

Tillage systems for continuous cropping in south Australia

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This paper describes the results of a field experiment designed to evaluate the long term effects of three tillage systems on wheat and grain legume yields, and to identify changes in the structural characteristics of the soils under these three tillage systems in a continuous wheat-grain legume rotation.

Methods

In 1977 a field trial was started at Roseworthy Agricultural College on a solonized brown soil (Gn. 1.46) (1) that had been under a medic pasture the previous year.

The trial consisted of a factorial design with three cultivation treatments, (direct drilling, cultivation by scarifier and cultivation by rotary hoe), two stubble handling methods (burning vs no-burning of stubble) and two crops, by four replications. An alternative cropping system was carried out so that, in each year, half the plots were sown to wheat and the other half to a grain legume (field peas, lentils and faba beans have been used). All plots were treated with Hoegrass post-emergent herbicide at 1.5 L/ha.

Duplicate soil samples (0-10cm) for aggregate stability and organic matter analysis were obtained from the wheat plots immediately following sowing in June 1980. They were air-dried and stored at 5°C. Aggregate stability was determined using a wet sieving method (2), and organic matter by a modified Walkely and Black titration method (2).

Results and Discussion

Wheat yields were significantly reduced under direct drilling in the first two years (see also (3)). However, by 1980 there were no differences between tillage systems. Observations indicated that rotary tillage was the most effective system for breaking up and incorporating cereal residues.

The yields of field peas and faba beans appear less sensitive to variation in seedbed conditions and thus yields were not depressed by direct drilling.

A significantly higher proportion of large water-stable aggregates was found in the direct-drilled soil. Organic matter content was also slightly higher. However, the change is small and, in the short term, the improved aggregation was most likely due to reduced disturbance.

Observations during 1980 showed a build-up of cereal root eelworm (*Heterodera avenae*) infestation in the wheat plots. This, together with weed competition, particularly from soursob, *Oxalis pes-caprae*, was the main agent responsible for lower-than-expected wheat yields in 1980. Wheat plant roots were sampled 6 weeks after sowing in 1981 for root damage due to cereal root eelworm. Results showed the direct-drilled wheat to have significantly less root damage. (Roget, D., personal communication).

1. Northcote, K.H. 1971. A Factual Key for the recognition of Australian soils. Rellim Tech. Publications, SA.

2. Grierson, I. 1977. Soil Conservation Branch Report S5/77, SADA, (D. Heanes, ed.).

3. Grierson, I., Smith, M. Regheb, O. 1979. SA Dept of Agric. Agronomy Conference - Working Papers, pp. 37-40.