

**MURRAY-DARLING BASIN
NATURAL RESOURCES MANAGEMENT STRATEGY PROGRAM**

Project Description: An action-research project involving Bourke Cotton Growers' Association Landcare Group and NSW Agriculture to monitor key factors in irrigated land use management and to evaluate them in terms of land use management and farm design.

Project No.: WN 0327.93
Project Title: Development of sustainable irrigated cropping systems.

Managing Agency: NSW Agriculture
Project Manager: Mr. A.J. Shaw, Program Leader Cotton
Project Duration: January, 1994 to June, 1996

Project Abstract: The *Development of Sustainable Irrigated Cropping Systems* project ran in conjunction with a Cotton Research and Development Corporation-funded project focused on cotton production issues. Activities included establishing and monitoring a district network of test wells/piezometers, on-farm case study of water use, EM-31 mapping of selected areas of farms and sites of proposed artificial waterbodies, EM-38 mapping of areas of saline soil and proximate to artificial waterbodies, neutron probe calibration, use of Landsat TM imagery for farm planning, limited analysis of efficiency index vs. key production features using commercial field data, use of SOILpak, grower workshops, information days and educational activities. No significant association could be found between yield of cotton/ML and independent cotton production variables. It was found that soil sodium levels had a significant effect on cotton yield and that areas of management-induced salinity related to soil saturation due to seepage from artificial waterbodies, especially when storages overlay or are formed from soil of high saturated hydraulic conductivity. Electromagnetic soil surveys revealed significant areas of potential concern; later validated by physical and chemical soil tests. Changes to farm design resulted.

Expenditure Statement:

	Expenditure of NRMS Funds	Expenditure of Other Funds (CRDC)*grower levy	Value of In-kind Contributions	
			Community	Other
Monies spent on:				
Salaries and Wages	\$ 31 917.12	\$ 46 522.00		
Operating Items	\$ 16 731.40	\$ 11 978.74		
Capital Items				
TOTAL	\$ 48 648.52	\$ 58 500.74		

Funds used by:


Community	\$ 48 648.52	\$ 58 500.74
Government		
TOTAL	\$ 48 648.52	\$58 500.74

Project Declaration:

Report prepared by: Danny Norris
Role in project: NSW Agriculture staff (District Agronomist)
Telephone No.: (049) 398888
Report completed: February, 1997

I/We declare that the details of the expenditure and information provided in this report are accurate and complete


Project Director/Manager


Department/Division Organisational Head

EXECUTIVE SUMMARY:

1. The *Development of Sustainable Irrigated Cropping Systems* project was an action-research project involving the Bourke Cotton Growers' Association Landcare Group and NSW Agriculture to examine the resource use aspects of irrigated cropping and attempt to relate these to the production system. It was ambitious in its conception and was concurrently funded through the National Landcare Program for the resource system investigations and through the Cotton Research and Development Corporation for the production system investigations. The yield of cotton per megalitre of water diverted from the Darling River was originally intended as a factor which would ultimately link the two fields of investigation. The project finished before it was due, lacked continuity of agency staff and was forced to respond to changing group dynamics. Significant progress was made in the project nonetheless with findings relating resource system condition to overall production.

2. The project was developed from group discussions and involved needs analysis/direction-setting workshops during the course of activities. A set of activities was formulated to determine where improvements could be made to the efficiency of use of water diverted from the Darling River. This involved quantifying the proportion of irrigation water which was used by the cotton plants and that which was lost through deep drainage, evaporation or run-off as the starting point for determining where efficiency of water use could be improved. The use of flow meters on river pumps was imminent at the time of application for funds and diversion output was to be used. A combination of difficulty with meters and grower resistance to data use as a result of water administration changes meant that there was not sufficient data available. Changes in approach were forced as a result.

3. Seepage losses from off-river earthen water storages was identified as a likely factor contributing to localized management-induced salinity. On-farm monitoring of evaporation vs. volume losses during periods of irrigation inactivity and the correlation between piezometer level changes and irrigation activity confirmed this.

4. Electromagnetic induction survey with an EM-31 (electrical conductivity measurement between 0-6m depth of soil) was performed on a nominated 200ha of each Landcare Group member's farm. Significant changes to farm development proposals were made as areas of potentially unsuitable soil texture were identified. Soil pits and chemical and physical tests were undertaken to "ground truth" survey maps. It was apparent from this that there were considerable levels of soil sodium in the district prior to irrigation.

5. Electromagnetic induction survey with an EM-38 (electrical conductivity measurement between 0-60cm depth of soil) was performed for group members and the output used to confirm the source or otherwise of problems in some fields and along water reticulation structures.

6. Group members actively experimented with alternative irrigated crops during the project. Pima cotton and peanuts are more water use efficient than upland cotton and have encouraging gross margins/ha. Both crops are now established in the district and production is supported by industry infrastructure such as roller gins for Pima and a sorting/drying plant for peanuts.

7. Group members also experimented with ways of being more water use efficient and trialed different planting configurations such as skip-row and double skip row, anti-transpirants and drip irrigation. Trial data presented at the Annual Bourke Cotton Industry Field Day indicated that furrow-irrigated cotton had 137 bolls/m prior to picking while drip-irrigated cotton had 171 bolls/m. Final yield data and cost comparisons were not available at the time of writing.

8. A number of investigations were undertaken using data from commercial fields. Those which were statistically significant and relevant to the objectives of the project are listed:

➤ **Soil sodium content significantly affects cotton production.** A significant negative relationship was found between soil Exchangeable Sodium Percentage and lint yield of cotton ($R^2 = 0.2037$; $p = 0.04$). A field trial using the EM-38 and soil test calibration reflected this when a significant negative relationship was found between soil Electrical Conductivity (ECe) and fruit counts (bolls/m; $R^2 = 0.6516$; $p = 0.0048$), plant height ($R^2 = 0.72$; $p = 0.0022$) and plant height:node ratio ($R^2 = 0.77$; $p = 0.00078$).

➤ **Applied gypsum will lower soil ESP in the top 20cm of soil.** Gypsum applied at a rate of 10.8 tonnes/ha lowered soil ESP from 12% to 6%. (data courtesy Steve Buster)

9. A number of important community education activities were undertaken as part of the project. These included field days, presentations at local agricultural shows, newspaper and radio interviews, a magazine feature in *Australian Cotton Video*, an outline and feature in a Landcare Forum in the Macquarie Valley, involvement in Bourke High School work experience program, participation in project activities by TAFE Multiskills students and contribution to the Western Catchment Management Committee's *Draft Strategy for Irrigated Land*.

10. Several recommendations (some reinforcing or supporting existing practice) are made with respect to encouraging on-farm trials, guidelines for siting off-river earthen storages, conditions for irrigation development proposals, training of government agency staff, landholder establishment and monitoring of piezometers/test wells on irrigation farms, and research on the fate of re-distributed sodium in the soil profile and quantifying the effect of this. Anonymous comparative analysis on a per field basis has merit for variables additional to the financial variables commonly used. Environmental variables reflecting soil sodium level, water diverted from the source river system and a yield/water use index could be considered.