Onion Nitrogen Management Research Update

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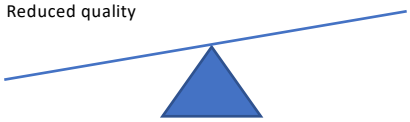
Balancing Risk in Nitrogen Management

Too Little N

- Yield Loss
- Reduced quality

Too Much N

- Environmental harm
- Added expense
- Quality impacts
  - Delayed maturity
  - Poor storage quality
  - Increased insect, disease pressure?



Research Question

How do nitrogen rate and source impact tradeoffs in yield, thrips populations, disease incidence, and storage quality in muck onion production?

Spoiler: Low thrips numbers and limited bacterial rot in the two site-years of our experiment meant we were not able to evaluate insect-disease-nitrogen interactions.

Methods

- Two-year on-farm experiment on muck soil in Hamilton, MI
- Onion varieties: 'Aldrin' (2017) and 'Champ' (2018)

Topdress N Rate Treatments

Trt	Topdress N	Total N[a]	Source/Timing
	lb N ac^{-1}		
1	0	90	Urea
2	50	140	Urea
3	100	190	Urea
4	150	240	Urea

[a]All treatments received approximately 90 (88.2) lbN/acre preplant. Remainder of total N rates applied topdress in early June.

Topdress N Source/Timing Treatments

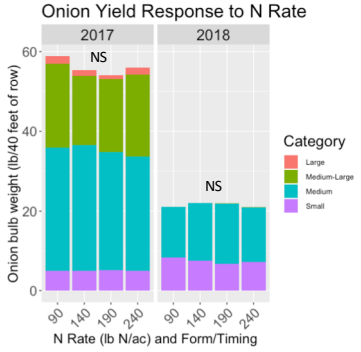
Trt	Topdress N	Total N[a]	Source/Timing
	lb N ac^{-1}		
3	100	190	Urea
5	100	190	ESN
6	100	190	Urea/ESN Blend (50/50)
7	100	190	Urea (Split Topdress[b])

[a]All treatments received approximately 90 (88.2) lbN/acre preplant. Remainder of total N rates applied topdress in early June.

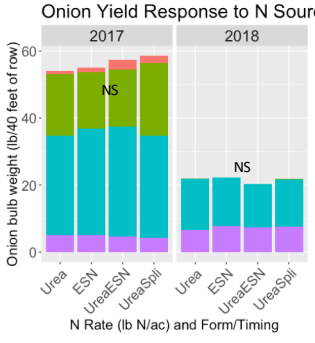
[b]Urea applied in two split topdress applications (mid-June and mid-July).

Data Collection: Yield by size category, storage quality, soil and tissue N content during the season

Higher N rates did not increase yield



Slow release N at topdress did not affect yield



- Also no evidence of delayed maturity

Higher N rates increased sprouting in 2017

Onion Quality Attributes Following Storage - 2017

Topdress N Rate	Rotten Bulbs	Sprouting Bulbs	Bulb Firmness	Bulb Moisture
Urea		%	lb in^{-2}	%
0	0.9	3.5 a	2.18	93.2
50	0.8	5.3 a	2.10	93.2
100	0.3	10.9 b	2.13	93.0
150	0.8	11.3 b	2.12	92.9
Significance	NS	0.02	NS	NS

- Stored in a cooler at 50°F prior to quality evaluations in early March
- No impact of N source/timing on storage quality
- 2018 storage quality measurements not completed yet

Results of similar study at Cornell

Ashley Leach[1], Stephen Reiners[2], and Brian Nault[1]

1. Onion yield does not increase with increased rates of nitrogen fertilizer.

Five rates of nitrogen were split-applied in 2017 and 2018 on a commercial muck onion farm with cv. 'Bradley':

1. 0 lbs. N/A at planting
2. 60 lbs. N/A at planting
3. 60 lbs. N/A at planting + 15 lbs. N/A at 3-5 leaves (75 lbs. N/A)
4. 60 lbs. N/A at planting + 45 lbs. N/A at 3-5 leaves (105 lbs. N/A)
5. 60 lbs. N/A at planting + 75 lbs. N/A at 3-5 leaves (135 lbs. N/A)

Consistently, onion plants fertilized with nitrogen have similar marketable yields (Figure 1a and 1b). In 2017, Plants treated with nitrogen had 66% greater marketable yields as compared to unfertilized onion plants, but all onions supplemented with nitrogen had statistically similar yields. In 2018, plants had similar yields regardless of nitrogen rate applied.

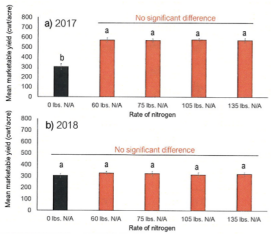


Figure 1 (right): Onion marketable yield (cwt/acre) in 2017 (a) and 2018 (b) within 5 rates of nitrogen. Onions with split applications of nitrogen were fertilized with additional nitrogen in June. Onions were planted in mid-April on 'muck' soil types in Elba, NY. Onions were harvested, cured for one week, and then weighed and graded.

Results of similar study at Cornell

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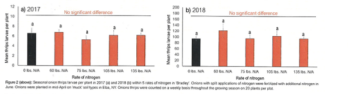
2. Onion thrips infestations are not impacted by nitrogen fertilizer.



Onion thrips are significant pests of onion, and we have not observed a season-long advantage of reducing nitrogen to reduce onion thrips infestations. Seasonal onion thrips larvae per plant is statistically similar between all nitrogen rates tested in 2017 and 2018 (Figure 2a and b).

3. Incidence of bacterial bulb rot increases with increased nitrogen fertilizer.

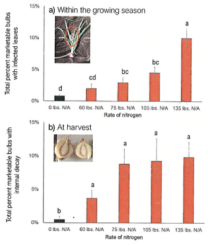


Figure 3 (above): Total percent onions with bacterial rot symptoms during the growing season (a) and at harvest (b) within differing rates of nitrogen in 'Bradley'. During the growing season (a), plots were examined for bacterial rot symptoms on two dates, 23 Jul 2017 and 16 Aug 2017. Any plant with wilted inner leaves (characteristic of *Pantoea ananatis*, identified and considered to have bacterial bulb rot (image inset). At harvest (b), a subsample of marketable bulbs ('Standard' and 'Jumbo' size grades) were longitudinally cut open at harvest to determine if the bulb was decaying (image inset).

In 2017, **nitrogen fertilizer significantly impacted the percentage of onion bulbs with bacterial decay** during the growing season and at harvest (Figure 3). Plots that received nitrogen fertilizer had approximately 3 times the amount of bacterial rot as compared to those plots that did not receive any fertilizer.

Summary

- MSU Nitrogen Recommendation for Onions on Organic Soils:
  - ➢140 lb N/ac
- Research supports this is sufficient, and **may often be significantly more than is needed to optimize yields**
- Evidence that higher N rates can increase severity of bacterial bulb rot and storability (sprouting)
- Can you reduce your N rates?

Pre-Sidedress Soil Nitrate Test (PSNT)

Research and Demos in MI Muck Onions, 1990-92

Dr. Darryl Warncke and Tom Dudek

Table 3. Comparison of nitrogen amounts recommended for sidedressing onions based of the presidedress soil nitrate test with standard grower practice.

Variety	Plant Population #/A	Preplant & Planting Time Fertilizer per acre	Soil Nitrate Credit lb N/A	Sidedress Nitrogen lb N/A	Yield cwt/A
FIELD 1					
Fortress	419,000	39 gals 7-22-4	86	PSNT 44 Grower 66	505 500
FIELD 2					
Norstar	200,000	175 lb 0-0-60 20 gal 8-32-0 10 gal 28-0-0	85	PSNT 37 Grower 112	420 400

Both fields were planted on April 23. Harvest dates were September 28 and 12 for fields 1 and 2, respectively

Soil Test Nitrate Levels in our N Trials:

- 2017, June 15: **102 ppm**
- 2018, June 19: **61 ppm**

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