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Perennial ryegrass for dairy cows Grazing from the third-leaf stage

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Planted pastures form the basis of the dairy industry on the eastern seaboard of South Africa. When compared with purchased concentrates planted pastures are relatively inexpensive. They also allow for year-round, high quality grazing, which is not possible with veld grasses.

In South Africa, ryegrass is the second most important irrigated pasture after lucerne. Its popularity, especially in the dairy industry, is largely due to its ability to meet the need for high-producing, high quality forage during the cooler months of the year. As with all planted pastures, pasture production, animal performance and therefore farm profitability are determined by, amongst other things, the level of grazing management.

To understand how to manage a ryegrass pasture to get the best out of it in terms of quantity and quality, managers of pastures and livestock require an understanding of how a ryegrass plant grows.

The basic structure of a ryegrass plant

Ryegrass plants are made up of a number of individual single stemmed units called tillers. Each tiller is able to survive independently although it is connected to other tillers at the base and is able to share nutrients, water and carbohydrates. Tillering is influenced mainly by light and nutrient supply (especially N, but also P and K). New tillers are dependent on the parent tiller until they have produced their own leaves and roots. This takes at least a month even under conditions that are suitable for rapid growth. The different parts of the plant are illustrated in Figure 1.

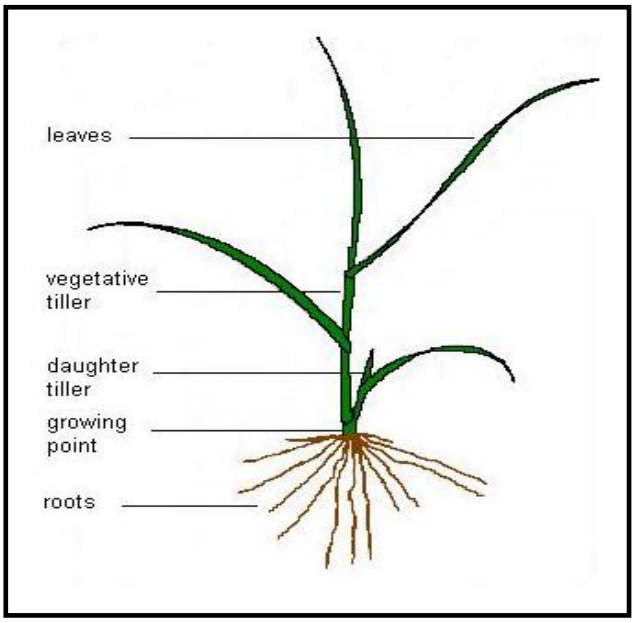

FIGURE 1. The ryegrass plant

- The growing point of the tiller is close to the ground. This limits damage during grazing. Leaves are produced continually from the growing point. One leaf is produced every 6-10 days in mid-spring and every 20-35 days in mid-winter, depending on the temperature.
- The youngest leaf is always at the top of the plant; older leaves are situated progressively nearer the base.

- The no. 1 leaf is the only one that is growing; the older leaves finish their growth at about the time the new leaf appears.
- Leaf **emergence** is influenced by temperature and soil moisture. Leaf **size** is influenced mainly by nutrient supply, moisture, light and temperature.
- 3-leaf stage: ryegrass plants typically maintain about three green leaves per tiller and once this 3-leaf stage has been reached the oldest leaf will die each time a new leaf is produced.

Grazing ryegrass – the 3-leaf stage

Plants contain energy reserves that are stored for maintenance and growth. In ryegrass, the majority of energy reserves are stored in the base of the tiller, with a little also stored in the roots. These reserves are important to the plant when photosynthesis (process of using sunlight to produce sugars) cannot keep up with demand for energy-rich organic compounds. This occurs just after grazing and also when light is unable to reach the plant to facilitate photosynthesis.

When a plant is grazed the leaves are removed, preventing the plant obtaining energy from the sun. This is when plant energy reserves are used. The priority for energy reserves is firstly leaf regrowth, followed by root regrowth, resumption of tillering and then replenishment of reserves.

Plants that have higher energy reserves before grazing have greater initial regrowth and are able to start photosynthesizing sooner, building up energy reserves faster. Regrowth is hindered by frequent grazing as this prevents the storage of energy. Close grazing physically removes part of the energy stores, which also hinders regrowth.

1-leaf stage:

- Water soluble carbohydrates (WSC) begin to be stored again
- Roots begin actively growing
- An imbalance exists between minerals, WSC and protein in the leaves
- Plants are most vulnerable to defoliation

2-leaf stage:

- WSC reserve levels have been built up enough for plants to be grazed again
- Roots are actively growing
- Tillering starts again
- Balance between minerals, WSC and protein in leaves is better

3-leaf stage:

- WSC levels are fully restored
- Root growth and tillering are fully active
- Overall top growth is at a maximum

Post 3-leaf stage:

- Death of first leaf
- Pasture quality declines
- Utilization during grazing declines

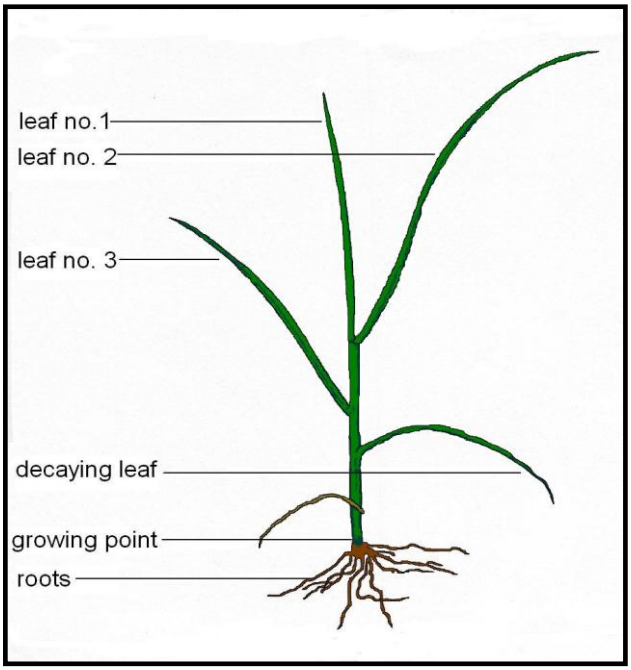

FIGURE 2. Leaf stages of a ryegrass plant

The optimum time for grazing to maximise persistence and productivity of ryegrass plants is after the 2½ leaf stage, but before the fourth leaf stage when the oldest leaf dies and is therefore wasted. In the long term, a grazing interval close to this results in larger tillers

with higher energy reserves than occurs under a more frequent grazing regime. The initiation and survival of daughter tillers is greater from these larger parent tillers than from smaller parent tillers as daughter tiller development and survival is inhibited by early defoliation.

Research on perennial ryegrass in Australia has shown that slight shifts in timing of grazing between the two and three-leaf stages can be beneficial. In late autumn and winter the third leaf is 40% heavier than the second leaf. Also, at this time of year the decline in nutritive value beyond the 3-leaf stage is smaller than at other times of the year, so grazing closer to the 3-leaf stage allows this growth to be captured without greatly compromising nutrient uptake.

In spring, leaves are larger (particularly under high nitrogen application) and canopy closure is reached at an earlier leaf stage than in autumn or winter. The resulting stem elongation and shading of lower leaves causes the pasture to experience a sharp decline in nutritive value. There is also no nett growth to be captured by waiting until the 3-leaf stage. At this time of year it can be beneficial to graze closer to the second leaf stage.

Post-grazing residual

Pasture management aims to optimize productivity, nutritive value and persistency, while not compromising the intake of dairy cows. Research into grazing management systems recommends maintaining a post-grazing residual of 4-6 cm (1500 – 1800 kg DM ha^{-1}) to promote ryegrass growth and persistence.

Continually leaving higher residuals (underutilization) results in a waste of feed, poor utilization in the next grazing cycle, reduced tillering due to shading by elongated stems and aerial tillering (tillers originate from elongated stems that are not attached to the base of the plant). The main reason for underutilization is the allocation of too much pasture for the grazing period. It is important that no residual plant material remains that can shade the growing points of the ryegrass. An economical way to ensure this is to use low-producing or dry cows as followers to the main herd, allowing them to graze down to the required 5 cm residual. The follower herd must not be in the pasture beyond day three or they will start to graze regrowth. If the correct grazing interval is practiced (i.e., the 3-leaf stage), a relatively high intensity of grazing won't deplete plant energy reserves.

However, continually leaving lower residuals (<4 cm) can result in weaker regrowth and poorer persistency of the pasture due to continual depletion of sugar reserves and reduced cover. Maintaining green cover is important as photosynthesis generates growth better and more quickly than carbohydrates mobilized from plant reserves.

Conclusions

Poor grazing management is a contributing factor to the non-persistence of perennial ryegrass. Proper grazing management will help to optimize persistence and maximize yield, quality and utilization. Grazing management practices should focus on grazing interval (centered around the 3-leaf stage) and leaving an appropriate post-grazing residual to maintain cover and persistence.

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