**Stubble and tillage effects on soil characteristics and grain sorghum yield**

G.A. Thomas[1], J. Standley[1], H.M. Hunter[1], D.P. Sinclair[1], G.W. Blight[2] and A.A. Webb[3].

[1]Department of Primary Industries, Biloela Research Station, Q 4715
[2]Department of Primary Industries, Rockhampton, Q 4700
[3]Department of Primary Industries, Indooroopilly, Q 4068

A study was commenced at Biloela in central Queensland in 1978 on the effects of stubble retention and tillage method on soil water storage, soil nutrient status and crop productivity in grain sorghum. At that time, reduced tillage practices were being recommended for fallow management as a soil conservation measure, but little was known of their effects on soil characteristics and crop production.

**Methods**

There were six treatments in four replicates of a R.B. layout. Treatments were disc, blade and zero tillage, each with stubble from previous crops either retained or removed at the start of each fallow period. Treatments were maintained on the same plots each year from 1978 to 1985. Plots were planted to grain sorghum (cv. E57) in December-January each year, following a seven to eight month fallow. Soil water content to a depth of 1.8 m was monitored with a neutron probe during the fallow and crop growth periods. Soil samples for chemical analyses were taken to a depth of 1.6 m at the start and end of each fallow period. Soil type was a grey, cracking clay (Ug 5.24; Entic Pellustert).

**Results and discussion**

Over a range of seasonal conditions from 1978-79 to 1983-84, there were few significant ($P<0.05$) treatment effects on soil water accumulation over the fallow period or available soil water at planting to a depth of 1.8 m. In one of the six years, levels in zero tillage with stubble retained were significantly ($P<0.05$) higher, by an average of 20 mm or 11% of the plant available water capacity, than those in disc tillage treatments. Zero tillage with stubble removed had significantly (P<u.05) lower available soil water at planting than most other treatments in four years.

There were minor stubble and tillage effects on some properties of surface soil (0 to 10 cm) from 1978 to 1985. Mean site analyses in June 1978 included 1.17% organic carbon, 0.125% total nitrogen, 23 mg $kg^{-1}$ bicarbonate extractable phosphorus and 0.138 mg $kg^{-1}$ calcium chloride extractable phosphorus. Mean annual decreases were found in these analyses of 3.8%, 3.1%, 7.5% and 10.0%, respectively. Stubble retention marginally reduced these decreases compared to stubble removal. The decrease in total nitrogen was significantly ($P<0.05$) less for zero tillage with stubble retained than for all other treatments. Net accumulation of nitrate to a depth of 60 cm at the end of the fallow tended, for a particular tillage treatment, to be higher where stubble was removed.

Mean grain yields over all treatments in individual years from 1978-79 to 1983-84 ranged from 1650 to 3250 kg $ha^{-1}$. Where stubble was retained, yields of disc and blade tillage did not differ significantly ($P<0.05$) in any of the six years. However, yields in zero tillage were significantly ($P<0.05$) higher in two years and lower in two other years than in disc and blade tillage. The lower yields in zero tillage were associated with establishment problems in those years. Stubble removal resulted in significantly ($P<0.05$) lower grain yields than stubble retention in disc, blade and zero tillage in two, one and five years, respectively.

Results indicate that grain sorghum productivity in central Queensland can be maintained, while taking advantage of the soil conservation benefits of reduced tillage practices and stubble retention.