Response of irrigated grain sorghum to split application of nitrogen II. biomass and grain yield

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Split application of nitrogen (N) may lead to improved efficiency of utilization of nitrogenous fertilizer, particularly if yield is increased. However, the crop must not encounter nitrogen deficiency between N applications (l). The increasing importance higher application rates of nitrogen used in grain sorghum production necessitate continuing updating of grain yield response data to provide soundly based recommendations to farmers, particularly as new varieties of higher yield potential become available.

Materials and methods

Details of treatments and cultural practices are given elsewhere (2). Above ground biomass at anthesis and maturity were assessed from 12 plants per plot. The data for maturity biomass was corrected for grain loss caused by weather damage by grain site counts and grain size data, yield was estimated from grain site, grain size and plant population data.

Results and discussion

There were no N rate and time of application effects on biomass at anthesis or time of application effects on maturity biomass or grain yield. Thus the 130 kg NO_3-N ha^{-1} available in the soil to 70 cm plus the 50 kg N ha^{-}l applied at planting was sufficient to meet crop needs for growth and reproductive development for about 40 days. Plants in the plots receiving N 44 days after planting were beginning to show signs of N translocation, hence any delay beyond about 40 days could risk yield reduction on sites similar N status. Split application strategy effects would almost certainly have occurred had soil N status been lower. Clearly split application strategies would need to take account of soil N reserve. though a total N supply at planting of about 180 kg N ha^{-1} seems adequate for varieties similar to Goldfinger for about 40 days under irrigated conditions.

Regression equations over N rate (N) for biomass at maturity (Y [t ha^{1}] = 7.69 + 0.091 N - 0.0002334 N^2, r = 0.98, R $_2$0.01) and grain yield (Y [t ha^{-1}] = 4.34 + 0.0499 N - 0.0001226 N, r = 0.9. P 0.01) showed calculated maximum biomass at 195 kg N ha^{-1} (9.4 t ha^{-1}) and in economic terms a N rate at which marginal cost equals marginal return of 180 kg N ha^{-} (sorghum $120 N = $0.63 kg^{-1}). This value could change for spring sowings depending on variety chosen and the different temperature and radiation conditions encountered. The losses associated with machine harvesting may reduce the economic optimum level of N application slightly. However, 180 kg N ha^{-1} is in excess of rates generally used on sorghum, suggesting that increased rates of N may be justifiable under conditions of full irrigation, on soils of similar or lower N status to that used in the trial (130 kg NO_3-N ha-l to 70 cm).

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