DEPARTMENT OF
PRIMARY INDUSTRIES

OUR RURAL LANDSCAPE

Sustainable development through innovation

Technical note 6 May 2006

Saline ground water adjacent to poly tunnel with fish tanks.

Productive use of saline water

The big picture

Victoria produces 65 per cent of Australia's total milk production and accounts for 84 per cent of the nation's dairy exports. In 2005, the industry accounted for $2.1 billion or 37 per cent of the total value of the Victoria's food exports.

Victoria's dairy industry owes a large part of its international competitiveness and export success to the existence of low-cost, pasture-based production systems. These pastures in turn rely on the State's water and soil resources.

Within Victoria's dairying regions, the dairy industry accounts for one-fifth of regional employment and one-quarter of regional income. In many cases, family farms are the basis of their regional communities.

The Australian dairy industry has undergone some major changes over the last two decades. The nation's dairy farms have become more efficient, but there are fewer of them. This is partly in response to trends in world dairy production and markets and partly due to the deregulation of the Australian industry. The final removal of government support for Australian market milk prices in 2000 accelerated the pace of change. The subsequent industry restructuring has meant that some small-scale dairy farms are now only marginally viable. While the greatest impact is clearly on farm survival, this situation also affects a farm's ability to undertake actions that benefit the environment.

In some dairy farming areas, such as the Goulburn Valley in northern Victoria, large-scale clearing of native vegetation over many years has resulted in rising water tables that have increased salt levels in the upper layers of the soil.

To help combat the growing salinity problem, farmers, catchment management authorities and government agencies have introduced a range of initiatives and engineering solutions, including ground water pumping schemes. These are designed to remove and relocate the saline groundwater from sensitive production and natural landscapes, to drive the saline water further underground or to keep it moving through the environment so that the salt does not accumulate in one place. The aim is to reduce the onset of further salinity problems and, wherever possible, to improve the affected land so it can again be used for ongoing agricultural purposes, in addition to restoring the values of natural assets impacted by salinity.

Many farms in these areas have publicly- or privately-owned groundwater pumps that could collectively have a significant impact on the water table at farm level and also in many cases at a sub-catchment level. However, the pumps are expensive to operate and many of the lower-yielding pumps do not provide a financial return. Currently, the main use of saline groundwater is to 'shandy' it with fresh water to reduce the salt content and then use the mixture to water dairy pastures (known as conjunctive irrigation).

But the groundwater generated by existing on-farm pumps also has the potential to be used in aquaculture as an alternative to increasingly precious fresh water for fish production purposes.

Aquaculture, the farming of fish and other aquatic organisms as opposed to catching them from the wild, makes use of water, but does not consume it.

Victoria
The Place To Be

Aquaculture therefore has the potential to use water that is being stored for other purposes without adversely affecting the achievement of those other purposes—and to boost the value of farm production without increasing water consumption. Slightly saline groundwater that has been used for aquaculture can still be used for conjunctive irrigation to water dairy pastures, and the fish will in fact have increased the value of the groundwater by releasing useful nutrients (nitrogen and phosphorus) in their waste.

The term 'integrated agri-aquaculture systems' refers to the integration of aquaculture and irrigated farming systems to optimise the economic and environmentally sustainable use of existing energy, resources and infrastructure.

Despite its leadership in other areas of primary production, Victoria has not achieved the same gains in aquaculture as other states. Using groundwater for aquaculture would provide environmental benefits as well as creating additional wealth for Victorian communities through diversification into sustainable new enterprises.

Previous work

The concept of multiple water use and the integration of aquaculture and agriculture to achieve complementary environmental and economic benefits were first investigated by Australian researchers in the early 1990s when several projects were undertaken by DPI Snobs Creek. These projects were funded by Fisheries Victoria and the Rural Industries Research and Development Corporation (RIRDC).

The work culminated in the late 1990s with a RIRDC-funded national strategic planning workshop that formally described 'integrated agri-aquaculture systems' (IAAS) as a new fisheries production framework with major relevance to irrigated agriculture in Australia. Geoff Gooley and Fiona Gavine from DPI Snobs Creek subsequently published a RIRDC-funded report entitled Integrated Agri-Aquaculture Systems: A Resource Handbook for Australian Industry Development.

Since that time, integrated agri-aquaculture systems have been developed through DPI's Ecologically Sustainable Agriculture Initiative by DPI Snobs Creek researchers for small-scale farm diversification in Victoria, prior to the present industrial-scale approach being developed under ORL.

Our Rural Landscape

One of four case studies funded by ORL project 1.3, 'Multiple Water-Use: Adding Value and Sustainability to Water in Agricultural Landscapes', this work focuses specifically on the multiple use of saline groundwater. Our Rural Landscape is a four-year, $50 million initiative that aims to produce greater value from the sustainable use of natural resources.

The saline water case study aims to give farmers a financial incentive to pump more saline water (and therefore to help reduce salinity problems at a farm-specific and possibly sub-catchment scale ultimately, subject to how extensive the uptake of this new practice may be. Using saline water to create new aquatic products from aquaculture could provide an alternative and sustainable source of farm income, potentially improving the viability of smaller dairy farms adversely affected by the recent restructuring of the Australian dairy industry.

In this farm-based case study, the project team is developing and demonstrating systems and products that could form part of a diversified farming enterprise on a stand-alone basis. However, these systems and products may be more likely to be adopted as part of a fully integrated, industry network with like-minded farmers.

At Kyabram, in Victoria's northern dairying region, project staff are working with a commercial dairy farm to develop a low-cost system that uses the farm's existing bore water pump to supply slightly saline groundwater (3 parts per thousand salt, or about one per cent of the salt content of seawater) for growing a range of fish species.

The production system is compatible with the existing farm enterprises and occupies land with limited use for any other purpose. It recirculates the water through a series of pre-fabricated raceways inside a greenhouse-style polyethylene tunnel that maintains the warmer temperatures required for some fish species. After the water has been used for aquaculture, it can be mixed with fresh water and applied to the dairy pastures.

Fish tanks within poly tunnel.

So far, preliminary trials have been conducted with Murray cod, rainbow trout, mullet and goldfish. The Murray cod and rainbow trout could be sold to other aquaculture producers to grow out to market size, while the goldfish could be sold to aquarium shops. The mullet could be used as a low-cost biological 'vacuum cleaner' for solid wastes accumulating in the raceways.

In recognition of the project's potential to help address local salinity problems by increasing the circulation of water through the soil, the Goulburn-Broken Catchment Management Authority has co-invested in the demonstration aspects of the case study. Engagement with the CMA and the local community has been facilitated by DPI Catchment and Agriculture Services (CAS) in the Wyuna region, where the demonstration site is located.

The project team has assessed fish growth, survival and feed conversion as well as production costs, revenue, and impact on water quality. The system is presently being recommissioned after addressing some initial design problems.

However, preliminary results indicate that the saline water is of a very high quality for aquaculture.

With minimal pre-treatment (mostly aeration and settlement), the water is suitable for nursery production, which is the stage immediately prior to final grow-out. Nursery production typically involves producing 'advanced stocker' fish such as Murray cod for on-selling to growers using systems such as those being trialled by ORL in the Sunraysia).

Juvenile Murray cod in saline ground water.

The future

The field-based demonstration site near Kyabram is being used to show other local farmers the merits of diversification through multiple water-use applications such aquaculture. The team's findings will also be communicated to potential next-users such as processors, buyers, marketers, freight forwarders and research and development investors, as well as hatcheries that may be interested in providing fingerlings for aquaculture producers.

When enough information has been collected on costs and outputs, the team should be able to predict the aquaculture production potential of any given farm for the aquaculture system tested at Kyabram.

They also expect to be able to quantify the amounts of nitrogen and phosphorus that will be produced by the fish and therefore improve the value of the water for growing irrigated crops and pastures.

The work complements other ORL projects that aim to make more effective use of Australia's precious water resources, as well as to foster the development of a local Murray cod aquaculture industry and support the management of wild Murray cod populations.

Other contributors to this work

The project's farmer partners at Kyabram are Ray, Judy and Brad Mueller and the three generations of the Mueller family now living and working on the family dairy farm. Other project partners in this project include the Wyuna Local Area Planning (LAP) Group, Goulburn-Broken CMA and CAS colleagues at DPI Tatura.

Further information

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