Leaf Phase Pasture Management

August 09 *A Farm Advice Sheet from* **SowtheSeed**

Using leaf emergence to determine pasture grazing rotations.

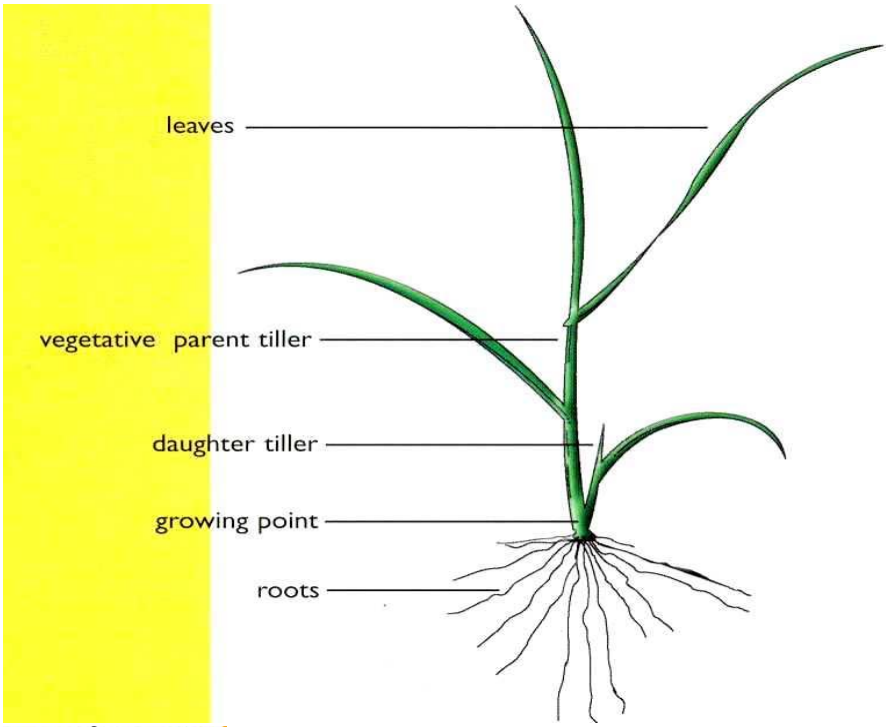
What is leaf phase pasture management?

This is the principle of using ryegrass leaf emergence rates for determining pasture rotation speed to maximize pasture growth rate and maintain quality. This principle maximizes potential ryegrass yield with the same level of inputs. Pastures that are grazed continually at the 2.5-3 leaf stage have higher pasture yields, maintain more drought resistant swards, have improved response to added nitrogen and are more persistent than pastures grazed at lower levels of leaf emergence.

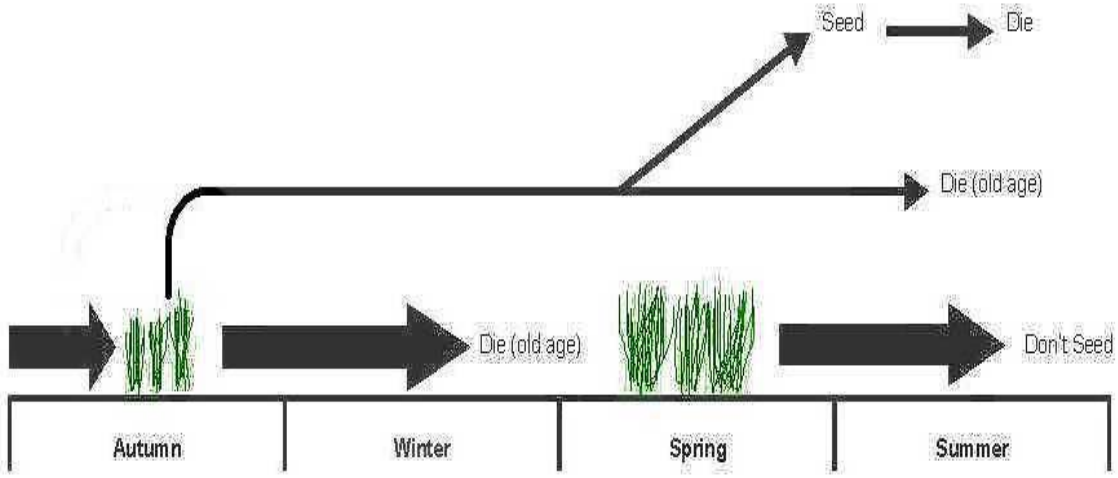
The ryegrass plant

The ryegrass plant consists of many separate individual tillers. Each tiller has its own root system and leaves, and can be grown independently if separated from the parent plant. Leaves form from the stem apex. If uninterrupted by defoliation (removal of leaf / stem material) each leaf will grow to its full length before the next leaf starts to emerge. The length of each leaf is determined by the available moisture, nutrients, variety, whereas the time of each leaf emergence is mainly determined by temperature. Each tiller has a limited life span which can range from a few weeks to up to a year. In an annual grass, tillers are formed over a restricted period and once they produce seed they usually die. Their life can be prolonged by being grazed before seeding and sufficient nutrient is available to continue vegetative growth. Perennial ryegrasses are capable of tillering at any time of the season but tend to tiller more frequently during the autumn and also in the spring. Each perennial plant therefore is a combination of tillers of various ages. New daughter tillers form from the stem apex of a mature tiller and can be dependant on the mother tiller for several weeks.

Tillers - functional unit of grasses

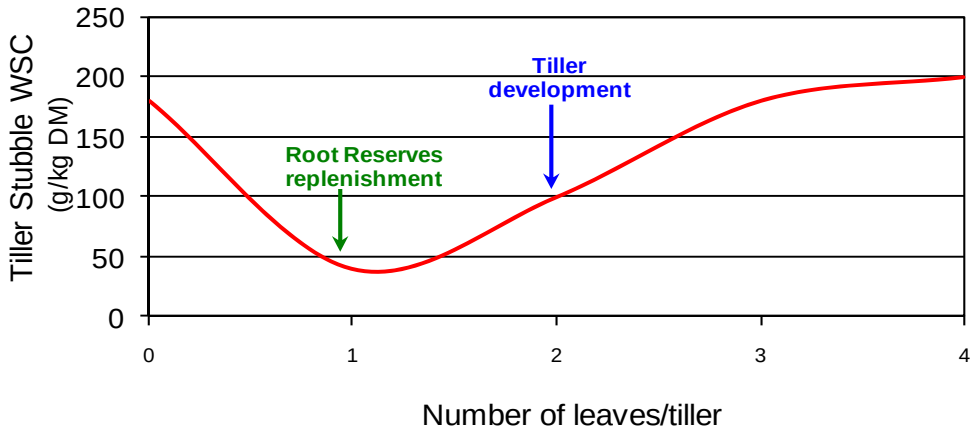


Perennial ryegrass tillering



Energy reserves

The plant uses photosynthesis and nutrients to create water soluble carbohydrate (plant sugars) to grow. Any energy not required for plant growth is stored in the tiller base (bottom 4cm) for survival when the plant is grazed. This is vital for regrowth following grazing, survival and long-term persistence of the plant. The diagram below shows the level of water soluble carbohydrate (plant sugars) in the tiller stubble at different leaf intervals post grazing. As the plant is grazed the sugar levels decrease because the plant has to use it's stored reserves to grow the first leaf. As this leaf emerges and starts to photosynthesise, it will begin to use the excess energy to build up the levels of storage again for the next grazing event. As can be seen by the diagram, the levels of water soluble carbohydrate (WSC) do not return to pre grazing until the third leaf has emerged. WSC is not partitioned to replenish root reserves until one leaf has emerged, and not partitioned to tiller development until two leaves have emerged.



Grazing Management

Grazing management is a function of three main aspects.

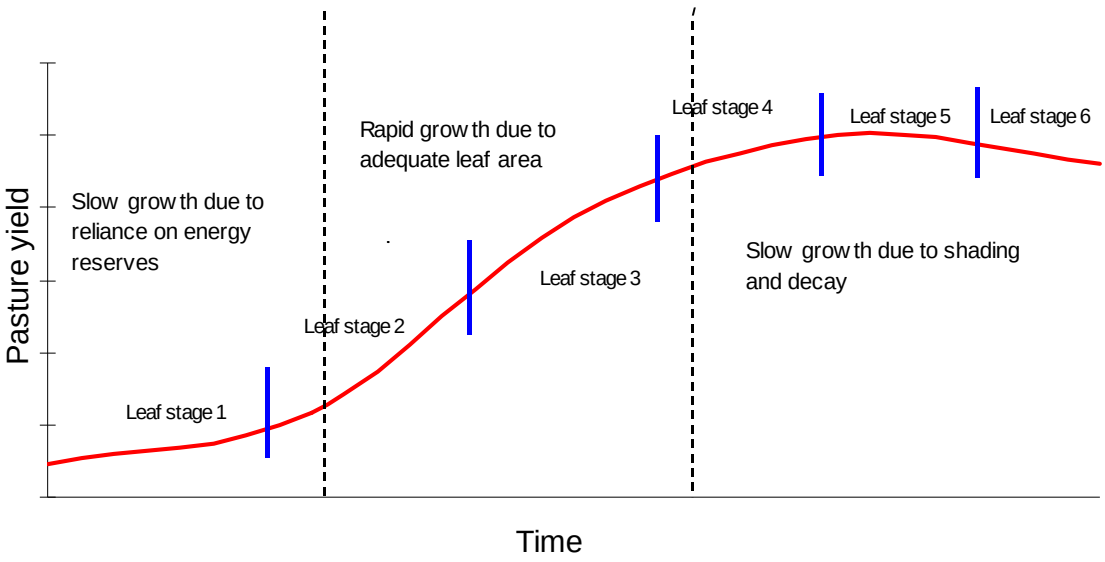
1. When to graze - or interval between grazing (rotation speed)
2. Intensity - or how hard to graze (residual)
3. Duration - or how long to graze

The most effective interval to graze ryegrass pasture should be determined by the leaf regrowth stage. By allowing ryegrass pasture to grow to three leaf emergence, it will allow the pastures to maximize regrowth and dry matter production. It will also help the pastures to be more persistent by improving rooting depth and vigor, and maximize tiller survival.

Research by Bill Fulkerson[1] and Danny Donaghy[2] has consistently shown that if ryegrass pastures are allowed to reach the 3 leaf stage, the proportion of pasture grown to each fully developed leaf is as follows:

1st Leaf	12-20%
2nd Leaf	30-35%
3rd Leaf	45-50%

The time for each leaf to emerge is the same if temperature light and moisture are constant. It is logical to allow pastures to capture the majority of the growth by allowing the plant to at least grow to 2 ½ to 3 leaf emergence before grazing.



1 http://www.vetsci.usyd.edu.au/about/staff/bfulkerson.shtml
2. http://fcms.its.utas.edu.au/scieng/agsci/pagedetails.asp?lpersonId=120

Times when grazing to 3 leaf emergence is not ideal

- When canopy closure occurs. This is when light cannot penetrate to the base of the sward and leaf senescence starts to occur due to shading. It is of concern if more than 25% of the paddock is affected:
    - high growth rates (mainly stem)
    - tillering will decline (depresses future growth)
    - quality is poor (too much fibre)
    - post-grazing residuals will increase

- To stop the spread of rust fungus (more than ⅓ of pasture affected in early regrowth)
- To prevent seeding in spring peak
- To control summer grasses when ryegrass pastures are dormant / semi-dormant

Grazing Intensity

Ideally aim to graze to a residual of 4cm of stem material. This will provide sufficient reserve WSC to allow maximum regrowth potential.

Leaving higher residuals could lead to aerial tillering which will reduce tiller survival and prevent the new tillers from forming.

Lower residuals will provide less reserve for new leaf growth. This is acceptable if the interval between grazings is infrequent, but will reduce persistence and DM production if it is frequent between grazing intervals.

Higher responses to applied Nitrogen

Research at Vasse Research station (Western Australia) by Martin Staines confirmed the case for grazing to leaf stage. A cutting trial consisted of 6 treatments. Three treatments had 1kgN/ha/day and three treatments had 2kgNha/day. Over 140 days pasture was cut at: 1½ leaves per ryegrass tiller (10 cuts every 14 days avg.),
2 leaves per ryegrass tiller (7 cuts every 19 days avg.) and
2½ leaves per tiller (5 cuts every 26 days).

As shown in the Table 1 below, pasture growth rate increased by allowing the pasture to be grazed at a later stage of leaf emergence at the same level of nitrogen applied. Also when higher rates of N were applied and grazing interval shortened the level of response reduced.

Table 1

Leaf Stage	Pasture Growth Rate (kgDM/ha/d)		
	1kgN/ha/d	2kgN/ha/d	Increase
1 1/2	48	71	23
2	49	78	29
2 1/2	61	95	34

If you compare the result from 1kgN/ha/day at 2½ leaf emergence and 2kgN/ha/day at 1½ leaf emergence, you will see that the increase in N applied only had a response of 10:1 compared with the 34:1 response if it was left to grow out to 2½ leaves/tiller.

If canopy closure is consistently occurring prior to the 2½ leaf stage, the first response should be to reduce the amount of N fertilizer applied, and not to speed up the rotation.

Nutritional characteristics of ryegrass at 2½ - 3 leaf emergence are more suited to milk production

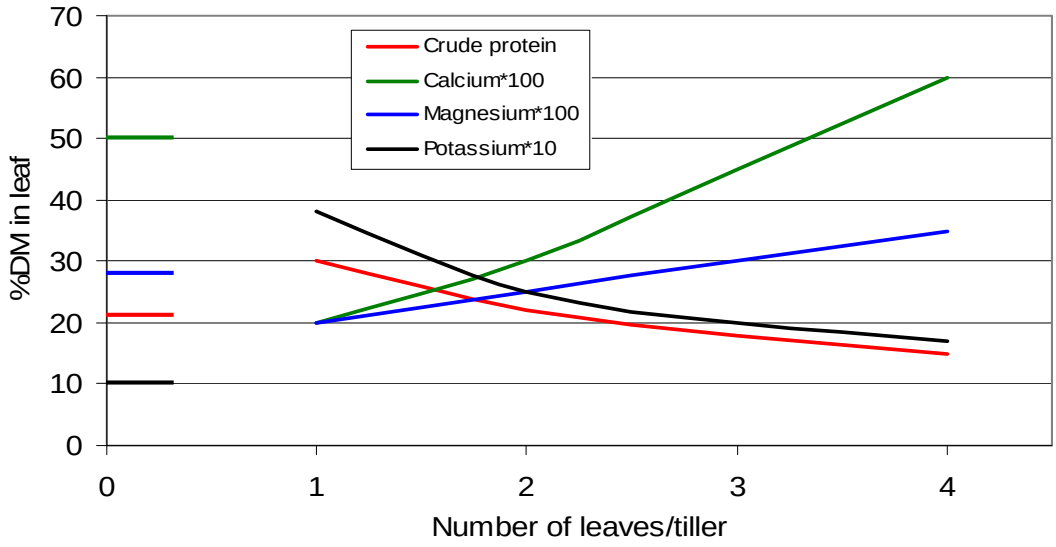
Protein levels decrease and sugar levels increase as pasture develops from 1½ to 2½ leaves. The optimum protein to sugar ratio is 1.1 for rumen function. Table 2 below shows pasture at 2½ leaf emergence is closer to this optimum protein to sugar ratio than pasture at 1½ leaf emergence.

Table 2

Pasture Composition	Leaf stage at cutting		
	1 1/2	2	2 1/2
Protein %	16	15	13
Sugar %	10	12	14
Protein:Sugar Ratio	1.7	1.1	1

Mineral composition changes over leaf growth phase also, as shown in the graph below. Calcium, phosphorus and magnesium percentage is higher, and potassium and nitrogen percentage lower in 2½ leaf emergence pasture compared with 1½ leaf emergence pasture. This is closer to cow requirements.

Leaf Stage and Pasture quality



If you have any further questions or would like to know how to integrate rotations based on leaf phase into your current pasture management strategy, please contact your Intelact Consultant or call Intelact Head Office on 0800 735 588