Local Land Services

Nitrogen strategies for kikuyu ryegrass pastures.

Winter - Spring Nitrogen

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Key Points

- **Spring offers potential for 80 to 100 kg/ha/d growth rates.**
- **Adjust stock pressure or cut silage to utilise extra feed.**
- **Apply 40 to 50 kgN/ha/grazing while soil moisture remains high and rain is probable.**
- **Use Pasture Forecaster to monitor soil stored moisture.**

Well managed ryegrass will provide high-quality forage in, late autumn winter and spring when nitrogen fertiliser and water are the main inputs needed achieve high growth rates. The management of these inputs, with strategic grazing and high utilisation rates in combination with the value of milk or meat produced, will determine how profitable the pasture is. Nitrogen fertiliser price rises through 2021-22 increases the pressure to improve efficiencies, yet nitrogen applied to ryegrass can still be a relatively low-cost feed source compared to silage, grain or hay.

Nitrogen response will be determined by the moisture supply though the grazing rotation of 18-35 days. Moisture for growth can come from rain, irrigation or, soil stored moisture. It is essential to assess moisture supply from all three sources and the future plant demand when you make nitrogen fertiliser decisions.

Managing fertiliser in a variable climate:

The NSW coast is a subtropical climate with "wet autumns and dry springs". This means autumn - winter conditions normally provide adequate soil moisture for pasture growth, but spring conditions are highly variable and moisture deficits occur as plant water demand increases steadily as weather warms Fig 1 (see overpage).

Although there are distinct seasonal trends, rainfall is highly variable and episodic. This sees large rainfall events followed by weeks of dry weather when pastures rely on soil stored moisture. East coast lows (ECL) and storms are an important feature of this region where large rainfall events produce 150 to 300 mm within several days. ECL occur 1-2 times a year at any time of year but quite frequently in March. They contribute 20% of the annual rainfall and reset the soil moisture profile. Such high rainfall events dramatically affect nitrogen response due to waterlogging close to the event but improve conditions for some time after the event by filling to soil profile to capacity.

Understanding these dynamics through the different seasons can improve nitrogen management and pasture utilisation leading to high profits for grazing enterprises. We can now combine an understanding long term seasonal trends, with real time weather data that includes soil moisture and soil temperature by accessing the Farming Forecaster platform (https://www.farmingforecaster.com.au). In variable climates, and variable seasons, it is important to remain optimistic to make use of good condition when they prevail, but also to have a plan to manage low rainfall events or extended dry periods.

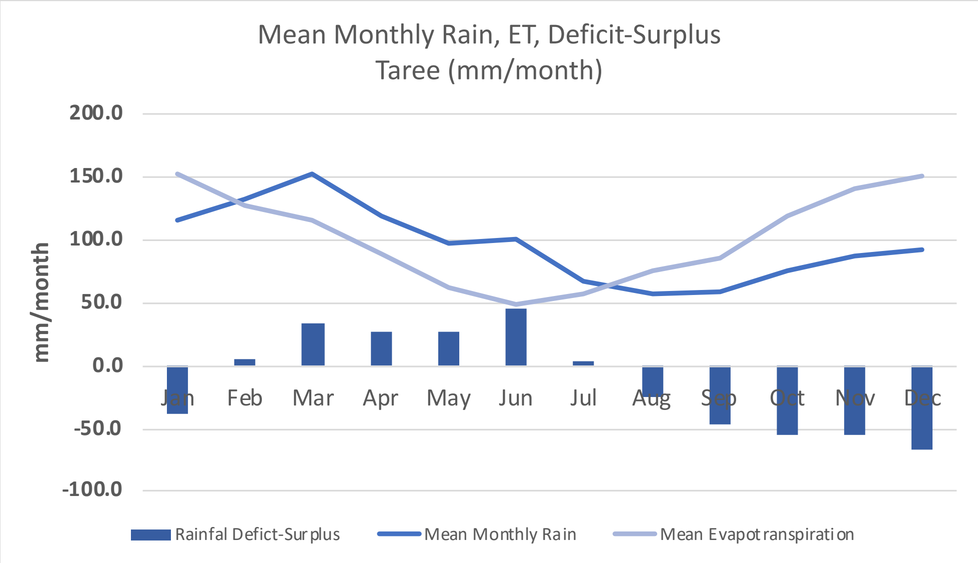


Figure 1. Mean Monthly Rainfall, Evapotranspiration ET, and the resultant surplus or deficit per month Taree calculated by DairyModTM. In this graph we see the deficit in rainfall increases as spring proceeds. This means soil stored moisture in July has a bearing on spring growth. Median rainfall is often 20% lower than mean, resulting in greater soil moisture deficits that shown here.

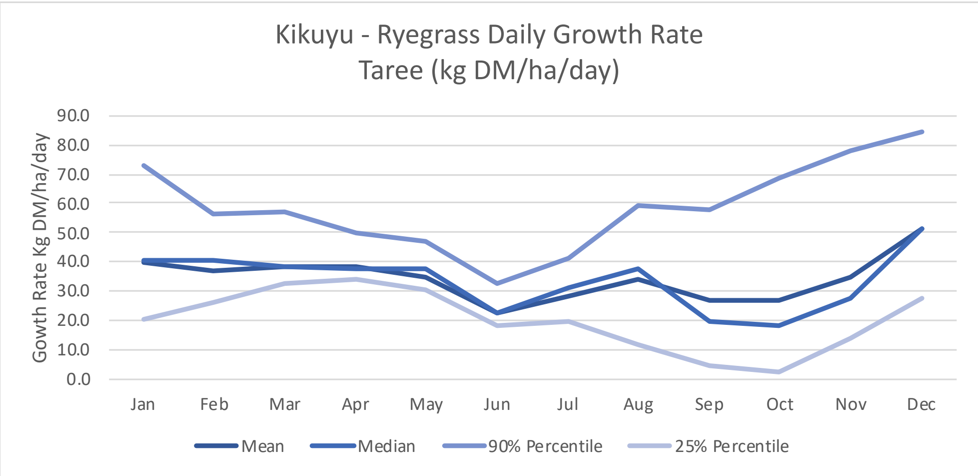


Figure 2: Modelled (DairyModTM) kikuyu-ryegrass growth rate (kg DM/ha/day) at Taree with Mean, Median, 90% Percentile, 25th Percentile. Spring shows a high variation in growth rates that peak in August then decline into September –October. (300kg N/ha/year applied to ryegrass only). This pattern of variable spring growth is driven by the rainfall and evaporation each year as shown in Figure 1. Note that median pasture growth is similar to mean until September and October when growth rate declines.

Making the most of good soil moisture

Late autumn and winter are when extra pasture growth is most valuable due to seasonal feed shortages. As temperatures decline into winter, growth rates decline. This can lead to feed shortages by mid-winter. However, as rainfall normally higher than evapotranspiration, and evaporation rates are low, soil moisture content remains favourable enabling good responses to nitrogen, even when rainfall may seem infrequent.

It is important to maintain a more aggressive approach to fertiliser in this period using higher rates to promote growth through winter and provide good nutrition for spring.

Capture Spring Growth Potential

Spring is when growth rates rise to 80 to 100 kg DM/ha/day and hence pasture production is highest Fig 3. When spring growth is utilised by grazing or silage, the cost per kilogram of ryegrass over the whole year is reduced Table 1. Extra spring growth in this period can be 30 to 50 % of the season's ryegrass production so it is essential to use the potential when as it arises.

Stocking rates are often set to match the winter growth rate, and if other actions are not taken the higher spring growth rate can be wasted e.g. in higher residues after grazing from taller stemmy ryegrass that is not eaten Figure 1.

Increasing spring intake can be achieved by one or a combination of the following strategies:

- Calving in late winter or very early spring to increase animal demand at that time
- Supplement through winter to support higher stocking rates
- Add extra stock in this period e.g. follow milking cows with heifers
- Reduce supplementation to ensure more pasture is consumed.
- Remove excess in silage by setting aside paddocks early

Table 1 Impact of capturing spring growth in a dryland setting on final yield and annual feed costs

		May	Jun	July	Aug	Sep	Oct	Total Intake	Cost/kg Ryegrass
Growth Rate	kg/ha/day	40	40	40	40	40	20		@$700/ha
Pasture Yield	kg DM/mth	1240	1200	1240	1240	1200	620	6740	10.4 cents
Growth Rate	kg/ha/day	40	40	40	80	80	20		
Pasture Yield	kg DM/mth	1240	1200	1240	<u>2480</u>	<u>2400</u>	620	9180	7.6 cents

Assumes input costs of $700/ha attributed only to the ryegrass phase.

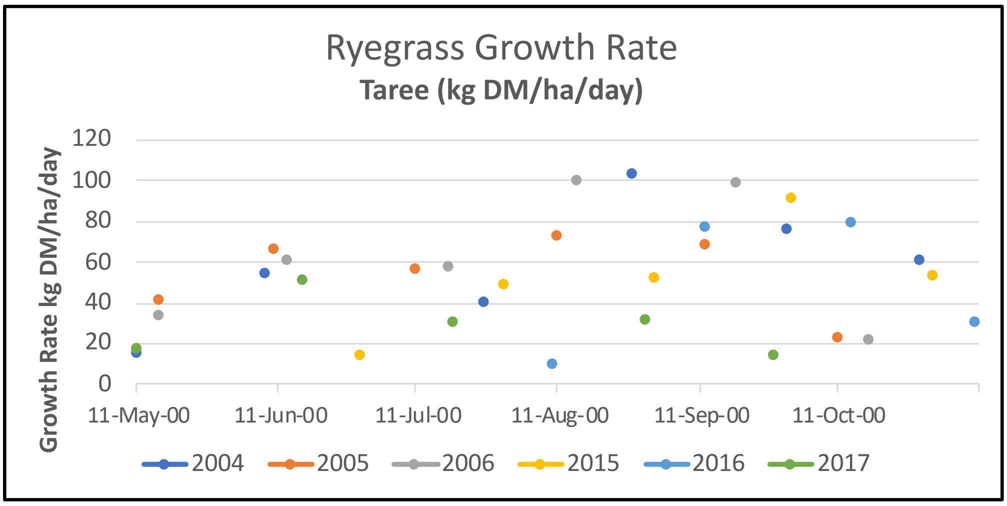


Figure 3: Ryegrass Growth Rates 2004 to 2006 and 2015 to 2017 (kg DM/ha/day) measured over 6 trial years at Taree and Oxley Island. Annual yields varied from 6 to 10 t/ha from sowing dates of late March to mid-April. Highest growth rates occur in August to early September. Spring growth is most variable following rainfall patterns.

However, because spring rainfall is so variable, there is always a need to have strategies to manage for lower pasture growth rates in dry springs. This occurred in 2017, 18, 19 where lack of spring rain allowed little ryegrass growth past August. In those three years nitrogen application in late-August was unwarranted due to moisture stress reducing growth throughout September. Prudent farmers could see the situation unfolding in July and began early sale of stock, and, or increasing supplementation to manage a dramatic loss of spring feed.

Calving some, or all of the herd in late summer autumn during high kikuyu growth phase can provide some flexibility for spring where there are options for de-stocking, or early weaning of beef calves in dryer springs, but retaining the young stock in better years.

Figure 3 shows the variation of spring growth rates from actual trial data, and Figures 2 shows modelled data that highlights the variation in spring pasture growth at Taree. This trend is true for most of the NSW coast.

Lush spring growth in August, where grazing was delayed due to wet conditions. Growth rates of 80 to 100 kg DM/ha/day are possible.

Assessing the spring potential

Given the variable nature of spring growth it is important to assess the seasonal outlook in June-July to anticipate future growth potential for August September. Farmers are familiar with watching weather predictions, historical rainfall trends and current evaporation rates but now have the use of the Farming Forecaster Platform (https://www.farmingforecaster.com.au) at 20 locations within the Hunter LLS to assess current soil moisture profile.

The soil moisture information provided by the probes can improve the confidence to increase or decrease stocking rate, supplements, and nitrogen application through this period

This network of 20 weather stations and soil moisture probes can provide daily measurement of rainfall, temperature, and soil moisture status at any time through the year. Each probe measures soil moisture and temperature at 10 to 20 cm intervals Figure 4. Using this data with soil texture and profile depth can provide a rough estimate of millimetres of soil stored water to 60 cm.

Ryegrass rooting depth will vary with soil type, but the soil moisture availability to 60 cm is the main driver of high growth rate. Further extraction can occur to 100 cm but growth rate is usually declining due to moisture stress in the upper layers. Nonetheless soils with a depth of over 1 meter can provide a total reserve, or plant available water PAW of 75 to 150 mm. Depth and soil texture being the two dominant factors affecting PAW. Table 3 shows the potential impact of extra stored soil moisture carried into the spring period can have for ryegrass growth.

In a normal year rainfall is above evaporation from February to July Figure 1, Table 2. This means soils often reach full point in June July, then begin to dry as temperature increases into spring. Mean annual rainfall from August to September at Taree is only 60 mm/month (Figure 1). Thus, a soil stored moisture reserve of 80 mm can provide 30 to 40 % of the moisture available for spring growth.

The rate of decline in soil stored moisture provides a useful real time measure of water used against water supply to the plants. We see in Figure 4 on that despite having a "full" profile in July, the soil water reserves declined to below 50% to 60 cm by September 15th where growth rate would be severely limited. Though this is not unusual for springs on the coast, each year will be different, it is possible to get large falls in spring that change the outlook greatly. For rapid growth soil stored moisture needs to be above 50% in the upper profile. However, we see in this graph that plants are depleting soil moisture to 60 cm and below in dry periods.

Table 2 Monthly Rainfall and Eto (mm/month) Taree

Mean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	P.A.
Rain	119	142	158	114	93	101	71	60	59	76	88	101	1182
Eto	153	128	117	89	62	49	57	75	85	119	142	152	1228

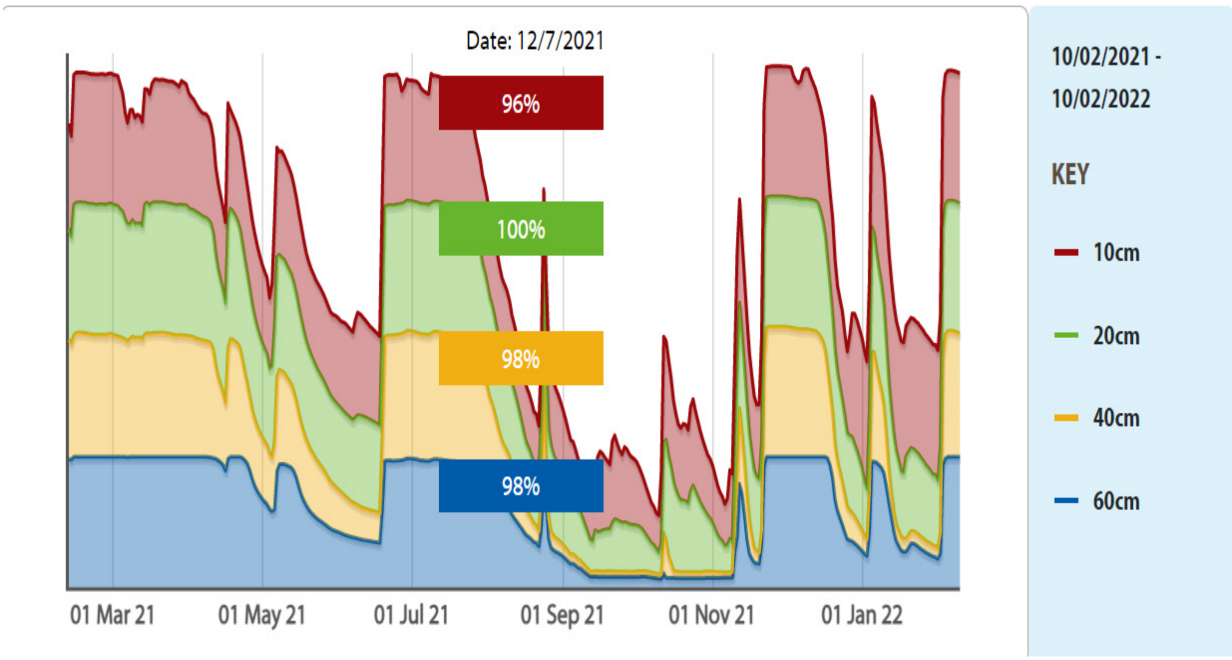


Figure 4 Pasture Forecaster plots soil moisture content for four depths, 10. 20, 40 and 60 cm depth over the past 12 months. This provides a clear picture of how much moisture is available. For example on the 12/7/2021 the soil profile was 98% full to 60 cm. By the middle of September the soil profile was dry with only 20% full to 60 cm.

While lush green ryegrass can look attractive and demonstrate high spring growth rates–the delay in grazing can lead to high stem material that is lower quality and often uneaten.

Tall rank spring growth can leave high stemmy residuals that waste the increased growth.

At all times watching the level of residual left after grazing can inform grazing management decisions.

Table 3: Growth Potential from Soil Stored Moisture (mm) or Rain.

Soil Store Moisture (mm)	Water Use Efficiency Kg DM/ mm	Potential Growth Kg DM/ha
25	20	500
50	20	1000
75	20	1500
100	20	2000

Note: The WUE factor is dependent on fertility and Eto at a given period as explained below.

Managing to Reach Potential

Nitrogen application and grazing management should aim to match growth potential that rises from 40 to 60 kg DM/ha/day in May June July to 80 to 100 kg DM/ha/day in August September (Figure 3). To achieve higher growth rates in August, adequate nitrogen must be applied in July and further applications kept up while ever soil moisture conditions are favourable i.e. above 50% of the soil moisture in the top 60 cm or if rain is expected.

On dryland growth rates generally declines as soil moisture dries in late September-October (Figure 1,2, 3, 4). In this period plant water use ETo changes from 1-2 mm/day in July to 5-6 mm/day by late -October and rainfall is below evaporation.

This can lead to one of two strategies as soils dry in September October:

1. Reduce the rate of nitrogen applied or
2. Cease applying nitrogen until further rain is imminent and the ryegrass is still in the vegetive stage of growth.

In either case, watching the rate of soil moisture decline on the nearest Farming Forecaster probe can provide useful insight in just how dry the soil profile is and when to cease application.

With irrigation, ryegrass growth rate stays high while soil moisture is maintained into October but growth rate can decline even with adequate moisture as day temperatures rise above 28 °C in October November.

How much rainfall is needed to ensure a good nitrogen response?

Rainfall requirement for the next rotation depends on:

1. Current soil moisture status
2. Current Evapotranspiration rate (Eto) mm/day.
3. Rotation length (days)

When the soil moisture profile is full then extra rain at any time will be lost in, evaporation, runoff, or deep drainage. We can know when this occurs because runoff and puddles are evident. As the soil dries then the capacity to store more rain increases.

Table 4 shows that the demand to moisture increases from 1.6 mm/day in June to 5- 6 mm/day in late October. We can consider how long 30, or 60 mm of rain would last over winter spring. We see that in May, June, July 60 mm of rain can provide enough moisture for a full rotation length of 30 to 33 days. At this time 30 mm of rain, with 30 mm of soil stored moisture can provide 60 mm moisture for a 33-day rotation.

Yet in September 30 mm of rain provide only 11 days of growth but rotation length is reduced to 21 day rotation. If the soil stored moisture has been used, there will be moisture stress without more rain, and hence lower nitrogen response or requirement. This suggest caution for nitrogen application unless more rain is predicted and signals the need for an irrigation within 11 days of the prior rain if that is an option.

As spring progresses higher amounts of rain are required to ensure a good nitrogen response. Table 4 indicates how many days of good growth could occur in 30 to 60 mm fell and soil moisture status was marginal. This can be compared to the rotation length required to achieve 3 leaves or 1500 to 2000 kg DM/ha growth. We see in October, a dry soil profile will require 80 mm of rain within the rotation to achieve potential growth.

Table 4 Effectiveness of rainfall, soil store moisture for given rotation length.

		May	June	July	Aug	Sep	Oct
Grazing Rotation Length	Days	30	33	33	28	25	21
Typical Eto	mm/day	2	1.6	1.8	2.4	2.8	4.0
30 mm rain lasts x days	Days	15	18	16	12	11	8
60 mm rain lasts x days	Days	30	37	33	25	21	15

Note: Rainfall is less effective than this table assumes because 2-4 mm evaporates before entering the soil depending on current ETo. Soil stored moisture is more effective because it is not lost in evaporation.

Nitrogen requirements

Milking cows require a diet with crude protein above 16-18 % to produce milk whereas ryegrass growth is optimized near 3% N or 21 to 23% crude protein. More fertile pastures may result in crude protein levels that exceed 28%. This imbalance is normally managed in most dairy systems by supplementing with lower protein grain-based concentrates allowing rations to be more appropriately balanced and more efficient use of the nitrogen/protein supplied from pastures. Every grazing aims to produce 1500 kg DM/ha intake with 3% N or 21-23% CP. This requires 45 kg N/ha/grazing to be sourced from the soil and or fertiliser to achieve potential growth rates (Table 5).

From this table if 1500 kg DM were harvested at 4.0% N then 60 kg N/ha would be removed if all material was removed from the paddock in silage or hay. When pastures are when grazed by dairy cows, up to 70 to 80% of nitrogen ingested may be returned to the paddock in dung and urine (Haynes and Williams 1993).

High losses of nitrogen in excreta occur from volatilization, leaching due to the high nitrogen application per hectare. Further loss occurs in that there is variable distribution within the paddock and deposition in other areas of loss such as laneways, dairy yards and water points. The time spent in each location has a great bearing on the percentage of nitrogen return to the pasture area by the cows.

While these figures are useful, they do not convey the complexity of nitrogen demand and supply. At any point in time the nitrogen already within the soil reserves will supply up to 70% of the nitrogen used by the pasture. The rate of nitrogen supplied from the soil is driven by microbial breakdown of soil organic matter. This process is called mineralization Figure 5, and depends on the soil nitrogen content, which is directly related to organic matter in soil. Nitrogen is mineralized by microbes when soil moisture is high and temperature is favorable for microbial activity.

Mineralised nitrogen is available then for plant use. The greatest release on the mid north coast is in March when temperatures are high and soil moisture is usually high. Mineralization declines into winter as temperatures decline and then slowly rise again, see Figure 5.

Although the soil provides a reserve, it is like a bank account that will decline over time if the nitrogen removed is not replaced with fertiliser and clover nitrogen, nitrogen derived from other

Table 5 Kilograms of nitrogen removed in harvested forage

	% N in forage ➔				
Kg DM/ha harvested 🡣	2.5%N (15.63%CP)	3.0%N (18.75% CP)	3.5%N (21.87%CP)	4.0%N (25%CP)	4.5%N (28.13%CP)
1000	25	30	35	40	45
1500	37.5	45	52.5	60	67.5
2000	50	60	70	80	90
2500	62.5	75	87.5	100	112.5
3000	75	90	105	120	135
3500	87.5	105	122.5	140	157.5

% N x 6.25 = % crude protein

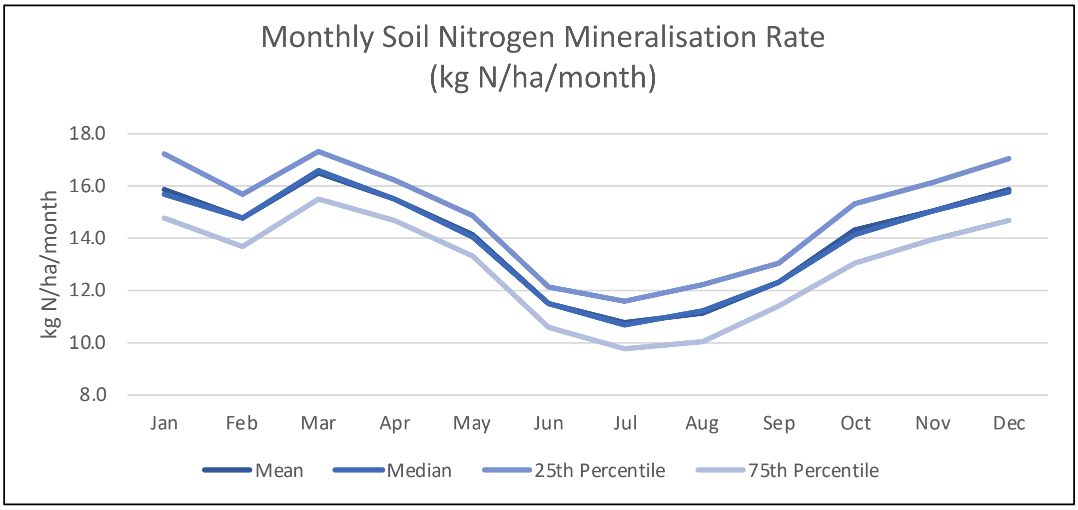
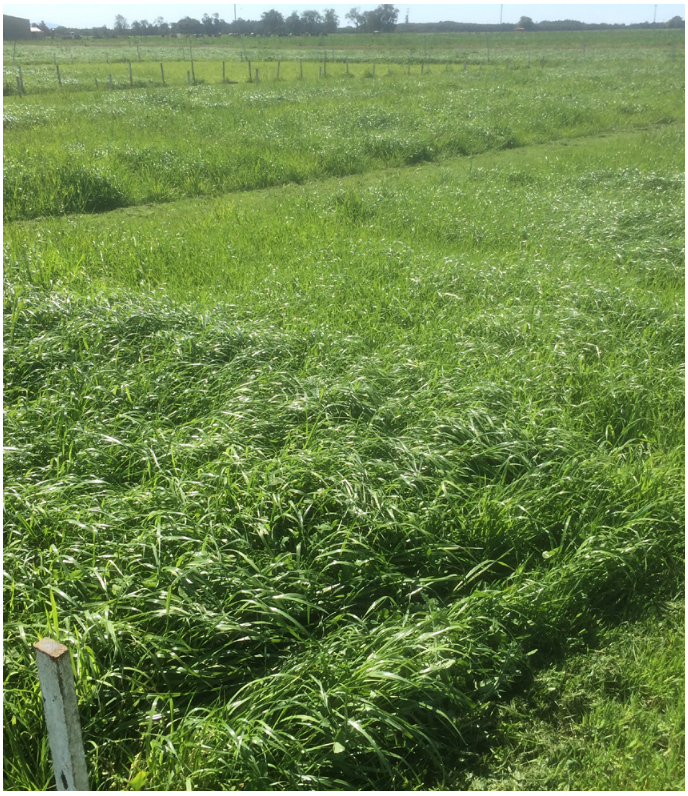


Fig 5: Modelled Monthly Nitrogen Mineralisation Rate (0 to 30 cm) under kikuyu ryegrass at Taree using DairyModTM. Mineralisation peaks in warm wet condition of March and declines as temperature cools into June July where fertiliser nitrogen is required to attain growth rates of 40 to 60 kg DM/ha/day.



Correct nitrogen application can achieve response rates of 15 to 25 kg DM/ha/kg N applied when conditions are moist and warm. Drying conditions reduce that response dramatically

bacterial and soil biological activity, or nitrogen from sources such as manure or urine.

Nitrogen removal is ongoing in pasture grazed for milk or beef production, and the transfer in urine and dung to tracks loafing areas and various environmental losses. Dairy farms with higher supplement use per hectare may require less nitrogen fertiliser than beef farms because nitrogen is imported in the feed. Farm design and management can substantially influence the pattern deposition of this nutrient in pastures.

Nitrogen application and removal rates can be expressed several ways:

- 30 to 50 kg N/Grazing,
- 30 to 50 Kg N/ month, and
- 1 to 2 kg N/day per of rotation length.

For example, when expressed as rates of 1-2 kg N/ha/day over the rotation length we see that in a winter rotation length of 28 to 30 days with a growth rate of 50 kg DM/ha there will be 1500 kg DM/ha produced. That will require 1.5 kg N/ha/ day to provide in the order of 45 to 50 Kg N/ha to achieve 3% nitrogen (Table 5). Since some of that nitrogen will come from soil reserves a rate of 30 to 40 kg N/ha may be sufficient to maintain growth depending on pasture composition.

In spring nitrogen mineralization increases so it is important to anticipate high growth (assuming adequate moisture) and ensure sufficient nitrogen has been applied. As growth rates increase, rotation length declines from 30 to 45 days in winter to 18 to 21 days in Spring. By applying the same quantity of nitrogen per day, or per grazing, the rate of nitrogen can increase by 50 to 100% per month but still supply the same amount of nitrogen for the dry matter produced. For this reason, it is best to use nitrogen rate per grazing or per rotation rather than per month.

Selecting the appropriate nitrogen rate through this period can be difficult because each paddock varies in soil reserves, nitrogen inputs and other loss factors such as leaching or waterlogging that all affect soil nitrogen availability. Critically, nitrogen application rate also needs to consider moisture availability and capacity to utilize nitrogen with growth when applied. There are several indicators that adequate nitrogen levels have been reached that are to be found in a separate fact sheet in this series.

The dry spring of 2017 left little growth and moisture stress by mid-September. This picture was taken 27th September 2017 showing significant moisture stress and growth rates of only 10 kg DM/ha/d for the previous 28 days.

Managing high prices for nitrogen

As fertiliser prices rise, high fertiliser efficiency will be essential to maintain profitability. Fortunately, both beef and milk prices are favourable, that can still enable a good margin providing nitrogen driven feed is efficiently utilised. Table 6 shows the impact of price and fertiliser response on the cost of forage produced per tonne at different response efficiencies. Nitrogen response for ryegrass can vary from 0 to 25 kg DM/ha/kg N applied. Where nitrogen use efficiency (NUE) is above 15 kg DM/ha.kg N applied the costs per tonne of pasture are still competitive. Responses below this may still be cost effective depending on utilisation, farm strategy, actual market costs of feed-based alternatives and value of product being produced. The latent impact of nitrogen application on plant health and future growth should also be considered as it is not only the immediate response that needs to be considered.

Table 6 Price per tonne of forage for fertiliser price and response.

	$/t DM of forage produced from nitrogen fertiliser					
	kg DM/ha/kg N Response					
Urea Price/ton	c/kg N	10	15	20	25	30
1000	217	217	145	109	87	72
1500	326	326	217	163	130	109
1750	380	380	254	190	152	127
2000	434	435	290	217	174	145

Response to nitrogen varies greatly with conditions and nitrogen rate. 10 to 20 kg DM/ha/kg N is the normal range but 25 kg DM/ha/kg N is possible in good spring conditions. Lower responses occur with moisture stress, water logging, and where other nutrients are lacking. Delaying application after grazing will also reduce response rate.

A number of factors can lead to improved nitrogen use efficiency, including the right timing, rate, placement and product.

Right Rate

A pasture monitoring project conducted on Hunter Valley dairy farms in 2009-11 measured feed quality from 540 pasture samples (mostly ryegrass). 64% of these samples had between 20 and 30% crude protein. In 24% of samples crude protein was more than 30% clearly an excess, and 11% had crude protein less than 20%, only 2% of samples were less than 16% crude protein. Clearly over fertilisation can be as important as under fertilisation and leads to significant losses.

Excessively high forage nitrogen (> 25% crude protein) can have animal health implications as excess nitrogen must be excreted at an energy cost to milk or beef production unless the diet is balanced with low protein supplements such as grain or maize silage. This leads to further losses where urine is highly concentrated and leads to greater environmental losses.

In general nitrogen application rates at the lower end of recommendations will have higher nitrogen use efficiency but may reduce production. It is important to monitor pasture response and adjust rates to achieve good ryegrass growth.

Application before or after grazing

Ideally nitrogen fertiliser will be applied within 2 to 3 days after grazing, before the regrowth leaf appears on ryegrass. Delays past this point can reduce the response to nitrogen. However, it is not always practical to be spreading nitrogen fertiliser every day, so a compromise where it is spread once a week works well. Urea is spread on pastures which have been grazed in the past 3 or 4 days and on the areas which will be grazed in the next 3 days (before the urea is changed into nitrate and absorbed by the grass).

Applying urea every 2nd grazing

Applying urea every second grazing is a strategy used to improve nitrogen utilization efficiency (NUE). This can grow similar or more pasture dry matter per kilogram of nitrogen applied, with lower application costs.

This strategy was shown to work in trials undertaken in the Hunter Valley if the aim is to improve NUE, but it can reduce the amount of pasture grown per hectare if rates are not high enough. The trials showed that there was a carryover benefit of applied N improving growth of the second grazing compared to Nil fertiliser. This response was small at the 50 kg N/ha but significant and beneficial at the higher rates 100-200 kg N/ha where there was sufficient nitrogen applied for two grazing.

The trial also showed that where high nitrogen rates (200kg N/ha) are applied with high rates of poultry litter, the nitrogen is not lost after the first grazing but is still available into the third grazing. This also applies to nitrogen than it not used for plant growth in dry times, in that much of the unused nitrogen will still be available when it rains.

Gibberellic Acid (GA)

Gibberellic acid is now commonly used as a growth promotant during winter marketed as ProGibbTM and other trade names. It is most effective when used with adequate nitrogen fertiliser and is not a replacement for fertiliser. Limited trials conducted by NSW DPI in the coastal areas of Hunter LLS region showed that the growth response from ryegrass treated with

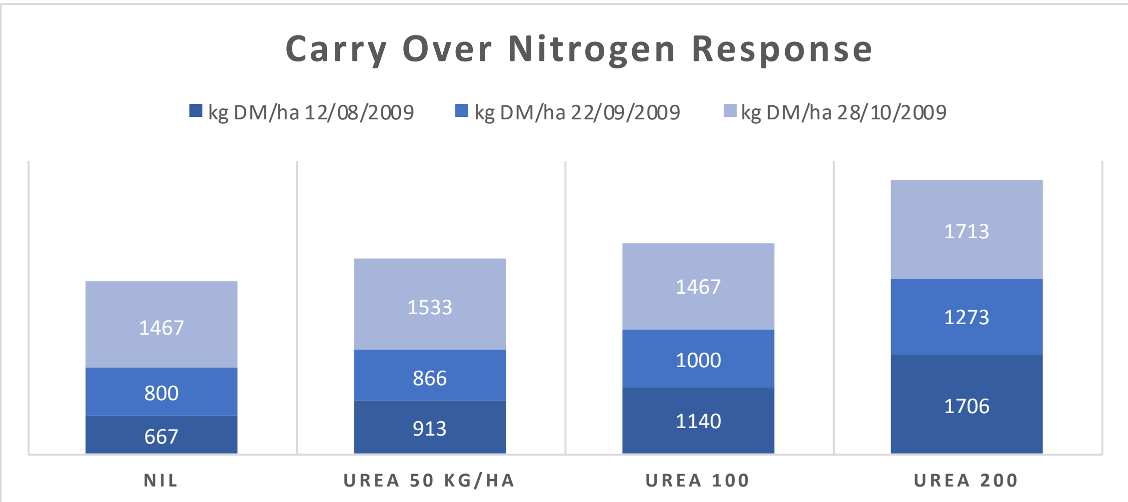


Figure 6: Ryegrass nitrogen response (kg/ha) over three cuts from a one-off application of 0, 50, 100, and 200 kg Urea/ha on the 15/7/2009. While there is carry over nitrogen to the second cut there is a no response in the third cut for the lower rates.

gibberellic acid may not be as great as responses achieved in colder climates. However, the broader research has shown gibberellic acid can improve nitrogen use efficiency during winter in inland and higher altitude areas and should be evaluated at the individual farm level with respect to its cost efficacy.

Nitrate poisoning

Nitrate poisoning is most likely to occur when plants take up high levels of nitrate nitrogen from soil and fertiliser but have not grown to turn that nitrate into protein in the plant. The risk is greatest with very young pasture regrowth (eg less than 2 leaf growth stage for ryegrass) and when weather is cold and overcast (so plants are growing slowly). This condition is extremely difficult to predict and can occur after long periods of fallow, on paddocks with high levels of effluent loading or where strong previous legume growth may increase the availability of nitrate nitrogen in the soil and so the risk of poisoning. Pasture nitrate levels can be tested.

Removing limiting factors

Nitrogen response will be reduced if other limiting factors are affecting ryegrass growth rates. This may include:

- Nutrient deficiencies: including phosphorus, potassium, sulfur or
- Toxicities: such as aluminum in acid soils, salts
- Moisture stress, insect pressure or disease such as rust.
- Grazing management flaws such as short or long rotation lengths, over grazing etc.

It is essential to address these stress factors early and on time to achieve high growth rates

Environmental Losses, volatilization, leaching and denitrification.

Concern over losses of nitrogen when using urea often stops farmers spreading urea on time. In winter and spring, the production lost by not applying required nitrogen on time normally far outweighs the small risk of losses from volatilization. Volatilization losses are much lower in soils with low (acidic) rather than high pH and most coastal and Hunter Valley soils tend to be acidic in nature.

In this period the main criteria for response is that there is sufficient soil moisture to provide good growth over the next rotation. Generally, the soil surface is moist enough to move the urea nitrogen into the surface soil by capillary action where it is adsorbed by surface roots. This is true even after several weeks without rain.

However, losses through leaching and denitrification can occur when fertiliser is applied within a 48 hrs of large rain events (>75-150 mm/day), such as an East Coast Low (ECL). On well drained alluvial soils the fertiliser nitrogen applied more than 48 hrs before the rain event will have been adsorbed by the plant. When fertiliser applied within 48 hrs of such rain events a proportion may be leached. In well drained soils rapid growth resumes within a few days allowing fertiliser to be applied so it is often better delay application till after the rain rather than within 48 hours of the rain.

On poorly drained and low-lying soils these events can flood and saturate the soil for 7 to 10 days causing higher losses and more damage from water logging. Although ryegrass is very tolerant of waterlogging, it is difficult to recover these losses, because fertiliser application is often delayed beyond ten days post grazing and so it is less efficient.

For these reasons, on poorly drained soils, if an ECL is anticipated it can be prudent to delay nitrogen application due within 48 hrs of the event till after the large rainfall events occur. The reduced growth will still occur but the fertiliser cost will not be lost. If the rain event is more than 48 hrs away it may still be worthwhile applying nitrogen because it avoids delays and allows the plant to respond.

More detailed discussion on nitrogen losses are found in other factsheets.

Impact on white and annual clovers

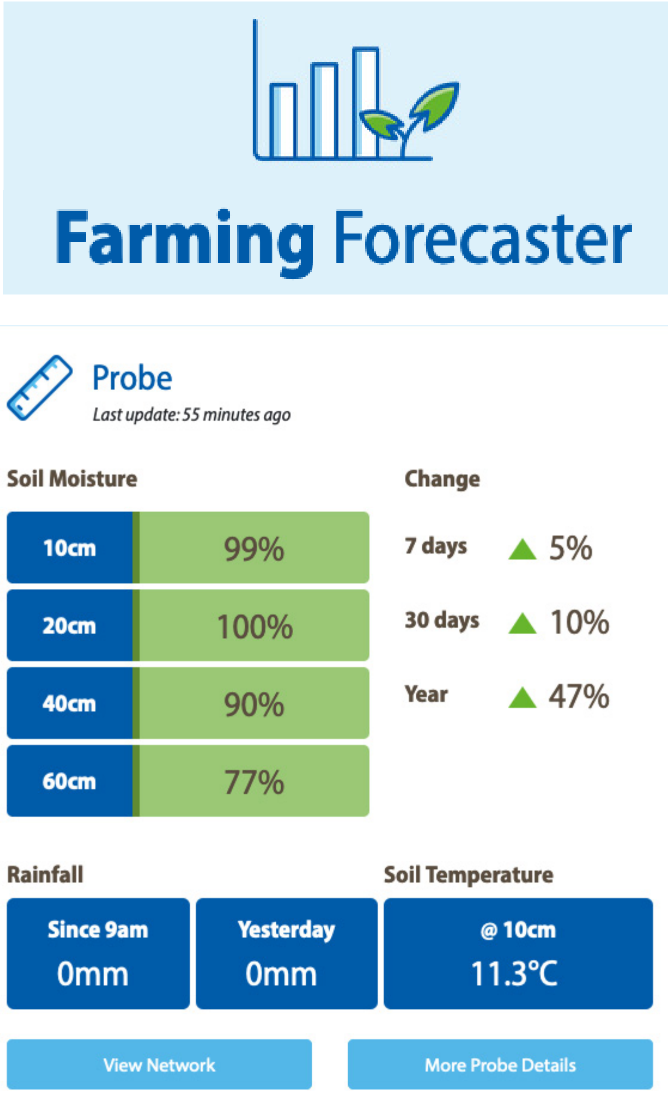
Clover content is desirable for dairy pastures as it does contribute to higher feed quality and some nitrogen. If clover content is sufficiently high (>30% of pasture dry matter), satisfactory pasture growth rates may be achieved with significantly lower rates of nitrogen being applied. High nitrogen rates can reduce clover content due to increased competition of the ryegrass. The impacts of high nitrogen rates can be reduced by grazing at canopy cover to reduce the shading effects. This is especially valuable in April May when clover is germinating, and seedlings can be shaded by tall grass growth.

In grazing situations where nitrogen fixed by pasture legumes such as white clover or annual clovers such as persian or shaftal clover, are important to production it is expected that approximately 25kg N/ha nitrogen will be fixed per tonne of clover dry matter grown. In most years the active clover growth period will only be 2 to 3 months, and 2 to 5 t/ha clover dry matter is likely to be grown making 50 to 125 kg N/ha available. If ryegrass is 2.5% N this would be enough to potentially grow from 2 to 5 t DM/ha which is way below the regional potential of 17 t DM/ha + which can be grown where nitrogen fertiliser is used.

Summary

Winter spring is a key period for forage supply on the NSW Coast. In kikuyu-ryegrass pasture systems most fertiliser is applied to the ryegrass through winter spring so it is essential to fertilise confidently through this period.

The soil moisture probe network on Farming Forecaster can provide added confidence to make these decisions after periods of no rain and the soil profile drying. It is important to understand seasonal rainfall trends, monitor local weather forecasts but refer to soil moisture probes to gauge current conditions.



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Dr Neil Moss Scibus

References:

Haynes, R.J. and Williams, P.H. (1993) Nutrient Cycling and Soil Fertility in the Grazed Pasture Ecosystem. Advances in Agronomy, 49, 119-199. http://dx.doi.org/10.1016/S0065-2113(08)60794-4

Further Resources:

These results are only part of the story for more details you can watch the webinar on

No 1: Richard Eckhard: https://youtu.be/TxldVGQjBVU

No 2: David Rowling: https://youtu.be/MwniTcwXvUA

No 3: Discussion: https://youtu.be/eOuxzrCqfMg

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