

Soil Amino Sugar Test for Determining Nitrogen for Corn

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In areas such as Massachusetts where considerable rainfall occurs in the period between planting and rapid phase of plant growth, a large portion of nitrogen will be lost by leaching to soil below root zone. Many farmers traditionally over-fertilize corn fields to compensate for nitrogen loss. This approach affects farm profitability and increases the risk of environmental nonpoint source pollution.

In recent years, many dairy farmers have started to minimize the use of nitrogen fertilizer at the planting time and are using Pre-Sidedress Nitrate-N Test (PSNT) to determine soil nitrogen status more accurately. This technique is especially recommended for field corn on dairy farms with a relatively long history of manure application. However, PSNT is not always accurate, an example being this year with cool wet conditions in early growing season. Taking samples for PSNT may not always be convenient since soil samples need to be collected at a time when many farmers are very busy with other tasks on their farms. Moreover, adverse weather conditions may delay nitrogen sidedressing with corn getting too tall to apply additional nitrogen.

Recently, reports from researchers in Illinois indicated that concentrations of amino sugar nitrogen in soil are correlated with yield of corn. Soils were classified as responsive when amino sugar N concentration was less than 200 mg kg^{-1} and non-responsive to N fertilization with greater than 250 mg kg^{-1} . This method has positive economic implications for production agriculture and should enable farmers to refine nitrogen management and help in the control of $\text{NO}_3\text{-N}$ pollution of ground water.

In this technique, the time of soil sampling for amino sugar nitrogen determination is thought to be much less critical than with the PSNT. It is possible that it can be done prior to the growing season using samples collected for evaluation of phosphorus and potassium, and other soil characteristics.

In order to evaluate the amino sugar nitrogen technique, experiments were conducted in different locations in Massachusetts and Connecticut in 2002, and continued in 2003. These on-farm studies were being conducted by farmers participating in one of the Farmer Research Group projects being coordinated by the University of Connecticut and the University of Massachusetts. In each farm, two treatments were imposed, one with adequate N application in spring, and one without any form of nitrogen source applied. Each treatment was replicated 3 times in each farm field. Each experimental strip consisted of 4 rows of corn in 2002 and 6 rows in 2003 with a length of 150 ft.

Soil samples from each strip were taken in the fall (between harvest and freezing), and also in the early spring for calculation of amino sugar N content. The comparison between the soil samples taken in the two seasons will show if the level of amino sugar N stays relatively constant during the winter, which would provide the flexibility of taking soil samples when the farmer is less busy with many other tasks on the farm.

Soil samples were also taken from all experimental strips for PSNT when corn plants were about 12" tall. Also, 8" long sections of five random stalks from each strip were removed from 6" above the ground at the time of harvest. Stalk samples were dried, ground, and analyzed to determine NO₃-N concentration. The results from all three techniques were compared for examining the accuracy of each technique on the farms.

The report presented below covers only the results of the 2002 experiment on two Massachusetts farms. Results include data obtained from all three techniques, along with harvested yield.

Farm ID	Soil Amino Sugar (Fall)		Soil Amino Sugar (Spring)		PSNT (ppm NO ₃)		Stalk Nitrate (ppm NO ₃)		Forage Yield tons/ac	
	-N	+N	-N	+N	-N	+N	-N	+N	-N	+N
1	99	118	107	112	11.5	16.0	763	5467	19.0	22.1
2	245	285	220	280	27.5	28.6	-	1700	18.5	17.7

Results indicated that adequate available nitrogen was important. However, the results obtained from all three techniques confirmed that no yield increase should be expected if soil N level is above a critical value. Strips which received adequate N out-yielded those with no added N fertilizer at the site with low soil amino sugar, PSNT, and stalk nitrate test. Additional N fertilizer to the site with high levels of soil amino sugar and above 25 ppm NO₃ (critical value for PSNT) did not increase yield.

The results for the soil amino sugar concentrations taken in fall and spring did showed that amino sugar level remained relatively unchanged during fall and winter seasons. This preliminary data indicates that soil samples can be taken before growing season when farmers are less busy with other activities on their farm.