

**Project Title: Optimizing Soil Nitrogen Management for Processing Sweet Corn to Maximize Marketable Yield and Quality and Minimize Damages to Water Quality**  
(Report of the first year)

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### Executive Summary

Timely supply of nitrogen with sufficient but not excessive amount is essential to processing sweet corn to assure maximum economic yield and quality, with sustained or improved environmental quality. Soils often contain significant amount of available nitrogen carried over from previous crops and/or released through mineralization of soil organic matter. A testing tool must be available to determine whether the processing sweet corn needs to be fertilized with nitrogen, and if such fertilizer nitrogen has to be applied at the optimum rate. New fertilization techniques for processing sweet corn must be developed for Ontario conditions. Nutritional information on processing sweet corn is also essential to establish database for Ontario nutrient management legislation.

The objectives of this experiment for year 2002 were 1) to determine the response of processing sweet corn to fertilizer nitrogen; 2) to evaluate the potential for post-harvest leaching losses of soil nitrogen as a function of fertilizer nitrogen rate; 3) to develop an optimum nitrogen fertilizer rate which maximizes marketable yield and quality and minimizes losses of soil nitrogen to ground water; and 4) to develop a pre-side dress soil nitrogen test technique for processing sweet corn to predict the fertilizer nitrogen needs.

In order to cover the possible variation caused by climatic conditions, the study was conducted on two sites: a Granby sandy loam soil at the Greenhouse and Processing Crops Research Centre (GPCRC), AAFC, Harrow, and a fine sandy loam soil at Ridgetown. At each site, nitrogen fertilizer at five rates including 0, 50, 100, 150 and 200 kg/ha was applied to create a range of initial soil available nitrogen levels. Two cultivars (Hollywood and Stetson) were included in the trial to test the potential variation caused by processing sweet corn variety. All nitrogen fertilizer was pre-planting broadcast-incorporated into beds with a power bedder. The trial was managed following the local practices. Soil samples were taken at depths of 0-30 cm at V4, V5, V6, and V7 stages. In addition, soil samples were also be taken before planting and at V6 stage to 60 cm depth. Soil samples were analysed for available nitrogen including nitrate and ammonia nitrogen. Soil samples were also be taken shortly post-harvest at 0-100cm depth to determine the potential for soil N losses. Plant tissue samples (kernel and stover) were taken at harvest and analyzed for total N content.

Marketable yield of sweet corn across both varieties at the Harrow site increased quadratically with fertilizer nitrogen rate and reached the maximum of 4440 dozen ear ha<sup>-1</sup>, with added fertilizer nitrogen at 81 kg ha<sup>-1</sup>. At the Ridgetown site, marketable yield increased with added fertilizer

nitrogen and maximized at 138 kg N ha<sup>-1</sup>. The fertilizer rate required for maximum marketable yield was 56 kg N ha<sup>-1</sup> higher at the Ridgetown site than what at the Harrow site, an implication of significant difference in fertilizer nitrogen requirement for sweet corn production between soil types and geographic locations.

Both fertilizer nitrogen rate and variety affected cob length and diameter at the Ridgetown site, but not at the Harrow site. At the Ridgetown site, responses of both cob length and cob diameter were quadratically related to fertilizer nitrogen rate, with the longest cob produced at 65 kg N ha<sup>-1</sup> added nitrogen and the thickest cob produced at 115 kg N ha<sup>-1</sup> added nitrogen. Since the reduction in cob length with increased nitrogen rate up to 138 kg N ha<sup>-1</sup> was only about 0.13cm, and in cob diameter only 0.05cm both of which are considered as insignificant as to marketable value, it seems that fertilizer nitrogen added at 138 kg N ha<sup>-1</sup> could embody the maximize yield with superior cob size.

Regardless of soil type and geographic location, neither fertilizer nitrogen nor variety effect was found on the sweetness of sweet corn in 2002.

Total crop nitrogen uptake including stover and grain nitrogen uptake ranged from 70 to 83 kg N ha<sup>-1</sup> at the Harrow site and from 44 to 49 kg N ha<sup>-1</sup> at the Ridgetown site. Of the total uptake at the Harrow site, grain nitrogen removal increased with added fertilizer nitrogen and reached the maximum at 150 kg N ha<sup>-1</sup> added nitrogen, which was 69 kg N ha<sup>-1</sup> more than what was required for maximum marketable yield (81 kg N ha<sup>-1</sup>). The calculated fertilizer use efficiency decreased significantly with increased fertilizer rate, implying that the significant contribution of soil mineral nitrogen and thus the importance of pre-side dress soil nitrogen test.

Threshold values for pre-sidedress soil nitrogen test varied with geographic location and soil sampling stage. The threshold values ranged from 32 to 51 mg N kg<sup>-1</sup> soil at the Harrow site and 8 to 54 mg N kg<sup>-1</sup> soil at the Ridgetown site. It was found that the threshold values were either the same or very similar within the same site when soil was sampled down to 60 cm depth (30-35 mg N kg<sup>-1</sup> soil at the Harrow site and 8-11 mg N kg<sup>-1</sup> soil at the Ridgetown site), regardless of the sampling stage and the type of target yield used.

Soil profile (0-100 cm) mineral nitrogen after harvest increased with fertilizer nitrogen rate at both sites. However, soil NO<sub>3</sub>-N remained mainly at the soil depth of 0-40 cm at the Harrow site and at 0-20 cm at the Ridgetown site, indicating the difference of NO<sub>3</sub>-N leaching potential between two sites. The increases in soil NO<sub>3</sub>-N with fertilizer rates added were largely enhanced when fertilizer N rates were above 100 kg N ha<sup>-1</sup> at the Harrow site and when above 150 kg N ha<sup>-1</sup> for variety B at the Ridgetown site. Hence soil NO<sub>3</sub>-N levels were corresponding well to the fertilizer N rates required for maximum marketable yield developed above. Any fertilizer N at rates above the requirement for maximum sweet corn yield production can pose a threat on the environment.