The effect of nitrogen and phosphorus application on yield of raingrown summer crops in Central Queensland.1. sorghum in Dawson and Callide Valleys

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The Dawson and Callide river valleys of central Queensland have a summer-dominant rainfall pattern. Grain sorghum is the major dryland crop grown in the region. Cropping is undertaken mainly on heavy cracking clay soils of low to medium phosphorus status. The nitrogen status of these soils is variable, but tends to decline with increasing age of cultivation.

The inevitable decline in soil fertility is expected to lead to the widespread use of nitrogen and "phosphorus fertilizers. The work reported here is part of a current project to assess nitrogen and phosphorus responses in summer crops throughout central Queensland.

Methods

Four trials, with treatments of 0, 25, 50 kg N ha $^{-1}$ and 0, 10, 20 kg P ha 1, were established in January 1981. All combinations of N and P rates except the 0 N, 20 P treatment were used. The trials were sown as a randomised complete block, with three replicates. Phosphorus as mono-ammonium phosphate (MAP) was banded 5 cm to the side of the seed row. Nitrogen was applied as urea, the rates of which were adjusted to account for the N content of MAP, in bands 10 cm to the side of the seed row.

The intended established plant populations was 70,000 plants ha ^{1}. However, owing to atrazine phytotoxicity, this was not achieved at all sites.

Results and Discussion

The application of 50 kg N ha $^{-1}$ as urea significantly (P 0.05) increased sorghum yield at 2 sites (by 650 and 350 kg ha ^{1}). At one of these sites and the remaining two sites, sorghum vigour was reduced by atrazine phytotoxicity. At the two sites which failed to respond to N application, the phytotoxicity was severe, and at one of them probably precluded an N response. The 2 sites at which N response occurred had soil nitrate nitrogen contents of 2.8 and 5.9 ug g ^{1} (0-60 cm sample).

Yield responses, both of 460 kg ha^{t}, were recorded to the application of 20 and 10 kg P ha $^{-1}$ at the 2 sites at which N response did not occur. These sites had 0.5 M $NaHCO_3$-extractable P (P(b)) (1) of 11 and 10 ug g $^{-1}$ in an 0-10 cm soil sample. A third site with a P(b) of 9 ug g^{-1} showed some yield increase (180 kg ha ^{1}) but this was not significant. The fourth site, which failed to respond, had a P(b) of 13.8 ug g^{-1}.

Despite the adverse effects of the atrazine phytotoxicity, this work indicates that N responses may be expected when nitrate nitrogen in the top 60 cm of soil is less than_6-8 ug g $^{-1}$ and P responses when P(b) in top 10 cm of soil is less than 12 ug g $^{-1}$.

Further work is planned to investigate the yield responses to N and P application and their relationship to extractable N and P levels and P sorption capacity.

1. Colwell, J.D. 1963. Aust. J. Exp. Agric. Anim. Husb. 3: 190.