INVESTIGATIONS ON GROWTH AND P UPTAKE CHARACTERISTICS OF MAIZE AND SWEET CORN AS INFLUENCED BY SOIL P STATUS

A thesis presented in partial fulfilment
of the requirements for the degree of

Doctor of Philosophy (PhD)

(*Plant & Soil Science*)

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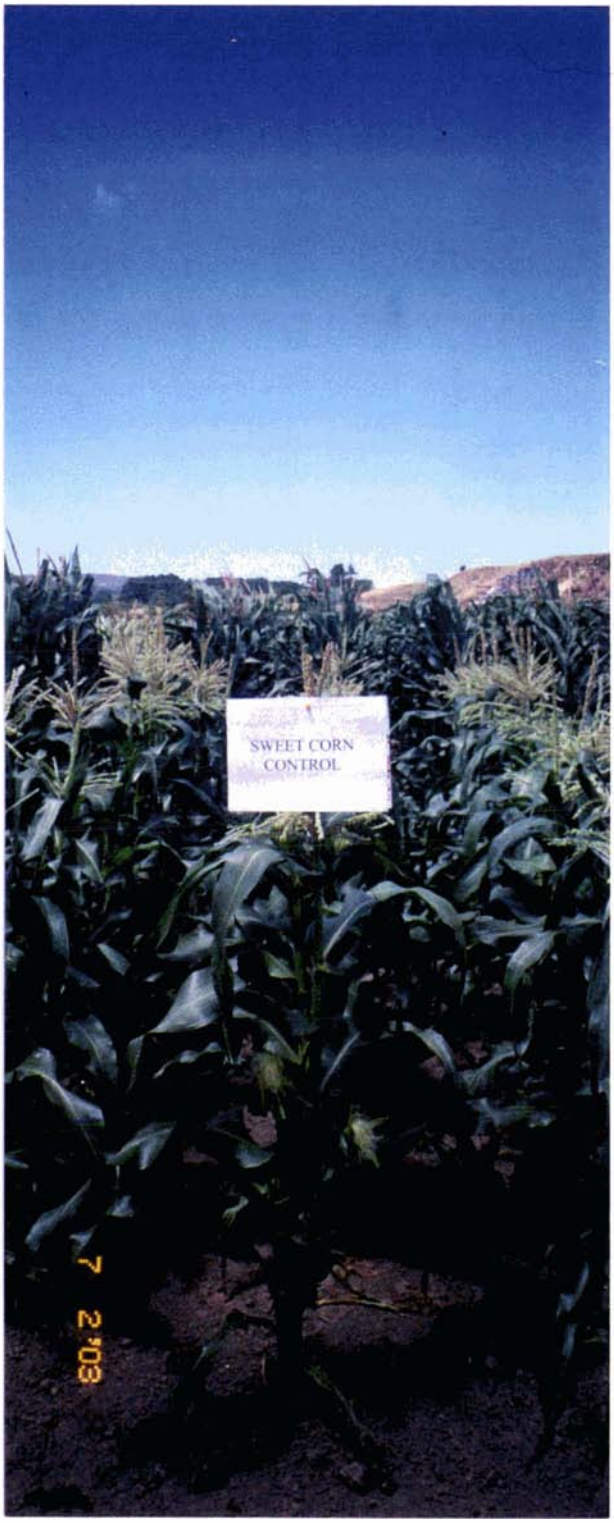
2005


MAIZE
CONTROL
7 2'03


SWEET CORN
CONTROL
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This thesis is dedicated to my family and teachers,

all of them supported a lot and expected from me to fulfil this task one day.

ABSTRACT

Despite being different cultivars of the same plant species (*Zea mays* L.), maize and sweet corn have contrasting P fertiliser recommendations in New Zealand, that are reflected in different target Olsen P values of 10-15 mg P/kg soil for optimum maize growth and 26-35 mg P/kg soil for optimum sweet corn growth. Three key hypotheses were developed in this study to explain why these differences may exist: i) maize and sweet corn differ in their responsiveness to P fertiliser i.e. maize is more internally P efficient and requires less P than sweet corn to grow, ii) both cultivars differ in external P efficiency i.e. their ability to take P up from soil iii) both cultivars differ in external P efficiency because they have different root system structure.

Two field experiments evaluated the growth and yield responses of maize and sweet to different rates of P fertiliser application. The first experiment was conducted in Hawke's Bay (2001-02) and second in the Manawatu (2002-03) with P application rates of 0, 100 and 200 kg P/ha in the Hawke's Bay and 0, 15 and 70 kg P/ha in the Manawatu. Both experiments were conducted on soils of low available P status. The Olsen P test values of 13 mg P/kg soil in the Hawke's Bay and 11 mg P/kg soil in the Manawatu were far below the recommended values for sweet corn (25-35 mg P/kg soil).

In both experiments and across all P treatments maize produced significantly higher dry matter yields than sweet corn during all sampling stages. In the Hawke's Bay experiment at 100 days after sowing (DAS), the maize (87719 plants/ha, 20.9 t/ha) produced 43% more dry matter than sweet corn (71124 plants/ha, 14.6 t/ha), whereas, in the Manawatu experiment (140 DAS), maize (71124 plants/ha, 15.2 t/ha) had a 39% higher dry matter yield than sweet corn (71124 plants/ha, 10.9 t/ha). In both the field experiments, the sweet corn fresh cob yield of 27 and 28 t/ha in the Hawke's Bay and the Manawatu regions and maize grain yields of 16 and 10 t/ha, respectively, were within the range of the reported commercial yields for each region.

In both experiments, the P fertiliser application raised the soil P status (Olsen P test values) but caused no significant increases in either maize or sweet corn yields (total dry matter, sweet corn fresh cob or maize grain). Commercially viable yields of both

cultivars were able to be achieved without P fertiliser application with Olsen P soil test in the range of 10-15 mg P/kg soil.

Sweet corn reached harvestable maturity at 115 DAS in the Hawke's Bay and 140 DAS in the Manawatu experiments. By this time maize had produced 4-6 t/ha more total dry matter yield than sweet corn, yet maize and sweet corn had achieved similar total P uptake (32- 37 kg P/ha at 100 DAS in the Hawke's Bay and 18-19 kg P/ha at 140 DAS in the Manawatu). At silking (after 75 DAS in the Hawke's Bay and approximately 110 DAS in the Manawatu), both cultivar's total leaf P concentrations (0.21-0.25%) were within the sufficiency range values for maize crops in New Zealand (0.18-0.33 %). Maize, however was more internally P efficient growing more dry matter per unit P taken up, which was more noticeable in the drier season. Fertiliser P application increased P uptake with both cultivars under moist conditions in the Hawke's Bay experiment (2001-02). However, the dry conditions in the Manawatu (2002-03) limited P uptake as well as restricted dry matter yields with both cultivars. Further, there were no significant differences between maize and sweet corn P uptake efficiency (kg P/kg root) despite significant differences in the root system structure (biomass) for both cultivars at all stages, which lead to different temporal patterns of P uptake.

The lack of maize yield response to fertiliser P in both field experiments is consistent with the New Zealand recommendations for growing a maize grain crop (because soil Olsen P was in the range of 10-15 mg P/kg). Howevcr, the lack of sweet corn yield response in both field experiments does not support the New Zealand recommendations for growing sweet corn (which assume optimal Olsen P values are 26-35 mg P/kg).

Acknowledgements

I would like to express my sincere gratitude to the following people and organisations.

First and foremost, I am extremely thankful to my chief supervisor Dr. Mike Hedley and co-supervisor Dr. Jeff Reid, who gave guidance, inspiration, enthusiasm and technical support throughout the study period. I admire the extra time devoted by Dr. Mike Hedley for completion of this study in time. My special thank to Dr. David Scotter for his collaboration and guidance for using soil water balance model work in this study. I am grateful to Dr. Cory Matthew for his suggestions with root work. I am also thankful to Dr. M.A.Choudhary (my ex-supervisor), who inspired and supported me to take up PhD study.

Thanks are extended to INR, FLRC and NZ Institute for Crop & Food research staff particularly to; Lance Currie, James Hanly, Ian Furkert, Bob Toes, Ross Wallace, Mike Bretherton, Anne West, Glenys Wallace, Mark Osborne, Adam Mackres, Stephen Trolove, Andrea Pearson, Wayne Hosking, Scott Shaw, Isabelle Sorensen, for their technical help with the field experiments and laboratory analyses. I am grateful to Moira Hubbard, Denise Brunskil, Irene Manley, Denise Stewart, and Pamela Howell for their kind support during the study.

Many thanks to postgraduate students; Zulfiqar Haider Butt, Zakir Hussain, Amsha Nahid, Harmanjit Singh, Jagrati Singh, Rita Bhandral, Alan Bannister, Caroline Schweikart, Asoka Senarath, Tin Maung Aye, Leigh Christensen, Entin Daningsih, David Houlbrooke, Christian Hepp, Tara Pandey, Zulkefly Sulaiman, Bhoj Bahadur Kshatri and many other fellow postgraduates in the Institute of Natural Resources with whom I shared knowledge, many beautiful moments, friendship and help in many ways.

I thankfully acknowleged NZ Institute for Crop & Food Research Ltd for providing me fellowship to take up this study. I also acknowleged two other scholarship providers for financial help during study; Helen E Akers PhD Scholarship and D.G. Bowler Scholarship for post-graduates in soil water management.

My special thanks to all Pakistani and Indian families in Palmerston North for their friendship, help and provision of spiritual needs during my study which has been so enjoyable for me and my family.

I would like to extend my kind gratitude to my two sisters (Ghazala and Nino) for looking after my mother during my stay abroad in New Zealand.

At last, my sincere gratitude to my wife (Rizwana), as she made my work possible and for bringing our family cheer and happiness, even I was sometimes grumpy with them during my studies. Rizwana sacrificed her own career for me to complete this task. I would like to say that without her continuous infusions of love, support, encouragement and above all PATIENCE!... I just couldn't have done it.

Tehseen Aslam

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

APPENDICES