

Tasmanian Dairy Industry Natural Resource Management Projects, August 2008



The information provides a summary of the main projects in Tasmania impacting on or relating to the dairy industry and its natural resource management. They include research projects, on farm works projects and demonstration projects.

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- Investigating the potential of Deficit Irrigation Strategies to improve the Efficiency of Water Use in Irrigated Temperate Pastures
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DairyTas Riparian and Shelterbelt Projects



On farm works (Envirofund)

DairyTas was successful with two Envirofund funded projects from the last round (announced October 2007). These are titled 'Improving water quality and biodiversity in Mowbray Swamp' and 'Improving water quality and biodiversity in Togari/Brittons Swamp'.

Agricultural Resource Management has been engaged to co-ordinate the projects, which involve a combination of planting of native shelterbelts/riparian vegetation and fencing of waterways and bush areas to exclude stock. 8 dairy farms in the Circular Head region are involved with the projects.

The projects are progressing well, with all of the plantings (including some excellent site preparation by the landholders) and most of the fencing works complete in Mowbray Swamp, with the remainder set to be completed by early 2009. Planting for Togari and Brittons Swamp area farms is now scheduled for autumn 2009, giving the landholders plenty of time to get some good site preparation completed.

The outcomes of these projects will be increased biodiversity, less nutrient inputs to waterways, and improved production through increased stock shelter.



Investigating the potential of Deficit Irrigation Strategies to improve the Efficiency of Water Use in Irrigated Temperate Pastures

Research (Small Project Grants)

The TIAR Dairy Centre have undertaken a range of research and monitoring studies investigating water use efficiency on commercial farms and the potential pasture production from best management irrigation strategies. This work has been valuable in assessing the amount of water required to maximise pasture production on farm and how this can be effectively achieved. However, little research has been undertaken to examine how farmers can best water their pasture when water becomes a limiting resource.

Modelling work undertaken at TIAR has identified that a deficit irrigation strategy in a temperate climate can significantly improve water use efficiency of temperate pastures species. A deficit irrigation strategy is aimed at applying a percentage of the rainfall deficit (rainfall - potential evapotranspiration) to make better use of summer rainfall.

A study undertaken in 2007/08, funded by DairyTas, monitored the pasture performance and water use efficiency from different deficit irrigation strategies and extended the outcomes of the study to differing soil types and regions by undertakings a series of modelling activities. The study demonstrated that improvements in the average response to irrigation across the Australian dairy industry of 1 tonne DM/ML can be increased by 50 to 90% under a deficit irrigation approach.

A deficit irrigation approach maintains the pasture in a responsive state and makes more efficient use of any summer rainfall events. Modelling work undertaken as part of the study also indicated that the removal of edaphic limitations and maximising pasture growth significantly improves the marginal irrigation response of dairy pastures. When edaphic limitations are removed, a deficit irrigation approach could potentially result in a marginal irrigation response of 2.8 t DM/ML. This is a considerable improvement above the industry average response and these findings are viewed as being critical to improving the efficiency of irrigation water use within the Tasmanian dairy industry.

The study has also attracted a second year of funding to investigate the interactions between deficit irrigation strategies and nitrogen use efficiency which will be undertaken in 2008/09.

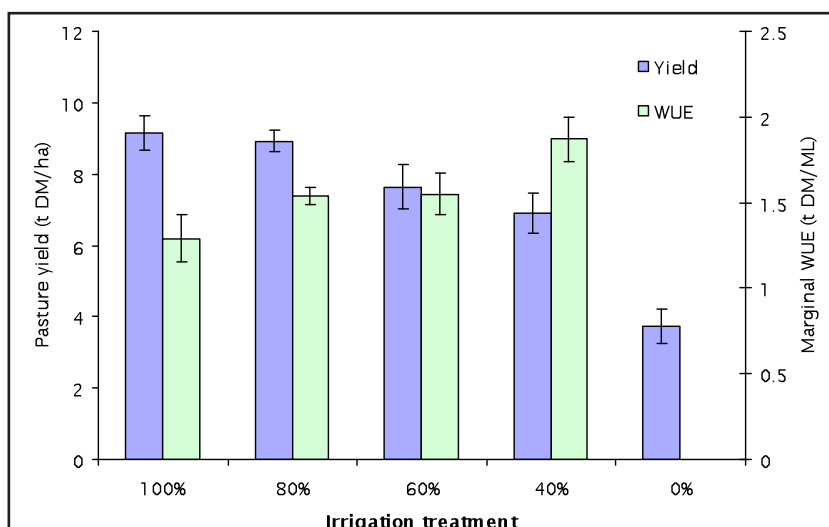


Figure. Pasture yield (t DM/ha) and marginal water use efficiency (t DM/ML) of each of the irrigation treatments for the period of November to April.

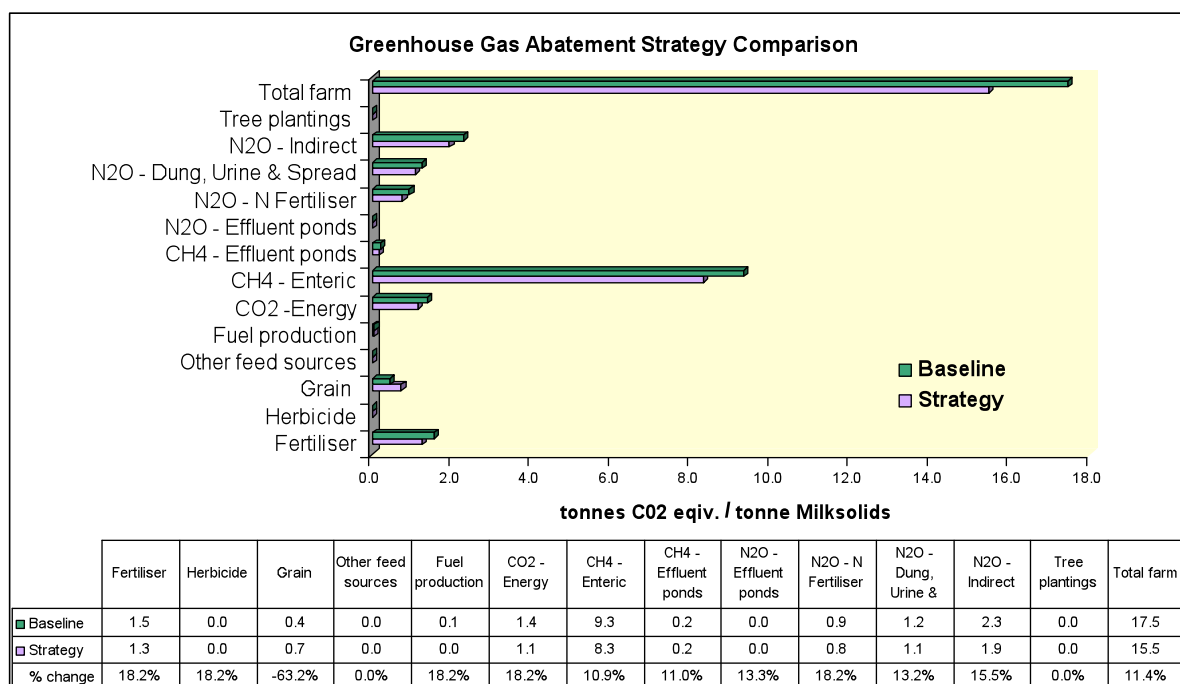
Whole farm systems analysis of Greenhouse Gas Emission Abatement Strategies for Dairy Farms

Research (Dairy Australia and DAFF funded)

There are numerous options identified for greenhouse gas (GHG) emission abatement on dairy farms. Cumulatively these options may reduce GHG emissions by 20 to 30%. However, a review of the impacts and possible outcomes for different abatement options at a whole dairy system level has not been done. This is a necessary step for positioning each abatement technology and to prioritise further investment. In 2007 the TIAR dairy centre commenced a project, funded by the Australian Department of Agriculture, Fisheries and Forestry and Dairy Australia, to quantify the potential reduction in GHG emissions for selected abatement strategies from a farming systems viewpoint.

The project is estimating how much methane, nitrous oxide and carbon dioxide is emitted from differing dairy farming systems using a series of accounting algorithms and assessing the impact of potential abatement options for each system. To undertake the analysis information such as milk yields, stock numbers, farm size, diet, fertiliser, diesel and electricity usage for a 12-month period is collated and GHG emissions per farm and per kg milk solid is estimated.

This allows a comparison between farming systems to ascertain which aspects have the greatest impact and to also identify key areas for abatement. As part of the project, a computer model has been developed that will allow individual farm details to be entered, with the model able to calculate the GHG emissions from each farm system. The model also allows for the examination of changing management practices has on farm emissions.



Results graph from the Dairy Greenhouse gas Abatement Strategy calculator.

Water Use and Nutrient Management Project



Farm Monitoring (NLP funded)

Seventeen dairy farms located in the South, North-East and North-West of Tasmania are currently involved in the final year of this three year study. The project is being run by the TIAR Dairy Centre for DairyTas. Commercial dairy farms located in the Derwent Valley (4 farms), Ringarooma (7 farms) and Flowerdale (6 farms) regions are involved with the monitoring of water use, pasture production and soil fertility as part of this study.

Hansen data loggers monitored soil moisture and temperature (°C) at each site, with 3 gypsum blocks installed at depths of 15, 35 and 50 cm. Loggers recorded soil moisture and temperature every 4 hours. The use of Hansen loggers, with a built-in display, allows for immediate recognition of soil moisture levels and provides farmers with the information required to adjust rates of irrigation accordingly. Generally, farmers continued to maintain soil moisture potential within the optimum range of 10-35 cb to maximise pasture production and reduce the risk of yield reduction due to a soil moisture deficit.

Each of the seventeen sites was re-sampled for soil fertility assessment in July and August 2007. Approximately 30 soil samples were taken from five paddocks following the 1st years sampling. Samples were analysed for phosphorus [(P) Colwell and Olsen], potassium (K), KCl sulphur (S), pH (1:5 CaCl₂) and electrical conductivity.

Year 1 and year 2 were compared. Farmer response to soil analysis results has been encouraging, with farms continuing their efforts to meet the optimum agronomic ranges for P, K and S. Soil fertility was of particular interest to the farmers, with the majority indicating the economic gain they achieved from their soil analysis for fertiliser inputs.



Dairy Effluent Management Projects



On Farm Works (NHT and NLP funded)

DairyTas is currently delivering round 3 and 4 of the effluent management program in conjunction with AK Consultants. By the end of 2008 over 160 dairy farms (over 30% of the industry) will have upgraded their systems to meet best practice in the context of the farm management resources and the management of the effluent on the property. This is over the 4 years since the project commenced operation in 2004.

Farmers have invested an average of \$16,000 in on ground works, a total investment of over \$2.5M.

The project involves approved farms having an effluent management plan prepared by the technical consultants, David Armstrong and Robin Badcock. The farmers then undertake on ground works to upgrade their effluent management system on a \$ for \$ basis for up to \$5,000.

Farm works undertaken include items such as effluent storage dams, sand and gravel traps, solids separation systems, irrigation equipment, pipework and the like.

The project has made significant progress in assisting dairy farmers to eliminate the risk of effluent leaving the property and impacting on waterways and water quality. Many farmers are also now able to utilise more effectively the nutrient value of the dairy effluent on their farm.



Alternatives to the Use of 1080 Project – Impacts of wildlife Browsing on Pastures in Tasmania



The Tasmanian Institute of Agricultural Research (TIAR) was contracted in 2007 to undertake a three year research project entitled 'New decision support tools to quantify and monitor the impact of herbivory of native wildlife on pastures & identify alternative control mechanisms'. Funding from the project is provided under the 'Alternatives to the Use of 1080 Program'.

The study aims to quantify and monitor the impact of herbivory ("browsing damage") by native marsupial species and game on native and introduced pastures supporting agricultural production (eg. dairy, beef, sheep) in Tasmania. The intention is to achieve the aims by using a combination of spatially-explicit models of herbivore population density and predictive pasture growth models coupled with quantitative field measurements of herbivore population density and in-situ estimates of herbivory and pasture production.

Findings to date: Native wildlife browsing can have a significant impact on pasture production, with the economic cost likely to be significant. Pasture percentage loss expressed as kg DM/ha due to wildlife browsing varied according to system (the extent of differential browsing impacts in irrigated versus dryland pastures is unclear at present), location, and wildlife abundance at all 12 sites. Pasture loss to wildlife browsing ranged from 12 to 100%, with an average of 65% over the 12 sites for the six month monitoring period.

'Edge effects' were evidence at all 12 of the main sites, with browsing generally higher near the bush line. The higher the abundance of wildlife, the greater the likelihood of browsing impacts away from the 'edge'. Edge effects can influence both pasture production and pasture species composition, however the full nature and degree of preferential browsing is currently unclear.

Wildlife management may be one of the most important factors influencing production and profitability. It is important to have an adequate understanding of wildlife number and movements/impacts on a property. While wallaby proof fencing has been proven to be effective, we have yet to test the benefits and costs on both an environmental and economic level. The research is ongoing to 2010.



Montagu Catchment Soil Phosphorous and Pasture Calibration



This is a jointly funded DairyTas and Dairy Australia project with TIAR

Project began in January 2007 and will conclude in December 2009.

Main aims:

- To demonstrate a relationship between soil available phosphorus (P) concentrations and pasture production on Hydrosols.
- To better match soil fertiliser requirements with pasture growth in the Montagu catchment.
- To encourage additional soil testing to improve nutrient distribution.
- To reduce the risk of surface P run-off from hump and hollow drainage systems to surrounding waterways.

Progress:

Pasture yield measurements have been taken at 2 ½ – 3 leaf stage of ryegrass growth (every 26 - 50 days) for a 12 month period. Average dry matter yield across all plots was 19138 kg/ha (19.1 tonnes/ha) for the 12 month period of April 2007 to March 2008. There were differences in dry matter produced at different soil phosphorus concentrations Olsen P from 25 to 90, but analysis of the individual plot data using Anova found that the differences were not statistically significant ($P > 0.05$).

Pasture production through the year (Figure 7) was greatest during the spring and summer months (September – January) and was least during winter (July/August) and late summer (February/March). The low pasture production in winter was thought to be due to a combination of low temperature and excess soil wetness.

The conclusion so far in this experiment, is that the different soil Phosphorus concentrations have produced no significant differences in dry matter pasture production.



Landscape Logic – A Tasmanian Perspective



The focus of Landscape Logic is to better organise knowledge and assumptions about links between management actions and environmental outcomes.

Objectives:

To establish water quality responses to changes in land use and land management, and how water quality in turn affects riverine and estuarine health and function.

Aims:

1. Identify relative impact of land use, land management and previous landscape interventions on water quality.
2. Provide new knowledge and improved assumptions about the responsiveness of river health to water quality as a result of historic changes in land resource parameters.
3. Provide new knowledge and improved assumptions about responsiveness of estuarine health to water quality as a result of historic changes in land resource parameters.

Approach:

1. Land use and land management change: At catchment scale, examine relationships between historic data on water quality and land use for multiple Tasmanian catchments, model nutrient and sediment outflows to characterize responses for local catchments by geomorphic settings, and model water quality response to land use using the model CMSS. At paddock and sub-catchment scale, relate historic satellite imagery and aerial photography to water quality data for case studies of interventions and record social and policy drivers for changes (e.g. riparian zone fencing & revegetation, stock crossings),
2. River health: Explore relationships between land use change, water quality and habitat characteristics and key components of river ecosystem health using existing data sets and field sampling. In the absence of good time series data, explore relationships between land use change, water quality and habitat characteristics and key components of river ecosystem health using space-for-time experiments (data from many catchments at one time with and without intervention rather than one or two catchments over long periods of time)
3. Estuarine health: Examine the relationship between landuse history (derived by the Spatial Information project team) and existing data on water quality, flow and estuarine health. Explore relationships between landuse at regional and catchment scales, water quality and quantity and a variety of indicators of estuarine health by re-visiting some of the 22 Tasmanian estuaries sampled in the mid-late 1990's.



Synchronising Phosphorus Fertilisation with plant phosphorus demand: a tactic to reduce phosphorus transfer from land to water

This project is funded by the Australian Research Council, with additional support from DairyTas, Impact Fertilisers Ltd and Roberts Ltd.

The project started in September 2005 and will conclude in January 2010.

Summary

Phosphorus loss from intensive pasture systems is a major issue internationally due to the pollution and nutrient enrichment of water ways. This study will examine how a strategy of synchronising phosphorus (P) fertiliser to periods of high P demand in ryegrass (*Lolium perenne*) may be used to improve the efficiency of P uptake and thereby reduce P losses in surface runoff. Simple models will be used to identify the key risk factors associated with surface P loss in order to improve the sustainability of P fertiliser use in pasture systems.

Activities and progress

1. Three field sites were established on commercial dairy farms (Elliott, Mt Hicks and Togari) to represent a range of soil P sorption properties. These sites received a range of P fertiliser treatments to examine the effect of single application compared to smaller rates applied strategically throughout the growing season on pasture production, pasture P and soil P levels. The field component was completed in Jan 2008 and soil and pasture nutrient analysis has been completed by the laboratory and data have been analysed statistically. A full report will be provided to industry by the end of September 2008.
2. A rainfall simulation experiment has been established in the glasshouse at TIAR using the soil from the Togari field site. This study will investigate the effect of applying 40 kg P/ha in a single application to 3 applications of 13.3 kg P/ha on P losses in surface P runoff using a rainfall simulator. We will also investigate the effect of getting runoff on day 0, 3, 6, 12, 24 after fertiliser application, as there is a concern that the 'danger period' for P losses following P fertiliser application are much longer than the current '4 day' recommendation, on some soil types. The rainfall simulations will start at the beginning of October (barring any unforeseeable issues) and will be completed before Christmas 2008.
3. The data from the rainfall simulations will be used to develop a P runoff risk model (in relation to P fertiliser application) for the Togari/Britton's swamp area by using the 3 years of runoff data collected by the Montagu Water Quality Monitoring project (Greg Holz).
4. The data from the field study will be used to further develop the P modelling component in DairyMod.

Defining the Soil Phosphorus Maintenance requirement of Dairy Pasture Soils



This project is funded by Dairy Australia, Incitec Pivot Ltd and Impact Fertilisers Ltd. The project started in April 2005 and it due to finish in June 2009.

Background

When farmers apply phosphorus (P) fertiliser, one of the most significant forms of loss is due to the soil P sorption/fixation processes. Limited research has indicated that the amount of P fertiliser required to satisfy the soils requirement for P (ie. P sorption reactions) represents a large proportion of P fertiliser recommendations (between 50-80%), yet the information available to determine soil P maintenance in Australian pasture soils, is almost non-existent. Defining the soil P maintenance requirements of pasture soils will have important environmental implications, as more accurate nutrient budgets will reduce the risk of over fertilisation and P loss from pasture systems.

Activities and progress

Seven field sites have been established around the north and north-west of Tasmania and maintenance P fertiliser is being applied and soils are being sampled every 6 months. It is important that soils are monitored over the longest time period possible before any firm maintenance recommendations are made, due to normal spatial and temporal variation which occurs with soils.

Preliminary results suggest that soil P maintenance requirements vary with soil type and soil P sorption/fixation capacity and that more P fertiliser is required to maintain stable P levels as the initial P level increases. For example, preliminary data suggests that a soil at Olsen P of 40 requires more P to maintain it at that level compared to an Olsen P of 15 mg/kg.



Accounting for Nutrients on Australian Dairy Farms



This project is funded by Dairy Australia and others.
The project started in July 2006 and it due to finish
on June 30, 2010.

Background

Accounting for Nutrients is a national project run out of the DPI at Ellinbank in VIC and involves significant activity in all the key dairy states (VIC, TAS, WA, SA, NSW and QLD). The project involves on-farm monitoring of nutrient flows on 44 dairy farms from around the country, in order to develop and validate a framework for nutrient accounting on dairy farms that will identify and provide opportunities to improve the profitability and efficiency of nutrient use and pasture production whilst identifying key areas of nutrient use efficiency and reducing nutrient losses to air, soil and water.

More specifically, the following outcomes and benefits will occur:

1. The Australian dairy industry adopts a uniform set of protocols for nutrient auditing that is based on the best current information and knowledge (longer term, this means an 'Overseer' type nutrient account approach).
2. Improvements in the profitability of dairy farms via an improved understanding of nutrient fluxes and accumulations and the influence of management on these.
3. Reductions in nutrient excess and accumulation that will contribute to reductions in the loss of nutrients to ground and surface waters (N&P) and the atmosphere (N)

Activities and progress

Tasmania is monitoring 4 farms as part of this project and to-date, 3 farm visits have been undertaken and a nutrient audit of all nutrient stores on these farms has been conducted (i.e. the amount of nutrients currently on farm in the form of hay/silage, grain, effluent etc).

Data available to date includes a profile of the fertiliser use, farm characteristics, effluent systems, feed systems and farm maps for the 44 farms and feed analysis from selected farms. Most of the states will be soil sampling their farms in spring/summer 2008 and this will provide an interesting profile of soil nutrient distribution from different states around the country.

