farm's standard operating procedure for handling their onions. Quee had a cooler where he stored the onions until December. Because of the more controlled, cooler conditions, he had fewer onions rot in storage. Dice said that in the future, she would store onions in as cool a place as possible.

### Thrips incidence

No differences were found between varieties for observed thrips appearance, thrips damage, nor thrips effects on storage. In the systems where thrips damage was measured for all plants growing in the field, there was no relationship between thrips damage and

yield, nor thrips damage and storage quality. Mitten found thrips damage to be ubiquitous in her patch, with all the individual onion plants having thrips damage on their leaves.

## CONCLUSIONS AND NEXT STEPS

There was no observable relationship between thrips and storage rot. Nor was any variety more vulnerable to thrips. Thrips damage was visible on many or most of the onions' leaves. Because we were not able to measure any differences among the varieties in terms of vulnerability to thrips, we do not have any recommendations for management or variety changes that might limit the damage they do. One of Mitten's hopes for this project was to identify varieties she could use as part of a trap-crop strategy to manage thrip pressure, but those conclusions will have to wait for future explorations and results.

There were clear, observable differences between varieties' yields and storage properties. Blush did particularly well. Ailsa Craig yielded well but stored poorly. And the staple Patterson variety, which everyone grew, did not yield or store well. Growers relatively seldom see the inside of onions, and McGary found the opportunity to cut into so many post-storage to be illuminating of how many apparently marketable might have hidden damage.

The variety trial introduced cooperators to new varieties. Quee said that he was particularly happy with the performance and quality of his 'Blush' crop. He had never grown it before, but would again in future. Quee also valued his increased awareness of thrips as a pest and threat to plant health.



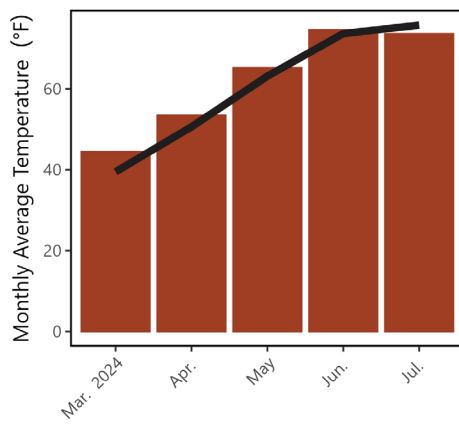
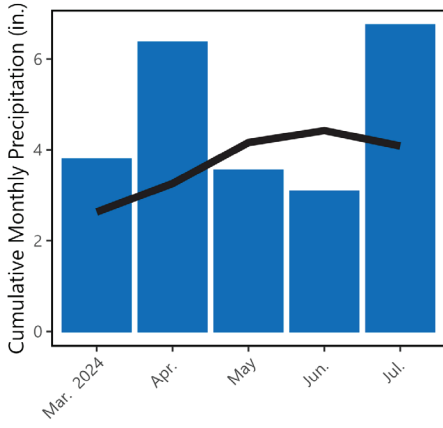
Post-storage examination of a Talon rep at Alice McGary's. Photo taken October 22, 2024

## APPENDIX — TRIAL DESIGN AND WEATHER CONDITIONS

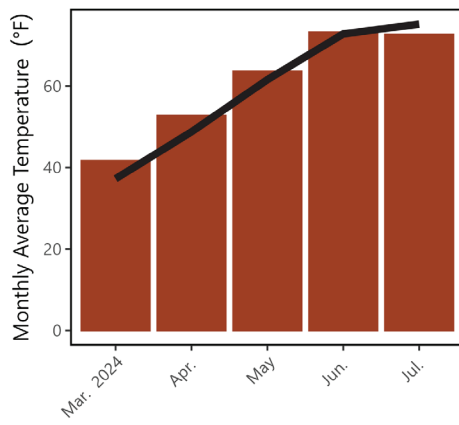
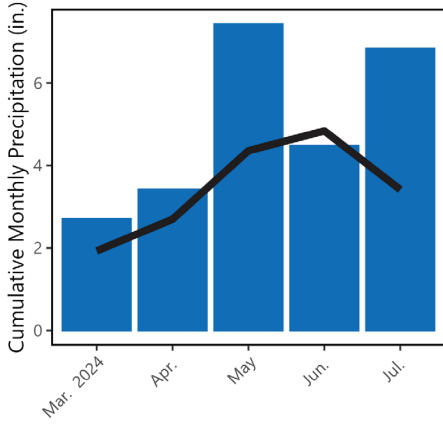
REP 1	A	B	C
REP 2	C	A	B
REP 3	B	C	A
REP 4	A	C	B

**FIGURE A1.** An example of the experimental design used by Dice, McGary Mitten, and Quee.

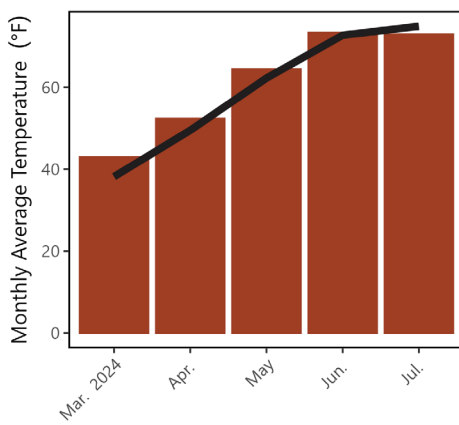
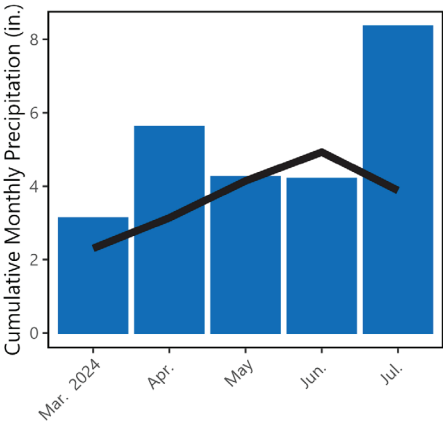
Dice



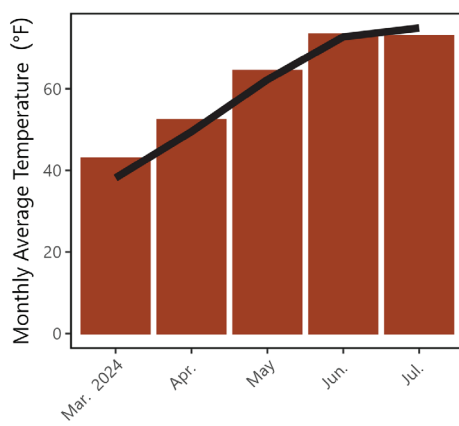
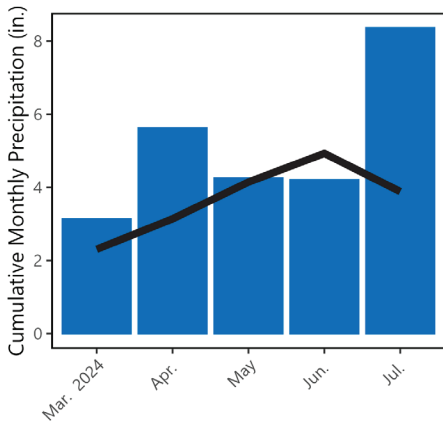
McGary



Mitten



Quee



■ Trial Growing Season    — 10-Year Average

■ Trial Growing Season    — 10-Year Average

**FIGURES A2.** Monthly cumulative precipitation and average temperatures in Wapello, Ames, Iowa City, and West Branch over the course of the experiment, March–July 2024 [12], [13].

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