THE EFFECT OF UREA, CATTLE MANURE, PLANTING DATE,

IRRIGATION AND WATER LOGGING ON SOIL NITROGEN AND

MAIZE YIELDS IN MAHAWELI SYSTEM C

By

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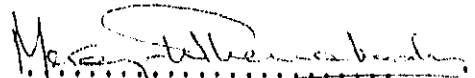

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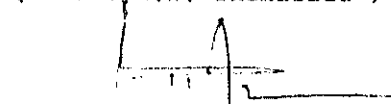
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ABSTRACT

Systematic experiments were conducted in Mahaweli system C to establish the response of maize to planting date, nitrogen fertiliser, cattle manure and drainage class in maha 1984/85 and to nitrogen fertiliser and irrigation frequency in yala 1985.

In maha 1984/85 maize was planted on three dates (24 September, 9 November and 24 December) on both a well-drained and an imperfectly drained Reddish Brown Earth at the Girandurukotte Research Farm. There were four rates of fertiliser: 0, 30, 60 and 90 kgN ha^{-1}, with and without cattle manure (12.5 t DM ha^{-1}).

In yala 1985, maize was planted with the same four nitrogen (N) fertiliser rates and was either irrigated every day, every fifth day or every 10 days.

Soil moisture in the top 200 cm was monitored throughout. Soil total-N, nitrate-N and ammonium-N were sampled at 30 and 60 days after planting, at 0-20, 21-40, 41-60 and 61-80 cm depth. Total plant N at harvest and ear-leaf N were also analysed. Grain yield was recorded.

In maha 1984/85 seasonal waterlogging caused nitrogen deficiency in maize, consequently maize yields ranged from 1.75 to 5.95 t ha^{-1} in response to planting date, drainage class, nitrogen fertiliser rate and cattle manure. Delayed planting on well-drained plots resulted in yield decreases from 5.15 t ha^{-1} when planted with the first rains on September 24, to 4.17 t ha^{-1} for the November 9 planting and only 2.70 t ha^{-1} for the late planting on December 24. Imperfectly drained plots yielded lower than well-drained plots; ie, 1.86, 1.40 and 1.33 t ha^{-1} for the above three dates of planting. There was no clear relationship between yield and duration of waterlogging, the index used needed further refinement (days the soil was greater than field capacity in the top 50, 100 or 200 cm profile).

Responses to N-fertiliser occurred in well-drained plots. Urea applied at rates between 30 and 90 kgN ha^{-1} increased yields by 1.1 to 1.2 t ha^{-1} (ie, by 25, 30 and 61% for the September, November and December plantings respectively).

Lower yields from late planting and imperfect drainage were associated with lower soil nitrate-N and higher soil ammonium-N. Total

soil N% varied with time, date of planting, N-application rate, drainage class and soil depth. Increases occurred after two applications of urea and thereafter decreased gradually with time.

Peak values of total N were doubled by increasing urea from nil to 90 kg N ha^{-1}. The peak total soil N% were always greater on well-drained than on imperfectly-drained soil. Nitrate-N was lower for December planting, due to the delay in planting from September to December. Subsoil N levels were very low.

The N-content of plant material at harvest varied with date of planting, drainage, N-fertiliser and cattle manure. Poor drainage caused N-deficiency in ear-leaf nitrogen. Nitrogen in plant material increased tenfold (from 0.2 - 2.25%) in response to 90 kgN ha^{-1} as urea and cattle manure. The response was less in the absence of cattle manure.

In the yala experiments (planting in May 1985) maize yields varied from 0.33 to 2.51 t ha^{-1}. There was a strong response to N-fertiliser, with a doubling of yield, between 0 and 90 kgN ha^{-1} on plots irrigated every fifth day. There was no response to fertiliser N on plots irrigated daily (due to waterlogging) or every ten days (due to drought stress). There was an interaction: N-fertiliser gave highest yields when the maize was irrigated every 5th day. The pattern of change in soil total-N, nitrate-N and ammonium-N was similar to maha.