Autumn Start-up

Autumn Start-up Shed Days
January & February 2016

- Cobram
- Dhurringile
- Shepparton
- Leitchville
- Nanneella
- Finley
- Calivil
- Stanhope
- Waaia
- Katamatite
- Bamawm
- Kyabram
- Tongala

Murray DAIRY | Dairy Australia
Your Levy at Work

AGRICULTURE VICTORIA

Lessons learnt from last time

- Tighten up your management – little things done well can make all the difference in a tight season.

- Complete budgets and feed plans – organise how and when to purchase water and feed

- Complete a water budget and only water up what you can water fully through to the break. When it rains you can increase the area under irrigation.

- Do not space out irrigation interval. This does not save water, it reduces growth and costs more as plants will not grow when water stressed.

- Stick to what you are familiar with in crop selection. Trying something new in a challenging year makes it difficult to achieve really good results. If you are going to try new crops, seek expert advice for proper crop management.

- Ryegrass can be forgiving if we get our management practices wrong.

- Ryegrass out-performs cereals when we have irrigation.

- Overgrazing cereals reduces yield substantially. The rules for grazing cereals are different to those for grazing ryegrass. For cereals, put the cows in when the crop has reached gumboot height and pull them out when it has been grazed down to work boot height.

- If you plan to cut hay or silage, choose a suitable variety and check the sowing window and maturity patterns. You need to be sure that you will be able to make good quality conserved feed. Will you be able to get onto the paddocks when the crop matures? Will weather conditions be suitable for curing?

- A feed test and weigh docket is a **must** for all feeds that come onto the property. You cannot afford to buy air or a product that is not fit for the purpose that it was purchased for.

- Sell any cow that is not performing, but make sure that your herd is large enough to re-establish production next season. Do not over cull and affect your recovery.

- Balance your cows' diet - a balanced diet will provide better feed utilisation. Maintaining body condition through the dry times allows for better recovery when conditions improve.

- Don't forget your young stock, they are your future replacements.

Historical Data on 'the Break'

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.

Figure 2 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.

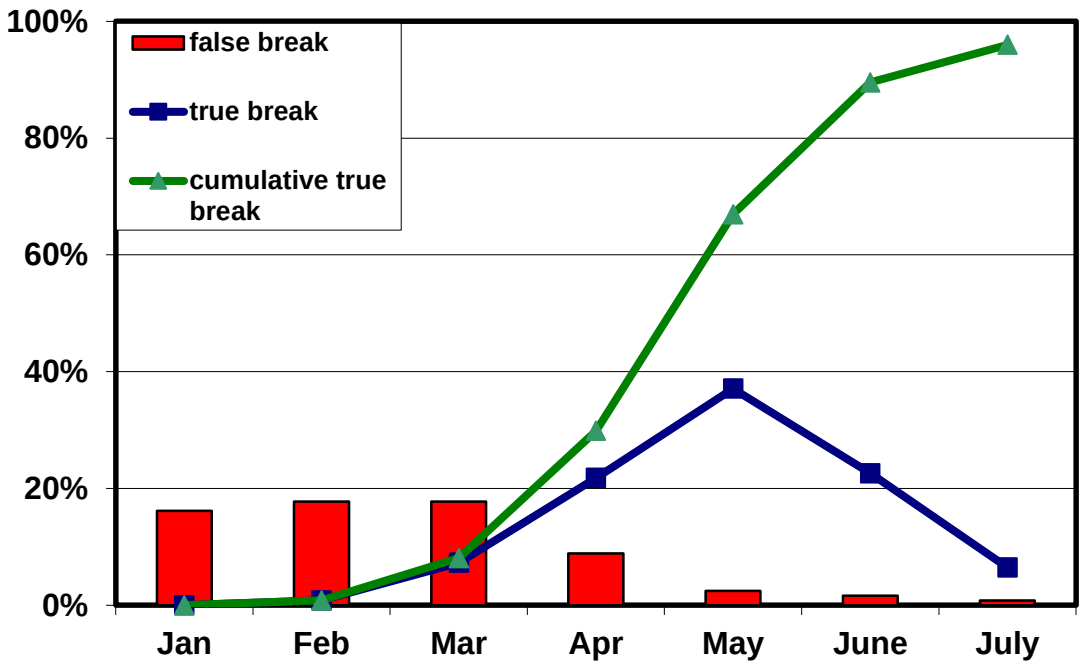

Figure 2. Rainfall (1886-2007) at Kyabram that may result in germination (% years)

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

Figure 2 shows 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.

Irrigating for the Autumn start-up

Pat Bloye, Dairy Extension Officer, DEDJTR Tatura

Autumn water use

The total amount of water required in autumn is dependent on:

- Frequency and volume of irrigations per given area, influenced by;
    - Soil type
    - Climatic variability (rainfall, temperature and evaporation)
    - Type of forage sown – pasture, cereal, brassica
- Total irrigated area

The number of irrigations and amount of water required will vary based on start-up times. Typically;

- Early February start-up, 7 irrigations (4-6 ML/ha)
- March start-up, 4 irrigations (2.5-4.5 ML/ha)
- Early April start-up, 2 irrigations (1.5-3.5 ML/ha)

The amount of water applied during the first irrigation is generally between 1-3 ML/ha. You would assume that in drier years, with no summer irrigation and minimal rainfall that the soil profile would be quite dry. Hence, a higher rate of water will need to be applied in the first irrigation. Subsequent irrigations will typically use 0.5 ML/ha (depending on soil type and irrigation system). A hot start to autumn (high evaporation) can lead to an extra 1-2 required irrigations for early sown pastures.

Importantly, the timing between the first two irrigations needs to be no longer than 4-6 days - do not stretch out the first irrigation. Longer irrigation intervals at this critical time (autumn start-up) does NOT save water. It stresses the plant seedling, negatively affecting germination and generating a poorer water-use efficiency.

Developing a water budget

While determining the amount of water needed for the autumn start-up is paramount for pasture establishment success, it only tells half the story. How much water do you actually have or have access to? Completing a water budget for the remainder of the season (based on what you plan to sow, and when) will minimise the likelihood of running out of water. It would be unwise to rely on the autumn break for early pasture establishment. Use your knowledge and prior experiences to advantage.

For lucerne, water use can vary more so than for pasture as it will be able to *survive* on less water than perennial pastures. However starving it of water will result in greatly reduced yields. Water use for highly productive lucerne will be similar to pasture.

Annual farm water budget

Water Needed For Rest of Season						
Perennial Pasture	ha	x	ML/ha	=	ML	
Annuals:						
September finish	ha	x	ML/ha	=	ML	
October finish	ha	x	ML/ha	=	ML	.
November finish	ha	x	ML/ha	=	ML	.
February start	ha	x	ML/ha	=	ML	
March start	ha	x	ML/ha	=	ML	
April start	ha	x	ML/ha	=	ML	
Other:						
Lucerne	ha	x	ML/ha	=	ML	
Summer crop	ha	x	ML/ha	=	ML	
Carryover*					ML	Volume planned to be carried over in to next season.
			Water Needed		**ML**	**A**
Water Available						
Allocation	High Reliability (ML)	x	Allocation %	=	ML	e.g. 100ML High Reliability x 100% allocation = 100ML
	Low Reliability (ML)	x	Allocation %	=	ML	e.g. 100ML Low Reliability x 0% = 0ML
Carry over – * 1st July, after 5% deductn	Amount of carry over (ML)**	-	Spill (ML)**	=	ML**	e.g. 100ML carry over – 5ML spill = 95ML
Water from bore	Water licence (ML)	x	Allocation %	=	ML	e.g. 100ML water licence x 70% allocation = 70ML
Water from spear points					ML	
Water from other. e.g. diversion water					ML	
Purchase of water allocation					ML	
			Water available		**ML**	**B**
Water Unavailable						
Water already used					ML	
Water sold					ML	
Other e.g. Transfers					ML	
			Water unavailable		**ML**	**C**
Total Water Available	Water available (B)	-	Water unavailable (C)	=	**ML**	**D**
Water Surplus/Deficit	Total water available (D)	-	Total Water Needed (A)	=	**ML**	

* Beware that carry over water exceeding your entitlement volume may be held in a Spillable Water Account and will not be released for use until GMW makes a declaration of a low risk of spill.

** Refer to your 'Water Usage Report' on 'WaterLINE Online' (*https://waterline.g-mwater.com.au/)* or contact GMW to obtain your carryover and spill volumes.

Be mindful of your Annual Usage Limit (AUL) and Annual Delivery Allowance (ADA). These can also be found on your 'Water Usage Report' on 'WaterLINE'.

*See also; *Murray Dairy Feed and Water Budget Tool*

A tip for water budgeting; be conservative with figures – anything better is a bonus!

Autumn yields and water use

For every month after February that the autumn start-up is delayed, a typical decline in annual pasture production ranges from 0.5-1.5 t DM/ha. However, early start-ups also pose the risk of poorer germination and reduced early growth, due to hotter temperatures.

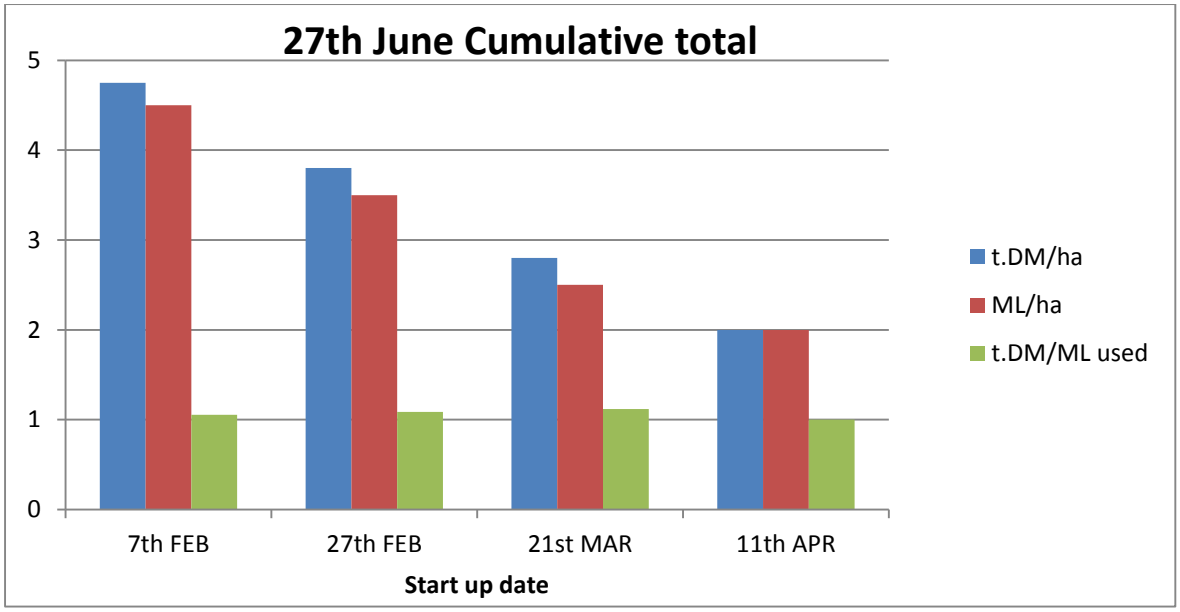

Figure 1. Sub Clover cumulative growth water use and water use efficiency to 27th June.

Figure 1 is based on subterranean clover (annual species). Note that perennial pastures would not tolerate hot temperatures at germination as well as sub clover would. Howeer, the overall trend would be similar. Water use efficiencies are similar across varying start-up times, a very early start-up (7th Feb) is quite risky given the chance of hot temperatures to occur throughout February and into March. Hot temperatures would impact germination and consequently reduce water use efficiency.

Pending water availability (based on your water budget), an option may be to stagger the sowing times. This strategy can minimise the risk associated with early start-ups.

Key message: do not plan to sow based on calendar dates. Plan to sow based on temperatures and water availability;

- Air temperature is the main driver for timing of autumn sowing. Ryegrass is suitable for sowing when average daily temperature is less than 25°C for a 7-10 day period
- For most cereals it is suitable to sow when average daily temperatures are less than 20°C for a 7-10 day period
- Hot temperatures mixed with exposed water (prior to any plant canopy build up) on freshly germinated plants is a recipe for failure

Keep in mind that the first irrigation uses 3-4 times more water than subsequent irrigations. Assume this year that the first irrigation would require 1-2 ML/ha, with subsequent irrigations using around 0.5 ML/ha. Remember to keep referring back to your water budget to ensure you have enough water to successfully germinate and establish a given area of pasture.

Total DM yields shown in Figure 1 declined approximately 1 t DM for every 3 week delay in sowing. Although autumn yield generally won't impact on spring yield, very early sown (early Feb) annual pastures may enter the reproductive phase earlier in spring compared to later sown pastures, compromising their overall annual yield. It is vital to get a high germination percentage, which is jeopardised by sowing in HOT conditions. Strongly consider the risk of sowing early against how highly you value the early feed.

What is the *value* of water and home grown feed to you?

Each farmer will *value* home grown feed differently, based on feed demand at various times of the year (dictated by calving period and stocking rate). Generally autumn and winter grazeable feed is of greater *value* given the 'cash cost' of replacement feeds. Given that the majority of farms will generate a surplus of grazeable feed in spring (and be conserved as fodder), a reduction in spring growth often results in a smaller surplus. This results in no upfront 'cash cost' to replace the reduction of feed.

Similarly, water is valued differently by each farmer. The value of water is driven by;

- Amount of water used
- Amount of extra feed grown and consumed
- The value of the extra feed grown

What is the *value* of temporary water for the autumn start up?

How much extra feed will be grown from the purchased water (compared to waiting a fortnight or until the autumn break)? Research showed that for every 3 weeks delay in sowing after 7th February, a typical decline in growth to the 27th June was 0.8-1 t DM/ha (see Figure 1). Pasture germination and establishment density will impact on total growth. Sticking to grazing guidelines of newly sown pastures is fundamental to high pasture consumption, and will ultimately increase the *value* of the water purchased.

The value of the extra feed grown is dictated by the replacement cost of equivalent quality feed, i.e. what would it cost you to purchase a high quality supplementary feed?

Table 1. Calculating the value of extra feed grown

Amount of purchased water	ML	(A)
Amount of extra feed grown & consumed from purchased water	t DM	(B)
t DM per ML used (B ÷ A)	t DM/ML	(C)
Purchase cost of equivalent quality feed	$/t DM	(D)
t DM/ML x $/t DM (C x D)	$/ML	(E)

In Table 1 the last calculation (E) provides an *estimated* figure for the amount you could pay for temporary water based on the forage response to water and replacement feed cost (as a *consumed* figure). Keep in mind that there should always be some margin for risk incorporated into your calculations, as it will be an 'estimated' figure for extra feed grown from purchased water. Remember to include a wastage factor and account for fodder moisture content when calculating the cost of equivalent quality replacement feed.

Unfortunately, the answer does not lie under a simple calculation, as there are many other non-quantifiable factors that will play a part in deciding whether to purchase feed or to spend the money to grow the early feed. What is the time period before being able to graze newly sown pastures? Do you have access to a suitable feeding area? Which options gives the greatest ease of overall feeding management? Do you have the ability to provide a balanced ration? etc. All of these factors significantly influence your decision. Speak with family, consultants, nutritionists, agronomist, other farmers etc. to make the most relevant decision for you.

Summary and tips for autumn water budgeting/water use…

- Water use will vary greatly between farms, and paddocks for that matter. Understanding <u>your</u> farm based on knowledge and experience is a huge advantage for developing a more accurate water budget
- For every three week delay in sowing in autumn, typically around 1 t DM/ha decline in yield up to late June
- Although very early sowing can increase autumn yield (if conditions are suitable), there is a large risk of significantly reduced germination due to conditions being too hot. Be aware that a cool February does not necessarily mean a cool March…
    - Sow once average daily temperatures are forecast to be below 25°C for a 7-10 day period
- Do a water budget. Know how much water you will have, and plan what you can do with it. Constantly review and adjust the budget as circumstances can change rapidly (i.e. perhaps a summer thunderstorm)
- If water is budgeted to be in short supply, consider staggering start-up times
- Put a *value* on your feed and water – when do you need the feed and how easy is it to manage?
- Stick to grazing management guidelines – getting a high pasture consumption ultimately reduces the cost per tonne
- If there is an option to purchase some more water on the temporary market for an early start-up versus buying in some equivalent quality fodder, do the sums (and don't forget to factor in wastage)
- **Do not plan to sow based on calendar dates - monitor soil temperatures and weather forecast and sow <u>when the time is right</u>**

Pasture Establishment of Ryegrass

Sarah Brown, Dairy Extension Officer, DEDJTR Tatura

To achieve a high pasture consumption there needs to be a dense, productive pasture. This starts at pasture establishment.

Plant densities

To achieve a dense, productive pasture aim for plant densities of 600 seedlings/m^2. Measure plant densities one week post emergence using a 40 cm x 40 cm square and count the number of ryegrass seedlings. A count of 100 seedlings per 40 cm x 40 cm square is equivalent to approximately 600 seedlings/m^2. This should be repeated at least 10 times per bay.

If pastures are below 600 seedlings/m^2 action may be required to increase plant densities. Pasture with counts lower than 80% will require more drastic action to perform at their best. Action may include:

- altering grazing allocation to avoid over grazing due to lower feed availability in the paddock,
- increased vigilance and action against weeds,
- over sowing or;
- spray out and resow if poor germination or a high portion of weeds

Selecting a variety

When selecting a variety to sow consider its purpose in your feedbase.

Annual Ryegrass: tends to be cheaper than Italian or perennial ryegrass varieties. In general they finish earlier in the spring as they tend to be earlier maturing, meaning they go to seed head earlier than Italians and perennials. Once a ryegrass tiller goes reproductive it dies. Annuals may be a preferable option if a paddock has been selected to go into a summer crop in the coming summer.

Italian Ryegrass: in comparison to annual ryegrass, Italian ryegrass provides the option of later season growth. Although more expensive, the longer season can allow an extra grazing or two if water options are available. Alternatively, if water is short then they may be finished earlier. Italians are often promoted as being able to last two seasons, though in our production systems they tend to be lower producing in the second year due to low plant densities after the reproductive phase and therefore are dried off.

Perennial Ryegrass: varieties have a range of heading dates. In dairy systems, mid to late maturity varieties tend to be used allowing for a longer period of higher quality feed production during the spring. Establishment of perennial ryegrass is slower than annual or Italian ryegrass. However, the establishment period in the following year is removed and can provide feed through the summer, provided they are watered adequately. The seed tends to be more expensive than annual or Italian ryegrass varieties.

If you decide to sow two or more varieties of ryegrass in a mix, make sure they have a similar heading date. During the seed head phase there is a significant decline in pasture quality. If you mix varieties with different heading dates (e.g. early maturing and a late maturing variety) there is a longer period of seed head production and subsequently lower quality feed.

When mixing species e.g. ryegrass and oats, there is competition between the species and compromises are made in the management of that pasture e.g. grazing management.

Soil temperature

The ideal soil temperature at sowing depth for ryegrass is between 15-25°C. While the best indicator of the ideal sowing time is soil temperature at sowing depth, the most practical indicator is when daily average air temperature is less than 25°C for a period of 7-10 days. Hot conditions in conjunction with irrigation during the germination/establishment period can reduce germination up to 90% due to scalding. If establishment is poor these paddocks will need to be resown. If nothing is done a weedy, unproductive pasture may result.

Sowing depth and soil seed contact

Good soil-seed contact and the correct sowing depth are essential. The sowing depth of seed is proportional to the seed size. A rule of thumb being sowing depth should be twice the length of the seed. Ryegrass seed should be sown at 1-2 cm. The seed should be surrounded by moist, firm and fine soil to maximise germination. If seed is sown too deep it will increase the time to emerge, or it may fail to emerge at all, resulting in poor plant densities. Low plant densities leave plenty of space (and moisture) for unproductive weeds to dominate the sward.

Soil moisture

New seedlings are more susceptible to moisture stress than established plants. Best management practices for irrigation and drainage need to be followed to minimise stress on new seedlings. A water budget should be completed (see Irrigating for the Autumn start-up section). If there is insufficient irrigation water to meet the farm's water requirements, sowing a smaller area, staggering sowing or delaying sowing to increase the probability of timely follow-up rainfall are options to assist managing water requirements and ensuring productivity.

Fertiliser

Newly sown pastures should have good fertility for seedlings to grow and thrive. Sowing with fertiliser such as superphosphate, superphosphate/urea, or DAP/MAP can assist seedling root development. Target soil test values for phosphorus, potassium and sulphur are in the Table 1.

Table 1. Soil test guidelines for 0-10 cm samples in relation to pasture performance goals.

Soil test guidelines for 0-10 cm samples in relation to pasture performance goals					
Dairy type system aiming for 95 - 98% potential yield at "Adequate" soil test result					
Pasture performance compared to potential	**<90%**	**90% - 95%**	**95% - 98%**	**98% - 99%**	**100%**
	Deficient - capital fertiliser required	Marginal – fertiliser required	Adequate – maintenance fertiliser required	High - Possible low fetiliser maintenance	Very High - no fertiliser required
	Olsen P (mg/kg)				
All soils	<9	9 - 14	14 - 20	20 - 27	>27
	Colwell P (mg/kg)				
PBI 0-15 (Very sandy)	<15	15 - 23	23 - 30	30 - 41	>41
PBI 15-35 (Sand, Sandy loams)	<17	17 - 26	26 - 34	34 - 47	>47
PBI 35-70 (Sandy/Silty loams)	<19	19 - 30	30 - 39	39 - 53	>53
PBI 70-140 (Sandy/Silty clay loams)	<22	22 - 35	35 - 45	45 - 61	>61
PBI 140-280 (Clay loams)	<26	26 - 42	42 - 54	54 - 74	>74
PBI 280-840 (Clay loams & Clay)	<37	37 - 58	58 - 75	75 - 102	>102
PBI >840 (Volcanic clays & Peat)	<50	50 - 90	90 - 120	120 - 150	>150
	Colwell K (mg/kg)				
Sand	<70	70 - 120	120 - 170	170 - 230	>230
Sandy/Silty loam	<80	80 - 130	130 - 190	190 - 250	>250
Sandy/Silty clay loam	<90	90 - 130	130 - 190	190 - 260	>260
Clay loam and Clay	<100	100 - 150	150 - 220	220 - 280	>280
	Exch K (meq/100g)				
Sand	<0.18	0.18 - 31	0.31 - 44	0.44 - 0.6	>0.6
Sandy/Silty loam	<0.2	0.2 - 0.33	0.33 - 0.49	0.49 - 0.64	>0.64
Sandy/Silty clay loam	<0.23	0.23 - 0.33	0.33 - 0.53	0.53 - 0.66	>0.66
Clay loam and Clay	<0.26	0.26 - 0.39	0.39 - 0.56	0.56 - 0.72	>0.72
	Sulfur (KCl-40) (mg/kg)				
All soils	<4.5	4.5 - 7.5	7.5 - 10.5	10.5 - 14	>14
	Sulfur (CPC S) (mg/kg)				
All soils	<1.5	1.5 - 3	3 - 4	4 - 6	>6

Direct drilling allows the seed and fertiliser to be located close to each other allowing the plant quick access to nutrients, compared to broadcasted fertiliser. Apply required follow up fertiliser blends (nitrogen, phosphorus, potassium and sulphur) based on soil tests prior to or soon after the first grazing. Completing a soil test will allow you to identify areas of the farm to target your fertiliser use to make the biggest return from your investment.

Be aware: fertilisers containing potassium, copper or large amounts of nitrogen (over 20 kg N/ha e.g. 100 kg/ha of DAP) may reduce germination rates if in contact with the seed.

Weed and pest control

Weed and pest control is a critical factor for successful establishment of pastures. Effective pre and post emergent control in paddocks with known weed issues will reduce the competition from weeds during establishment. Newly sown pastures should be monitored for pests such as crickets, red-legged earth mites and lucerne flea and sprayed as required.

Speak with your trusted agronomist regarding the most effective control methods of pests and weeds.

Grazing Management

First grazing management

The first grazing is crucial to get right, as it can set the pasture up for the remainder of the season. The pasture should be 10 cm high and at least at the 2 leaf stage. Before grazing check if the root system is developed enough by using the 'pluck test'. To complete a 'pluck test' take a tiller between your fingers and pull in a motion to mimic a hungry cow's bite. If it tears without pulling the plant out of the ground, it is ready to graze.

Graze pastures to a residual height of 4-6 cm. This will help promote tillering, minimise damage to the pasture and set the residual height for future grazings. On-off grazing should be used to help achieve residuals of 4-6 cm when grazing new pastures. This is achieved by taking the cows out of the paddock and placing them in a standoff area once the ideal residual is reached. If the cows are allowed to stay in the paddock they will continue to graze the pasture resulting in over grazing, leading to slower regrowth and increased risk of pasture damage.

Oversowing

The normal rotation does not need to be altered when oversowing. The new seedlings will establish amongst the existing pasture, as long as it is well managed. Leaving a longer regrowth period will result in shading of the seedlings, reducing survival rates.

For subsequent grazings, graze the pastures at the 2-3 leaf stage or canopy closure, whichever comes first, down to a residual of 4-6 cm to gain the best balance between quantity and quality.

As the season progresses and temperature and daylight hours decrease, the leaf appearance rate will decrease. It will take more time to reach the 2-3 leaf stage, so the grazing rotation should be lengthen accordingly. To prevent over grazing and achieve a residual of 4-6 cm more supplements in most situations will be required.

Summary/Tips

- To achieve a dense, productive pasture, aim for plant densities of 600 seedlings/m^2.
- The ideal soil temperature at sowing depth for ryegrass is below 25°C.
- Ryegrass seed should be sown at 1-2 cm depth.
- Closely monitor pests and weeds, taking action when required.
- Graze new pastures when they are at least 10 cm high, at / or past the 2 leaf stage and have passed the 'pluck test'.
- Leave a post grazing residual of 4-6 cm.
- Adjust rotation length as season progresses. Aim to get in and graze at the 2-3 leaf stage.

Ryegrass Check

Brett Davidson, Senior Dairy Extension Officer, DEDJTR Tatura
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Name:

Address:

Paddock ID:

Paddock History:

Last year:
2 years:
3 years:

Variety: **Seed Treatment:**

Sowing Date: **Sowing Rate:**

Sowing Depth:

Soil Temperature (measured at 9 am):

Paddock Preparation e.g. Land formed, cultivation, direct drilled, chemical fallow

Amount of Trash Cover:

Sowing Method: Disc / Tyne / Broadcast

Date Irrigation/Rainfall Event

Watering Times **Water on:** **Water off:**

Fertiliser date	Fertiliser Type	Application Rate
e.g. 2/3/16	DAP	120 kg/ha

Soil test date: Please attach results

Soil Type: sandy loam / loam / clay loam / heavy clay

Paddock Grade: <1:600 1:600 – 1:1000 >1:1000

Plant Emergence Date: **Soil Crusting:** Yes / No

Plant Density (1 week after emergence):

Pests: Mice / Ants / Crickets / Cockchafers / RLEM / Blue Oat Mite
Estimation of Damage:

Pluck Test of Pasture:

Date of First Grazing:

Leaf Stage at First Grazing:

Post Grazing Residual Height: **mm**

Other notes that may impact on establishment/yield loss: e.g. chemical treatments/pests/waterlogging

Bare Patches: Yes / No

Approximate area affected (%):

What is the cause? e.g. flood, pest

Use of Forage Cereals in the Dairying System

Paul Wallace, Dairy Extension Officer, DEDJTR Tatura

The term forage cereal simply refers to a cereal (e.g. oats, wheat, triticale, barley or rye corn) that is being grown and managed for forage production rather than grain production. Traditionally cereals have been grown to produce grain, with oats also being grown for hay. Cereals have been gaining popularity in recent years on dairy farms for use as a forage crop. The major reason for this is that they are relatively drought tolerant and generally yield better than ryegrass when moisture is limiting. During the vegetative stage when they are grazed, quality is comparable to ryegrass. However, the more mature the cereal gets, the more its quality declines. Cereals are generally fairly cheap and simple to establish. Once understood, their management is also fairly simple. They are suited to a range of soil types, fertility levels and climatic conditions.

Choosing a Variety

Diversity

Any variety of cereal can be sown for grazing and fodder production. There is a huge range in cereal species and cultivars/varieties within each species, so in some cases "Cereals aren't Cereals". There is a cereal variety available for just about every end use, with some varieties having characteristics that are more suited to fodder production such as higher forage yields and quality, and regrowth after grazing; or whether it is for silage, hay or grain production, or a combination of all of these.

General Cereal Characteristics

Oats

• Provide both quantity and quality in the vegetative stage.

• Quality declines rapidly when the grain begins to form due to the amount of husk compared to other cereals.

• Is highly resilient and a competitive cereal in different environments.

• In comparison to other cereals there are fewer weed control options.

• Possibly more prone to lodging than most other cereals.

Wheat

• Most wheat varieties need to be sown very early in order to achieve maximum dry matter, especially if to be grazed.

• Winter wheats (have a winter habit and/or a vernalisation requirement), have a wide sowing window from early March - June.

• Reasonably tolerant, but can be susceptible to diseases.

• Reasonable range of weed control options.

Barley

• Generally a smaller range of maturities available.

• Generally a short season early maturity option.

• Can be sown late (July).

• Can produce a bulk of feed quickly.

• Generally less tolerant of acidic or waterlogged soils.

• Slightly better quality of conserved feed produced.

Triticale

• Triticale is a hardy cereal which can tolerate a wide range of soil and seasonal conditions.

• Can tolerate more water-logging than other cereals.

• Can be more susceptible to frost damage than other cereals.

• Most varieties are mid to late maturity and can be sown over a wide sowing window.

In recent years, there have been many varieties released. This now means that there is a huge variance across each type of cereal. This also means that there are no longer characteristics that are unique to only one type of cereal.

Once you have determined what it is that you want and when you plan to sow, it is possible to match a variety (or varieties) with the right maturity, growth habit, and disease and pest resistance for your needs. If you do not know the characteristics of the variety you have purchased/have in the silo, you may be sowing a cereal that will not perform to your expectations.

Maturity

The maturity of the variety you intend to sow is critical to getting the end result you desire. All cereal crops are categorised into the following maturity categories:

Very Early (VE)	Early (E)	Mid (M)
Mid-Late (ML)	Late (L)	Very Late (VL)

Very Early (very quick to mature) varieties are generally best sown late (late May, June, July). If sown too early, they will run up to head during winter, exposing the grain heads to frost risk. Sown early, they will be a grazing only option as head emergence is at the wrong time for hay production. However, because of their quick growth habit, they provide good early DM production. Sown late due to a late break, they are a great option.

Mid maturing varieties are ideally sown in mid-May and will generally be ready for hay cutting in mid-October. Sown too early, they are a grazing only option, as they will also run up to head in winter. They are still productive for hay/grain when sown late.

Late maturing varieties are best sown early and have extended grazing period into winter when compared to the shorter maturity types. Some are a little slow to start in autumn. Be careful when choosing '*late'* to '*very late'* cultivars, as they will mature much later than other types and may be heading or grain filling during periods of high temperatures and/or moisture stress. As a result, you may need to budget for an irrigation to make quality hay or grain.

Winter Habit and Vernalisation

Varieties with a **winter habit** will not run to head until they experience increasing day length after the winter solstice. Examples include Bimbil & Blackbutt oats and Wedgetail wheat (these are ideal for sowing early for grazing then locking up).

Some varieties have a **vernalisation** requirement, which means these varieties needs exposure to cold temperatures before going reproductive. This is a trait of northern hemisphere varieties that spend winter under snow. The advantage of these types is that they can be sown early and are guaranteed not to run up to head until after winter. Some examples are Brennan and Tennant wheats.

Maturity and time to hay cutting

If an early (E), a mid (M) and a late (L) maturing variety are all sown at the same time in mid-May, there will generally be 7 days difference between each maturity category. An E type will generally be ready for cutting early October, a M in mid-October and a L in late October. The difference in maturity will be even more pronounced if the crop is left for grain. Conversely, if an E, M & L variety were all sown late (June), there will be less difference in time to cutting because the varieties all respond to warmer/increasing temperatures in spring, narrowing the gap between cultivars.

Paddock Selection

Cereals crops are tolerant of a range of soil types and conditions, but to grow to their optimum, any stresses need to be kept to a minimum. Ideally the paddock selected to grow a cereal should have;

- Water on and off within 12-15 hours.
- Reasonable fertility, particularly the phosphorus levels.
- Moderate to good soil structure i.e. no surface crusting and a degree of tilth, no large clods, no hardpan and not compacted by livestock hooves.

Establishment

Crop establishment is about getting enough plants established to allow the crop to meet your requirements, be it for grazing, hay or grain.

Soil Preparation

For the seed to germinate and establish, it needs a soil that has enough moisture to start the germination process and keep the developing plant supplied with water until the roots have developed sufficiently. It also needs soil with air spaces to supply oxygen to the developing plant and the soil must be soft enough to allow the developing roots and shots to move through it.

You may be able to direct drill in sub clover paddocks with a loamy soil, but you would have little success with a grey clay that has been permanent pasture for 20 years. Under-cultivating and leaving a cloddy seedbed will result in a poor seed-soil contact that dries rapidly. Over cultivating soil to powder will smother the seed when wet, and potentially crust so badly the seed cannot penetrate.

Sowing Rates

Sowing rates are not fixed; they depend on a range of factors. When calculating your sowing rate, there are three main things you should know;

1. Plant population. Sowing at different times of the year will affect how much seed you should sow because tillering or shoot production is greater when conditions are warm and reduced when the conditions are cooler. To optimise production, we are trying to obtain the optimal shoot numbers without creating too many as this can result in weaker stems and the potential for the crop to fall over or lodge. Higher sowing rates are used when using the crop for grazing as you are trying to maximise early growth.

2. Seed size is the second question. As you can imagine, the smaller the seed size, the more seeds you have in each kilogram.

3. Expected establishment is the third question. This is also the hardest question to answer as there are so many variables. Most experienced cereal growers know what to expect from their soils. A Mallee farmer may get 80-85% of seed sown to establish. Expected establishment is not germination, although germination tests will let you know if there is a problem with the seed. Establishment is also affected by the paddock conditions at sowing. Good soil moisture, warm soil temperatures, good soil-seed contact and good soil tilth all contribute to improving establishment. Cold and wet soil, insect pests, soil crusting, seed sown too deep and a cloddy seedbed are factors that will reduce establishment.

Time of Sowing

Sowing early - be careful if planning to sow cereals earlier than late April. If sowing early, choose a late to very late maturity type or a type with winter habit because early and mid-season varieties will run up to head too early (see section on Varieties). This is because they are programmed to turn reproductive in response to accumulated temperature (day degrees) and will run up to head in winter. This exposes plants to frost risk when heading and also means that they will be ready for hay/silage at a time of year when it is generally too cold and wet. Grazing will delay maturity of most cultivars.

Sowing late - will often have yield penalties (less vegetative growth, fewer reserves, less DM or grain yield).

There are 4 main strategies for sowing:

1. Pre-irrigate

In the ideal world, the recommended strategy would be to pre-irrigate, spray the weeds out, then sow. This strategy gives you control over sowing time and a chance to control weeds reasonably cheaply. However, it is not without some risk as there is always the chance that it will rain after irrigating making the paddock too wet to get on and sow.

2. Dry Sow

This allows you to spread the workload and sow into dry soil then wait for rain. Dry sowing also means that the crop can start growing as soon as rain arrives. The downside is that we need enough rain to wet the soil sufficiently to get germination and establishment before the moisture runs out. If we only get 10 mm, it may be enough for the seed to start germination but then dry out, effectively killing the seed. Dry sowing can lead to problems if there has been inadequate weed control prior to sowing and potentially having to rely on in-crop herbicides. It can also be an issue if you sow a mid or late maturing variety and it doesn't rain until June, meaning the crop will be trying to mature late in the season.

3. Waiting for Rain

Waiting for the break gives you the opportunity for some pre-sowing weed control. It will be important to choose the maturity of the variety to suit the timing of the break. It also avoids a false break. The down side is the potential loss of valuable season length particularly if the break is late and you have to wait for the paddock to dry out so you can sow.

4. Watering Up

A risky strategy that can sometimes work. There is a very real risk of bursting the seed. The following conditions need to be met if it is going to work:

- Quick watering
- Dry soil profile
- Very shallow seeding (< 25mm) and no soil crusting
- Higher sowing rates as establishment is poorer
- No follow up rains
- Similar to dry sowing, weed control can be difficult.

Fertiliser

Phosphorus

If your soil P levels are greater than 35 ppm Colwell or 15 ppm Olsen, then you only need to supply the amount of P that will be removed (see Table 3 below). The crop needs most of its P early in the crop development so ideally the P should be sown into the seed furrow. This is particularly important if P levels are low. If you have good levels of P, then spreading may be an option but still not the preferred method.

Nitrogen

N is a slightly different story. A hay or grain crop needs only a small proportion of the total N requirement before stem elongation. This offers the opportunity to only sow small amounts or no N at sowing (based on your soil test) and see how the season progresses. Depending on how the season looks, you can then top-dress to meet the potential yield.

Seed dressing

Bunts and smuts are fungi that can decimate grain crops (spores grow in place of the grain) so grain growers use a seed treatment annually on all planting seed. For those sowing into old pasture, it may be possible to avoid a treatment in the first year. However, if this is not your first crop, or if you can't guarantee your seed is uncontaminated, use a seed dressing. They are cheap ($ 3-4/ha) and are recommended even if cutting for hay, as these spores in developing heads will make hay unpalatable. These fungi are seed (and wind borne) and once a paddock is infected, spores can hang around in soil for years.

Other physiological traits of cereals

Dwarfism or plant height.

In general, most wheats are semi-dwarf, which means that they generally grow to a medium height (when not moisture stressed or sown really late). Oats can be any height, though short varieties like Echidna & Eurabbie may produce less DM if sown late (they are competitive for DM when sown on time). Other oats may be really tall (e.g. Wintaroo and Graza 50). Tall varieties may be prone to lodging, which may be a problem if you are targeting grain, less so for hay. Triticale is generally taller than the other cereals (some can grow over your head), but barley ranges depend on sowing date.

Growth Habit

Like pastures, some cereals grow upright or erect (generally wheat and triticale), while others spread along the ground (prostrate) before becoming more upright (typically barley). This has implications for grazing, for example if it is a prostrate type you can safely graze to 5 cm, while a more erect type should only be grazed to 10 cm. This is to preserve the amount of leaf area on the plant, which ensures a more rapid recovery post-grazing.

Surface Soil Temperature

As with pasture species, high soil temperatures can limit germination of cereals, even with available soil moisture. Different cereals have different tolerances for soil temperature at emergence. In general, croppers never sow wheat, barley or triticale before April because the soil temperature is too high. These cereals prefer surface soil temperatures between 15-25^{o}C, as poor emergence may occur if the temperature is too high. The exception to this is oats, which can be sown at comparatively higher temperatures (e.g. Echidna, Saia, Taipan are known to emerge ok up to 30^{o}C). Some people successfully sow oats in February, but there have also been lots of failures. The recommendation is be careful with sowing in February and March due to high surface soil temperatures, especially if relying on rainfall to keep crops alive until late autumn when rainfall is more reliable.

- Germination of oats is normally satisfactory within a soil surface temperature range of 10-25°C.
- If soil surface temperatures are above about 20°C, the coleoptile will normally be shorter. If adequate soil moisture is present, it is best to sow cereals shallower than 4-5 cm, to allow them to establish successfully. The seed still needs to be sown deep enough to ensure it has access to enough moisture.

Provided the above temperature ranges are adequate, some cereals (variety dependant) can be sown in early March. Cereals will survive better than ryegrass and clover if irrigation frequencies are spread out, due to better drought tolerances. Irrigating cereals at temperatures above about 25°C with insufficient canopy cover to shade the water can scold the plants.

Early Vigour

This describes how quickly plants emerge and grow in the early stages of crop development. Increased early vigour can shorten the time to the first grazing. In general barley has better early vigour than oats, and better than wheat and triticale.

Tillering

There are plenty of differences between the tillering capacity between varieties of the same cereal class. Assuming a May sowing, barley tillers better than oats, and better than wheat and triticale.. Varieties with winter habit tend to tiller more, while there are some early maturing wheat varieties which have limited tillering bred into them. Tillering can relate to DM yield; sow low tillering varieties more densely for hay and high tillering types less densely.

Feed Quality

The nutritive value of cereals when grazed before they begin to go reproductive is very good and much the same as ryegrass at the same stage. Average nutritive values for cereals at grazing stages are greater than 11 MJ of ME/kg DM, greater than 20% Crude Protein and approximately 35-40% Neutral Detergent Fibre. Table 3 shows the range of feed values for cereals.

Table 3. Range of dry matter quality of wheat, barley and triticale in vegetative stage, South West Victoria (2004-2007). Source Grain & Graze, Free Food For Thought (2008).

Crop	Energy (MJ ME/kg)	Protein (%)	Neutral detergent fibre NDF (%)
Wheat	12.4	28.4	38.9
Barley	11.5	27.5	41.7
Triticale	12.2	27.1	41.2

Choosing the right time to cut the cereal for silage or hay is crucial in balancing out quality and quantity of the forage. The crude protein (CP) of cereals is fairly consistent between the different types, and is generally within the range of 8.5-11.0% CP. Dry matter digestibility is generally within the range of 65-72%, with barley slightly better than oats and wheat and triticale. All cereals will tend to have an ME range of 9-10 and NDF of 50%.

Grazing Management

When to Start Grazing

Cereal plants have two root systems, the primary which is attached to the seed and travels deep into the ground and the secondary which arises at the crown (where the plant meets the ground) and is

shallower and attached to the tillers. Grazing plants before the secondary roots are attached well to the ground will lead to plant loss from uprooting. The DM will also be very low at this time.

The secondary root system will develop when the plants start tillering and making new stems, this usually starts when the plant has four true leaves. Like newly established ryegrass, the 'pluck and twist test' will tell you if the cereal is ready for grazing. Make sure that you do quite a few across the whole paddock.

It is important not to graze crops into the ground. Just like our ryegrass pastures, they need a residual amount of dry matter left to recover from grazing. For prostate growing varieties, it is recommended to retain a residual height of 5 am and 10 cm for more erect types.

Leaving bare patches lets the light into the soil and encourages weed growth. Cereals are best if they are stripped grazed and not set stocked as this will allow the plant to re-energise and give maximum regrowth.

When to Finish Grazing

If the paddock is to be locked up for fodder production it is important to stop grazing before the heads start being pushed up above the ground. This process is called jointing, or stem elongation and starts when the plant has 6-7 leaves on the main stem (not counting any of the tillers) and is also referred to as growth stage 30. The first visible indication of this is the first node stage which is a visible and palpable bump or swelling 1-2 cm off the ground. The best place to look is the main stem, as the first node stage occurs here first (not the tillers). In a grazed paddock the main stem will be the fattest of the tillers, in an un-grazed crop it will be the longest stem and leaves on the plant when you stretch them out. In the earlier stages, the easiest way is to slice a stem in half with a knife and the node is more easily seen. Removing the node will decrease the amount of fodder that is available in spring.

Crops that are moisture or frost stressed should be managed carefully for nitrate poisoning of stock. Follow the usual recommendations of providing alternative feed sources, run off paddocks, close monitoring and decreasing the time on the offending feed until the rumen adjusts.

In general – stock should enter at gumboot height and be removed at workboot height. If planning to harvest as hay/silage (or grain), then monitor growth stage and protect the node.

Weed Management

Broadleaf and grass weeds - control them while they are small (<8 cm in diameter). There are plenty of control options available.

Grass weeds - are more problematic. Annual ryegrass and wild oats, if cut early, may not be a quality issue. But brome, barley and silver grass will impact on hay quality. There are limited post emergent sprays in oats for grass weeds and better options in the other cereals. Most grass weed control should be done the year before, then again with pre-emergent herbicides prior to sowing.

Genetic similarity of barley and barley grass; oats and wild oats make them difficult to control in-crop.

Consult with your agronomist and always observe withholding periods of all chemicals.

Irrigation

Cereals will generally hold on better without irrigation/rainfall compared to plants like ryegrass.

Autumn - Cereals don't like water logging so it is important to not water too frequently in late autumn.

Spring - *I*rrigation may need to start as early as the first available water or might normally be expected to start sometime around booting stage. The important thing is to maintain a supply of readily available soil moisture to the plants. Best water management of a hay crop would be to have the crop just running out of moisture at cutting time. For hay you would need to budget on at least one spring irrigation and potentially 2-3 depending on the season and the maturity class of the variety. Some of the very long season varieties can need moisture up to November. Irrigation can cause lodging of cereals, but grazed plants tend to have better anchoring.