Cornell Cooperative Extension
Cornell Vegetable Program

# Nitrogen Fertility Management for Garlic – It is Less Than You Think

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NORTHEAST SARE
Sustainable Agriculture Research & Education

# Garlic Fertility Recommendations

PLANT NUTRIENT RECOMMENDATION ACCORDING TO SOIL TEST RESULTS FOR GARLIC

| GARLIC | NITROGEN (N) LBS PER ACRE | PHOSPHORUS (P) LBS $P_2O_5$ PER ACRE | | | | POTASSIUM (K) LBS $K_2O$ PER ACRE | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOIL TEST RESULTS | | VERY LOW | LOW | OPTIMUM | ABOVE OPTIMUM | VERY LOW | LOW | OPTIMUM | ABOVE OPTIMUM |
| Broadcast and Incorporate in fall | 40 | 150 | 100 | 25-50 | 0 | 150 | 100 | 50 | 0 |
| Sidedress in spring when shoots are 6 inches high | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sidedress 3-4 weeks later | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **TOTAL RECOMMENDED** | **120** | **150** | **100** | **25-50** | **0** | **150** | **100** | **50** | **0** |

Garlic crop uses 150-175 lb/A of nitrogen

# Garlic Fertility Recommendations

| GARLIC | PLANT NUTRIENT RECOMM<br>NITROGEN (N) LBS PER ACRE |
|---|---|
| SOIL TEST RESULTS | |
| Broadcast and Incorporate in fall | 40 |
| Sidedress in spring when shoots are 6 inches high | 40 |
| Sidedress 3-4 weeks later | 40 |
| **TOTAL RECOMMENDED** | **120** |

Deduct 10-15 lbs of N per 1% of OM

→ 95 lbs N

Deduct nitrogen credits for previous crop/cover crop – soil test!

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# 2017-2018 Garlic Research Trials

| | 2017 | | 2018 | |
|---|---|---|---|---|
| | **Batavia** | **Long Island** | **Albion** | **Long Island** |
| **Soil type** | Gravelly loam | Sandy loam | Hilton loam | Sandy loam |
| **Previous crop** | Sod, turned over in the fall | Rye cover crop, turned over in spring | Oat cover crop, turned over in the fall | Sunflower windbreaks |
| **Planting configuration** | • **2 rows 15-inch** apart **per 5 ft**<br>• **6-inch plant** spacing<br>• **34,848** plants/A<br>• **Flat** bed | • **2 rows 15-inch** apart **per 5.6 ft**<br>• **6-inch plant** spacing<br>• **31,114** plants/A<br>• **Flat** bed | • **2 rows 7-inch** apart per **2.5 ft**<br>• **6-inch plant** spacing<br>• **69,696** plants/A<br>• **Flat + hill** | • **2 rows 15-inch** apart per **5.6 ft**<br>• **6-inch plant** spacing<br>• **31,114** plants/A<br>• **Flat** bed |
| **Seed Sources (all German hardneck)** | 1, 2 & 3 (infested) | 1 & 2 | Combo of healthy bulbs from 1 & 2 **Medium & Large Bulbs** | Combo of bulbs from sources 1 & 2 |

# 2017 Trial - Batavia, NY

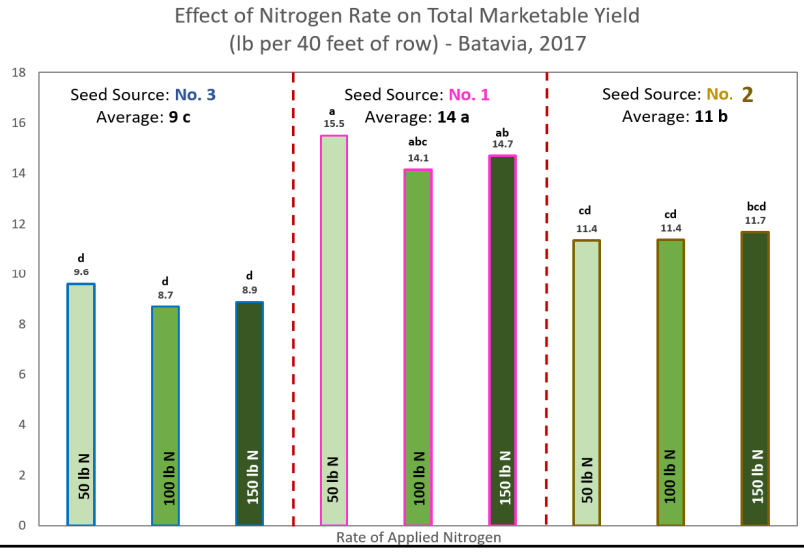
# 2018 Trial – Albion,NY

Oct 26, 2017

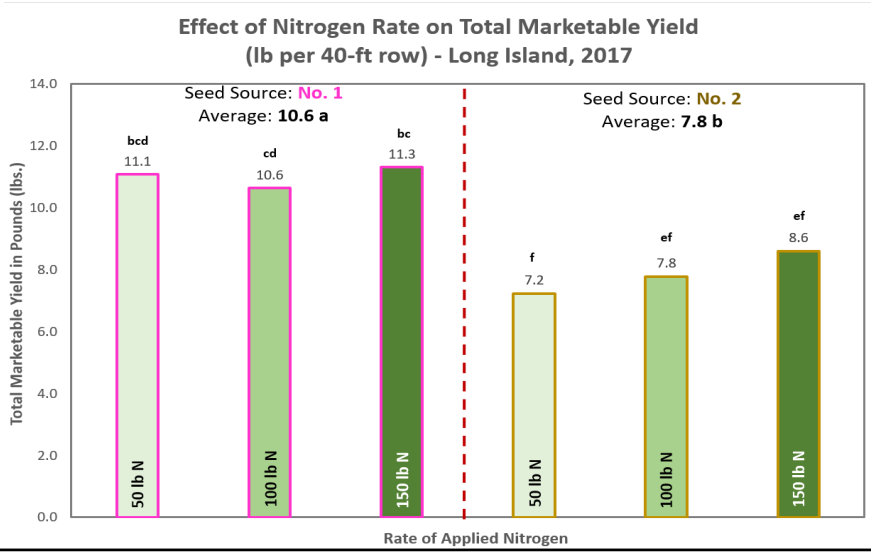
# 2017-2018 Garlic Research Trials

| | 2017 | | 2018 | |
|---|---|---|---|---|
| | **Batavia** | **Long Island** | **Albion** | **Long Island** |
| **Nitrogen application** | 50, 100, 150 lb/A Urea (**46-0-0**) **broadcast per area and rained in** (Apr 13) | 50, 100, 150 lb/A Ammonium Nitrate (**34-0-0**) **Side-dressed** at emergence and **incorporated** (Apr 10) | **0**, 50, 100, 150 lb/A Urea (**46-0-0**) **rate/A concentrated over rows and rained in** (Apr 23) | 50, 100, 150 lb/A (**32-0-1**) **Side-dressed** at emergence and **incorporated** (Apr 12) |
| **Other fertilizer** | **P & K** according to soil test in **fall** | **P & K** according to soil test in **fall** | **Dairy manure in fall**; **P & K** in **fall** according to soil test | **P & K** according to soil test in **fall** |

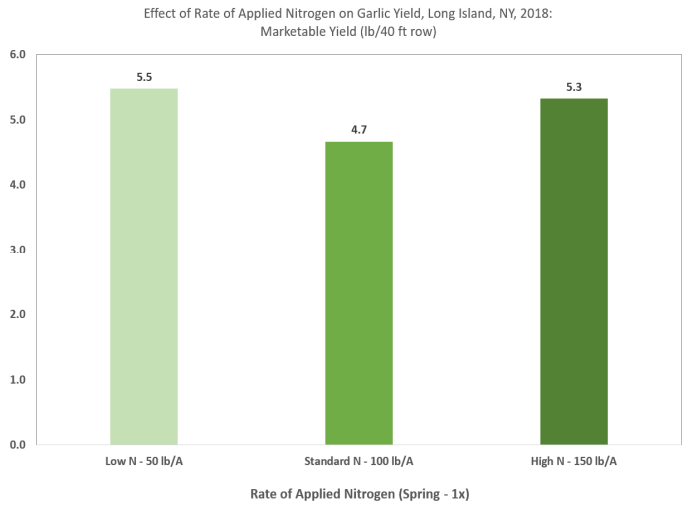
# Results: 2017 Trial - Batavia, NY
## Total Marketable Yield (lb/ 40 ft row)



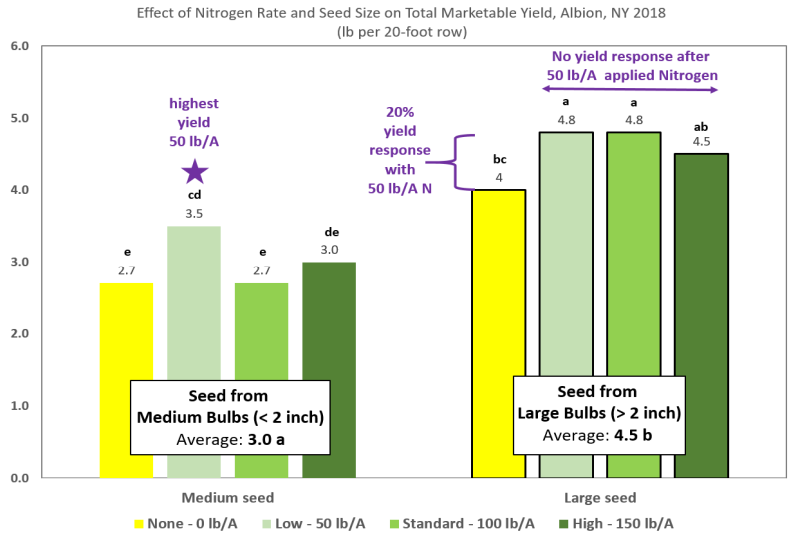

# Results: 2017 Trial – Long Island, NY
## Total Marketable Yield (lb/ 40 ft row)



# Results: 2018 Trial – Long Island, NY
## Total Marketable Yield (lb/ 40 ft row)

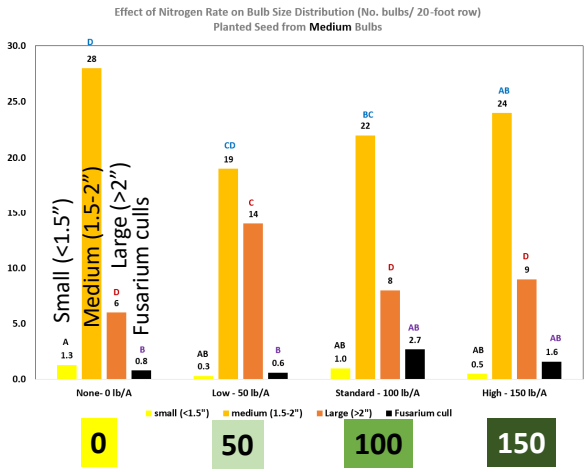



# Results: 2018 Trial – Albion, NY
## Total Marketable Yield (lb/ 20 ft row)



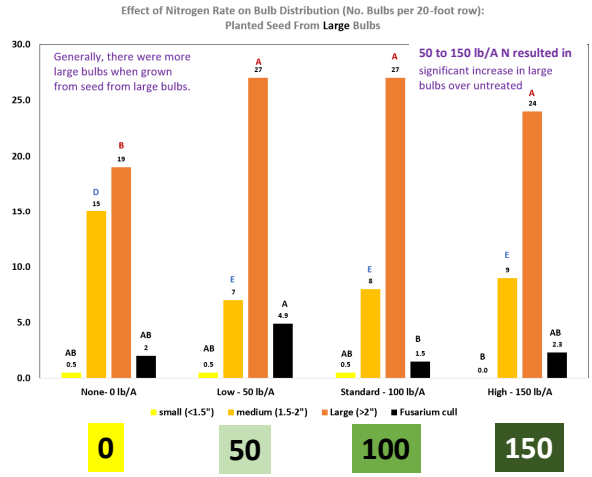
# Results: 2018 Trial – Albion, NY
## Bulb Size Distribution

**Medium**




0 | 50 | 100 | 150

**Large**

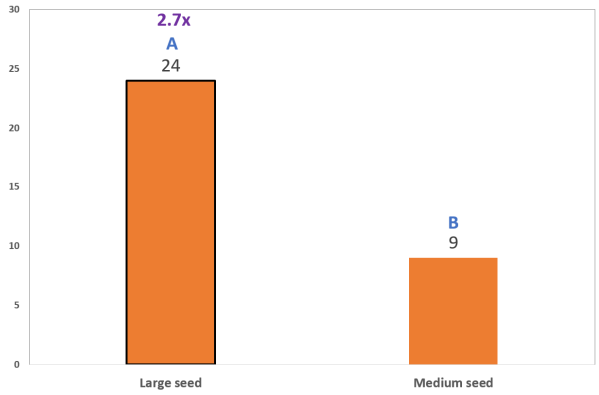



0 | 50 | 100 | 150

**Albion, 2018**

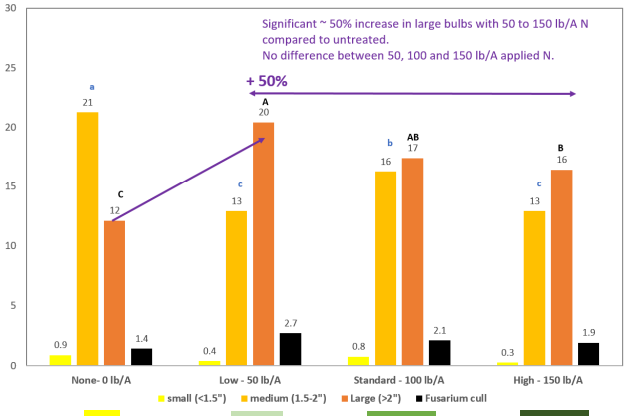
# Results: 2018 Trial – Albion, NY
## Bulb Size Distribution – Pooled Data

Large bulbs (pooled across N rate)




Garlic grown from large seed had almost triple the number of large bulbs at harvest.

Bulb Size Distribution (Pooled across seed size))

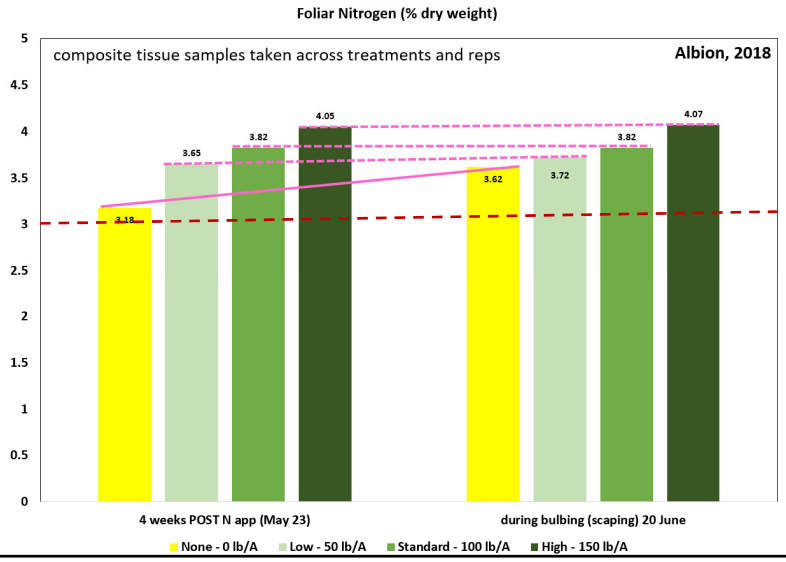



0 | 50 | 100 | 150

**Albion, 2018**

# Results: 2018 Trial – Albion, NY

## Foliar Nitrogen (% dry weight): May 23, Scaping (Jun 20)

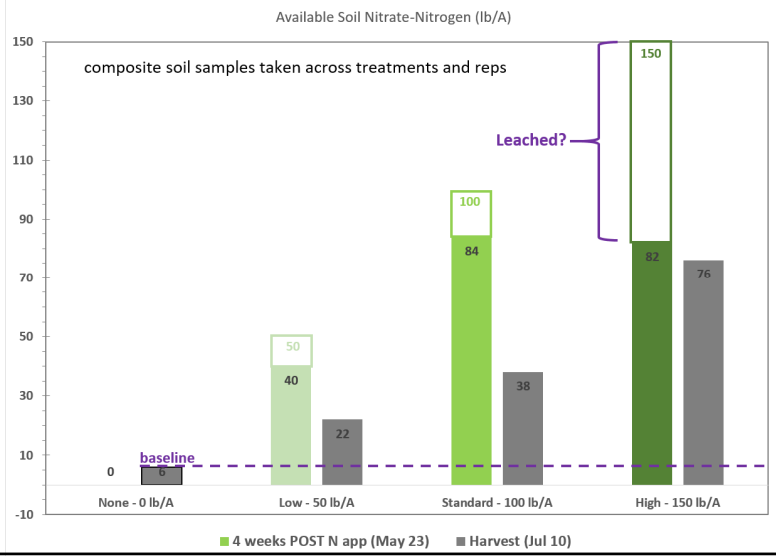



**3% = sufficient**

No change between May 23 and Jun 20 suggests crop has all it needs by the end of May.

# Results: 2018 Trial – Albion, NY

## Available $NO_3$-N in Soil: May 23 & Harvest (Jul 10)




**Albion, 2018**

# Effect of Nitrogen on Garlic: Summary

- In 8 out of 8 datasets (= 100%), no difference in yield between 50, 100 and 150 lb/A of inorganic nitrogen applied in the spring
  - **2** growing seasons (2017, 2018)
  - **3** trial locations (Batavia, Albion, Long Island)
  - **3** planting configurations/planting densities (31,114 to 69,696 plants/A)
  - **3** types of inorganic nitrogen (46-0-0, 34-0-0, 32-0-1)
  - **3** fertilizer application techniques (broadcast & rained in, concentrate over row & rained in, side-dressed between rows and incorporated)
  - Different seed sources/sizes
- Compared to no nitrogen, 50 lb/A resulted in significantly 20% higher total yield due to 1.4x to 2.3x more large bulbs

# Effect of Nitrogen on Garlic: Summary

- **Garlic only needs 50 lb/A nitrogen (available in spring when crop begins to grow)**
  - **Higher rates (75-100 lb/A) may be needed in no N-credit situations**
  - **Higher rates (75-100 lb/A) for organic (applied in fall, lag in availability in cold soil)**
- To determine whether you need to side-dress 3-4 weeks after spring application, take a tissue and/or soil test
  - Side-dress if <3.5% N per dry weight, <50 lb/A of available NO3-N in the soil?
- Seed size was the most important factor associated with yield
  - Seed from large bulbs had significantly almost 3x greater yield than seed from medium bulbs

# Effect of Nitrogen on Fusarium in Garlic: Summary

- In 2 out of 7 datasets (= 29%), Fusarium clove coverage was higher with higher rates of applied N:
  - 2017 Batavia Seed Source No. 1: 150 lb/A (16%) 2x more than 100 lb/A (9.3%), 3x more than 50 lb/A (6%)
  - 2018 Albion Medium Seed: 100 & 150 lb/A (~19%) greater than 0 & 50 lb/A (~12%)
  - 2018 Albion Large Seed: 100 & 150 lb/A (~23%) greater than 0 & 50 lb/A (~17%)
  - **NOT ENOUGH OF A RELATIONSHIP BETWEEN NITROGEN & FUSARIUM TO BE RELEVANT**

# Questions?

- Anyone interested in participating in a post-harvest practices survey in 2020?

Thanks to McAllister Family for hosting so many garlic trials!