Dairy Directions — Analysing Farm Systems for the Future

Providing robust analysis of the impact of on-farm changes and innovation on the profitability of dairy farm systems

Using carryover water — does it pay?

Background

Water users can now manage their own water availability and risk by making use of carryover, which allows water holders to take unused water from one season into the next. A review of carryover water by the Victorian Government led to a number of changes taking effect in July 2013. A key change was capping the amount of water that can be carried over to 100% of entitlement. This analysis investigated the potential impact of this change for an irrigated dairy farm in northern Victoria and examined the question 'what impact does purchasing water to carry over have on the overall cost of water for an irrigated dairy business under different seasonal conditions'.

Table 1 Carryover water scenarios

Season 1	Decision	Season 2
Wet	Carryover	Wet
		Average
		Dry
	No Carryover	Wet
		Average
		Dry
Average	Carryover	Wet
		Average
		Dry
	No Carryover	Wet
		Average
		Dry
Dry	Carryover	Wet
		Average
		Dry
	No Carryover	Wet
		Average
		Dry

Seasonal conditions tested

The problem was set out in a decision tree framework to identify the possible outcomes and probabilities associated with decisions about carryover water. Eighteen scenarios were defined, based on the chance of a wet, average or dry season, and whether water was carried over into the following season or not (Table 1). The probability of different water allocations was defined by the water reliability profile for the end of season water allocation for the Goulburn System (Table 2).

Case study farm and assumptions

Details from a farm in northern Victoria was used as the basis for the study. The farm had 979 ML of high reliability water share (HRWS) and 448 ML of low reliability water share (LRWS). Given the areas and type of pasture and crops grown, 1900 ML/year of irrigation water was typically required.

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Table 2. Parameters for the different year types. The frequency and expected allocation years for each year type were derived from the Northern Region Sustainable Water Strategy (Department of Sustainability and Environment 2008).

Year type	Allocation range in profile (%)	Number of years in 100	Expected allocation (%)
Wet	> 101	33	121
Average	76 – 100	57	91
Dry	< 75	10	49

Case study farm and assumptions cont.

If the price to purchase water was below $100/ML, or the end of season allocation was greater than 50% HRWS, it was assumed the farm would carry over 25% of irrigation water requirements into the following season (approximately enough water for the first three irrigations in spring of the following year). At less than 50% HRWS allocation, or if water cost more than $100/ML, purchasing water to carry over into the next year was considered too expensive. In this event, the farmer would rely on taking their chances and purchasing water when needed in the following year.

What was the difference for the farm between using carryover and not using carryover?

The long-run probable cost of water over two years with carryover was only $1,000 more than when no carryover was used. This is a small difference in a total of ~$260,000. But for the individual seasons there was a greater difference in water costs, with the cost of water in season 1 less when no carryover was purchased compared with when carryover was used, but more expensive in season 2 (Table 3). The results of the decision tree analysis for the 18 scenarios are shown in Table 4.

Table 3. The cost of water with and without carryover over two seasons for the case study farm.

Scenario	Cost of water ($)		
	Season 1	Season 2	Total
No carryover	130,000	132,000	262,000
Carryover	162,000	101,000	263,000

For the farm analysed, the benefits of carrying over water were greatest when season 1 was wet or average and season 2 was dry (Table 4). When season 1 was dry, or where a wet or average season was followed by an average season, there was no difference between carrying over and not carrying over water on the cost of water. In these situations, temporary water was too expensive, or the end of season allocation was below 50% HRWS and water was not carried over into the next season.

The benefits of carrying over water occurred infrequently (7 years in 100), but the analysis did not account for how the benefits may vary with timing of water allocation announcements. For example, if opening allocations were low and winter/ early spring was dry, the benefit of carrying over water would be greater than if allocations were high. In this situation, farmers would be able to access carryover water as soon as an allocation was made, and begin irrigating immediately if required. Anecdotal evidence suggests that farmers are purchasing water to carry over as just such insurance, so they have access to water at the start of the next irrigation season.

Table 4. Likelihood of occurrence and cost of water with and without carryover under different seasonal conditions for the case study farm.

Season 1	Decision	Season 2	Cost of water (2 years ($)	Probability (%)	Benefit/cost of buying
Wet	Carryover	Wet	172,000	10	-9,000
		Average	209,000	17	0
		Dry	331,000	3	20,000
	No Carryover	Wet	163,000	1	-
		Average	209,000	2	-
		Dry	351,000	0	-
Average	Carryover	Wet	222,000	14	-9,000
		Average	265,000	25	0
		Dry	399,000	4	20,000
	No Carryover	Wet	213,000	5	-
		Average	265,000	8	-
		Dry	419,000	1	-
Dry	Carryover	Wet	366,000	0	0
		Average	439,000	0	0
		Dry	630,000	0	0
	No Carryover	Wet	366,000	3	-
		Average	439,000	6	-
		Dry	630,000	1	-

What if carryover was always used?

If there were no restrictions on when carryover water was used, the cost of water over the long-term for the two seasons was $6,000 greater than if no carryover was used (Table 5), as water was carried over when season 1 was dry, which was not the case in the original analysis. While the cost to carryover water when season 1 is dry is higher than if it was wet or average, dry seasons occur infrequently, so the difference between always carrying over water and carrying over water under restricted conditions was relatively small (Table 6).

Regardless of the conditions in the first season, if season 2 was either wet or average and carryover water was used, there would be a net cost incurred to carry over water. In this situation, the farmer could have purchased temporary water when necessary in season 2 for less than the cost of purchasing water to carry over in season 1. Doing this would also reduce the farmer's exposure to the dam spilling, and also losing 5% of carryover water as seepage and evaporation.

Table 5. Long-run cost of water if no water was carried over, if water was carried over with restrictions (when temporary water price was less than $100/ML and end of season allocation greater than 50%), and if water was carried over every season.

Scenario	Cost of water ($)		
	Season 1	Season 2	Total
No carryover used	130,000	132,000	262,000
Carryover used - with restrictions	162,000	101,000	263,000
Carryover used - without restrictions	180,000	88,000	268,000

Table 6. Likelihood of occurrence and cost of water when water is carried over every year compared with not carrying over water for the case study farm.

Season 1	Decision	Season 2	Cost of water (2 years ($)	Probability (%)	Benefit/cost of buying carryover water ($)
Wet	Carryover	Wet	172,000	10	-9,000
		Average	209,000	17	0
		Dry	331,000	3	20,000
Average	Carryover	Wet	222,000	14	-9,000
		Average	265,000	25	0
		Dry	399,000	4	20,000
Dry	Carryover	Wet	366,000	0	0
		Average	439,000	0	0
		Dry	630,000	0	0

What if the proportion of high and low reliability water shares owned was different?

The impact of owning different proportions of HRWS and LRWS when carrying over water from year to year was tested using scenarios where it was assumed the farmer owned either all HRWS, or all LRWS. Similarly to the initial analysis, carryover water was purchased when the price of water was less than $100/ML and end of season allocated greater than 50% HRWS. The farmer carried over 25% of annual water requirements to meet the needs of the first three irrigations of the following season.

Compared with the base system, where 979 ML of HRWS and 448 ML of LRWS were held, the total cost of water over two years was less when only HRWS was owned (Table 7). This decrease was primarily due to the likelihood of receiving more allocation, which reduced exposure to the temporary water market, therefore, holding a larger proportion of HRWS reduced the overall cost of water over two years.

Over the long-term, carrying over water when owning only HRWS, was $17,000 more expensive than not using carryover water (Table 7). The relatively reliable nature of HRWS reduces the benefit of using carryover water. In addition, in a high allocation year and when only HRWS is owned, any carryover water is likely to end up being held in the spillable water account and potentially lost in years where the dam spills.

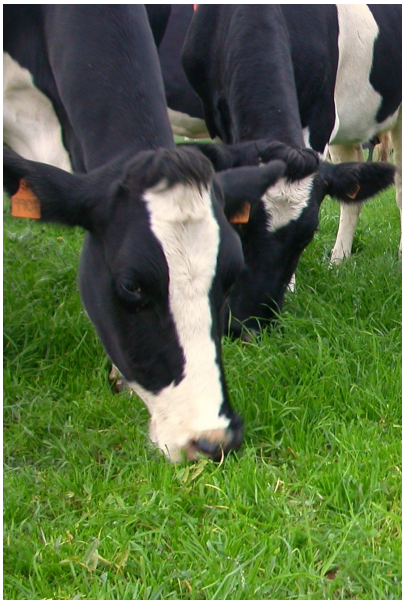

Table 7. Long-run cost of water when only high or low reliability water share was held compared with the base farm.

	HRWS (ML)	LRWS (ML)	Cost of water ($)		
			Season 1	Season 2	Total
No carryover	1500	0	102,000	103,000	205,000
Carryover	1500	0	131,000	91,000	222,000
No carryover	0	1500	222,000	226,000	447,000
Carryover	0	1500	220,000	178,000	398,000
No carryover	979	448	130,000	132,000	262,000
Carryover	979	448	162,000	101,000	263,000

If the farmer held 1500 ML of LRWS and no HRWS, the total cost of water over two years was greater than for the base farm that had both HRWS and LRWS (Table 7). The increased cost was associated with the need to purchase most of the water required each year from the temporary market, as an allocation of LRWS was only expected in about 33 years in 100. When carryover was used in a system that held only LRWS, the long-run the cost of water over two years was $49,000 less compared to when no carryover water was used, as exposure to the temporary water market in season 2 was reduced.

Key points

- For the farm examined, there was little difference in the cost of water over a two-year period between using carryover water and not using carryover water. However, for individual seasons, there were differences.
- When there were no conditions applied to when carryover would be used, the cost of water over the two seasons was greater than if no carryover water was used, or if restrictions (less than $100/ML for purchasing carryover water and end of season allocation greater than 50% HRWS) were applied.
- Under the assumptions used in the analysis, the impact of holding different proportions of HRWS and LRWS was greater on the long-run cost of water over two years compared with the decision to use carryover water or not. The analysis carried out ignored the change in capital required to hold different volumes of HRWS and LRWS, or the benefits of using carryover to ensure water is available at the start of the irrigation season.

References

Department of Sustainability and Environment 2008, Northern Region Sustainable Water Strategy Discussion Paper, Department of Sustainability and Environment, Victoria.

Further information

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Dairy Australia
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Funded by Dairy Australia and your dairy service levy
Murray DAIRY
Australian Government
Department of Agriculture, Fisheries and Forestry
The University of Melbourne Australia

Published by the Department of Environment and Primary Industries, **February 2014**

ISSN; 2201-4764
ISBN: 978-1-74326-752-1 (online)