Organic Garlic Fertility Trial Results

Introduction: Rates and timing of fertility applications on garlic vary greatly due to a lack of definitive recommendations. Nitrogen needs are of particular interest because of the concern that mistimed nitrogen applications will not be available to the garlic when it needs it. This study focused on finding the nitrogen levels that optimize yield and determining what percent of nitrogen should be applied in the spring versus in the fall.

About the trials: Three organic farms on Long Island, in the Hudson Valley, and in the Mohawk Valley Region were selected for trialing. The soils on these farms ranged from sandy to gravelly loam with a high organic matter content. Soil tests were taken using Agro-One testing laboratory in September of 2012 to guide fertility recommendations. Fertilizer was then applied to thirty-foot plots as a banded application in-furrow at planting. Phosphorus and potassium were both brought to the optimal levels as indicated by the soil tests and based on current recommendations (Table 1), and nitrogen was applied at 6 different levels (Table 2). Nitrogen recommendations were reduced based on the percent organic matter in the soil. Recommendations were reduced by 10 lbs/A for every percentage of organic matter in the soil.

Table 1: Phosphorus and Potassium recommendations for garlic. These nutrients are always applied before planting.

Garlic	Phosphorus (P_2O_5) Lbs/A					Potassium (K_2O) Lbs/A				
Soil Test Results	**Very low <3lbs/A**	**Low 3-6**	**Medium 7-13**	**High 14-40**	**Very High >40**	**Very low <50**	**Low 51-100**	**Medium 101-200**	**High 201-300**	**Very High >300**
Incorporate at planting	200	150	100	50	0	200	150	100	50	0
TOTAL	150	100	75	50	0	150	100	75	50	0

Table 2: Six treatments were applied to the garlic, in 30 foot blocks replicated twice. N levels were reduced based on organic matter.

50 lbs total Nitrogen	**100 lbs total Nitrogen**	**150 lbs total Nitrogen**
All fall	All fall	All fall
75% fall, 25% spring	75% fall, 25% spring	75% fall, 25% spring

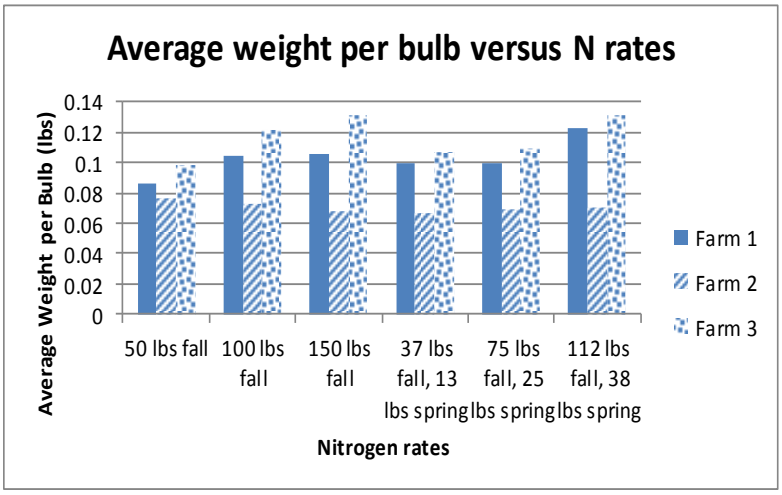
Slow release forms of nitrogen including alfalfa meal and pelletized chicken manure were applied in the fall. All nitrogen applied in the spring was in the form of fish emulsion, which was considered quick release. Care was taken not to fertilize excessively with phosphorus or potassium in order to reach optimal nitrogen levels. For example, pelletized chicken manure might supply half the needed nitrogen, but once phosphorus was optimized the remainder of the nitrogen was applied as alfalfa meal.

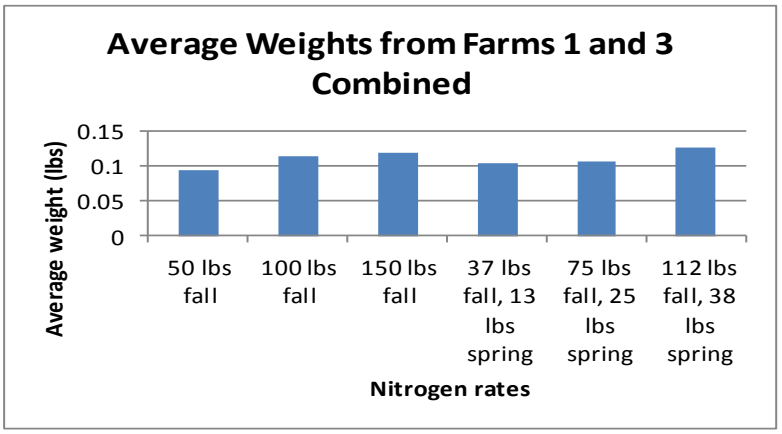
Existing recommended call for splitting the spring nitrogen applications. However, research by Angela O'Callaghan indicates that splitting the application does not increase yields. Therefore, we applied spring nitrogen in one application, as close to when garlic begins growing as possible.

Results:

Two of the farms showed clear trends related to the fertility treatments: Farms 1 and 3. Farm 2 did not show clear trends, which might be explained by the high weed pressure on this farm. The weeds might have both consumed most of the nitrogen and competed with the garlic, suppressing yields. When this farm is removed

from the data, it becomes clear that 50 lbs of nitrogen is not enough to maximize yield, regardless of timing. What is not as clear is what the effects of timing and rates are once we jump to 100 lbs of nitrogen. According to the data, 100 lbs of fall nitrogen leads to better yields than 100 lbs of nitrogen split between the fall and spring. 150 lbs of nitrogen yields better than 100 lbs both in the fall and as a split application, but the difference is fairly small—if a grower produced 1000 pounds of garlic using the 100 lbs of N in the fall rate compared to the 150 lbs of N in the fall rate, he or she would only increase yield by about 50 lbs, or 5%. Comparing the 100 lb rate to the 150 lb rate with a split application increases the yield gain to 139 lbs, or about 14%.





Discussion: Although it is clear that more work needs to be done to determine the best relatively high rate of nitrogen to use to maximize garlic yield, it is clear that applying at least 100 lbs of nitrogen is necessary to maximize yield. Whether all of the nitrogen is applied in the fall or some is held back until the spring is a question we will continue to examine. In the mean time, growers are encouraged to look at their cropping systems and make decisions based on the expense of additional nitrogen application in the spring versus the possible returns. If a spring nitrogen application is relatively easy to accomplish through drip or by side-dressing, I would not hesitate to split the nitrogen application. If making a spring application is extremely difficult, using a higher fall application rate can nearly make up the difference. To make your own complete comparisons, please see Table 3, which has the average weight bulbs from each treatment, averaged over the trials at farms 1 and 3.

Table 3: The average weight per bulbs averaged over trials 1 and 3

Treatment	Average Weight
50 lbs fall	0.093
100 lbs fall	0.113
150 lbs fall	0.119
37 lbs fall, 13 lbs spring	0.104
75 lbs fall, 25 lbs spring	0.105
112 lbs fall, 38 lbs spring	0.127

NORTHEAST SARE Sustainable Agriculture Research & Education

This project supported in part by the Northeast Sustainable Agriculture Research and Education (SARE) program. SARE is a program of the National Institute of Food and Agriculture, U.S. Department of Agriculture.