

Reducing evaporation with chemical monolayer technology

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The 'drivers of change' at Cubbie Station have been reduced water availability, an extended period of drought and a commitment to improved water use efficiency through the reduction of evaporative losses because of the economic, environmental and social value of water.

What is chemical monolayer technology?

A monolayer is a chemical 'cover' comprised of a lime base mixed with an industrial alcohol that is approximately one molecule in thickness. It floats and spreads across the storage surface to reduce evaporation.

There are two types of chemical evaporation control methods available — WaterSaver and Hydrotect. The 120 hectare storage site at 'Cubbie Station' trialed the WaterSaver monolayer.

Monolayer technology differs from physical methods, such as E-VapCap, as chemical evaporation retardants have lower evaporation reduction efficiencies and have significantly lower capital costs. But chemical methods have higher operating costs, as they need to be reapplied every three days depending on the environmental conditions.

Why WaterSaver?

WaterSaver uses cetyl and stearyl alcohols to reduce evaporation by decreasing the evaporative partial pressure of the water vapour above the water surface, resulting in a lower evaporation rate.

'Cubbie Station' had previously investigated and implemented, where possible, the more traditional methods of reducing evaporation — such as deeper cells or dividing and managing storages through cells — and were looking for other solutions that were applicable to their situation to reduce evaporation further.

The physical structure options — for example floating covers and shade cloths — were impractical for the size of their storages. Therefore they wanted to capitalise on other alternatives, so WaterSaver was chosen as it was appropriate to their size.

What equipment is required and how does it work?

The following equipment was installed to ensure the monolayer was effectively distributed across the entire surface of the 120 hectare storage.

- A mixing hopper;
- A centrifugal pump;
- A grid distribution system, comprised of

poly-pipes, with nine outlets evenly spaced across the storage surface. The main distribution lines used were 50 mm diameter poly-pipes, whilst the risers were of various sizes to ensure a uniform distribution of the monolayer across the storage surface; and,

- Two pressure sensor transducers, which separated out the seepage component of the storage.

Application of the monolayer is completed automatically through a mixing hopper and centrifugal pump. Monolayer is stored in a hopper and a screw auger is used to distribute the powder into the granny pot where it is turned into a slurry with water. From here, the monolayer substance is pumped into the main distribution grid using a diaphragm pump.

Effectiveness

Prior to the four to six month trial at Cubbie Station's storage, which commenced in July 2004, the chemical monolayer had only been implemented on a small-scale. This project is clearly more developmental — it was difficult to assess the effectiveness as it was in its first stage of assessment.

Chemical covers are generally susceptible to wind and wave interferences. As a result of unfavourable environmental conditions, the monolayer was disrupted which left the water surface exposed to evaporation until the wind or wave action ceased.

The evaporation reduction noted was equivalent to 20 per cent. But depending



Mixing hopper used to mix the chemical monolayer.



A monolayer has ongoing expenses.

on the environmental conditions, evaporation reduction has been documented to range from zero to 40 per cent.

Other minor problems encountered were:

- Air locks in the positive displacement pump which slowed down the trailing of the WaterSaver product with the applicator;
- Powder clogged in the hopper; and,
- The distribution system became tangled.

According to irrigation consultant Sarah Hood, the monolayer appeared to be economical in this situation under certain conditions, but difficulties with the application process make it impractical at this point. She also raised the possibility of applying the monolayer by plane at one stage, which may be a practical application alternative in this type of farming system.

Economics

Compared to shade structures and floating covers, a monolayer has little capital expenditure, but it does have ongoing operating and maintenance expenses.

The mixing hopper and centrifugal pump costs approximately \$35,000 and the grid distribution system costs \$18,000. The quantity of WaterSaver required to be used per hectare is 0.5 kg and the product costs \$18.00 per kg. In



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terms of evaporation reduction, the cost per mL is \$365.

Quality issues

In terms of water quality concerns, there are no known health risks associated with WaterSaver as studies have proven it to be readily biodegradable, non-toxic and permeable to oxygen. In addition, it has been approved by the World Health Organisation (WHO), registered with the National Sanitation Foundation (NSF), and listed by the United Nations Environment

Program as Environmentally Sound Technology (UNEP EST).

For further information contact:

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You should also refer to Section 2.7 “Managing Evaporation and Seepage in Storages and Channels” in WATERpak. If you don’t have a copy, contact your local IDO or Cotton CRC Water Team member.

