Final Report

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Nitrogen Management for Pumpkins and Squash

Coordinator

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$40,000

Match

$43,003

Duration

1997 to 2000

Summary

N fertilizer recommendations for pumpkins and winter squash can be improved by using PSNT. Fields testing greater than 30 ppm N one week before vines begin to run will not respond to additional N. Fields testing less than 30 ppm N will likely respond. N rates exceeding 90 lb/A can cause yield reductions. Seventy-five percent of commercial fields sampled in Connecticut and New Hampshire were at or above the 30 ppm level.

Objectives.

Establish a critical nitrate concentration for the pre-sideress soil nitrate test (PSNT) for pumpkins and squash.

Aggressively advocate the adoption of PSNT to determine N requirements for pumpkins and squash.

Evaluate the usefulness of stem nitrate concentrations and soil nitrate concentrations at harvest to determine excess N availability to pumpkins and squash.

Methods

Thirteen nitrogen rate experiments were conducted in Connecticut, New Hampshire, and New York. The N rates were 0, 30, 60, 90, 120, and 150 lbs N/acre arranged in a randomized complete block design with four replications. The experiments were direct-seeded to pumpkins in the first half of June. The plot sizes were either 24' by 30' or 20' by 15'. Plants were thinned to one plant per hill about two weeks after seeding. Weeds were controlled by using the stale seedbed method or Curbit herbicide, and the fields were then mechanically cultivated and hand-hoed.

The N fertilizer was applied before planting. Soil samples were collected from the surface foot of soil about one week before the vines began to run. The soil samples were spread to air-dry within a few hours of collection, and the dried soil was passed through a 2 mm screen. Calcium chloride (0.10 *M)* was used to extract the nitrate from the soil and the nitrate concentration was determined by using the Cd reduction method. Yields were estimated by weighing all the pumpkins, except the totally green pumpkins, in each plot. Relative pumpkin yields were calculated for each N treatment as a percentage of the plateau yield from the quadratic model relating yield to fertilizer N applied within each experiment. If the quadratic model could not significantly (alpha=0. 10) describe the relationship between yield and fertilizer N, then single-degree-of-freedom contrasts were used to determine the plateau yield.

Results

The average yield response to N for the 13 experiments was a quadratic response, or a C-shaped curve (see table 1). The average yield for the 13 experiments reached a maximum of 15.91 tons/acre at the 90 lb/acre treatment. The yield for the 90 lb/acre treatment was 4.19 tons /acre greater than the zero N treatment. The two highest N treatments, 120 and 150 lbs N/acre, produced yields significantly lower than the 90 lb/acre treatment. These results suggest that 90 lbs N/acre should be the maximum recommended rate of N for pumpkins and not the current recommended rate of 130 lbs N/acre in the New England Vegetable Management Guide. The average yields, however, do not provide complete information about the yield response to N. The yields from the individual experiments provide much more complete information.

The yields at the individual experiments were quite variable. At five of the 13 experiments there was no response to N fertilization. At three of the experiments 30 lbs of N/acre provided sufficient N for maximum yield. Four experiments reached maximum yield at 60 lbs N/acre, and one experiment needed 90 lbs N/acre for maximum yield. These yield results suggest that a single rate of N fertilizer should not be recommended for pumpkins. Our results from the PSNT suggest that use of the test would greatly improve the ability of a grower to make a better guess at the correct rate of N to apply for pumpkins. When growers realize they are guessing at the correct rate of N to apply for pumpkins, more growers will use the PSNT because the test provides information to greatly improve the grower's guess.

The PSNT provides information about the N fertility status of the soil immediately before the time of topdressing. Preliminary analysis of the soil nitrate data from these experiments shows that relative yields less than 93 percent were associated with nitrate-N concentrations less than 30 ppm, and relative yields greater than 93 percent associated with nitrate-N concentrations greater than 30ppm. This relationship of yields with soil nitrate-N concentrations defines our critical concentration of soil nitrate-N; fields testing greater than 30 ppm nitrate-N probably will not require topdressed N fertilizer, and fields with nitrate-N concentrations less than 30 ppm probably will respond to topdressed N fertilizer. This 30 ppm critical concentration is similar to the critical

concentrations that have been estimated for sweet corn, field corn, and cabbage. Calculation of the relative yields in this data set is difficult because of the variable yield response to N fertilization. The yields were especially variable for the treatments with the higher rates of N. We believe the response to N fertilization was variable because of erratic fruit set.

Our preliminary recommendation topdress or sidedress N applications based on interpretation of the yield and soil nitrate data are shown in Table 1. Pumpkin growers should use the test for a number of years and keep records of the soil concentrations, N applications, rainfall, and yields. Careful study of data from at least three years should allow a more accurate guess at the amount of N required at the time of sidedressing.

Table 1. Preliminary topdress or sidedress nitrogen recommendations for pumpkins based on the PSNT (nitrate-N concentration of the surface foot of soil about one week before pumpkin vines begin to run).

Soil nitrate-N (ppm)	Nitrogen topdress or sidedress recommendation lbs N/acre
0 to 10	50 to 90
10 to 20	30 to 60
20 to 30	0 to 40

+ Soils with concentrations greater than 30 ppm nitrate-N receive no topdress nitrogen.

Impacts and potential contributions.

These results indicate that pumpkins require variable amounts of N fertilizer. Application of more than 90 lbs N/acre can decrease the yield of pumpkins. Maximum yield can be obtained with rates of N from 0 to 90 lbs/acre. The reliability of our N fertilizer recommendations for pumpkins could be improved by using the PSNT to guide fertilization. Preliminary analysis of the relationship between relative pumpkin yield and soil nitrate concentrations in the surface foot of soil about one week before the vines begin to run suggest that fields testing greater than 30 ppm N will not respond to N fertilizer applications. Fields testing less than 30 ppm nitrate-N likely will respond to N fertilizer.

Seventy-five percent of commercial fields sampled in Connecticut and New Hampshire tested 20 ppm/N or above. This resulted in N fertilizer recommendations averaging 60 lb/A less than those published in the New England Vegetable Management Guide. With almost 20,000 acres of pumpkins and winter squash grown in the Northeast, this represents a potential savings of 900,000 lb of N and $288,000.

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Appendices

Changes in Plan of Work.

The project was extended from two to three years duration due to unusual weather conditions encountered in year 2.

Events.

New England Vegetable and Berry Conference
December 14-16, 1999, Sturbridge, MA. Attendance: 1100

Connecticut Small Fruit and Vegetable Growers Conference.
January 18, 2001, Vernon, CT. Attendance: 75