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Cotton Research and
Development Corporation



Cotton Industry Water Balance Workshop – *Proceedings* –

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Toowoomba

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Summary of Presentations

Drainage

Anthony Ringrose-Voase, CSIRO Land & Water, Adelaide: His paper reviewed methods to measure or estimate deep drainage. Direct measurement is costly, but a deep drainage meter is being developed. The usual indirect method is to measure all components of the water balance except drainage which is determined by difference, and is therefore prone to gross error because errors or spatial variation in rainfall, run-off and Et accumulate in the drainage term. Furthermore on swelling clay soils, on which most cotton is grown, additional errors result from: (i) change in soil volume with the shrink/swell properties (causing errors of up to 80mm in soil water content); (ii) differences in field and laboratory estimates of upper and lower limits to plant available water content caused by the effect of overburden; and (iii) by-pass flow between peds (soil structural units. Water moves between these units during wetting/drying cycles in uncompacted cracking clays). Much work needs to be done to improve understanding of water movement in swelling soils, and measurement of soil water, in order to estimate drainage more accurately.

Ian Gordon, Senior Soil Scientist, DNR, Brisbane: reviewed results of measuring drainage by lysimetry, and estimating it by soil water measurement and modelling. Sites ranged from the Macquarie valley to the Darling Downs. There was considerable variation among sites, even among 'typical' grey clays on which most cotton is grown.

Water Input

Paul Dalton, Development Engineer, NCEA, Toowoomba: reported the results of a whole farm water balance approach to analysis of the irrigation systems of four selected farms in the Border Rivers. Estimates of whole farm irrigation efficiency ranged from 24 to 75%, with losses partitioned to storage, transmission and deep drainage.

Run-off

Mark Silburn & Dave Waters, APSRU & DNR, Toowoomba: reviewed measurements of run-off from a number of locations from the Macquarie Valley to Emerald, and discussed practices to reduce run-off.

Janelle Montgomery, Research Officer, Cotton CRC, Uni. New England: gave an account of measuring the components of the water balance of irrigated cotton fields at three sites by measuring Et for the field, and input and run-off for selected furrows, then estimating drainage by difference.

Evapotranspiration

Wayne Meyer, Program Leader, CSIRO Land & Water, Adelaide: reviewed methods for measuring or estimating evapotranspiration, including lysimetry, pans, meteorological methods (the various combination or Penman equations) and micro-meteorological methods (Bowen ratio). A form of the Penman equation, calibrated and validated for the southern Murray-Darling basin, has been widely and successfully used in that region, but has not yet been tested in the northern Murray-Darling basin where most cotton is grown.

Sunil Tennakoon, Experimental Scientist, CSIRO, Narrabri: also reviewed methods for measuring or estimating evapotranspiration, but with particular reference to cotton production and the need to evaluate water use efficiency.

Water Use Efficiency

Geoff McIntyre, Phil Goyne, Nick Austin and Don Yule reported on several State (Qld and NSW) initiatives to improve on-farm water use efficiency.

For more information about the above presentations please contact Helen Dugdale, CRDC.



Working Groups and Plenary Session

The questions addressed by the working groups and their responses are outlined in Appendix 3. In answer to the first question, "*What research areas/projects exist, what knowledge do we have?*", a total of 30 projects were identified by participants as relevant to the water balance in cotton. These are listed in Appendix 2. Answers to the remaining questions tended to overlap and merge into a single set of issues. Participants prioritised these issues after the workshop in response to a questionnaire, ranking them in the order in which they are now presented in Appendix 4.

Summary and Conclusion

Research is done on the problems associated with management of the water balance based on the premise that science can contribute to their solution. How good is the science being used? Is our knowledge of the processes involved adequate? Are our measurements accurate? The major purpose of the workshop was to evaluate the science being used to solve the problems.

Understanding is lacking of the processes involved in drainage in swelling clay soils. Uncertainty in the measurement or estimation of components of the water balance is cause for concern, particularly on swelling soils on which most cotton is grown, and particularly for soil water content and deep drainage.

The priorities listed in Appendix 4 cover the full spectrum of R&D from science to technology and management. Most nevertheless are closely linked and form a cohesive package. The first priority is Water Balance Studies of Systems. The 6th and 7th priorities (study of the effects of management and the need for long term study to cover episodic events, respectively) are special aspects of the first. Priorities 2, 3, 4 and 8 are research to improve measurement of components of the water balance. Obviously acceptable water balance studies cannot be done without reliable measurement of the components. Priorities 2, 3, 4 and 8 are therefore concomitant with the first.

The 5th priority is for co-ordination across funding bodies. If priorities 1, 2, 3, 4, and 8 are to be met, funding is likely to come from several sources. It is imperative that this funding is coordinated. Concern was expressed about coordination of the 30 projects related to management of the water balance listed in Appendix 2, reflecting a wider concern previously voiced by CRDC. Given the uncertainty in measuring components of the water balance the outcome of some of these projects may be questionable. Priorities 9, 10, 11, 12, 13 and 14 (spatial variability, importance of drainage, CRC farming systems trials, minimum data sets, role of ground water and weather station network, respectively) will all emerge from the first, Water Balance Studies of Systems, if it is done properly. Two issues are left, 15th (trickle scoping study) and 16th (CRDC & CRC partners in National Irrigation Science Network, NISN), which are only loosely related to the main thrust of recommendations.

Further discussion after the workshop led to a suggestion for a research program on the water balance of the cotton crop. This could be modelled on the recent very successful program jointly funded and managed by CRDC, LWRRDC and MDBC on pesticides in the riverine environment. Such a program would harness the skills and expertise of scientists in a range of disciplines to strengthen and undergird past and current problem-oriented research. The pesticides program is a major foundation to BMP in the cotton industry. If BMP is to be expanded to include water management a similar program is required on the water balance. Water is the issue ranking alongside pesticide use as a major environmental challenge, both in public perception and in future access by farmers to water resources. The program would make a major contribution to the coordination lacking among the plethora of recent projects initiated independently by various bodies under the slogan of improving water use efficiency.