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*CSIRO Plant Industry
Cotton Research Unit
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FINAL REPORT

Project Title: **Nitrogen dynamics in modern cotton farming systems**

Project code: **CSP 54C**

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Project CSP 54C Nitrogen dynamics in modern cotton farming systems

SUMMARY

Cropping systems experiments at ACRI

N_2 fixation was assessed in legume rotation crops as well as their benefit to the following cotton crop. The legume crops contributed 100 to 300 kg N/ha. Novel techniques have enabled us to determine that about 40% of legume-N is associated with the root system. The importance of below-ground legume N has previously been underestimated. The N fertilizer required by the following cotton crop was reduced according to the input of legume N. Soil and petiole nitrate tests were able to predict sensible N fertilizer rates for all cropping systems.

Surveys of commercial legume crops

Faba beans, peanuts and soybeans fixed up to 400 kg N/ha; much of this N was removed in grain but these crops contributed up to 250 kg N/ha N to soil N. Adzuki bean, mung bean or pigeon pea fixed only small amounts of N. Winter legume crops including field peas, lentils and lupins and pasture species used for green manuring, fixed up to 170 kg N/ha.

Decomposition and availability of legume stubble-N

Loss of N from the legume stubble was about one-third that fertilizer N. As legume stubble N is in an organic form, it is conserved in the soil until it is mineralized. Possibly 50% of legume stubble N may become available to the next cotton crop. N loss from legume stubble is substantially less, compared with fertilizer N, hence legume stubble is considered of greater fertilizer value per unit of N.

Soil structural improvement

Legume crops improved soil structure. Faba bean, lablab and field pea reduced soil resistance to penetration for many months after the incorporation of stubble and these effects were still obvious during the next cotton cropping phase.

N fertilizer response following commercial legume crops

Following successful legume crops, N fertilizer rates rate can be substantially reduced (commonly halved) compared with rates a grower would normally apply in that situation, without impairing yield. Growers have not previously taken advantage of the contribution of legume crops to soil N.

CRC farming systems experiments

Soil analyses have indicated high levels of nitrate at depth at the Warra (dryland) site not apparent at the irrigated sites. Disrupted soil N cycling is suspected at Beechworth, where normal rates of fertilizer have been applied (according to soil N analyses) but crop N uptake and N fertilizer recovery has been low. Legume rotation crops have not contributed much N to the soil at these sites.

INGARD efficacy and N nutrition

Sicala V-2i yielded almost 10% higher, had only 25% of the insect damage compared with Sicala V-2 within a cropping systems experiment at ACRI. The Ingard crop matured almost 1 week earlier than the conventional crop and N fertilizer recovery was significantly enhanced. Because of the reduced insect damage, the Ingard crop set more fruit earlier, creating a greater demand for N. INGARD worked effectively, as this crop was not unduly stressed, being grown on well-structured, highly fertile soil.

Extension

All this information has been presented to the cotton industry via conferences, research coordination meetings, field days and extension articles. There has also been considerable publicity in the general press.