Pre-sidedress Nitrate Test in Pumpkins FNE04-516

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Goals:

The goal of this project was to reduce the amount of nitrogen applied to pumpkins by utilizing the pre-sidedress nitrate test (PSNT). Excessive nitrogen is known to be harmful to pumpkins by decreasing yield through stimulation of vegetative growth instead of fruit set. Since peas are a part of our farms' rotational scheme, the study was designed so that the pumpkins would follow a crop of peas with the hopes that the peas would increase the amount of nitrogen available for the pumpkins. By utilizing the PSNT, the appropriate amount of nitrogen necessary can be determined, eliminating the possibility of over-fertilizing and damaging a pumpkin crop. Ideally, the use of the PSNT will reduce the amount of nitrogen that is applied and prevent excessive fertilizer applications and reduce the cost of fertilizer.

Farm Profile:

Grant J. Hitchner Farm is a 600 acre vegetable farm in southern New Jersey producing pumpkins, carrots, potatoes, spinach, green beans, corn, wheat and soybeans. Despite challenging weather conditions, this was the second year that pumpkins were grown for a profit.

Participants:

The technical advisor for this project was Dr. Joseph R. Heckman, a specialist in Soil Science with Rutgers Cooperative Extension. Dr. Heckman assisted in developing an experimental design for the project. Dr. Heckman was also responsible for interpreting the PSNT results and making recommendations based on those results. Additionally, Dr. Heckman helped analyze the results and make proper conclusions about the study. Lastly, Dr. Heckman assisted in disseminating the results of this project through an article in the Plant & Pest Advisory, a newsletter published by Rutgers Cooperative Extension for New Jersey growers.

Project Activities:

This study was conducted in 2004. The project began by broadcasting fertilizer (14-7-14) at the rate of 500 lbs/A on April 10th, prior to planting peas. Peas were then planted at a rate of 150 lbs/A. The peas were disked in on June 9th and the pumpkins were seeded by hand on June 19th. A total of eighteen rows were planted with three replicates, six rows per replicate. Each replicate had two rows of the following varieties: Baby Pam, Howden, and Howden Biggie. Rows were 200 ft long with pumpkins planted 10 ft apart down the row and on 10 ft centers. On July 21st, prior to the vines reaching 6" in length, the PSNT was conducted by taking 12 inch soil cores from 10-15 areas in each replicate. Soil samples were taken to the lab on July 22nd to be analyzed. Dr. Heckman reviewed

the results and determined that all plots fell below the minimum requirement for the sidedress fertilizer application. This was most likely due to excessive rainfall throughout the season, causing the nitrogen to be leached out of the soil. Initially, the project was designed so that each replicate had six rows, with three rows receiving the standard sidedress fertilizer application, and the other three rows receiving the sidedress fertilizer rate based on the PSNT results. Since all plots fell below the minimum rate for sidedressing, Dr. Heckman suggested that some different rates of fertilizer be applied to the plots to determine if the yield and quality of the pumpkins would be significantly affected. Therefore, the following rates of Calcium Nitrate were applied as a sidedress application on July 30th:

Plot 1, rows 1-3: 345 lbs/A (50 lbs N)
Plot 2, rows 4-6: control, no fertilizer applied
Plot 3, rows 7-9: 500 lbs/A (75 lbs N)
Plot 4, rows 10-12: 345 lbs/A (50 lbs N)
Plot 5, rows 13-15: 175 lbs/A (25 lbs N)
Plot 6, rows 16-18: 345 lbs/A (50 lbs N).

Following the fertilizer application, the overall crop vigor and canopy were visually assessed and documented at one, two and three weeks after the sidedress fertilizer application on July 30th. On Aug 19th, approximately three weeks after the sidedressing, twelve mature leaves were taken from each plot (four leaves from each row) and taken to the lab on the same day to determine the amount of nitrogen in the plants. As the pumpkins matured, each plot of pumpkins was harvested, counted and weighed. The rind color of each pumpkin was rated on a scale from 1 to 5 (1 being pale orange, 5 being a deep orange). Pumpkin handles were also rated on a 1 to 5 scale (1 short and thin, 5 long and thick).

Results:

The results from the PSNT are as follows:

Plot No.	NO3-N (mg/kg)
1	15.72
2	18.9
3	15.52
4	15.66
5	18.74
6	16.24
Avg.	16.80

A PSNT rating of 25 is considered to be adequate, while a rating of 10 is considered to be very low. The average rating was 16.80, which was moderately low and would necessitate a sidedress fertilizer application for all plots. The New Jersey Vegetable Production Recommendations recommends a total rate of 50-100 lbs/A of nitrogen for pumpkins (25-50lbs/A broadcast and disked in, followed by 25-50 lbs/A as a sidedress application when vines start to run). There was no fertilizer broadcast prior to planting the pumpkins, but the pumpkins followed a crop of peas, which in most situations would

increase the amount of nitrogen in the soil. Due to excessive rainfall throughout the season, a significant amount of nitrogen may have leached out of the soil.
Based on the leaf sample analysis, the percentage of total nitrogen in leaves ranged from 5.72 to 6.81 % and was not significantly different among the various fertilizer rate treatments.
Based on the visual inspections, all plots were similar in terms of growth and vigor.
Average weight of pumpkins is shown in Figure 1.

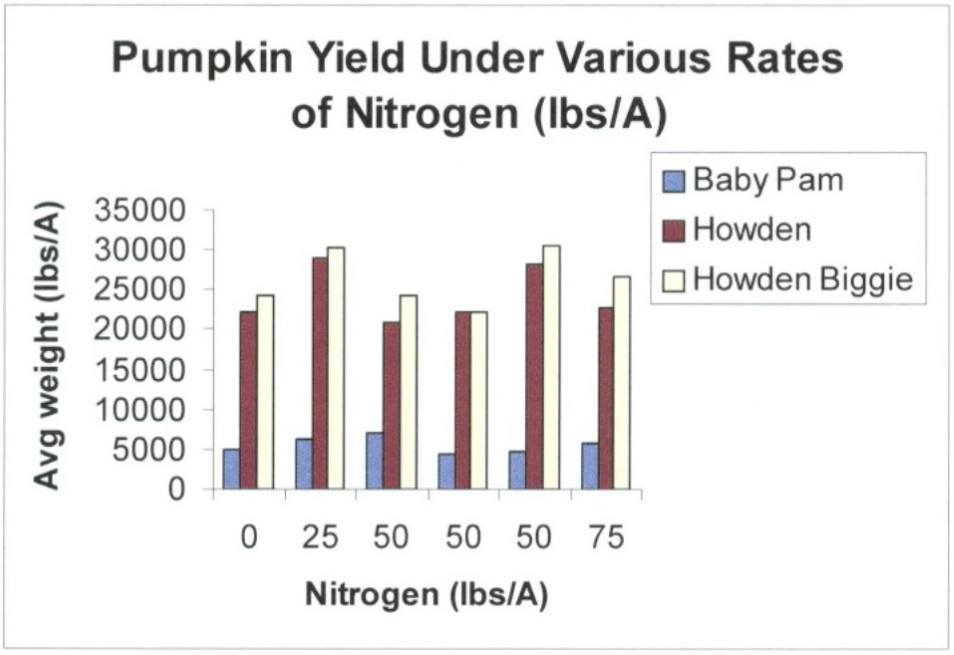

Figure 1

Without a sidedress application, there may be a slight decrease in yield for pumpkins. However, there was not a significant difference in yield with the various rates of fertilizer. The variety Baby Pam appeared to be the least affected by various fertilizer rates, while the varieties Howden and Howden Biggie showed a slight, but not significant change with the different rates of fertilizer. A sidedress application rate as low as 25 lbs/A of nitrogen could be a sufficient application rate, reducing the amount of fertilizer needed and thereby cutting fertilizer cost.
From a crop quality standpoint, the various fertilizer rates did not appear to affect rind color (Figure 2) or handle quality of the pumpkins (Figure 3).

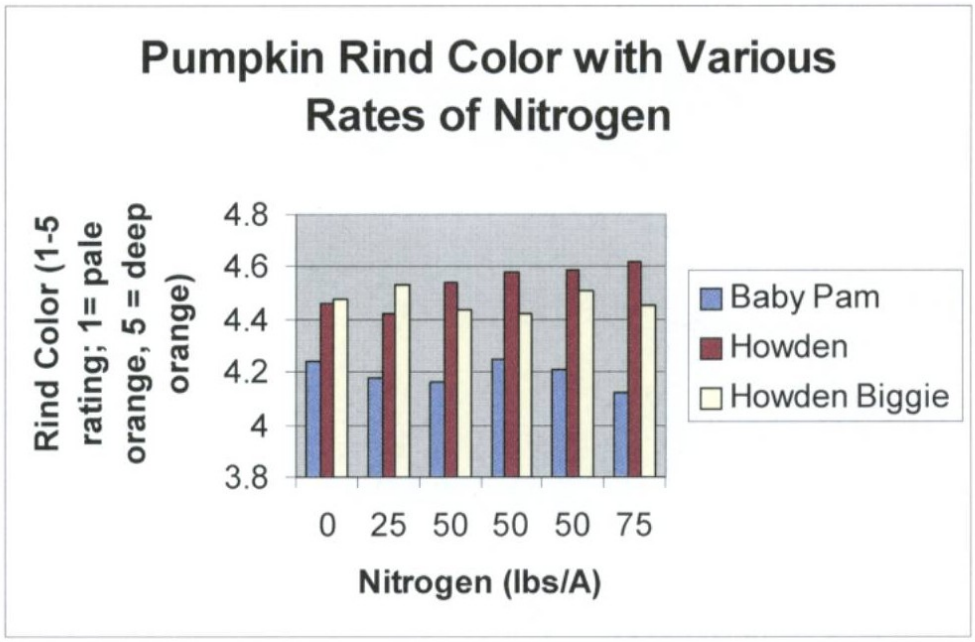

Figure 2

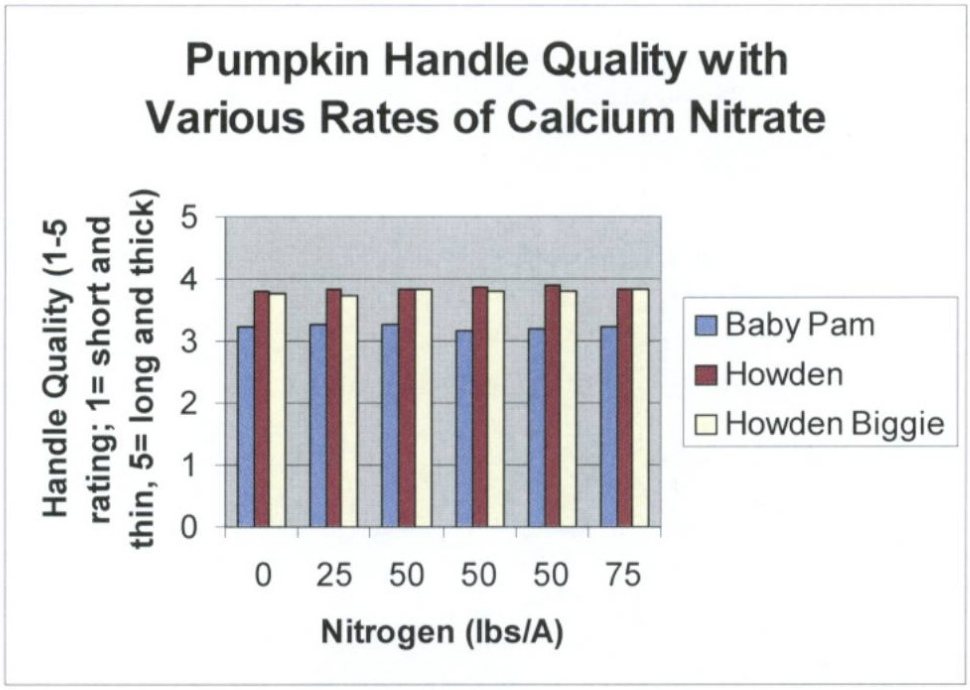

Figure 3

Conditions:

Weather conditions greatly affected this experiment. Pumpkins were planted after a crop of peas with the hope that the peas would increase the amount of nitrogen available. However, excessive rainfall throughout the season may have contributed to low PSNT results, which required that all of the plots receive a sidedress fertilizer application. The weather also may have affected yield due to high incidence of disease. The field was

sprayed with fungicides on a weekly schedule, but despite these efforts, there was still a considerable amount of downy and powdery mildew in the field. If this experiment had been conducted in a season with normal or below normal rainfall, it is very possible that the PSNT could have indicated that no fertilizer was needed.

Economics:
Since the results indicated that a low rate of a sidedress fertilizer application may be sufficient for pumpkin yield, rind color and handle quality, this could possibly result in savings on fertilizer cost. However, it's important to keep in mind that in this study the pumpkins followed a legume crop, which in most situations would increase the amount of N available. For farms that are not planting pumpkins after a legume crop, more fertilizer may be necessary to achieve quality yields. The cost for the PSNT (total of six soil samples) was $45.

Assessment:
Although the experiment could not be carried out as initially planned, some interesting and useful results were still achieved. This study indicates that growers may be able to reduce their overall fertilizer use and still obtain quality pumpkins with normal yields. However, this study would need to be replicated before making any conclusions. Since the weather had a great impact on this study, it would be interesting to conduct the experiment again in a dry year. Additionally, it would be useful to use the PSNT on a field of pumpkins that was not previously in a legume crop.

Adoption:
This research was practical and very applicable to grower's practices. Additional research does need to be completed to supplement these results. The PSNT would be a useful application for our farm and would definitely result in more accurate fertilizer applications.

Outreach:
I am working with my technical advisor Dr. Heckman to write an article for the Plant & Pest Advisory which is a publication for growers in the state of NJ.

Report Summary:
This study initially set forth to investigate the use of the PSNT to potentially reduce the amount of sidedress fertilizer applied to pumpkins. However, due to excessive rainfall throughout the growing season, the PSNT indicated that all of the plots in my experiment required a sidedress application. Accordingly, various rates of fertilizer were applied to determine if different rates of fertilizer significantly affect pumpkin yield, rind color, and handle quality. Although more data needs to be collected, my initial observations indicate that low rates of fertilizer (25 lbs N/A) may be sufficient to maintain pumpkin yield, rind color, and handle quality. This could reduce the amount of excess fertilizer applied with the standard sidedress rates and could also potentially reduce the cost of fertilizer to the grower. However, it is important to remember that the pumpkins followed a crop of peas (that received a broadcast fertilizer prior to planting), which most likely affected the PSNT. Even more importantly, the lowest rate of fertilizer was 25 lbs N/A and resulted in average pumpkin yield and quality. Considering that the NJ Recommendation Guide recommends a total season fertilizer application of 50-100lbs N/A, there is a potential to reduce that rate by 75% and not affect the pumpkin crop.