Nitrogen Status of Corn on Massachusetts Dairy Farms

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In spring of 2001, 12 field experiments were conducted to collect crop yield and nitrogen sufficiency data using the "end-of-season cornstalk test". This activity was possible through funding from USDA-NRCS and Massachusetts Dept. of Environmental Protection. Six farms were selected across the state and within each farm one to three manured fields were chosen. Selection of the farms was primarily based on soil type and geography. In each location, the experiment was designed as a complete randomized block with 3 nitrogen rates of 0, 80 and 160 lb N/acre. The rates of nitrogen were determined based on the results of Pre-sidedress Nitrogen Tests. On fields where farmer had already applied some nitrogen at the planting, added N was adjusted to be equivalent to the 0 (or farmer rate), 80, and 160 lb N/acre.

In each field, three rows (30" apart and 150' long) were selected and tagged. The selected area then divided into three 50' sections, each represented one replication. The three rows within each replication were divided further into three 15' segments and designated at random to one of the 3 nitrogen rate treatments. When the corn plants were 12" high, nitrogen in the form of ammonium nitrate was applied to the middle of all three rows by hand. Final harvest was taken at black layer stage using 10' of middle rows. After hand harvesting, corn silage yield was adjusted on 70 percent moisture.

For determination of nitrogen sufficiency, the "end-of-season corn stalk test" was used. Stalk samples were collected at the black layer stage, from 5 corn plants at random adjacent to the final harvest area, from each plot within each designated field. An 8 inch segment from each stalk was cut 6 inches above soil surface and labeled according to treatment and field. The stalk samples were then stored in a freezer until being analyzed for nitrate-N concentration.

Stalk samples from the freezer were dried to constant mass in a forced-air oven at 70° C. Dried corn stalk samples were then ground using a Cyclotec 1093 sample mill to pass through a 1.00 mm screen. Ground corn stalk samples (0.20 g) were extracted in 50 ml of distilled water, shaken at 200 oscillations/minute for 15 minutes and filtered with # 1 Whatman filter paper. Nitrate-N was analyzed with a nitrate electrode.

Yield of corn silage yield varied from 18 to 35 tons per acre (Table 1). Nitrogen concentration in corn stalk increased with increasing N application rate. In general no yield improvement was obtained beyond the accepted N sufficiency range of 700 to 2000 ppm of nitrate-N in corn stalks. Through this project participating farmers became aware of realistic corn yields, and acknowledge that they have a better understanding of how application of surplus N would result in accumulation of N in the lower parts of the corn stalk. They also understood that this N did not translate into ears, and did not produce higher yields. Interestingly, in 5 fields out of 12, a decreasing trend in yield was observed as stalk N concentration increased. Further investigation is needed for a more

precise conclusion of negative effects of high N levels on yield. More than half of these farmers have decided to lower N application rate in this year at least some of their corn fields. Two farmers have decided to stop using starter fertilizer and will use PSNT to determine N requirement for their corn fields.

Table 1. On-farm nitrogen sufficiency evaluation.

Farm ID	Field #	N Rate (lb/acre)	Silage corn yield (tons/acre)	Stalk NO_3-N (ppm)
1	1	0	24.6	492
		80	25.1	2175
		160	28.1	3667
	2	0	26.0	5417
		80	25.7	4000
		160	25.0	6750
	3	0	21.1	4833
		80	29.8	5333
		160	26.9	5833
2	1	0	17.8	542
		80	21.9	5983
		160	19.5	7667
	2	0	23.4	508
		80	27.6	4700
		160	35.7	7750
	3	0	21.4	1350
		80	28.4	7583
		160	24.4	7668
3	1	0	22.0	6167
		80	19.9	6417
		160	20.1	7250
	2	0	27.9	3917
		80	26.0	3650
		160	30.9	7333
4	1	0	22.5	5592
		80	24.3	9417
		160	23.6	6583
	2	0	25.2	2850
		80	25.2	3750
		160	28.0	4750
5	1	0	21.8	4025
		80	18.8	5750
		160	22.1	8500
6	1	0	28.4	5000
		80	28.0	5850
		160	25.1	9667