LMRIA SUSTAINABLE SOILS PROJECT - SUMMARY OF CURRENT PRACTICES
Project: DSAdaff0212

Report No: DSA-0212-B

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The author of the report accepts no liability or responsibility for the interpretation and implementation of the recommendations and guidelines contained within.

At all times the best current available information is utilised in the preparation of reports. This report is intended as, and can only be used as, a guide only.

January 2012

Funded by Dairy Australia and your dairy service levy

DairySA

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1. Introduction

Dairy SA Project DSAdaff0212 aims to:

1. Summarise current land management practices
2. Select and establish 10 demonstration sites within the LMRIA with a focus on improving productivity and reducing soil acidity in a cost effective manner
3. Develop case studies for the demonstration sites which document management, enterprise and economic analyses of options adopted
4. Contribute to communication of project outcomes via a range of methods including media releases, field days and on-farm discussion group/s

MBP Consulting and sCOWn Consulting were engaged by DairySA to visit and interview landholders in the Lower Murray Reclaimed Irrigation Areas (LMRIA) to determine the range of current land management practices and enterprises post drought. A sample farm visit sheet is included as Appendix A.

This report presents a summary of current farm management practices derived from the results of on-farm visits and should be read in conjunction with Excel spread sheet "LMRIA Visit Data Final.xls".

This report contains possible confidential personal and business information relevant to the individuals and businesses visited/interviewed and should not be disseminated publicly or to other diary or private enterprises without first obtaining permission of the individuals and businesses visited/interviewed.

2. General

The farms visited comprised of 21 dairies (all but 4 of those operating post drought) and 12 beef/hay enterprises. One property was visited that grows tomatoes in plastic tunnel houses on an area of 'swamp'. This property has not been included in the land area and water statistics as the area is quite small and it is irrigated by drip irrigation. Further investigations are being undertaken.

The 21 dairy enterprises visited comprised 1,696ha of reclaimed area representing approximately 16 gigalitres of allocated water (not including ELMA). There was approx. 344ha of irrigated highland and 13,347ha of dryland associated with these reclaimed areas. A perceived 200ha of reclaimed land was said to be acid affected by interviewed landholders.

The 12 beef/hay enterprises visited comprised 735ha of reclaimed area representing approx. 3.7 gigalitres of allocated water. There was approx. 144ha of irrigated highland and 2,517ha of dryland associated with these reclaimed areas. A perceived 34ha of reclaimed land was said to be acid affected by interviewed landholders.

In total the 33 visited enterprises comprised 2,431ha of reclaimed area and 19.643 gigalitres of allocated water. Associated with this was 488ha of irrigated highland and 15,864ha of dryland.

It is estimated that there are a further 4 dairy enterprises comprising approx. 170ha and 9 beef/hay enterprises and 1 horse property comprising approx. 591ha that were not visited. This gives a total area of 25 dairy enterprises of approx. 1,866ha and 21 beef/hay enterprises and 1 horse property comprising 1,326ha. This gives a total 'productive' farmed area of approx. 47 enterprises comprising 3,192ha in total. It is estimated that there are a further 24 landholders in the LMRIA who would be ELMA only water holders and not deriving significant income from their LMRIA land holding.

Total ELMA for the LMRIA area is approx. 20 gigalitres (RMCWMB, 2002). The 33 visited farms comprise a further approx. 19.643 gigalitres of allocated water for production. It should be noted that some farmers elected not to report to the interviewers their water allocation data. These were a minority - 1 reclaimed and 3 highland.

3. Current Practices

3.1 Dairy

Irrigation Practices
Irrigation practices in the LMRIA have changed significantly post drought. This is due to a number of factors including:

- Out of level channels
- Inlets which have 'sunk'
- Leaking paddock and river inlets
- Severe cracking of soils in paddocks
- Out of level paddocks
- River inlets which are unserviceable due to damage

This in turn has been caused by a number of factors including:

- Inability to water at times during the drought due to water access issues associated with low river level
- General slumping, settling and consolidation of soils and landscapes due to lowered water table level due to low river level
- Localised severe slumping
- Water allocation restrictions during the drought
- Some sales of water allocations during the drought

Of the 21 dairies interviewed only 7 (33%) are currently watering at pre-drought intervals, from 20-30 days in early spring and late autumn to 12-14 days in summer. The rest are irrigating at intervals from monthly to only one per season. Those watering at pre-drought intervals are mainly those which watered to some extent during the drought by means such as construction of coffer dams, use of lift pumps and leasing in of water.

Only 7 of 21 (33%) dairies have water use at volumes per ha near to pre-drought levels. This is around 1meg/ha/irrigation up to 2Ml/ha/irrigation. The rest are using extremely variable amounts from 4-5 up to 7.4Ml/ha/irrigation. Some dairies interviewed did not know how much water they were using. Three of the 21 dairies (14.2%) had sold over 90% of their water allocation.

Pasture/Crop Types

Table 1 below summarises pasture and crop types currently utilised in the LMRIA.

Table 1. Pasture and Crop types grown in the LMRIA post drought - dairy

Pasture/Crop Type	Number of Farms	*Percentage
Pasture	17 of 21	81%
Winter Mix	10 of 21	48%
Cereal	3 of 21	14.2%
Millet	4 of 21	19%
Lucerne	6 of 21	29%

* Note that the percentages add to more than 100% as many farms had 2 or more pastures/crops

It should be noted:

- ‘pasture’ included both improved ryegrass/clover and older paspalum/kikuyu pasture.
- Generally, those dairies that irrigated during the drought sustained improved pasture.
- In some cases cereal and Lucerne appear together on the same paddock as the cereal was used as a cover crop for the Lucerne. However in some cases cereal was grown for hay.
- Winter mix and millet also appear together on the same paddock as a rotation in some cases

Very few dairies experimented with alternative crops/pastures, e.g. one had tried chicory.

Although pasture and winter mix still form the mainstay of production in the LMRIA, Lucerne has also become a major choice. This developed during the drought where Lucerne was grown on many farms due to low availability of water and lowered water tables. Historically Lucerne was extensively grown in the area before the barrages were finished around 1940. After the barrages the water table in the LMRIA rose and Lucerne was less successful due to wet sub-soil conditions. During the drought the water table level fell making Lucerne once again a viable option. There is some conjecture that now the water table has risen with restored river water levels that Lucerne will not persist.

Establishment Methods
The use of rotary hoeing or direct drilling for pasture/crop establishment was found to be around half and half. Success was varied with both methods with mostly successful results reported.

Some reported that they only use direct drilling for over sowing existing pasture. In other cases both rotary hoeing and direct drilling were used together - typically the paddock was worked up and levelled with cereal sown and Lucerne then direct drilled in later. In other cases the paddock was worked up and rolled, then direct drilled.

Working up may have been over represented in the results due to the need to re-level paddocks post drought. Historically direct drilling has been adopted on a large scale pre-drought. Both methods are acceptable practice for the LMRIA soils, however, working up can lead to some loss of organic matter as seen in previous PIRSA trials in the area (Philcox, 1991).

Fertiliser Practices
Fertiliser use in the LMRIA post drought is very low. Only 9 of 21 dairies use fertiliser (43%).

Table 2 below summarises fertiliser type and use in dairy enterprises in the LMRIA post drought.

Table 2. Fertiliser type and usage in the LMRIA post drought - dairy

Fertilser Type	Number of Farms	*Percentage
Superphosphate	1 of 21	5%
Sweepings	2 of 21	9.5%
Urea	3 of 21	14.2%
19:13	5 of 21	24%
Easy N	1 of 21	5%

It should be noted that one dairy in the LMRIA is growing pasture bio-dynamically using composts, manures, organic certified Rapid Raiser, fish and kelp sprays and organic humates.

The dairies using superphosphate and sweepings are all applying appropriate rates for maintenance in a dairy production system.

The 3 dairies using urea are applying appropriate rates as is the dairy using 'Easy N' foliar spray-on nitrogen.

Of the 5 dairies using 19:13 two are applying low rates of fertiliser, for example 40kg/ha of 19:13 which is only 5kg/ha of phosphorous and 8kg/ha of nitrogen. Recommended minimum dairy industry practice is to base recommendations on soil testing. Dairy SA Best Management Practice includes soil *and* tissue testing *plus* incorporation of the Dairy SA 'Better Fertiliser Decisions' program. Additionally, 60kgs/ha of actual nitrogen has been found by PIRSA in trials on the LMRIA to give the most economic dry matter response for nitrogen (Philcox, 1991).

Historically, soil nutrient level in the LMRIA is high as consequence of both a high natural fertility and good historical fertiliser practice adding to the soil reserve. Dairies wishing to save financially could withhold phosphorous fertiliser types. As a minimum, fertiliser decisions should be made on the foundation of soil and or plant tissue analyses.

Grazing Practices
Dairy grazing practices in the LMRIA post drought are extremely varied. Rotations at the time of the interviews varied from 14-18 days out to 31 days.

Two farms have adopted a total mixed ration (TMR) with no grazing on the floodplain. Another five farms have adopted a grazed mixed ration approach using mixer wagons with only limited grazing on the floodplain. This is to be expected post drought due to the variation in ability to irrigate, available pasture type and the adoption of mixed ration feeding on some farms in response to the drought and consequent impacts on the ability to grow a quality fresh feed in the paddock.

Notably, the two TMR dairies are now planning to get their 'swamps' back into production to again contribute to the feed system.

Stocking rates (SR) per grazed hectare are also low compared to pre-drought. Average stock rate is currently 2.95 cows per hectare (range 2 to 4 cows/ha). Where the diary enterprise grazes irrigated highland, this was included in the SR calculation. 12 of 21 dairies graze irrigated highland (57%).

General Practices
11 of 21 dairies (52%) include pasture topping in their practices. This practice is a good source of return of organic matter to the soil.

3 of 21 dairies (14%) include application of manure to the land in their practices. This practice is also a good source of return of organic matter to the soil.

The LMRIA soil is historically highly biologically active (high numbers of beneficial bacteria, fungi and micro-fauna) which can respond well to the application of organic inputs.

3.2 Beef/Hay

Irrigation Practices
The same factors that have affected irrigation practices for dairy have also impacted on properties that have switched to beef/hay enterprises (see 3.1 above).

Of the 12 beef/hay properties interviewed none are currently watering at pre-drought intervals. All are irrigating at intervals from monthly to only one per season.

Only 3 of 12 (25%) beef/hay properties have water use at volumes per ha near to pre-drought levels. This is around 1meg/ha/irrigation up to 2Ml/ha/irrigation. The rest are using extremely variable amounts from 4-5 up to 8Ml/ha/irrigation. Some beef/hay properties interviewed did not know how much water they were using.

Five of the 12 beef/hay properties (42%) had sold over 90% of their water allocation.

Pasture/Crop Types
Table 3 below summarises pasture and crop types currently utilised in beef/hay properties in the LMRIA.

Table 3. Pasture and Crop types grown in the LMRIA post drought - beef/hay

Pasture/Crop Type	Number of Farms	*Percentage
Pasture	7 of 12	58%
Winter Mix	2 of 12	17%
Cereal	5 of 12	42%
Millet	2 of 12	17%
Lucerne	7 of 12	58%

* Note that the percentages add to more than 100% as many farms had 2 or more pastures/crops

It should be noted:

- 'pasture' included both improved ryegrass/clover and older paspalum/kikuyu pasture.
- Generally, those beef/hay properties that irrigated during the drought sustained improved pasture.
- In some cases cereal and Lucerne appear together on the same paddock as the cereal was used as a cover crop for the Lucerne. However in some cases cereal was grown for hay.
- Winter mix and millet also appear together on the same paddock as a rotation in some cases
- Cereal was used for both hay and grain production, not just as a cover crop for Lucerne establishment

No beef/hay properties experimented with alternative crops/pastures.

Pasture and Lucerne form the mainstay of beef/hay production in the LMRIA. Lucerne reliance developed during the drought where it was grown on many farms due to low availability of water and lowered water tables. As previously stated, Lucerne was extensively grown in the area before the barrages were finished around 1940. During the drought the water table level fell making Lucerne once again a viable option. There is some conjecture that now the water table has risen with restored river water levels that Lucerne will not persist.

Cereal forms a much larger portion of pasture/crop grown for the beef/hay properties than with dairy due to its use for hay production and with one farm having successfully reaped grain from 'swamp' land.

Establishment Methods
The use of rotary hoeing or direct drilling for pasture/crop establishment was found to be around 50% versus 20%. Success was varied with both methods with mostly successful results reported.

As with dairy, working up may have been over represented in the results due to the need to re-level paddocks post drought. Historically direct drilling has been adopted on a large scale pre-drought.

Both methods are acceptable practice for the LMRIA soils, however, working up can lead to some loss of organic matter as seen in previous PIRSA trials in the area (Philcox, 1991). Direct drilling has been successful with cereals as well as pasture/Lucerne.

Fertiliser Practices
Fertiliser use in the LMRIA post drought is very low. Only 5 of 12 beef/hay properties use fertiliser (42%), very similar to the dairy result.

Table 4 below summarises fertiliser type and use in the LMRIA post drought.

Table 4. Fertiliser type and usage in the LMRIA post drought - beef/hay

Fertilser Type	Number of Farms	*Percentage
Superphosphate	1 of 12	8%
Sweepings	1 of 12	8%
Urea	2 of 12	17%
Gypsum	1 of 12	8%
Lime	1 of 12	8%

The beef/hay properties using superphosphate and sweepings are all applying appropriate rates for maintenance in a beef/hay production system.

The 2 beef/hay properties using urea are applying low rates, 25 and 50kgs/ha/application. The most economic rate for urea in the LMRIA derived from PIRSA trials is 120kgs/ha/application or 60kg of actual nitrogen (Philcox, 1991).

One property has been using gypsum and lime annually for many years.

Historically, soil nutrient level in the LMRIA is high as consequence of both a high natural fertility and good historical fertiliser practice adding to the soil reserve. beef/hay properties wishing to save financially could withhold phosphorous fertiliser types. As a minimum, fertiliser decisions should be made on the foundation of soil and or plant tissue analyses.

Grazing Practices
Beef/hay properties grazing practices in the LMRIA post drought are extremely varied. Some properties use set stocking (continuous grazing), some strip grazing and some rotational to ‘follow the feed’.

No beef/hay properties use total or partial mixed rations.

Stocking rates (SR) per grazed hectare are also low compared to pre-drought. Average stock rate is currently 2.45 cows per hectare (range from 1 to 3 cows/ha). Where the beef/hay enterprise grazes irrigated highland, this was included in the SR calculation.

General Practices
2 of 12 beef/hay properties (17%) include pasture topping in their practices. This practice is a good source of return of organic matter to the soil.

No beef/hay properties include application of manure to the land in their practices. This practice is also a good source of return of organic matter to the soil.

The LMRIA soil is historically highly biologically active (high numbers of beneficial bacteria, fungi and micro-fauna) which can respond well to the application of organic inputs.

4. Conclusions

The total area of 'productive' farms remaining in the LMRIA is estimated to be 3,192ha from this report. Historically there was approximately 5,200ha of productive irrigated farm land (EPA, 2009) which was almost exclusively utilised for dairy production. Approximately 4,200ha of this land was rehabilitated under the LMRIA rehabilitation project with approximately 1,000ha of land retired from farming and not rehabilitated (EPA, 2009). Dairy production has therefore reduced from approximately 5,000ha to 1,866ha – a reduction of approximately 63%.

This report represents approximately 76% of land that has undergone rehabilitation in the LMRIA.

There is approximately 1,008ha of rehabilitated land that is currently 'unproductive' but which has an ELMA water allocation attached to it. SA Water own approximately 290ha of this land, a small portion of which is utilised for carbon offset via tree lots for carbon sequestration. A further 1,000ha of land lays idle with no rehabilitation.

Of the 1,008ha of rehabilitated currently unproductive land, it is not possible to judge without individual on-site assessments, how much could be brought back into effective and appropriate irrigated production. Many factors would need to be considered including, but not limited to:

- The condition of irrigation and drainage infrastructure
- The condition of farm infrastructure such as fences, pumps, bridges, etc.
- The extent and severity of soil cracking and slumping
- The extent and severity of soil degradation in relation to nutrient, salinity, acidity and organic matter
- The condition of levee banks confining the affected area/s

Other factors to be considered could include: the availability of livestock, people's willingness and ability to take on degraded land with potentially high set up costs, people's willingness and ability to acquire water allocations.

It is possible that, depending on location and therefore ELMA quantity, that some of this land could be utilised for low water requirement crops such as *Sulla*, which is the subject of trials under this project. Consideration could also be given to cereals and winter mix or to native vegetation, either as revegetation with local species, for wood lotting or for carbon sequestration projects with alternative appropriate species.

The remaining 'productive' land, comprising of irrigated dairy and beef/hay production, is predominantly based on pasture. There has been some experimentation with other crops during the drought such as lucerne, chicory and cereals. All enterprises have had little or no fertiliser input. Lower water use on some farms has led to a trend to pastures becoming dominated by older species such as paspalum, kikuyu, Prairie grass, couch, strawberry clover and Ladino white clover.

Farms that watered during the drought to some degree, sometimes with as little as one irrigation per season, appeared to have recovered faster post drought. This emphasises the importance of the application of some water during drought conditions, even if it is limited to ELMA. This was also a key finding of the national workshop.

It is reported from the survey/interviews that for the area to recover fully from the drought a significant proportion of the land in the LMRIA requires work including, but not limited to:

- Laser levelling
- Infrastructure repairs
- Levee bank assessment and repairs
- Re-pasturing
- Alternative crops for lower water allocation areas

5. References

EPA (2009) *"Lower Murray Reclaimed Irrigation Area (LMRIA) Rehabilitation Project Environmental Monitoring Final Report"* EPA, Adelaide, SA, ISBN 1-921125-99-3.

Philcox, MB (ed. 1991*) "Lower Murray Water Management Unit - Research Trial Summaries, 1988 to 1991"* SA Dept. of Ag. research report

RMCWMB (2002) "*Water Allocation Plan for the River Murray Prescribed Watercourse*" published by the River Murray Catchment Water Management Board, 2002.

Appendix A Sample Farm Visit Sheet

Name: **Irrigation Area:**

Land Area (ha):
Swamp: Highland: Acid affected: Dryland:

Water Allocation (meg):
Swamp: Highland:

Enterprise/s:
Dairy: Beef: Hay: Other:

Watering:
How often:

How much:

Difficulties/differences per before drought:

Pastures/crops grown (ha):
Pasture: Winter Mix: Cereal: Lucerne:
Millet: Other:

Establishment method/s:
Direct drill:
Rot hoe and sow:
How successful:

Fertilisers used:
Super: DAP: Sweepings: Urea:
Ammonium Sulfate: Other:

Feed practices:
Mixed rations:
Stock rate: milkers
Graze rotation:

General practices:
Pasture topping:
Manure spreading:
Other:

What work needed to be able to use water on swamps:
(e.g. inlets, drains, other)

Problems arising from the drought:
(e.g. hard setting soils, soil cracking, slumping, acidity, etc.)

Other:
(from general discussion)

Future Plans: