The effect of surface soil stability on water intake and the yield of irrigated maize

W.K. Mason, K.E. Pritchard and D.R. Small

Kyabram Research Institute, RMB 3010, Kyabram, Victoria 3620

Soils that have grown pasture for a long period usually have optimal physical properties for seedbed preparation and plant/soil water relationships. However, as soon as cultivation begins, these desirable characteristics begin to depreciate. The experiment reported here examined the effects of a range of soil stabilities on crop performance.

Methods

The soil type was Lemnos loam, a duplex red-brown earth with 10-15 cm loam topsoil over a heavy clay subsoil (Dr 2.33). Four different soil stability levels had been generated by a previous experiment. The percentage water stable aggregates for treatments 1 to 4 were 1=45%, 2=53%, 3=61%, 4=69%. Treatments 1, 3 and 4 had grown eight consecutive crops in the previous four years while treatment 2 had grown one crop of maize, three years of lucerne and then a crop of oats. Maize was sown uniformly across all treatments and soil water content was measured with a neutron probe.

Results and discussion

Water contents immediately after each irrigation are shown in Figure la for the most and least stable soil. As a general rule, each furrow irrigation failed to replace the water extracted by the crop during the previous drying cycle. By subtracting the total water content immediately after the final crop irrigation from the value measured at the start of the season we obtained a value called the 'loss of intake" which was closely correlated with soil stability (Fig. lb). More stable soils which maintain their intake capacity throughout the season should need irrigating less frequently than soils with lower stability.

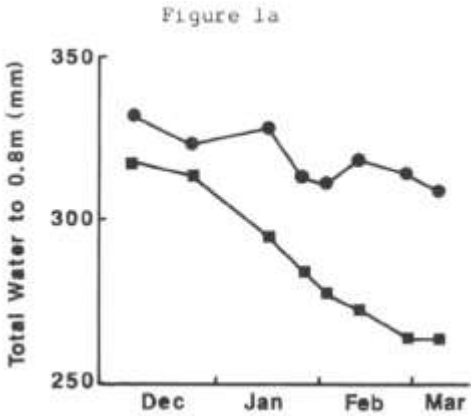

Figure 1a. Total soil water content immediately after each irregation for treatments 1 (n) and 4 (•)

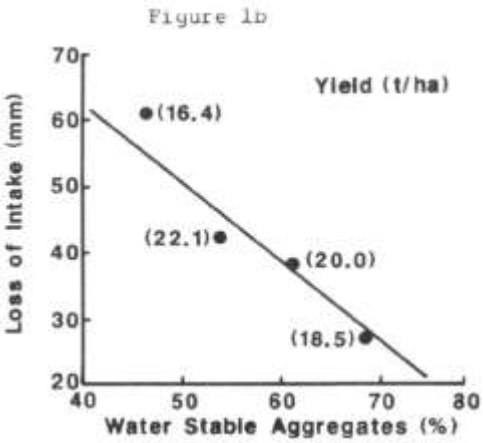

Figure lb. Initial minus soil water content after the final irregation (loss of intake) vs aggreagte stability. Crop yields are also shown.

The treatment with the most unstable soil also had the lowest yield, but overall, tnere was no relationship between surface soil stability and yield. All the yields were significantly different from each other and apart from the lowest yield of 16.4 t/ha, all were very high yields. It appears from this data that if soil has 50% or more water stable aggregates then yield is not sensitive to soil stability.