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Rural Water Note RWN 04

Reducing Farm Dam Evaporation ▫ September 2007

Evaporation is generally regarded as the most significant contributor to water loss from farm dams in Western Australia, and so it has the potential to be a major area for making water savings.

Typical annual evaporative losses range from one metre in the south-west of the Wheatbelt to more than 2.5 m in the north-east. As typical farm dams are only 3–4 m deep, it is clear that any savings from reducing evaporation can significantly improve their reliability. This is particularly important during prolonged drought or low rainfall.

Because research has shown that wind is a critical factor driving evaporation, high wind days are the days when we want the water source to be protected.

Windbreaks

One of the lowest cost options for reducing evaporation from farm dams is to install windbreaks. Research by the Department of Agriculture and Food has shown that using windbreaks to slow the wind over the water surface of dams can reduce evaporation by 20 to 30 per cent.

Windbreaks can alter the downwind micro-climate by reducing the wind speed and turbulence of the air flow for some distance downwind of the shelter. They also provide shade which decreases evaporative loss through lowering water temperature.

The height of a windbreak determines the length of sheltered area downwind. The length of this sheltered or quiet zone is between five and 10 times the windbreak height.

Further downwind, beyond the *quiet zone*, the airflow gradually recovers to its upwind velocity in the more turbulent wake zone (see Figure 1).

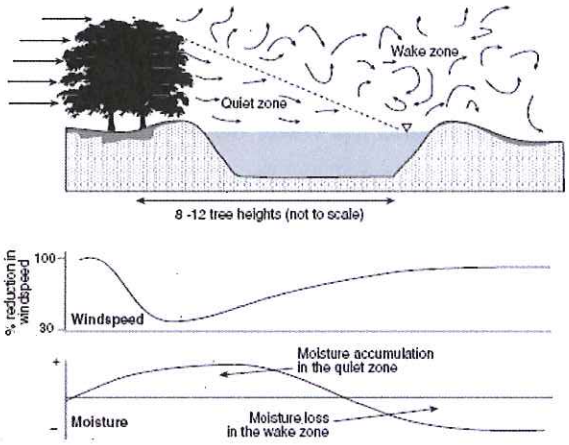

Figure 1. a) Dam windbreak system showing the quiet and wake zones created downwind; b) wind speed reduction downwind compared with upwind; c) relative moisture levels downwind of the windbreak showing an increase in the quiet zone and decrease further downwind.

It is important not to have the dam in the turbulent wake zone, as turbulence will prevent the accumulation of a moisture blanket.

When designing and planning windbreaks, consider:

- Windbreak types – artificial barriers and tree shelterbelts have different advantages.
- Orientation – reduce the impact of hot dry northerlies and easterlies.
- Windbreak height – the quiet zone is around eight times the windbreak height.
- Distance from water – lateral root growth can be two to five times the tree height.

- Combinations of species to maximise the density of the foliage and reduce gaps.
- Protection from stock while the windbreak is established.

Other alternatives for evaporation control

Double dams (compartmented water storages) concentrate dam water through transferring all the water from the main storage to another smaller, deeper storage. Dam water transfer should only be considered if the dam water surface area is going to be reduced and the water depth is increased.

Double dams and dams with large deep silt pits (> 500 m^3) can reduce evaporation by 10–20 per cent and increase water supply efficiency.

Transferring all of the water reduces the water surface area exposed to the wind and sun (Figure 2). In addition, the increase in dam water depth reduces the temperature of the water, which aids in decreasing evaporative losses.

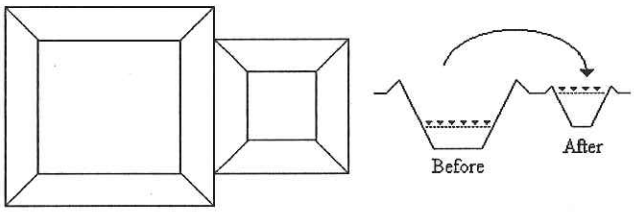

Figure 2. Using double dams to reduce evaporation

Shade cloth can provide a significant evaporation reduction (70%). Note that wet shade cloth can be very heavy; therefore, regularly spaced drain holes are needed along with strong supports throughout the dam.

Monolayers are comprised of a chemical film across the water surface. Their efficacy is reduced when turbidity of the dam surface increases or when wind pushes the layer to one side of the dam. They need to be re-applied regularly.

Figure 3. Windbreak placed according to the direction of prevailing winds.

Various floating, modular devices can be effective, but are often costly. New technology is being developed in this area.

Although most of the above options are expensive, they become more cost-competitive as water itself becomes more valuable.

Further information

Hipsey, M., 2002. *Using windbreaks to reduce evaporation from farm dams*. Farmnote 72/2002. Department of Agriculture and Food, Western Australia.

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