Cornell Cooperative Extension
Cornell Vegetable Program

My big fat onion variety nitrogen rot project

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Empire Producers Expo – Onion Pest Management Session
Syracuse, NY: January 16, 2019

Acknowledgements

- Funding for this project provided by:
  - Monsanto/Seminis – Ron Garton
- Grower Cooperators:
  - Max Torrey, Big O, Elba, NY
  - DiSalvo's, Oswego
- Assistance provided by:
  - Amy Celentano & John Gibbons, CCE-CVP
  - Frank Hay & Sarah Pethybridge crew

Objectives

To evaluate "a handful" of onion varieties for bacterial bulb rot.
- **Identify tolerant or susceptible varieties, and perhaps explain why?**

- What is the relationship between bulb rot and nitrogen?
  - What can I learn about the effects of nitrogen fertility on onion variety?
    - Examples: Are there differences in nitrogen use between a shorter and a longer days to maturity variety? Between a vigorous and less vigorous variety?
- Experiment with different artificial bacterial inoculation techniques.
- Take a closer look at root health.

What Made this Project So Fat?

- **2 Locations:**
  - Elba
  - Oswego Co.
- **7 varieties**
  + 5 in Oswego
- **3 Nitrogen rates**
  - 37 lb/A
  - 100 lb/A
  - 150 lb/A
- **4 replications**

= 84 (Elba) to 144 (Oswego) plots/trial

= ~1 acre of trial area (all by hand)

- Soil NO3-N – 3-4 times
- Soil NH4-N – 3-4 times
- Tissue analysis – bulbing, harvest
- Plant characteristics – 1x
  - Measure neck diameter
- Root health assessment
  - Pink root
  - Fresh weight
- Artificial bacterial inoculations
  - Toothpick prick – 2 pathogens 1x
  - Backpack sprayer – 1x
- Yield, grade, rot assessment

Two Very Different Locations

Oswego

- Awesome
  - Low weed pressure
  - No thrips pressure
  - Minor disease
- pH – 5.4
- OM – 58.6%

Elba

- Extremely tough growing conditions
  - Extreme weed pressure
  - Extreme thrips pressure
  - IYSV
- pH – 5.9
- OM – 54.4%

Two Very Different Locations

Oswego

Aug 2, 2018

Elba

July 28, 2018

Two Very Different Locations

Oswego

Sep 28, 2018

Elba

Sep 20, 2018

Methods – Fertilizer Application

Fertilizer treatments blended and applied by hand. Grower incorporate mechanically.

Methods - Planting

Oswego

Grower plant trial with commercial seeder

Elba

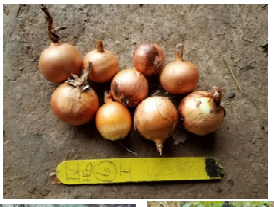
Grower make beds, plant barley, mark rows and drop drench. Trial planted with push seeder.

Differences Among Varieties

Trailblazer (95 days)

Oswego

- Least vigorous
- Most blue-green
- Most thrips



Elba

Aug 2

Sep 6

Aug 1

Aug 18

Saddleback (100 days)

Oswego

- Healthy roots
- Light green
- Good-moderate vigor

Elba

Aug 2

Sep 6

Aug 1

Aug 18

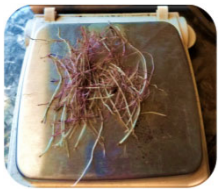
Root Assessment (Aug 9) – Torrey, Elba
% pink root, fresh root weight (g/10 plants)

Saddleback (100)
PR: 21% d
5.35 g **B**

Pocono (110)
PR: 28% c
5.52 g **B**

Montclair (112)
PR: 29% c
6.35 g **AB**

Braddock (107)
PR: 29% c
5.81 g **AB**



Trailblazer (95)
PR: 64% a
1.94 g **C**

Generally, longer day varieties have less pink root and more root mass.

Catskill (105)
PR: 34.1% b
5.12 g **B**

Red Wing (118)
PR: 34.1% b
7.38 g **A**

Generally, shorter day varieties have more pink root and less root mass.

Root Assessment (Aug 9) – Torrey, Elba
% pink root, fresh root weight (g/10 plants)

Saddleback (100)
PR: 21% d
5.35 g **B**

Short days with LESS pink root = tolerant

Pocono (110)
PR: 28% c
5.52 g **B**

Montclair (112)
PR: 29% c
6.35 g **AB**

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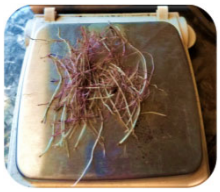

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PR: 64% a
1.94 g **C**

Catskill (105)
PR: 34.1% b
5.12 g **B**

Red Wing (118)
PR: 34.1% b
7.38 g **A**

Long day/ Big roots with pink root = susceptible

Catskill (105 days)

Oswego

- weaker roots
- Moderate-less vigor

Elba

Aug 2

Sep 6

Aug 1

Aug 18

Braddock (107 days)

Oswego

- Most floppy leaves
- Vigorous
- Healthy roots
- Greener leaves

Elba

Aug 2

Sep 6

Aug 1

Aug 18

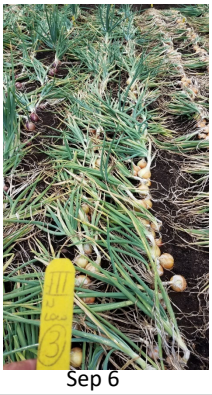
Pocono (110 days)

Oswego

- Moderate vigor

Elba

Aug 2



Sep 6

Aug 1

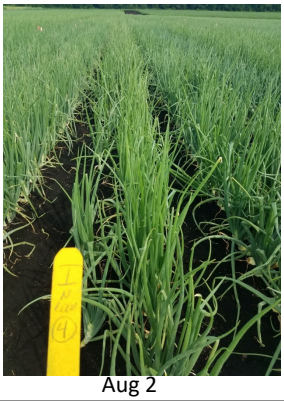
Aug 18

Montclair (112 days)

Oswego

- Greener leaves
- Vigorous

Elba



Aug 2

Sep 6

Aug 1

Aug 18

Red Wing (118 days)

Oswego

- Vigorous
- Fewest thrips
- Floppy leaves
- Pink root

Elba

Aug 2

Sep 6

Aug 1

Aug 18

Relationship Between Variety, Nitrogen & Bulb Rot

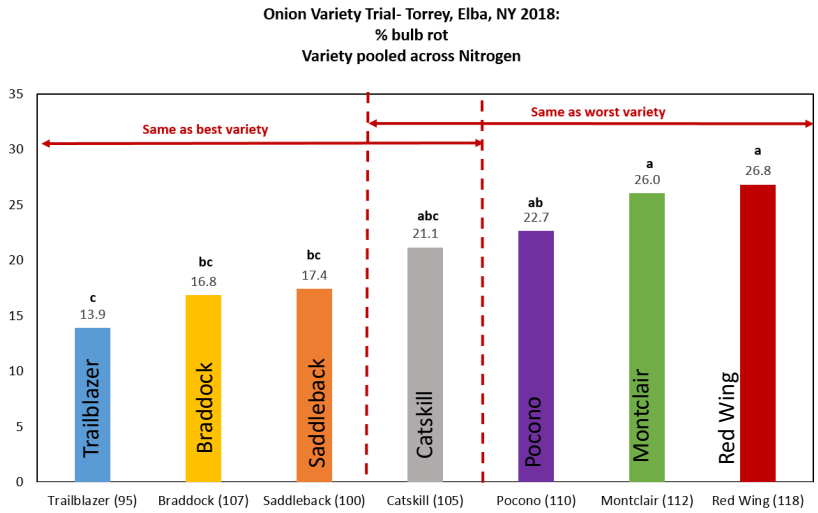
NONE!

No crop response in yield among 37 lb N, 100 lb N and 150 lb N

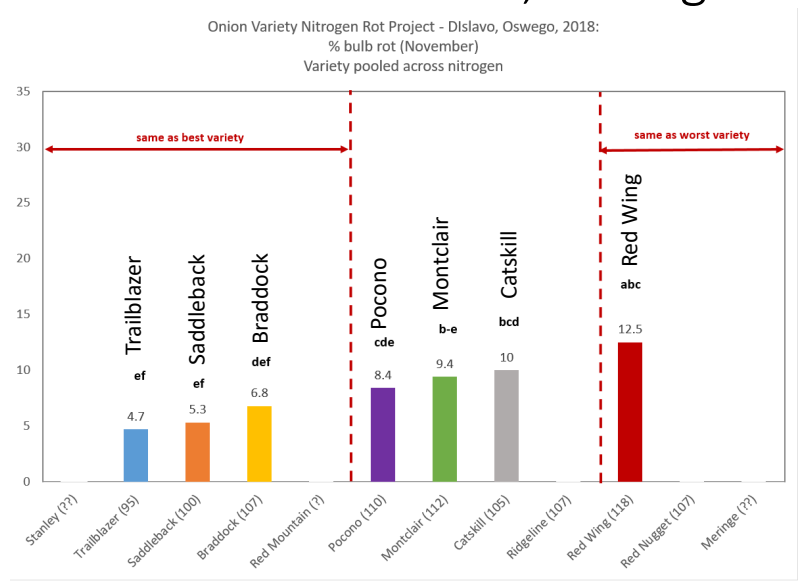
I'll explain later…

All varieties pooled across nitrogen treatments

% Rot at Harvest – Torrey, Elba



% Rot at Harvest – Disalvo, Oswego



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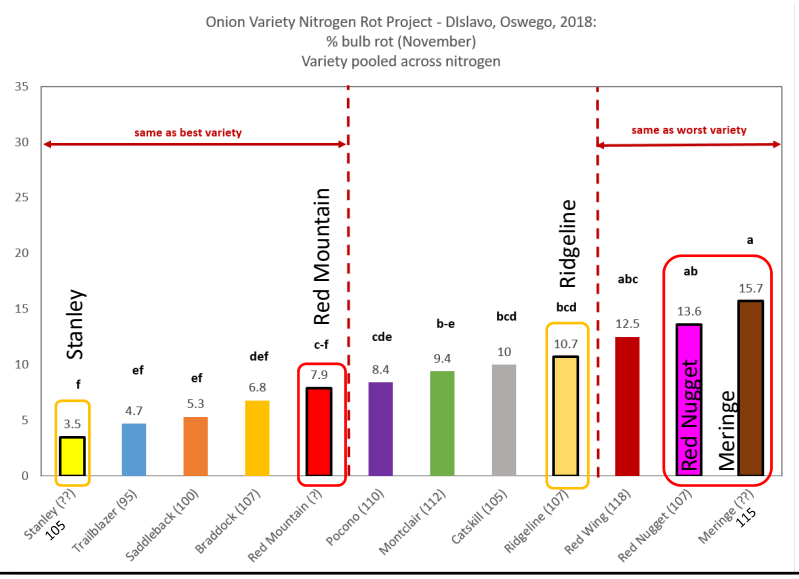
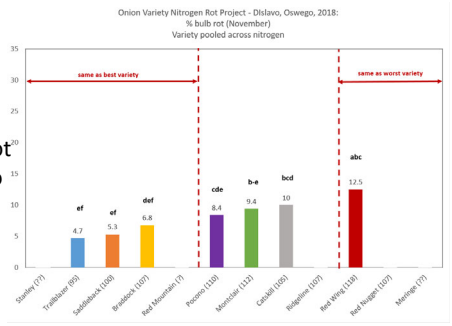
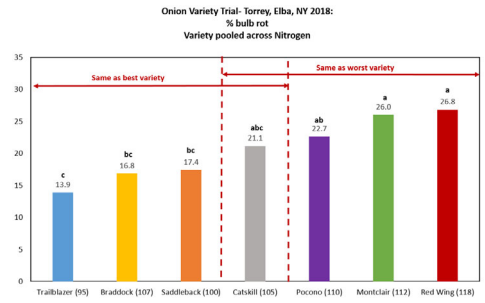


% Rot at Harvest vs. Neck Diameter

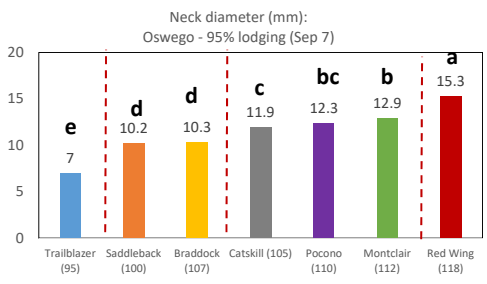
% Bulb Rot - Oswego



Bulb rot appears to be much related to neck diameter

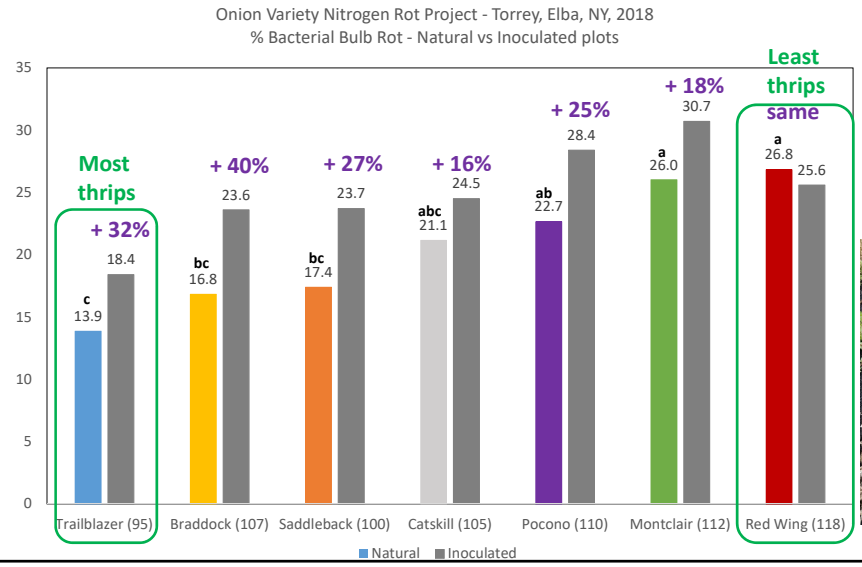


% Bulb Rot - Elba



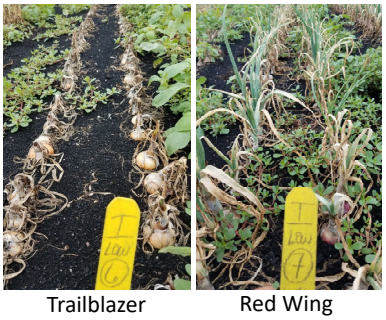
Neck Diameter (mm) 95% lodging (Sep 7) - Oswego

Backpack sprayer artificial inoculation % Bulb Rot – Natural vs. Artificial



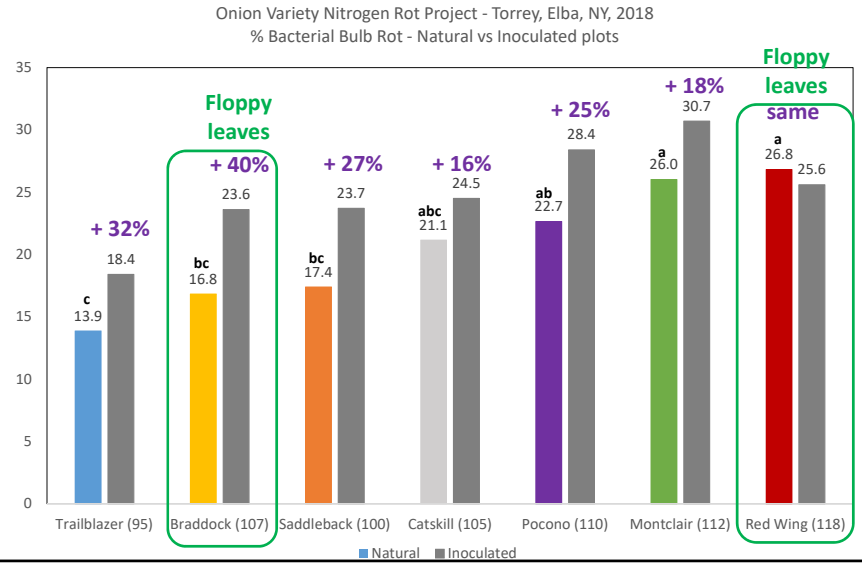
Backpack inoculation:
Tankmix of:
- *Pantoea agglomerans*
- *Pantoea ananatis*

High volume
Aug 18 – start lodge
After rain in morning



Trailblazer Red Wing

Backpack sprayer artificial inoculation % Bulb Rot – Natural vs. Artificial



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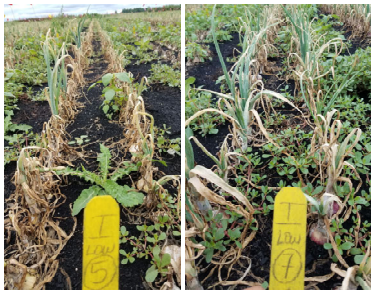
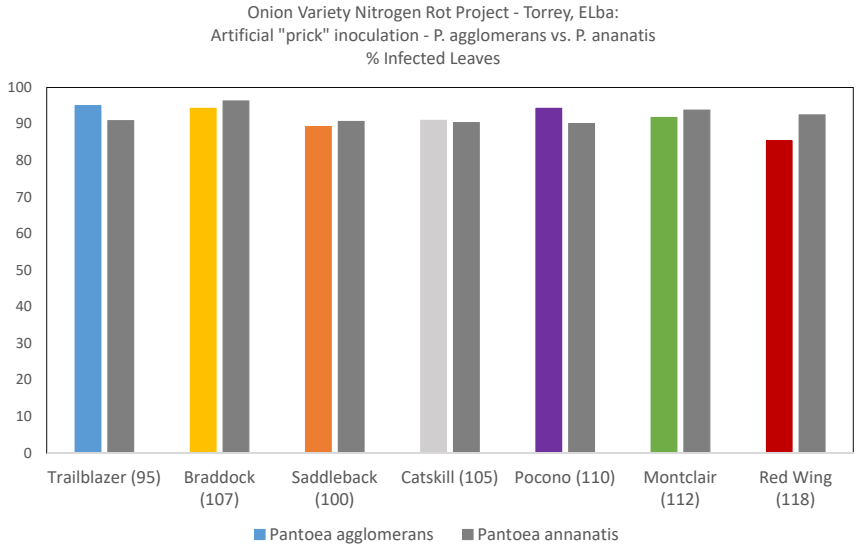


Braddock Red Wing

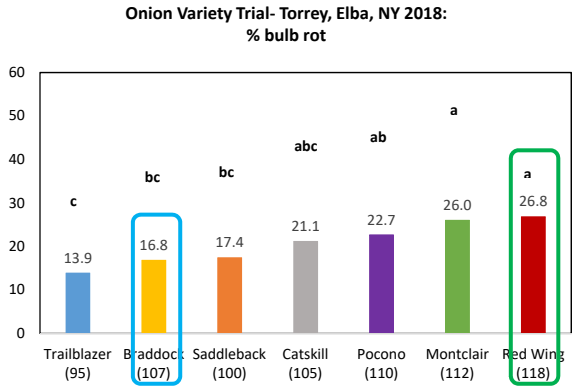
Toothpick "prick" artificial inoculation
% Infected Leaves – *Pantoea agglomerans* vs. *P. ananatis*



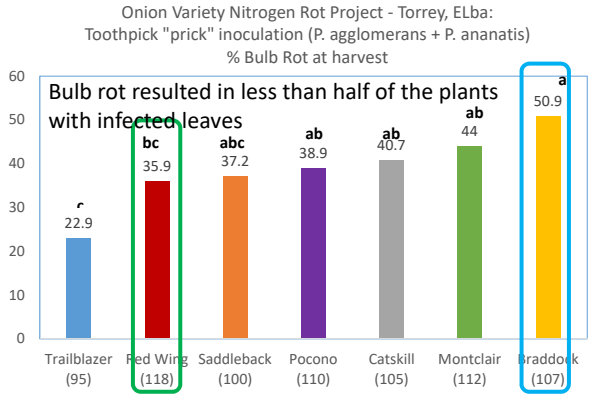
- No difference between species.
- Very high level of infection.

Natural vs. "Prick Inoculation: % Rot at Harvest

Natural



Prick Inoculation



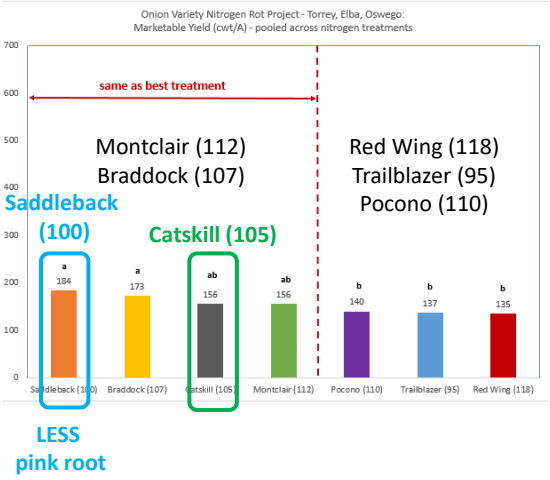
Red Wing LESS rot

Braddock MORE rot

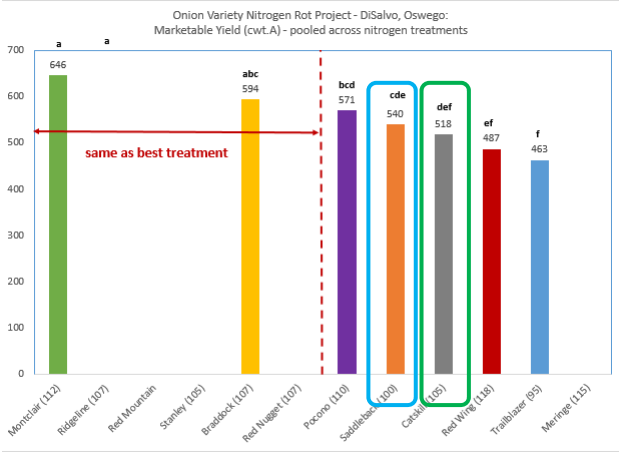
Braddock and Red Wing responded differently to prick inoculation compared to natural infection.

Marketable Yield (cwt/A)

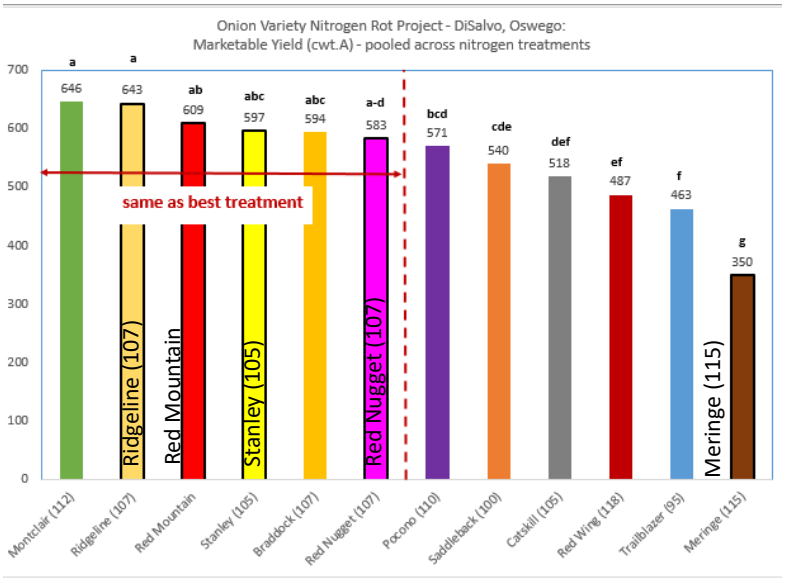
Elba



Oswego



Marketable Yield (cwt/A) - Oswego



Red Mountain (??)

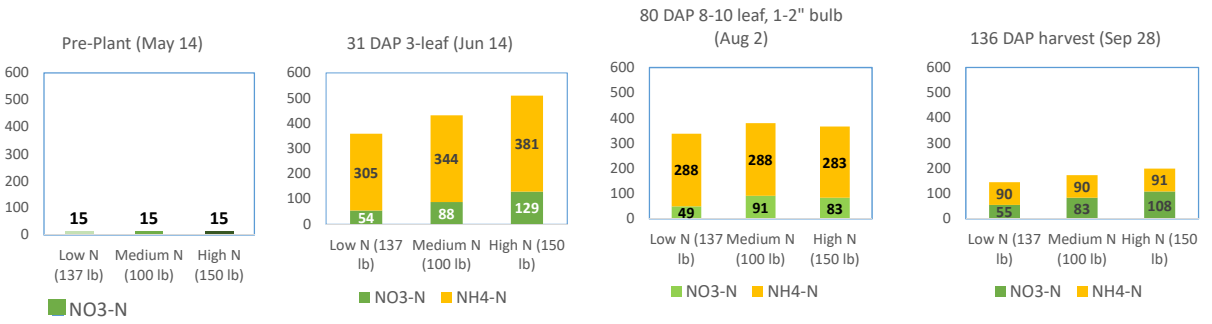
Red Nugget (107)

Meringe (115)

Ridgeline (107)

Stanley (105)

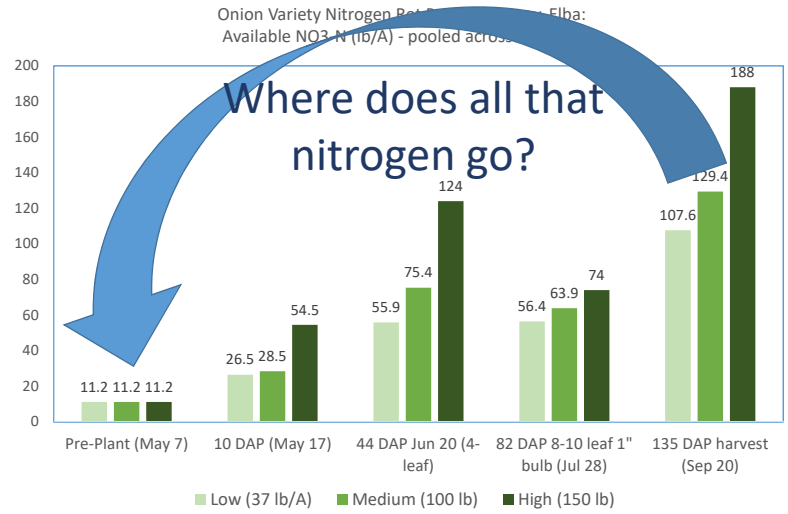
Seasonal Availability of NO3-N & NH4-N (lb/A) pooled across varieties - Oswego



Over growing season:
NH4-N drew down (used by crop),
NO3-N initially increased (after released from fertilizer), drew down by crop, No No change in NO3-N change from bulbing to harvest (soil has a strong baseline level?)

Left at harvest (total N):
Low – 145 lb/A
Medium – 173 lb/A
High – 199 lb/A

Seasonal Availability of NO3-N (lb/A) pooled across varieties - Elba



Over growing season:

- General increase in NO3-N – suggests not been drawn down enough by crop.
- Small crop does not need that much nitrogen.
- Weeds also did not take up all of that nitrogen (they could have whatever they wanted!)

Left at harvest (NO3-N):
Low – 108 lb/A
Medium – 129 lb/A
High – 188 lb/A

Not even these weeds used up the nitrogen

Summary

Most Thrips: Trailblazer

Least Thrips: Red Wing

Most Pink Root: Trailblazer, Red Wing

Least Pink Root: Saddleback

- Lack of crop response to 37, 100 and 150 lb/A of applied nitrogen was very interesting/surprising.
- Amount of nitrogen left in soil at harvest suggests that there are nitrogen credits in muck soil that are not being accounted for.

Least Vigorous: Trailblazer

Most Vigorous: Red Wing, Braddock, Montclair

Smallest Neck: Trailblazer

Largest Neck: Red Wing

Most Bulb Rot: Red Wing, Montclair

Least Bulb Rot: Trailblazer, Saddleback, Braddock

Lowest Yield: Red Wing, Trailblazer, Pocono

Highest Yield: Montclair, Braddock, Saddleback*

*Elba only