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Management systems for cotton on permanent beds - Maximizing the benefits of rotation crops.

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SUMMARY

A survey of cotton growers in 1992 (CRDC Project DAN 76C) showed widespread interest in the use of rotation crops, plus a need for more information about the benefits of legume rotations and the effect of rotation management on subsequent cotton crops. To investigate the effect of rotation crop type and management on soil properties, cotton productivity, and overall farm productivity, 3 field trials located in 2 regions (Namoi and Macquarie Valleys of NSW), were set up in 1993.

Trial A was located at the Australian Cotton Research Institute near Narrabri. This trial was established on the site of a former experiment which ran from 1985 to 1993. During this period the plots received 3 treatments: continuous cotton/intensive tillage; continuous cotton/ minimum tillage; and a wheat-cotton rotation/minimum tillage. In 1993 the plots were split and the following rotations were imposed on sub-plots: continuous cotton; cowpea/cotton; and fallow/cotton. Trial B was located on the property 'Glenarvon' near Wee Waa. This site had grown cotton for several years prior to 1993 when the following 4 rotations were established: cotton/unfertilized wheat; cotton/wheat with 140 kg N ha^{-1}; cotton/unfertilized chick pea (grain harvested); cotton /unfertilized chick pea (grain not harvested). The wheat and chick peas were sown in June 1993, and cotton in October 1994. Trial C was established at 'Auscott-Warren'. The site had been sown with cotton for the 3 years prior to 1993 when the following 7 rotations were established: continuous cotton; cotton/fallow; cotton/field peas; cotton/low input wheat (rainfed, 16 kg N & 17 kg P ha^{-1}); cotton/high input wheat (irrigated, 99 kg N & 17 kg P ha^{-1}); cotton/low input wheat/dolichos; cotton/low input wheat/dolichos fb. 24 kg P & 73 kg K ha^{-1}. The winter rotation crops (wheat and field pea) were sown in June 1993. All plots were sown to cotton in October 1994. Rotation crops were again planted in June 1995 at trial sites B and C. In all sites rotation crop stubble was incorporated. Soil measurements were made in all sites with the aim of detecting changes in structure and fertility which could affect the soil's ability to produce a good crop of cotton, and included pH, electrical conductivity, nitrate-nitrogen, exchangeable cations, dispersion, bulk density, strength and organic matter. Changes in soil moisture; crop growth, development and yield of all rotation crops and cotton; and economic returns were also monitored.

Trials B and C have only run for one rotation cycle so the effects are small and difficult to interpret,

although trends are apparent. At site A, however, cotton yields following 8 years of cotton/wheat rotation were clearly better than continuous cotton. The tillage system used on the continuous cotton was also important, with yields following minimum tillage better than those following maximum tillage. Higher cotton yields were associated with less soil compaction in the 0-15 cm zone, and greater water extraction from the subsoil. These results are supported by Trial C at Warren, where the continuous cotton, which had the poorest soil structure, yielded less than any rotation treatment. In Trial B cotton yields following wheat were 11% higher than those following chickpeas. This was largely due to differences in the incidence of verticillium wilt. In contrast to this, at Warren (Trial C), cotton yields after a winter legume (field peas) were equal to those after wheat, although verticillium wilt was not a problem at that site. To summarize, it is clear that rotation crops can benefit a following cotton crop, although which one is 'best' appears to be determined by the existing physical, chemical and biological environmental conditions at any one site.