Soil Nutrient Analysis Laboratory

Soil Nutrient Analysis Laboratory; 6 Sherman Place, Unit 5102, Storrs, CT 06269-5102 • Phone: 860-486-4274
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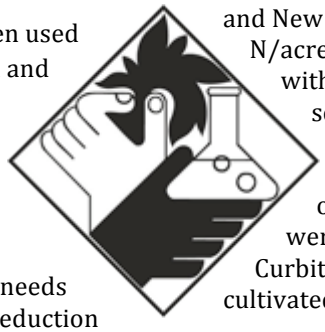
USING THE PRE-SIDEDRESS NITRATE TEST FOR PUMPKINS



The pre-sidedress soil nitrate test (PSNT) has been used to improve nitrogen (N) management in field corn and sweet corn. The test involves collecting a soil sample from the surface foot of soil when corn plants are 6 to 12 inches tall. If the soil nitrate-N concentration is greater than about 25 ppm, no fertilizer N needs to be topdressed. If the concentration is less than 25 ppm, topdressed fertilizer is needed. Use of the PSNT to estimate N needs for field and sweet corn usually results in a large reduction in the amount of N fertilizer applied to these crops.

The reduction in N fertilizer rates from use of the PSNT usually is the result of elimination of extra N fertilizer that growers often apply to corn. This extra N fertilizer is called "insurance N"by many growers because the extra N insures that the crop will not be deficient in N, especially towards the end of the growing season. Growers can apply "insurance N" to corn without the fear of yield reductions from excess N fertilization because excess N does not reduce the yield of corn. Unfortunately, "insurance N" guarantees a reduction in profit because most corn fields in most years are substantially overfertilized when growers apply "insurance N." The PSNT reduces the amount of "insurance N"needed by providing previously unavailable information about the N status of the soil immediately before the time of topdressing.

Application of "insurance N" to annual vegetable crops, such as pumpkins and tomatoes, is not advisable because the yields of these crops often are reduced from excess N fertilization. Excess N fertilization of pumpkins and tomatoes often results in a C-shaped response to fertilization, or a response where the yield increases with increasing rates of fertilization, reaches maximum, and then declines with the application of more fertilizer. This type of yield response to fertilization makes the practice of applying "insurance N" a guaranteed profit reducer.

Development of a soil nitrate test for pumpkins should improve N management in pumpkins, improve the profitability of pumpkins, and minimize the potential for nitrate contamination of water supplies.
The objective of this study was to determine if the PSNT is a useful tool for estimating the N topdress requirement for pumpkins.

METHODS AND MATERIALS

Thirteen nitrogen rate experiments were conducted in Connecticut, New Hampshire and New York. The N rates were 0, 30, 60, 90, 120 and 150 lb 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 size was either 24 feet long by 30 feet wide, or 20 feet long by 15 feet wide. Plants were thinned to one plant/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 AND DISCUSSION

The average yield response to N for the 13 experiments was a quadratic response, or a C-shaped curve (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 lb N/acre, produced yields significantly lower than the 90 lb/acre treatment. These results suggest that 90 lb N/acre should be the recommended rate of N for pumpkins and not the current recommended rate of 130 lb N/acre in the *New England Vegetable Management Guide*. Looking only at the average yields, however, does 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 four of the experiments, there was a quadratic or C-shaped response,

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and at four other experiments, there was a response to only 30 or 60 lb N/acre. These results suggest that it will be impossible to recommend a single rate of N that will be the most profitable rate for every growers' fields.

The PSNT provides information about the N fertility status of the soil immediately before the time of topdressing. This information can improve the reliability of N recommendations. In these experiments, relative yields less than 90% were associated with soil nitrate-N concentrations less than about 25 ppm, and relative yields greater than 90% were associated with soil nitrate-N concentrations greater than 25 ppm. This suggests that fields with nitrate-N concentrations greater than 25 ppm do not need topdressed N fertilizer, and fields with nitrate-N concentrations less than 25 ppm will respond to applications of N fertilizer. 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. We plan to collect one more year of data to further quantify the yield response to N fertilization.

CONCLUSIONS

These results suggest that 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, suggests that fields testing greater than 25 ppm N will not respond to N fertilizer applications. Fields testing less than 25 ppm nitrate-N likely will respond to N fertilizer.

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Information on our site was developed for conditions in the Northeast. Use in other geographical areas may be inappropriate.

Table 1. Mean yields of pumpkins at various rates of N fertilization at each experiment.

TRT	P1 95	P1 96	P1 97	W11 97	S2P 98	NY 98	NHBB 98	NHD 98	NHHort 98	S2P 99	NY 99	NHBD 99	NHD 99	Mean
	Tons/Acre													
0	15.8	8.9	15.0	9.3	4.0	11.5	11.6	4.6	18.4	10.6	12.9	14.1	11.6	11.4
30	17.1	9.4	15.5	16.2	7.2	11.2	12.6	6.7	19.8	12.9	14.6	12.5	14.8	13.1
60	17.2	13.3	17.3	11.7	7.4	11.2	12.7	9.3	22.0	14.6	15.2	13.4	11.1	13.6
90	16.5	11.5	24.8	18.5	8.0	13.8	13.0	8.6	23.0	14.6	14.9	14.9	13.1	15.0
120	16.4	11.7	21.8	13.6	10.2	10.9	13.1	7.4	26.3	12.7	14.9	15.1	10.7	13.4
150	15.0	11.5	19.1	17.5	12.8	11.1	13.6	6.8	28.1	15.7	16.6	12.5	14.3	15.0
Mean	16.3	11.1	18.9	14.5	8.3	11.7	12.8	7.2	22.9	13.5	14.9	13.8	12.6	13.6
	NS	w	w	l	l	NS	NS	w	=	w w	l	NS	NS	w

NS Response to N fertilizer not significant, alpha=0.10.
w, w w C-shaped (quadratic) yield response to N fertilizer significant at 0.05 and 0.10 probability levels, respectively.
l Significant response to first increment of N fertilizer (30 lb/acre) using orthogonal single-degree-of-freedom contrast of mean yields of zero N treatment and mean yields of all fertilized plots, alpha=0/10.
= Significant response to second increment of N fertilizer (60 lb/acre) using orthogonal single-degree-of-freedom contrast of mean yields of zero N treatment and mean yields of all fertilized plots, alpha=0/10.

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