AN EVALUATION OF FIELD SOIL STRUCTURAL ASSESSMENT TECHNIQUES FOR GREY CRACKING CLAYS UNDER IRRIGATED COTTON PRODUCTION

by

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Uncertainty in assessing the soil structural condition in the field was seen as a weakness of soil management for cotton production on irrigated grey clay soils. Characterisation of soil structural problems and amelioration techniques are well defined, but the diagnosis of such problems has largely been dependent on the visual assessment of soil profiles. Cotton growers and consultants often found these assessments to be subjective and lacked confidence in basing soil management decisions upon them. A project was set up in the Macquarie and Namoi Valleys, NSW to evaluate the ability of existing methods of describing soil structure and plant measurements for reliability and accuracy in assessing soil structural condition in the field. The techniques evaluated included visual soil profile descriptions: Peerlkamp Scheme as modified by Tom Batey and SOILpak score; soil strength: Rimik cone penetrometer, Chatillion penetrometer and shear vane; core bulk density and air–filled porosity; oxygen flux density; total water extraction patterns and daily water use over one irrigation cycle; root distribution patterns; root morphological patterns and lint yield.

The baseline technique against which techniques were evaluated was clod shrinkage analysis. The parameters derived from the shrinkage curve were weighted according to their ability to discriminate between sites and then combined, by principal component analysis, to form a soil structural index (SSI). The techniques evaluated were compared to the SSI using regression analysis. There was no single technique that showed exceptional promise in estimating the soil structural condition in the field. Models derived from multivariate analysis using a number of techniques explained between 47% and 68% of the variation in the predicted SSI but had some usage limitations. It became evident during the project that yield was poorly correlated to SSI, as the addition of extra nitrogen and more frequent irrigations can mask the effects of compaction. A comparison was made of the ability of selected soil structural techniques to detect differences in soil structural condition. The most sensitive measurements were bulk density, air–filled porosity, shear vane measurements and Rimik cone penetrometer measurements. This study identified a range of problems and difficulties associated with soil structural assessment in the field, and emphasised the need to further develop and refine field soil structural assessment techniques.