When Do I Sow

Phone Seminar Notes – Feb 5th, 2009
by Tom Farran (DPI Kyabram)

Key Factors

When deciding when is the best time to sow or irrigate up pasture/crops several key factors need to be considered:

1) Temperature - Will the pasture/crop successfully germinate and what will the growth be like?
2) Moisture – How much irrigation water do I have? When will it rain? What is the risk of a false break? How efficiently will it use the water at that time of the year?
3) Species chosen – What temperature requirements does it have? What is its growth habit?
4) When is the feed needed?

Other key elements to ensure a successful pasture/crop include:

- Good seedbed and seed to soil contact
- High establishment density
- Good soil fertility
- Minimal effect of pests and diseases.

The success of these is determined by the level of time and preparation that goes into each.

All of these decisions are easy in hindsight – but we do not have this benefit. As the farm manager you need to interpret the information and make decisions based on how YOU think the seasonal conditions will unfold.

Temperature effects on germination

High temperatures limit the germination of many crops and pastures even if soil water is available.

Clovers

For annual clovers such as subterranean, balansa and berseem, the proportion of seeds that will germinate is greatly reduced at soil surface temperatures above 25°C.

The germination of the Persian clover cultivar “Maral” (also known as shaftal clover) is not affected by soil surface temperatures up to 35°C.

The germination of other Persian clover cultivars at high temperatures is between that of subterranean and “Maral” Persian clover.

Ryegrass

The germination of ryegrass is also reduced at high soil surface temperatures over 25°C. This limits the likelihood of successful ryegrass establishment from early starts.

Cereals

Germination of oats is normally satisfactory within a surface soil temperature range of 10°C to 25°C.

Some varieties can germinate at higher soil surface temperatures, but no varieties will germinate at 35°C.

In general, maximum soil surface temperatures need to be a couple of degrees lower for germination of wheat’s and barley’s.

If soil temperatures are above 20°C the coleoptile (first shoot) will normally be shorter so if adequate soil moisture is present it is best to sow cereals shallower 4-5cm to allow them to establish successfully. It still needs to be sown deep enough to ensure the seed has access to enough moisture.

An indication of maximum daily soil temperature can be determined by placing a thermometer at the planting depth from mid to late afternoon.

Cold temperatures

The cooler the temperature gets the slower the germination and growth of plants.

As the season progresses and day length and temperature declines it may be better to select plant species that are more suited to those conditions e.g. winter cereals, annual ryegrasses.

Water

When sowing dry without the assistance of irrigation, false breaks or small rain events need to be taken into account. They can germinate the seed but then without follow up rain or irrigation the seedling can run out of moisture.

Historical Data on 'the Break'

Table 1 looks at 121 years of rainfall data in Kyabram and identifies, for each month, the percentage of true versus false breaks. For example, 16% of the historical records show a germination event occurring in January. However, all of these events were a false break, with none of them providing adequate soil moisture to maintain plant growth after germination. In contrast, a true break occurred in May 38% of the years with only 7% of the years producing a false break.

Table 1. Rainfall (1886-2007) at Kyabram that may result in germination (% years)

Month	False break	True break*	Cumulative true break
January	16	0	0
February	18	1	1
March	18	7	8
April	8	22	30
May	7	38	68
June	2	24	92
July	1	6	98

*True break - defined as adequate soil moisture following germination to maintain plant growth for a minimum of three months. Data from Kevin Kelly (DPI Kyabram)

The table tells us that the later we push into autumn, the better the chance that a rainfall event will be a true break. It is very risky to sow without any irrigation before late April due to the increased chance of a false break.

Water use

The quantity of water required largely depends on the number of irrigations required in autumn and spring. Climatic conditions (amount and distribution of rainfall and evaporation), soil type and depth of water table will also influence water requirements.

The typical number of irrigations required for annual pastures and forages in autumn are:

- Early February start-up, 7 irrigations
- March start-up, 4 irrigations
- Early April start-up, 2 irrigations.

The number of required irrigations can be 1 or 2 lower in a wet year and 1 or 2 higher in a dry year with high evaporation rates.

The amount of water applied at the first irrigation in autumn on annual pastures or forages is typically 1–3 ML/ha. Subsequent irrigations typically require 0.5 ML/ha, depending on your soil type or irrigation layout.

Water use varies greatly from farm to farm and from paddock to paddock. Recording your own water use will help greatly in the future to plan your irrigation strategies

Cereals can be started up in March if the temperature has cooled down enough (refer to temperature requirement section) and provided a suitable variety has been chosen. Cereals will survive better than ryegrass and clover if irrigation frequencies are spread out due to better drought tolerance.

Spreading out the irrigation frequencies is normally used with cereals due to their dislike for wet feet and also in the warmer temperatures (over about a maximum temperature of 25^{o}C) irrigating a cereal crop which hasn't developed a canopy yet that is capable of shading the water can result in cooking the plants. Spreading out irrigations does not mean that you will necessarily use less water, because the next watering you do will use more water.

The benefit of cereals ability to survive better if irrigation frequency is spread out is that if you run out of irrigation water it is more likely to survive until rainfall does come, within reason. However, if you do not have enough irrigation water to irrigate the crop through until you could reliably expect rainfall, delaying sowing is a safer strategy to avoid the risk of losing the crop or stressing it to the point that it will struggle to recover properly.

The farmers who have been starting up cereals early have mostly found that;

- early March start-up uses 2-3 irrigations
- Mid to late March start-up uses 1-2 irrigations
- April start-up uses 1.

It is risky to water cereals too late (past late April) because they are susceptible to water logging and will typically suffer far more than a ryegrass or clover will.

Stretching out irrigation frequencies will mean that each irrigation uses more water than more frequent irrigations, often saving little or no water. If irrigations are stretched to the point that the cereal plants are placed under considerable stress this can cause poor water use efficiency.

Quick Tip: The typical number of irrigations required for **annual pastures** and forages in **spring** are:

- August requires an irrigation in 25% of years
- Late September finish, 1 irrigation
- Late October finish, 2 irrigations
- Late November finish, 4 irrigations.

The number of required irrigations can be 1 or 2 lower in a wet year and up to 2 or 3 higher in a dry year with high evaporation rates. The first irrigation in spring following a dry winter may require up to 1.0 ML/ha and normally about 0.5 ML/ha for subsequent irrigations.

Autumn Yields

The time of establishment affects autumn-winter Dry Matter (DM) production.

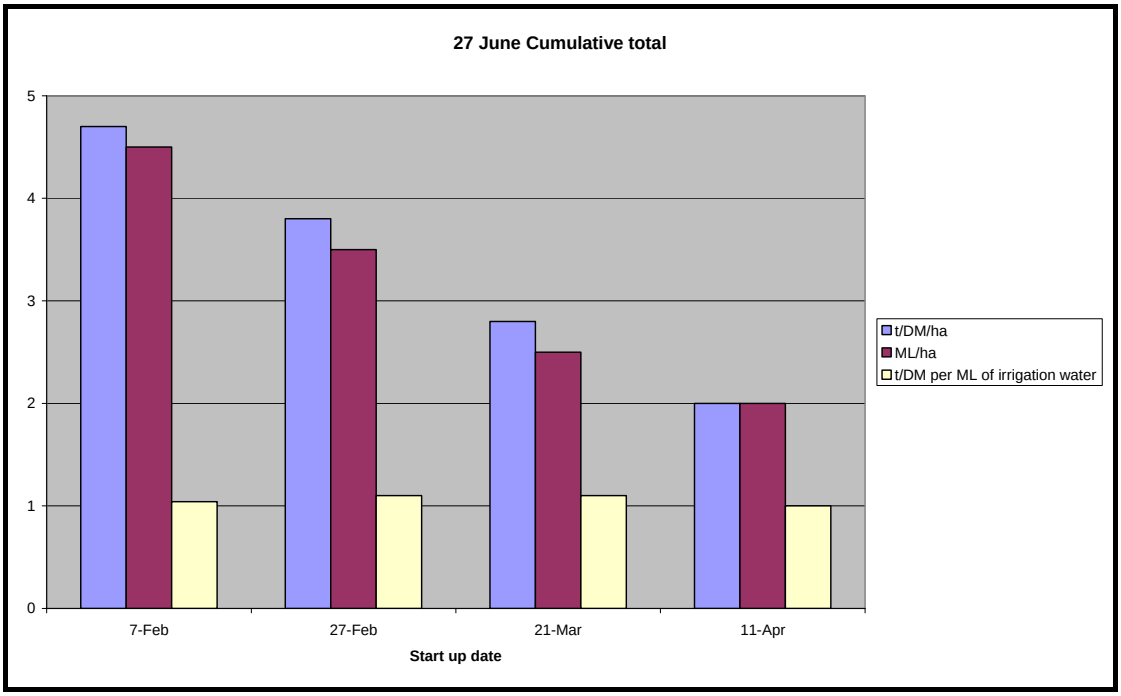
For every month that irrigation start-up is delayed after early February, the potential autumn-winter DM production from annual pastures declines by 0.5 to 1.5 t DM/ha, with a decline of 0.9 t DM/ha being typical.

Starting up early in February or early March has a high risk of poorer responses or complete failure if hot weather is experienced.

The DM production from annual clover species is similar up to late June (given similar starting times), averaging 4.7 t DM/ha for an early February start-up, 3.8 t DM/ha for a late February start-up and 2.8 t DM/ha for a late March start-up.

With annual clover species a late ***autumn*** start-up time has little effect on DM production in spring. However by sowing some varieties earlier than recommended it can cause them to flower earlier in the spring. Flowering earlier normally reduces the amount that they will grow during the spring. This can also reduce the total amount grown for the year despite growing more in the autumn.

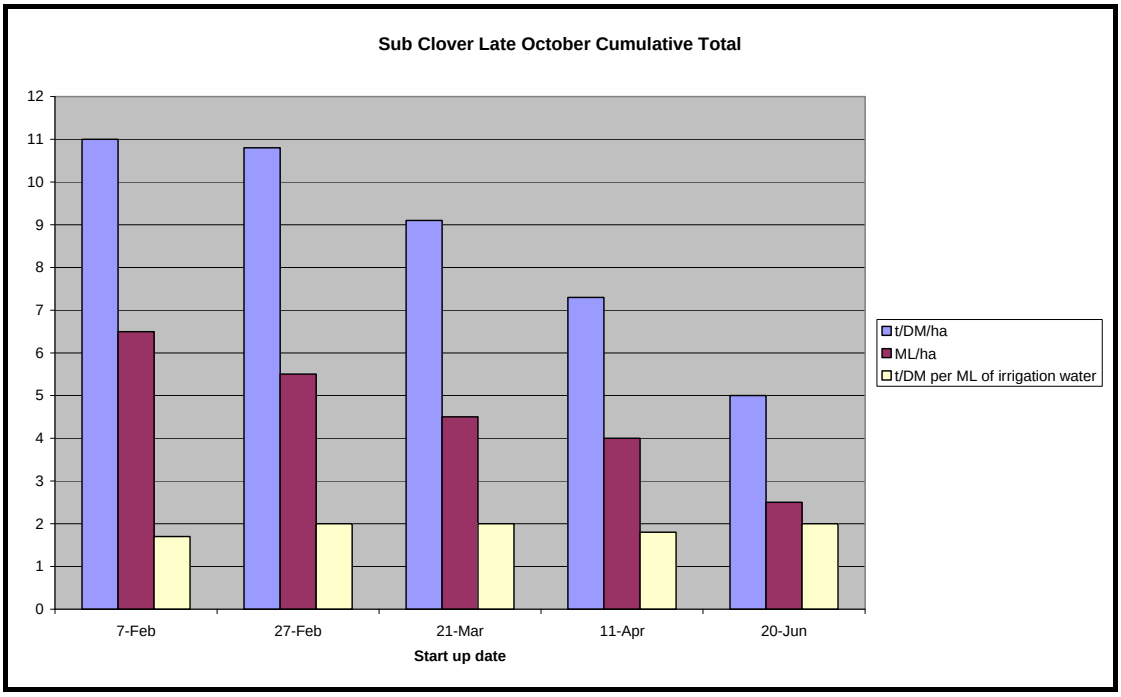
The following graphs show how yield, water use and water use efficiencies are affected by varying autumn start ups. The numbers can vary a lot from season to season. The following data is based on averages and shows trends that might be observed during 'typical' seasons. However, hot, dry, cool or wetter than typical seasons will show up different trends, with hot and dry seasons favouring the later start-ups, while cooler, wetter autumns favouring earlier start-ups in terms of water use efficiencies. Over recent seasons higher water use has often been observed.



Graph 1: This graph shows DM grown to 27th June with different start-up dates and the associated water used and the water use efficiencies.

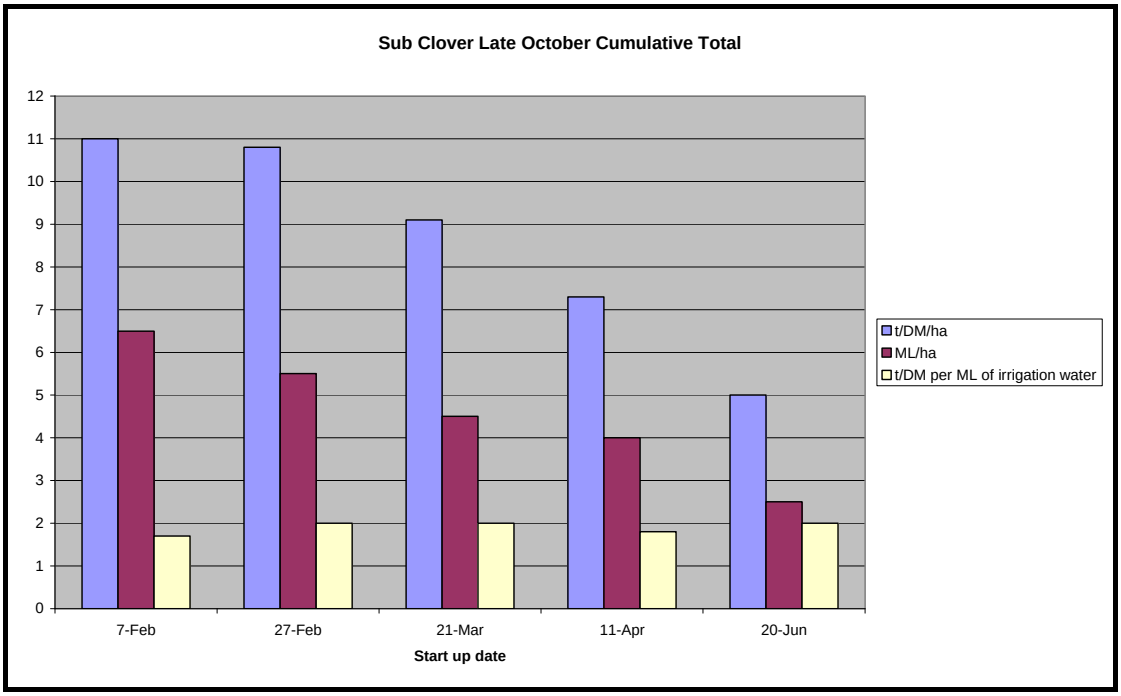
This graph shows that yield during autumn/early winter are greatly reduced by starting up later, while water use more than doubles by starting up in early February rather than waiting until mid April. In this data the water use efficiencies are similar between all the start-up times. An earlier

start-up is a much riskier strategy due to the fact that if it gets hot, you may get a poor germination. In addition, you are likely to use more water while possibly getting poorer growth. Another factor affecting water use efficiency is that the first irrigation normally uses about 3 times as much water as the subsequent irrigations e.g. to water one hectare once uses typically about 1.5ML in total, to water twice uses typically 2ML in total.



Graph 2: This graph shows DM grown by sub clover until the end of October with different start-up dates and the associated water used and the water use efficiency. The 20th June start-up was sown with out irrigation but was irrigated the same as the others during spring.

This graph shows how start up times can impact on the full season in sub clover pastures. Starting up annuals early will generally cause them to flower earlier at the other end of the season. This will mean that quite often the annuals growth rates will slow down even though it is at a peak growth time of the year (October), and this is the reason for the 7 February yielding similar to the 27th February. The water use efficiency is lower as a comparison to the others for the February 7th due to the poorer spring performance due to the earlier flowering.



Graph 3: This graph shows DM grown by shaftal until December with different start-up dates and the associated water used and the water use efficiency. The 20th June start-up was sown with out irrigation but was irrigated the same as the others during spring.

The reason for the 7 February yielding less than the 27th February is because the shaftal will have started to flower earlier in the spring due to the earlier start-up meaning that it growth slowed during a peak growth period. This data set also shows that the optimum use of irrigation water over the full season was achieved by waiting until the after mid March to begin irrigating. Similar water use efficiency of irrigation water was achieved by all start-ups after mid March.

There hasn't been much research carried out in the NIR on the performance of cereals from early start-ups. Farmers and agronomists that have tried irrigating cereals up in late February or early March have indicated that the cereals seem to grow as well as annual pastures or a little bit worse over the autumn period, but then grow much better than the annual pastures over the winter period. Many of these farmers have learnt the hard way that if you are going to start a cereal up earlier than mid April it is critical that you choose a very late maturing variety. Even better in many cases is a cereal with a "winter" habit, an example is Mackellar wheat. Some farmers that have started up early maturing cereals in early March have found that they have come out in head by May and produce very little quality feed and have needed to re-sow something else.

Time to first grazing

The amount of time that is needed from when a pasture or crop is sown or first irrigated (this includes rainfall) and when it can be grazed varies greatly. Both the species and varieties chosen affect this with some being faster to establish or not needing to be as well established at first grazing. Day length and temperature also affect how quickly a pasture or crop can get to a stage that is ready to be grazed. Longer days or warmer weather encourages quicker growth and increases leaf appearance rates in many plants.

If sowing in early March it is reasonable to expect that you may be able to start grazing in 6-8 weeks for most crop and pasture types. If not sowing until early June it is probably more likely that you will be waiting 8-12 weeks for your first grazing.

It is important to make sure that all plants are firmly anchored into the ground prior to grazing by doing the "pluck test".

Appropriate grazing management can make a huge difference to the amount that your crop or pasture will grow. Normally the first grazing is the most critical to get right in terms of setting up your pastures or crops to grow the most possible.

Scenarios

Available research data was used to look at a range of scenarios to try and find the optimum use for a set amount of irrigation water on a set amount of land. It was assumed that any area that had not been irrigated would be sown to a cereal and would contribute some feed. Some interesting results were that there was very little difference in the amount of DM grown up until the 15th August as long as irrigation was delayed until after mid March. Using lots of combinations of watering small areas up to 3 times or large areas just the once and many combinations in-between, the biggest difference achieved was 5%, which is a lot smaller than the variance in seasonal conditions or growth. In the scenarios no examples before mid March were done. Refer to Appendix 1 for assumptions used and examples. From this limited case study the following conclusions were found;

- There is very little difference in the total amount grown by using different start-ups times (after mid March).
- Using a range of start-up times will spread the risk associated with climate conditions.
- Using different start-ups can help to avoid large amounts of feed being ready to graze all at once.
- Warm and dry conditions will favour holding off a bit and starting-up a larger area later while a cool and/or damp autumn will favour starting up earlier. Unless you can predict the upcoming weather, using a range of start up dates will spread the risk.
- If quality feed is required early then starting up early can make good sense as long as the cost of the water to grow this feed doesn't outweigh the amount you could purchase feed of similar quality for.

Dry sowing or Waiting for the Break?

There are many pro's and con's for either sowing a pasture or crop into dry soil and waiting for the rain or waiting for the soil to be moist from rain and then sowing.

Sowing into dry soil is most common when the break arrives later than desired. This means that the day length will be getting shorter and soil temperature is also dropping and getting the crop or pasture up and growing becomes the highest priority. This situation also normally means that farmers with large areas to sow need to get started so that they are finished before it gets too cold. Having the seed in the soil, sitting and waiting for the rain means that it will be up and growing far quicker than if the seed wasn't sown until after moisture arrives.

One of the downsides to sowing dry is that the seed could be subject to a false break. This is where there is enough rainfall to allow the seed to germinate, but not enough to sustain it. The further into the season it gets, the less likely this is to happen. Many farmers use Anzac day as guide to when they will begin to dry sow cereal crops if the breaking rains haven't arrived (which is the case in about 70% of years).

Another technique used if the risk of a false break is high, is to sow the seed deeper. This is not possible with some species with small seeds (e.g. ryegrass and clover). Sowing deeper means that it takes a larger rainfall event for the moisture to get down to germinate the seed. The larger rainfall event is more likely to be sufficient to sustain the developing plant. This is a bit of a trade off because the deeper you sow, the longer it takes for the plants to emerge which takes away some of the advantage of dry sowing.

Generally the larger seed sized plants (like cereals) are more suited to dry sowing because they can be sown deeper and are also a bit more resistant to false breaks. This doesn't mean that small seeded plants like ryegrass and clovers can't be sown dry but it is just more risky. This option becomes more viable the later into the season it gets (e.g. May).

Weeds can pose another problem with dry sowing. Trying to control weeds once the crop/pasture has germinated is normally much more expensive, less effective and can be damaging to the crop/pasture. Weeds can also cause crop/pasture establishment problems as some weeds will germinate faster and can choke the new crop/pasture (e.g. capeweed). Waiting for the break, and then giving the weeds a chance to germinate before spraying and then sowing, allows the use of the often cheaper and more effective knockdown herbicides (e.g. glyphosate). In the longer term, in can often be better to forgo the early growth of a crop/pasture and wait for the break in paddocks that have a history of weeds in them that are likely to be hard to control within the crop/pasture once it has germinated.

Tom's Top 10 Tips

1) High temperatures limit the germination of many crops and pastures even if soil water is available.

2) A high establishment density (good germination) is critical to have a productive crop/pasture.

3) Just because it is cool in one month doesn't mean it will stay cool in the next. This lesson was learnt by many farmers last season after the cool February. There were many complete failures of late February/early March sown pastures and higher water use and poor growth of many others after temperatures rose again in March.

4) Water use varies greatly from farm to farm and from paddock to paddock. Recording your own water use will help greatly in the future for water budgeting and to plan your irrigation strategies.

5) Warm and dry conditions will favour holding off a bit and starting-up a larger area later while a cool and/or damp autumn will favour starting up earlier.

6) **Using a range of start-up times will spread the risk associated with climate conditions.**

7) It is risky to water cereals too late (past late April) because they are susceptible to water logging and will typically suffer far more than a ryegrass or clover will.

8) For every month irrigation is delayed in autumn, typically 0.9t/ha less will be grown (up until the end of June).

9) The later we push into autumn, the better the chance that a rainfall event will be a true break. It is risky to sow without any irrigation before late April due to the increased chance of a false break.

10) Starting up some species (e.g. annual clovers and 'spring' cereals) earlier than recommend will result in them flowering earlier. This will mean they will grow less DM for the season also often resulting in poorer water use efficiency over the full season.

PUBLISHED BY: DEPARTMENT OF PRIMARY INDUSTRIES
FARM SERVICES VICTORIA
KYABRAM, VICTORIA, AUSTRALIA
FEBRUARY 2009

Valuing temporary water for autumn sowing

Water is worth a different amount to each farmer. Its value depends on the amount of feed you can grow with it and the value of that feed. The following information looks at one process for valuing temporary water for use in autumn start-up.

The value of the water on any individual farm will depend on:

1) Amount of irrigation water used
2) Amount of extra feed grown and consumed from autumn irrigations
3) The value of the extra feed grown

1. Amount of irrigation water used

How much irrigation water will you use to start up your pasture or crops or to get one or two extra irrigations? This will depend on soil types, moisture profile of the soil and when you decide to start up. The typical number of irrigations required for annual pastures and forages in autumn are:

- Early February start-up, 7 irrigations
- March start-up, 4 irrigations
- Early April start-up, 2 irrigations.

The number of required irrigations can be 1 or 2 lower in a wet year and 1 or 2 higher in a dry year with high evaporation rates.

The amount of water applied at the first irrigation in autumn on annual pastures or forages is typically 1–3 ML/ha (keeping good irrigation records will help to determine the exact amount for your farm). Subsequent irrigations typically require 0.5 ML/ha or more, depending on your soil type or irrigation layout.

2. Amount of extra feed grown and consumed from water purchased

How much extra feed will be grown from the water that you purchase (versus starting up one fortnight or one month later or waiting for the autumn break to sow)?

For every month earlier that pastures are irrigated up, there is potential to increase autumn-winter DM production from 0.5 to 1.5 t DM/ha, with an increase of 0.9 t DM/ha being typical. This increase is seen up until early February or when temperatures are too high for good germination. Extra feed grown will depend on pasture density, good weed and pest control and climatic conditions.

Good grazing management is then required to ensure as much as possible goes down the cow's throat. A farm that consumes only 7 t DM of pasture per hectare per year will not get the same value out of water as a farm that consumes 11 t DM per hectare per year.

3. The value of the extra feed grown

What is the value of the extra feed you have grown? Or in other words, what would it cost you to buy a tonne of feed of the same quality to feed your cows?

What is the quality of the pasture or crop you will grow? What is happening on the hay and grain markets? Also think about potential wastage and feed-out costs of bought in feeds and always compare feeds on a dry matter basis.

Calculating a value:

Amount of purchased water used	_____ ML	(A)
Amount of extra feed grown & consumed from water purchased	_____ t DM	(B)
Tonnes DM ÷ ML used (B ÷ A)	_____ t DM/ML	(C)
Value of purchased feed of equal quality	_____ $/t DM	(D)
t DM/ML x $/t DM (C x D)	_____ $/ML	(E)

This last number (E) gives you a rough idea of how much you could pay for temporary water versus buying in equivalent quality feed to feed your cows. The estimate for any individual farmer will vary according to their personal feeling about risk. Some margin for risk should always be included in any analysis. This is the risk that the figures you use don't eventuate, i.e. you use more water on your first irrigation than expected or don't get the growth rates you counted on.

An example:

Amount of irrigation water used	(two irrigations) 1.5 + .5 = 2 ML	(A)
Amount of extra feed grown & consumed from water purchased	1.5 t DM	(B)
Tonnes DM ÷ ML used (B ÷ A)	1.5 ÷ 2 = 0.75 t DM/ML	(C)
Value of purchased feed of equal quality	$350/t DM	(D)
t DM/ML x $/t DM (C x D)	0.75 x 350 = $263/ML	(E)

Every farm will have a different price they are willing to pay but the process above shows one way to work through the calculations. As with many decisions, the right answer will only be known with hindsight.

If you would like help working through this process for your farm call a DPI dairy extension officer at Kyabram (03) 5852 0529, Echuca (03) 5482 1922, Cobram (03) 5871 0600 or Wodonga (02) 6043 7900.

Appendix 1: Possible DM grown until 15th August on annual pastures irrigated and cereals not irrigated.

100ha 125ML

	Ha	Amount of irrigations	tDM
Option 1	25	3	125
	41	1	140
	44	0	66
total	100	125ml	**331**
Option 2	83	1	282
	17	0	25.5
total	100	125ml	**308**
Option 3	50	3	250
	50	0	75
total	100	125ml	**325**
Option 4	62.5	2	256
	37.5	0	56
total	100	125ml	**312**

100ha 75ML

	Ha	Amount of irrigations	tDM
Option 5	15	3	57
	25	1	85
	60	0	90
total	100	75ml	**250**
Option 6	30	3	150
	70	0	105
total	100	75ml	**255**
Option 7	50	1	170
	50	0	75
Total	100	75ml	**245**

Assumptions

Irrigation 1st watering uses 1.5ml/ha, every other uses 0.5ml/ha
3 irrigations late march, 2 irrigations mid April,
1 irrigations late April/ early may, dry mid to late may

Yields 3 irrigations =5t/Dm, 2 irrigations = 4.1t/dm,
1 irrigations = 3.4t/dm, 0 irrigations = 1.5t/dm (cereal).