Measuring losses from on-farm water storages in the cotton industry.

David Wigginton[1*]

[1] National Centre for Engineering in Agriculture, USQ, West St, Toowoomba 4350, Australia
* corresponding and presenting author, david.wigginton@usq.edu.au

Summary

Irrigators across the Australian Cotton Industry utilise large on-farm storages to capture irregular water supplies. Commercially available measurement technology was employed to measure the losses from over 125 storages across the industry. Mean seepage losses were found to be very low (2.59mm/day), although some individual losses were high. However, for a selection of 10 farms, storage losses still accounted for 79% of all on-farm losses.

Introduction

Given that the total capacity of on-farm storages in the cotton industry could be in the order of 3150 GL (Webb, McKeown & Associates, 2007) and that storage efficiency can range from 50 to 85% (Dalton et al, 2001), the potential losses from these storages could be significant. Recent advances in the field of seepage and evaporation measurement have resulted in the development of the Irrimate™ Seepage and Evaporation service, which is now offered as a commercial service.

The cotton industry secured funding from the National Water Commission to test the commercial evaluation service, build capacity for continued commercial measurement and investigate the magnitude of storage losses across the industry.

Storage losses were measured for over 125 storages across the industry. In addition, whole farm water balance analysis was undertaken on 30 of these farms, to determine the importance of storage losses as a component of all on-farm losses. Finally, a number of case studies of possible storage modifications were undertaken to determine their cost effectiveness.

Methods and Materials

The Irrimate™ Seepage and Evaporation service is a commercially available measurement service which combines highly accurate measurements of storage water depth with advanced data analysis techniques in order to separate seepage and evaporation losses. New and existing suppliers of this service were contracted to undertake over 125 storage evaluations with the aim of:

- measuring losses from a significant proportion of storages across the industry;
- improving the capacity of the commercial sector to deliver these measurement services through training and financial support;
- improving the measurement service through widespread testing of equipment and software and validation of the approach; and
- improving future demand by creating awareness of the magnitude of potential storage losses and the benefits of this service to assess these.

Storage measurements are conducted over a period of between 5 and 10 weeks and provide values for seepage and evaporation (in mm/day) and a 'dam factor' which relates individual storage evaporation to a known reference evaporation.

Additional funding provided by the Qld Department of Environment and Resource Management's Healthy Headwaters Program allowed these figures to be used as part of a whole farm water balance analysis to determine the significance of storage losses as a component of overall farm losses. Case studies of potential amelioration strategies (splitting into cells and increasing wall height) were also analysed using the Evaporation Ready

Reckoner www.readyreckoner.ncea.biz. These services were also conducted by consultants using a similar capacity building model.

Results & Discussion

Analysis of the first 70 storage evaluations suggests that mean seepage is 2.59mm/day. Although the highest recorded seepage rate was 38mm/day, 83% of storages had seepage of less than 4mm/day (Figure 1), a rate that can be considered low.

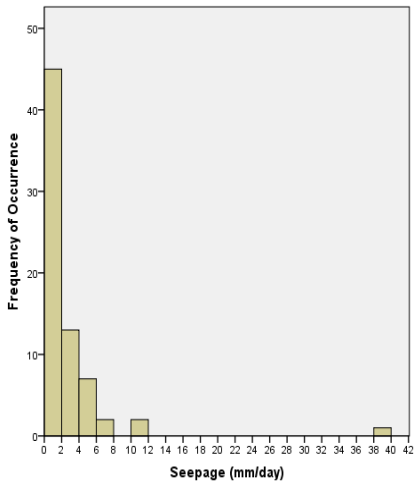

Figure 1 – Histogram showing all seepage results (mm/day)

Before measurement, growers were asked to estimate their seepage loss as low, moderate, high or very high. Of those growers who estimated their loss to be low, 12% actually had a measured loss that could be more accurately described as moderate (4 to 10mm/day). Those growers who estimated that their storage losses were either high or very high (only two individuals) were indeed accurate, with seepage rates of 11.5 and 38 respectively.

Whilst seepage losses are generally low, analysis of 10 whole farm water balance assessments indicates that storage losses still contribute largely to all losses on farm. As illustrated in Table 1, storages account for an average of 27% of the on farm water use, or 79% of the total non-crop use (i.e. losses).

Table 1 – Proportion of water used in each irrigation system component

	Storage	Channel	Drain	Operational	Field Application	Crop Water Use
Water Use	27%	1%	0%	1%	5%	66%

Cost benefit assessment of options to reduce seepage and evaporation losses, including splitting a storage into two cells or raising the wall height, provided many examples where such costs would be below $200/ML. In such cases, this investment is likely to be worthwhile.

References

Dalton, P., Raine, S. And Broadfoot, K. (2001) *Best management practices for maximising whole farm irrigation efficiency in the cotton industry.* Final Project Report. National Centre for Engineering Publication 179707/2, USQ, Toowoomba

Webb, McKeown and Associates Pty Ltd 2007, *State of the Darling, Interim Hydrology Report*, Murray Darling Basin Commission, Canberra.