Controlling evaporation losses from farm dams

Introduction

As much as 40% of water stored in a farm dam can be lost through evaporation, depending on the depth of the dam and its surface area. Dam design can significantly decrease evaporation by reducing the surface area to volume ratio (deeper, narrower dams) and planting windbreaks to provide shade and reduce wind turbulence.

Over the years, a number of commercial products have also been developed to minimise water losses, including floating plastic covers and chemical products that change the surface characteristics of the water and reduce evaporation. Research was undertaken by the National Program for Sustainable Irrigation's predecessor (the National Program for Irrigation Research and Development) in 2002 to assess these products. This fact sheet captures the key findings, which show that their effectiveness can depend on a combination of cost, durability and their vulnerability to being disturbed by the wind and associated wave action.

**** Please note products were available in Australia at the time of the project. Comments about their effectiveness are based on models available in 2002. The prices quoted were accurate in 2002 and are used to give some sense of relative costs only.***

What the research shows

Chemical barriers

Chemical barriers to reduce evaporation have been explored since the 1950s, mainly using alcohol (cetyl, stearyl and aliphatic alcohols) to spread a film over the water surface. Retreatment is required every two to four days, depending upon the amount of turbulence on the water surface. It is estimated this approach can reduce evaporation by about 30%, and chemical barriers are less environmentally and visually intrusive than physical structures.

Floating barriers

Aquacaps is a floating barrier made of polyvinyl chloride (PVC), high tensile wire, bubble film and low-density polypropylene. The barrier consists of a series of interlinked domes supported by a ring that penetrates the water. When the domes cover 80% of the water surface, Aquacaps have the potential to reduce evaporation by an average of about 70% annually. They also reduce water temperatures and water turbidity. The main limitation to their use is cost. Estimated costs of installation in 2002 were around $16/m2.

E-VapCap is a patented system that involves a floating cover made from light-impervious polyethylene sheeting (like a heavy version of bubble wrap). The product reduces or stops algal growth. It is close to 100% effective at reducing evaporation. Cost was estimated at about $6.60/m2 in 2002, making it a cost effective option, however wind can be a problem.

Shade cloth dam covers have the advantage of reducing evaporation without affecting water quality and aquatic life. Up to 95% of UV light is prevented from reaching the water and evaporative effectiveness is estimated at up to 75%. If the dam is used for aquaculture the shade cloth also provides protection from birds.

Biological covers

Biological covers are less efficient at lowering evaporation than plastic products. For example, studies in Thailand have shown that duckweed can reduce evaporation by up to 10%, but it has other undesirable effects, such as affecting water quality, reducing the dam's suitability for recreation and introducing a single dominant species of aquatic plant.

Summary

Chemical treatments are less permanent and can be applied seasonally, when most needed. This probably makes them the most affordable option for smaller producers and producers of lower value commodities. Chemical treatments also have low impact on recreation, the look of the dam, and plants and animals in the dam. However, they are less efficient than physical structures, which become more appealing when water is very scarce. The exclusion of light by physical structures may be an advantage in suppressing algal growth and reducing water temperatures. Significant reductions in evaporation can also be achieved by designing storages so that they are deep relative to their surface area, and by providing shading and reduction in wind turbulence by planting windbreaks.

Field trials of some options are being undertaken in Queensland by the National Centre for Engineering in Agriculture at the University of Southern Queensland. For more information visit the website at http://www.ncea.org.au/Irrigation/Evaporation/EvapControl.

Further information

More information about the project assessing evaporation control products is available from the NPSI Irrigation Research CD 1993-2004, in the paper titled Current Knowledge and Developing Technology for Controlling Evaporation Losses from On-Farm Storage, NPIRD Report QNR29, Department of Natural Resources & Mines, Queensland, Hobson, M. and C. Christiansen (2002). To get a copy of the CD contact the Program Officer Joanne Caruso, phone: (02) 6263 6005 or email: joanne.caruso@lwa.gov.au.

Useful information about the issue is also available from:

- The Department of Natural Resources and Mines website. Look for "Methods for reducing evaporation from storages used for urban water supplies", a 30-page report published in 2003. http://www.nrm.qld.gov.au/compliance/wic/pdf/reports/urban_wateruse/evapinstorages.pdf
- The Water Use Efficiency information package produced by Land and Water Australia. http://www.lwa.gov.au/downloads/publications_pdf/PR030566.pdf

About the Program

The National Program for Sustainable Irrigation focuses research on the development and adoption of sustainable irrigation practices in Australian agriculture. The aim is to address critical emerging environmental management issues, while generating long-term economic and social benefits that ensure irrigation has a viable future. The Program has 14 funding partners: Land & Water Australia (Managing Partner); Sunwater, Queensland; Horticulture Australia Limited; Goulburn-Murray Water, Victoria; Cotton Research and Development Corporation; Harvey Water, Western Australia; Lower Murray Water Authority, Victoria; Wimmera Mallee Water, Victoria; Ord Irrigation Cooperative, Western Australia; Australian Government Department of Agriculture, Fisheries and Forestry; Department of Natural Resources and Mines, Queensland; Department of Primary Industries and Resources South Australia; Department of Environment Water and Catchment, Western Australia; and Department of Agriculture, Western Australia.