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EFFECT OF NITROGEN FERTILIZER PLACEMENT  
ON NITROGEN UPTAKE AND YIELD  
OF SWEET CORN (Zea mays L. saccharata)

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ABSTRACT

Five placements of nitrogen fertilizer applied to sweet corn (Zea mays L. saccharata) at the four fully expanded leaf stage, that is control (no nitrogen), a band of nitrogen placed on the soil surface near the row, on the soil surface between the rows, at 3 cm depth between the rows and at 10 cm depth between the rows were studied following three sowing times. Total plant nitrogen and sap nitrate were determined along with total plant dry weight at six growth stages. Leaf extension and leaf appearance were also followed in order to monitor the response of plants to nitrogen fertilizer applied.

Nitrogen fertilizer application resulted in significantly higher nitrogen uptake, plant dry weight and marketable ears under both dry and wet conditions. Nitrogen fertilizer applied at 10 cm depth between rows resulted in significantly higher nitrogen uptake, plant dry weight and marketable ears than that applied on the soil surface between rows under dry condition. Nitrogen fertilizer applied on the soil surface near the plants performed well under both dry and wet conditions. The sap nitrate test was more sensitive than total nitrogen measurement in indicating the timing of nitrogen uptake. Sap nitrate levels were influenced by nitrogen fertilizer application and soil water content. The general critical value of sap nitrate over the vegetative growing period was about 1000 ppm. The sap nitrate test appeared to be a very useful monitoring tool for plant nitrogen status. Further studies in the uses of sap nitrate test, especially the critical value, are needed. Use of leaf extension to detect the response of plants to nitrogen fertilizer applied was not successful. Nitrogen fertilizer application tended to accelerate leaf appearance under the low soil nitrogen status.

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## CHAPTER ONE

### INTRODUCTION

Subsistence farming relying on rainfed monocropping has been traditionally practised by farmers in many cultivated areas in Thailand. In recent years, however, some cropping systems, for example, double cropping, have been developed and practised by some farmers. Unfortunately double cropping is often difficult as the pattern of rainfall is rather erratic, especially in most parts of the Northeastern Region of Thailand. In this region, the amount of rainfall drops sharply during the later period of the rainy season resulting in a declining soil moisture regime for the second crops. In order for double cropping to be successful, suitable second crops of short duration combined with good management are needed.

Among the promising second crops, sweet corn (Zea mays L. saccharata) seems to perform well in many areas. Apart from the relatively short duration required by this crop, the high demand for sweet corn locally and from processing plants in some areas, has made sweet corn an increasingly important crop in recent years.

Sweet corn needs a good supply of nitrogen fertilizer to achieve a high yield. At the present time nitrogen fertilizer is relatively expensive compared with the returns from produce sold. Moreover, the erratic rain causes the plants to respond variably to the applied nitrogen fertilizer. Consequently fertilization sometimes results in a very low profit to the farmers.

Rainfall pattern, especially the distribution, is rather erratic and unpredictable. This causes fluctuation and difference in soil water content between soil layers. Consequently this may affect the availability of nitrogen fertilizer applied. So that the proper placement of nitrogen fertilizer may be needed for maximum and

efficient nitrogen supply to plants.

It is often found that the residual fertility from the first crop is sufficient for the short duration second crop, or at least for the early growth (Jones, 1974; Rao et al., 1983; Sanmaneechai et al., 1984). Moreover, in practice, there is a problem of labour shortage occurring during the end of the first crop and the beginning of the second crop. Therefore this study examined the methods of nitrogen fertilizer application after crop establishment.

As the efficient use of nitrogen fertilizer is important for profitability, it was thought necessary to examine methods that could be used to monitor nitrogen supply to the plants and to detect the response of plants to nitrogen fertilizer applied. Among the many methods available, nitrate sap tests and measurement of leaf growth are some of the promising methods because they are quick and simple. Both these techniques were included in this study.

Although the distribution of rainfall in Palmerston North, New Zealand is relatively uniform throughout the year (N.Z.M.S., 1983) compared with that of Thailand, the latest 11 year rainfall data show that there were some dry spells during the summer months. Therefore the conditions at Palmerston North may be used to simulate those of Thailand through the appropriate experimental planning and design. This study wanted to simulate sweet corn as second crop in a double cropping system and under a declining rainfall situation. The objectives of this study were to study:

1. nitrogen uptake and dry matter yield of sweet corn as affected by nitrogen fertilizer application.
2. the effect of different nitrogen fertilizer placements on nitrogen uptake, dry matter and marketable sweet corn yield.
3. the nitrogen dynamics in the plants by using sap nitrate tests and the relationship between sap nitrate levels and nitrogen uptake.

4. the possibility of using leaf extension and leaf appearance to detect the response of plants to the nitrogen fertilizer applied.