FINAL REPORT

Corporation's Code: ....DAQ69.....

Project Title: A pilot study of on-farm research on dryland cotton

Project Objective:
To provide the basis for improved crop and soil management in dryland cotton production systems by:
1. monitoring on-farm performance of cotton-based dryland cropping systems;
2. using on-farm data to prove the creditability of our simulation models;
3. with growers and consultants, using the models to determine production strategies for cropping systems that include cotton that are both profitable and sustainable.

Project Duration: One year pilot study (1994-95)

Project achievements:
Four main activities were undertaken within this project:

1. Negotiate farmer involvement

- At the invitation of Lyn Brazil, representing the Brookstead Farmers group, and Mike Lucy, DPI Pittsworth, on-farm monitoring sites were established on the farms of Lloyd Bailey (Bongeen), Wayne Saal (Brookstead) and David and Kent Wright (Yandilla). Around each of these farms a small network of neighbouring farmers and interested consultants/advisers were established. A total of around 20 farmers and 4 advisers were directly involved in project activities.
- At each on-farm site, several trials were negotiated for the 1994/95 summer crop season on issues of interest to the collaborating farmer and his associated grower network. The questions these trials addressed were:

  Lloyd Bailey - what N rates are required for dryland cotton (with high initial soil N)?
  - how does dryland cotton compare with sorghum?
  - what is the fate of N fertiliser applied early?

  Wayne Saal - what N rates are required for dryland cotton (with low initial soil N)?
  - how much soil moisture is lost over a long dry fallow?

  David & Kent Wright - what starting soil moisture do I require to plant dryland cotton?
  - what is the difference in soil moisture storage under conventional versus zero till?

2. Monitor climate, soil water, soil N and crop performance

- An automatic weather station (measuring rainfall, max/min/ground temperatures, radiation, relative humidity) was established centrally at the Brookstead farm, while manual climate stations (rainfall, temperatures) were sited at the remaining two farms.
- In order to determine the water holding capacity of local soils, 7 ponds were established on different soil classifications in the district. These ponds provided information on the upper limit of plant available water, hydraulic conductivity, bulk density (and neutron probe calibration) for each soil type. In addition, the project organised for Cliff Thompson (CSIRO Fellow, who originally classified the soils in this area) to conduct a travelling field day to describe the soils on the project farms. All this information has been made available to growers and consultants.
- As part of the negotiated on-farm trials, 12 paddock fallows on 3 dryland farms were monitored in April and August 1994. Information on the pre-plant soil water and N status of each paddock was supplied to collaborating farmers and their neighbours through personal visits and a larger group field day.

- Large amounts of mineral nitrate (200 - 400 kg N/ha) were discovered at depth (~ 90 cm) in several farmer paddocks. This large source of N was unknown to the farmers/consultants due to the normal commercial practice of sampling only the top 15cm soil for N. This project, therefore, benefited the growers not only through the substantial savings in fertiliser (that would have been applied to crops), but also by demonstrating to growers and consultants the value of deep soil coring.
- Monitoring data contributed to answering two of the posed questions (what is the fate of N fertiliser applied early? what is the difference in soil moisture storage under conventional versus zero till?). That is, over the 1994 winter fallow, little soil N was lost and the zero-till fallow resulted in more soil moisture storage than the conventional fallow.
- The crop monitoring has been less successful due to the drought - less than half the sampled paddocks were planted (mostlt to sorghum and not cotton) and some planted cotton crops failed. The major surviving trials addressed the question of what N rates were required for dryland sorghum (on a strip that was planned for cotton). On this site, crop management, establishment and yield data were collected.

3. Test model capabilities

- The OZCOT cotton model and the APSIM-Sorghum model have been exposed to the on-farm collaborators. Predictions against past commercial dryland experience have been encouraging (Table 1).

Table 1: Comparison of yield predictions for cotton and sorghum crops - shaded examples indicate crops monitored specifically for this project.

COTTON			**Cotton yield bales/ha**	
			observed	predicted
Bailey, Bongeen	13.11.94	61%	6.1	5.7
Town, Dalby	1.12.92	58%	2.0	2.0
	11.10.93	45%	4.0	3.7
Skerman, Kupun	1.12.92	52%	1.9	2.2
	28.9.93	45%	2.0	2.6
	10.11.93	80%	3.0	2.8
Walters, Dalby	14.10.92	48%	1.3	0.9
SORGHUM	**Sown**	**Starting SW**	**Grain yield (14% moisture) t/ha**	
Crocker, Banana	15.9.93	5%	0.0	0.1
Bailey, Bongeen	2.12.94	55%	5.7	5.1
Black, Brookstead	10.1.95	44%	5.1	4.3
Fairweather, Capella	14.1.93	13%	0.4	0.4
Haeusler, Dalby	24.9.92	46%	2.6	2.3
	30.11.92	48%	2.5	2.6
	14.12.93	48%	4.6	4.6
Town, Dalby	30.11.92	62%	0.6	0.7
	14.10.93	47%	4.2	4.6
	20.12.93	97%	7.9	7.7
	11.02.94	100%	2.2	1.9
Saal, Brookstead N0	13.12.94	63%	4.7	4.8
N70		63%	6.5	6.2
N120		63%	6.4	6.2
Walters, Dalby	14.10.92	22%	0.0	0.8
Wright, Brookstead	14.10.92	66%	5.3	5.6

- In December 1994, presentations on the topic of soil nitrogen dynamics were given to a meeting of the Brookstead Farmer's group. Here, Dr Merv Probert from APSRU demonstrated the ability of

APSIM to closely simulate the soil N dynamics measured for two long-term QDPI experiments (Warra, Hermitage). Questions on the fate of soil N were addressed using the APSIM model.

4. Apply the models to real issues

- In preparation for winter plantings, in May 1994, simulations on the prospects of wheat versus cotton and sorghum were presented to the whole Brookstead Farmer's group for the three collaborating farms (using measured data on pre-plant soil water and N). The results suggested that growers were better off waiting for cotton, especially if their soil water profiles were less than full.
- A total of seven interactive modelling sessions (each taking 4-5 hrs) were held with the small collaborator networks. At these "kitchen table" sessions, the application of the simulation models to many management issues relating to cotton production systems was requested by growers and consultants (e.g. cotton v's sorghum v's maize, planting times, N fertiliser rates, fallow water storage etc.). Several examples can be given where growers altered planned management practices as a result of model simulations (Table 2). In addition, the results of some simulations formed the basis of several articles that were published in the rural press.

Table 2: Examples of issues that were explored with farmer groups using simulation models.

Farmer group	Issue	Insight from simulation	Impact
Bailey	Short v's long fallow into cotton	Expected returns from sorghum-fallow-cotton equalled long-fallow cotton (for strip 14B)	Farmer planted sorghum in 14B rather than his original plan to long fallow into cotton
Bailey	N fertilization on soils with deep N	No yield improvement from added fertilizer	Farmer applied no N in contrast to his stated preference to apply some starter N.
Wright	Cotton planted on low initial SW	Yield prospects were low compared to sorghum or wheat crops.	No cotton was planted in 1994/95. Farmers requested runs done to assess yield prospects before planting 1995/96 crop.

- On a number of occasions, simulation results concerning pressing issues have been undertaken for local consultants on a request basis.

Summary

The achievements of this project have been substantial for an activity that was a one-year pilot study. The evidence of farmer and consultant collaborators gaining appreciation for the value of on-farm monitoring and modelling has been established. The project piloted an action learning approach to decision support that demonstrated promise in encouraging farmers to evaluate strategies for improved crop management. What remains is for the follow-on project (funded by CRDC) to develop the process for delivering these benefits to the wider industry. These recommendations were aligned with the CRDC review of this project in December 1994.

Supervisor's Signature:  **Date:** 21.2.96