EFFECTS OF ROTATION CROPS ON SOIL PROPERTIES AND COTTON YIELD IN THE MACQUARIE VALLEY OF NSW

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Crop monoculture frequently causes a build up of weeds, diseases, insects and soil fertility problems. Furthermore continuous cotton production in the Macquarie Valley often causes soil compaction leading to poor crop growth and yields. While cotton growers in the Macquarie Valley have shown an interest in using rotations to minimise degradation of the crop environment, information on the merits of different rotations is sparse. This experiment was set up to provide such data.

MATERIALS AND METHODS

An experiment was established in 1993 to evaluate the effect of 7 rotation systems (Table 1) on cotton (*Gossypium hirsutum*) yield, soil quality and economic returns in a sodic, grey clay (Entic chromustert; Ug 5.24) in the Macquarie Valley (147° 46' east, 31° 47' south). The experiment was conducted in a commercial field which had grown cotton the previous 3 years. Each plot was 40 metres wide by the length of the field (700 metres), and all work was done with commercial equipment.

The wheat (*Triticum aestivum*) in treatments 4, 5, 6 and 7 was harvested and the grain removed. The field peas (*Pisum sativum*) in treatment 3 and Dolichos (*Lablab purpureus*) in treatments 6 and 7 were sprayed with Roundup

1	COTTON 92-93	COTTON 1993-94	COTTON 94-95
2		FALLOW	
3		FIELD PEAS (16 KG N/HA, 17 KG P/HA, No Irrign)	
4		WHEAT-LO (16 KG N/HA, 17 KG P/HA, No Irrign)	
5		WHEAT-HI (99 KG N/HA, 17 KG P/HA, 1 Irrign)	
6		WHEAT-LO + DOLICHOS	
7		WHEAT-LO + DOLICHOS + EXTRA FERT. EXTRA FERT. = 11 KG N/HA, 24 KG P/HA, 73 KG K/HA	

Table 1. Rotations used in the trial

to halt their growth and prevent seed set. In May 1994 the stubble on all plots was incorporated at the start of ground preparation for the 1994-95 cotton crop, which was sown over the entire field.

Soil properties monitored were compaction (cone index measured with a recording penetrometer), organic matter fractions (particulate, mineral associated and total), plastic limit (drop cone penetrometer), pH (0.01M $CaCl_2$), nitrate-N (extracted by 1M KCl), and exchangeable cations (extracted by alcoholic 1M NH_4Cl, pH 8.5) and aggregate stability (as dispersion index). Establishment, dry matter production and grain yield (if applicable) was measured for all rotation crops. Growth and development of the 1994-95 cotton crop was monitored on all plots, while lint yield was calculated from seed cotton yield and gin turn out percentage.

RESULTS AND DISCUSSION

Extensive drying of the soil profile is known to facilitate cracking and ameliorate compaction in cracking clays. In this context low management wheat (Rotation 4) resulted in the driest soil profile in 1993, while fallow (Rotation 2) was the wettest (Figure 1).

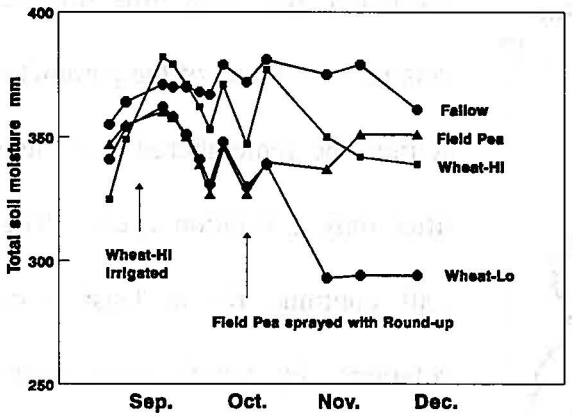

Figure 1 Total moisture (10-110 cm) under the different rotations

Penetrometer readings indicated, however, that trafficking rather than profile drying was the major determinant of soil compaction, as lowest and highest compaction were observed under fallow and continuous cotton (Rotation 1) respectively.

When all treatments were sown to cotton in 1994-95, continuous cotton produced least lint with no significant difference between the other rotations (Table 2).

Table 2 Lint yields of the 1994-95 cotton crop following 7 different rotations

Rotation	Lint Yield
1. Continuous cotton	1.79 t/ha
2. Fallow	2.05
3. Field peas	2.19
4. Wheat-lo	2.09
5. Wheat-hi	2.19
6. Wheat-lo+Dolichos	2.04
7. Wheat-lo+Dolichos+Fert.	2.00
l.s.d. (P=0.05)	0.145

There were differences in many of the soil properties measured, but often only 1 rotation was significantly different to the others. Some of the more pronounced differences were; low particulate organic matter and high dispersion index in rotation 2 (fallow); high nitrate nitrogen levels in rotation 3 (field peas); and high soil strength with rotation 1 (continuous cotton). Soil strength, measured as cone penetrometer resistance, for various rotations and depths is shown in figure 2.

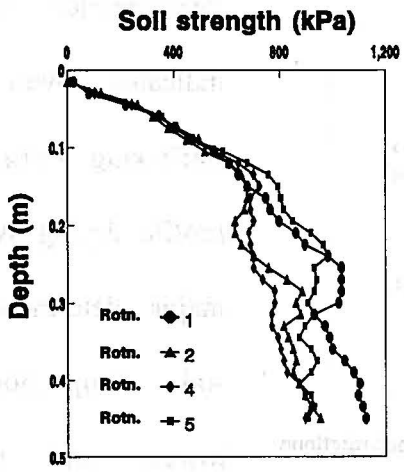

Figure 2. Soil strength in October 1994 under 4 rotations

Although there was little difference between rotations for many of the parameters measured, it must be remembered that these results are after only 1 rotation cycle. The experiment will continue for at least 3 cycles of all rotations, by which time more differences should be apparent.

ACKNOWLEDGMENTS

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