The National Centre for Engineering in Agriculture (NCEA), University of Southern Queensland (USQ) has for the last two years been assessing different techniques for suppressing evaporation from storages. The project has been funded by the Queensland Government’s Department of Natural Resources and Mines through their Rural Water Use Efficiency Initiative (RWUEI). Evaporation mitigation technologies (EMT) assessed included chemical monolayers, floating covers, modules and suspended shade structures. The EMTs were investigated according to their efficiency in reducing evaporation, durability in the field and economic practicality.

The potential evaporation losses from on farm storage is enormous, particularly in irrigation areas in northern NSW and southern Queensland. It is estimated that farm water storages in Queensland alone equate to a total capacity of 2,500,000ML. Most of these storages are shallow (4 to 5m) and annual evaporation can remove up to 40% of this capacity. This equates to an annual evaporation loss of 1,000,000ML which is sufficient to irrigate about 125,000 hectares and generate an annual gross value of $375 million, or alternatively supply significant water to the environment.

Pressure Sensitive Transducer (PST) systems were developed to measure evaporation and seepage losses from storage. The method works by continuously recording water depth to an accuracy of about plus or minus 1mm/day. Each unit is fixed above the dam floor by a float-weight mechanism. The units were used to distinguish evaporation from seepage losses by comparing the rate of water level change through the day and night. The method is regarded as a potentially successful alternative to conventional ground water sensing methods for determining dam seepage losses, which may not pick up flows through cracks in a dam floor or wall.

PST water depth data is analysed to separate out the seepage component using Penman-Monteith (PM) based EvapCalc version 2.0 software developed at the NCEA. According to PM theory, solar radiation and temperature alone are responsible for about 90 percent of the evaporation loss. Evaporation losses generally rise to 7 or 8mm/day in the summer, whereas seepage losses range from 1-2mm/day for a well constructed earth storage to more than 10mm/day from poorer quality storages.

More research is required to fine tune the EvapCalc model to account for dam geometry, heat effects and advection. Aerodynamic and surface resistant constants...
need to be determined for open water surfaces, as does the effect of the sun’s angle of incidence on water surface albedo values.

The various covers or Evaporation Mitigation Technologies (EMT) have been trialed at test sites located at Toowoomba, Stanthorpe, St George, Dirranbandi and Capella.

Evaporation Control System’s E-VapCap is a floating plastic cover treatment which has demonstrated a better than 90 percent reduction in evaporation in the 10m diameter test tanks at USQ Toowoomba’s AgPlot site.

Netpro’s cable supported shadecloth structure achieves an almost a 90 percent reduction in both radiation and wind, which has translated to around a 70 to 80% reduction in evaporation, demonstrated in both the USQ test tanks and at the Stanthorpe site.

A chemical treatment, Nalco’s WaterSavr is a single molecule layer of acetyl alcohol with repulsion agents which facilitate rapid spreading of the product across the water surface. The product’s performance is affected to a certain degree by the wind, but continuous reapplication could overcome this problem. The evaporation reduction performance has been rated at better than 20 percent, which could prove economical for temporary or seasonal fill storages.

A technical assessment of each of the products has been undertaken, while an economic analysis provides guidelines on the cost per ML water saved of each product.

The NCEA research team comprises Director Erik Schmidt, Ian Craig, Andrew Green, Michael Scobie, Andrew Piper and Charles Reynolds. A poster presentation ‘Evaporation Control Project’ showing the various treatments can be found on the NCEA website www.ncea.org.au/Irrigation/Evaporation/

References


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