



A new grazing management strategy for Northern Dairy:

Part 2-Management of grazing intensity and pasture utilisation

By Dr. Marcelo Benvenuti

The Queensland Department of Agriculture and Fisheries (DAF) C4Milk team has developed a new grazing management strategy for tropical and temperate grasses and legumes for Northern dairy systems.

The new grazing management strategy called PUP grazing (**PUP: p**roportion of **u**n-grazed **p**asture) is based on the horizontal utilisation of all leaf material, leaving the stemmy and contaminated material behind (Diagram 1, Image 1). This grazing strategy provides a solution to the management of pastures with variable stem heights. The PUP grazing strategy allows you to consistently maximize cow productivity.

This article (Part 2) covers key principles on how dairy cows utilise the pastures offered and the implications for the management of grazing systems. The previous article (Part 1, Northern Horizons July 2017) focussed on pasture structure and how cows choose to selectively graze the pasture on offer.

The PUP grazing management strategy is an improved version of current grazing management rules. For example the current rules for grazing ryegrass and kikuyu are based on grazing at 2 ½ to 3 and 4 ½ to 5 leaves respectively. The PUP strategy uses the same pre-grazing leaf stages, the difference is in the grazing intensity. Current recommendations target a five centimetre post grazing residual. Our approach to this is completely different. We need to consider what the cow needs to achieve a high quality intake.

Each pasture type is different as demonstrated above with the ryegrass and kikuyu. However the new grazing management approach is the same using a set of principles based on current grazing recommendations for each pasture type, with the addition of new principles derived from new research being conducted at Gatton Research Dairy.

Targeting 100 % horizontal utilisation of a pasture strip excluding contaminated pasture clumps consistently allow the milking cows to graze the top leafy stratum of a pasture, ensuring higher diet quality and larger pasture intakes. This is the basis of our new grazing strategy called PUP grazing.

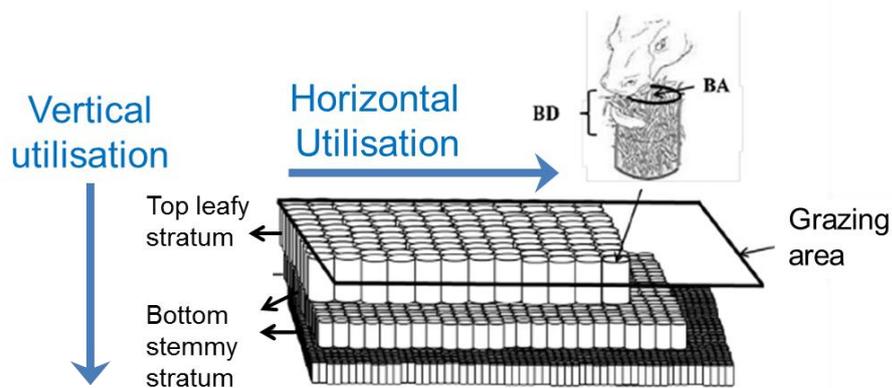


Diagram 1. Representation of the grazing down process. Cows graze down the pasture both vertically and horizontally. The new grazing management strategy is based on the horizontal utilisation of the pasture. The cylinders represent bites taken from the pasture by the cows (BD and BA mean bite depth and bite area). Dairy cows can take large bites and achieve high levels of pasture intake and diet quality only when grazing the top leafy stratum. Bite size, intake and diet quality decline when cows are forced to graze the bottom stemmy stratum. Therefore, animal performance declines when the top leafy stratum has been grazed across the area of the pasture (horizontal utilization of the pasture) irrespective of the height of the bottom stemmy stratum. Consequently, targeting 100 % horizontal utilisation of the pasture area excluding contaminated pasture clumps consistently allow the milking cows to graze the top leafy stratum of a pasture, ensuring higher diet quality and larger pasture intakes. This is the basis of our new grazing strategy called PUP grazing. Diagram adapted from Gregorini *et al.* (2013).



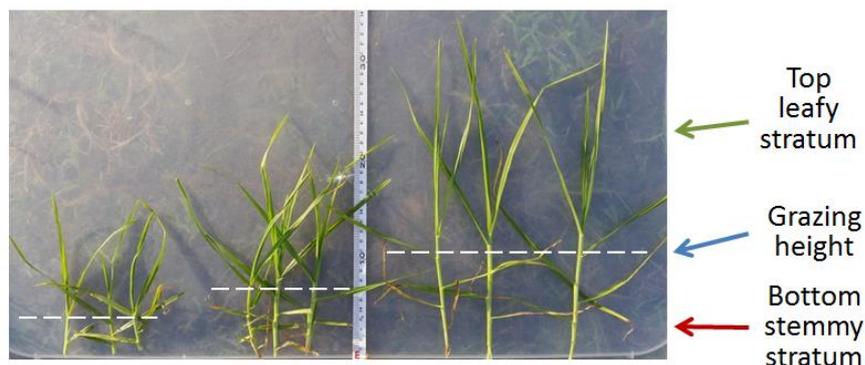
Image 1. Grazing trial conducted at Gatton Research Dairy in December 2016. The image shows cows grazing down lucerne pastures. Cows graze down the pasture both vertically and horizontally. The new grazing management strategy is based on the horizontal utilisation of the pasture.

Pasture structure, forage quality and selective grazing

The key conclusions from the first article published in Northern Horizons in July 2017 were:

- The structure of both tropical and temperate grasses and legume pastures typically consists of a top leafy stratum and a bottom stratum with a high proportion of stems known as the bottom stemmy stratum (Image 2).

Image 2. Plant structure and grazing height for kikuyu and lucerne pastures observed during grazing trials at Gatton.



-The large difference in leaf to stem ratio between strata results in large differences in forage quality between strata. The nutritive value is much higher for the top leafy stratum compared to the bottom stemmy stratum, with higher crude protein and energy and lower fibre concentrations.

-Dairy cows strongly prefer to graze the top leafy stratum and they only consume the bottom stemmy stratum once the top leafy stratum has been heavily depleted.

-Dairy cows will graze stem in preference to grazing pasture previously contaminated by either urine or faeces.

Grazing intensity, diet quality and forage intake

Dairy cows can achieve high levels of pasture intake and diet quality only when grazing the top leafy stratum (Diagram 1). A number of grazing studies have shown that intake, diet quality and milk production decline when cows are forced to graze the bottom stemmy stratum. For example, in a

recent grazing study conducted at the Gatton Research Dairy in December 2016, results showed that when dairy cows were forced to graze the bottom stratum of lucerne pastures, forage intake, diet quality and milk production were decreased. The experiment consisted of four levels of pasture allocation in a partial mixed ration (PMR) feeding system (Table 1, Image 1). The pasture allocation for treatment 4 was designed to leave five cm of pasture residue after grazing. However, the results show that cows refused to graze the pasture any lower than 25 cm. Instead of grazing the pasture down into the stemmy stratum the cows severely decreased their dry matter and energy intake (Table 1). This was associated with a reduction in milk production of up to 1.6 litres per cow per day.

Table 1. Results of a grazing trial conducted at Gatton Research Dairy in December 2016 on lucerne pastures. The average pre-grazing pasture height was 54 cm.

Treatment	T1	T2	T3	T4
Pasture allocation (kg DM/cow/day)	30.6	20.5	15.1	10.9
Post-grazing pasture height (cm)	39.1	34.1	31.5	25.4
Pasture intake (kg DM/cow/day)	9.3	8.5	6.9	6.4
ME intake (MJ/cow/day)	207.2	195.5	178.4	171.0
Proportion of un-grazed pasture (% of area)	9.2	10.1	2.9	0.7
Consumed pasture quality				
ME (MJ/kg DM)	10.2	10.1	10.0	9.9
CP (%)	24.5	23.6	23.0	22.5
NDF (%)	27.9	29.3	29.7	30.7

Using milking cows to achieve target residual pasture heights may compromise their productivity

In order to achieve optimum pasture growth and yield, target residual pasture heights of about 5 cm are currently recommended for some pasture species such as ryegrass, kikuyu and lucerne. It is therefore important to reduce the residue levels to 5 cm when they have accumulated in excess of this point. Pasture residues typically consist of stemmy and dead material accumulated at the bottom of the plant. As indicated in the previous section, if milking cows are forced to remove this bottom stemmy stratum their productivity will be compromised. It is therefore recommended to reduce pasture residues mechanically or using dry or young stock every 2 or 3 grazing rotations.

Given our greater understanding of pasture grazing dynamics, it is now recognised that the height of the bottom stemmy stratum is highly variable over a season. It would be inappropriate to recommend a fixed residual post-grazing pasture height for milking cows if the aim is to consistently achieve optimum diet quality and pasture intake. Even in well managed pastures the height of the bottom stemmy stratum is highly variable within and between paddocks (Figure 1), particularly for hot tropical environments during periods of high pasture growth rate. The height of the bottom stemmy stratum depends on the pasture species and pasture height (Image 2) as well as the irrigation, fertiliser and grazing history of the pasture (Image 3). Therefore, grazing management strategies based on fixed post-grazing heights are unrealistic when there are variations of height in the bottom stemmy stratum of a pasture, as trying to graze at a standard height will compromise cow intake and then productivity.

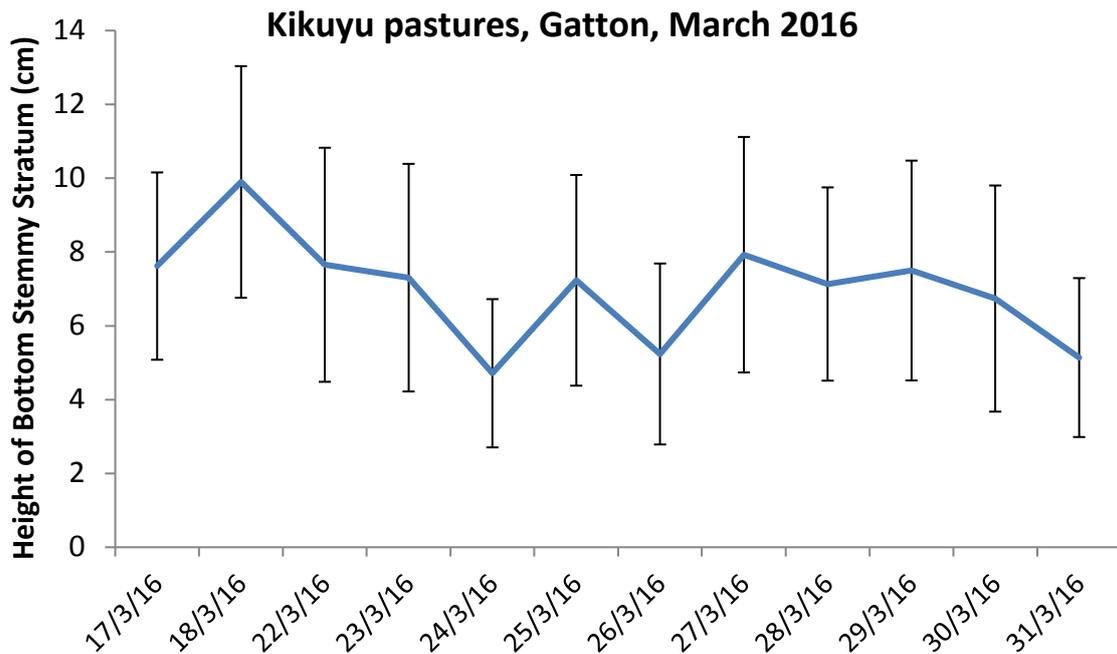


Figure 1. High variability of the height of the bottom stemmy stratum between and within paddocks in well managed Kikuyu pastures. Vertical lines represent the variability in the stem height data.



Image 3. This image illustrates the large variability in plant structure found in kikuyu. These two tillers are of the same age and have similar number of leaves but they are largely different in total height (14 vs 30 cm) and stem height (6 vs 13 cm). The difference is that the tiller on the right received less water. If a pasture consists of tillers on the left with stem height of 13 cm and if the cows are forced to graze the pasture down to the recommended 5 to 6 cm, total cow productivity will be reduced in 24 hour period due to a lower diet quality and intake.

Horizontal utilisation of the pasture and the new grazing management strategy

The new grazing management strategy called PUP grazing is based on the horizontal utilisation of all leaf material, leaving the stemmy and contaminated plant material behind. This grazing strategy provides a solution for the management of pastures with variable stem heights. This allows you to consistently maximize cow productivity. As indicated above, dairy cows can achieve high levels of

pasture intake and diet quality only when grazing the top leafy stratum (Image 1). Intake, diet quality and milk production decline when cows are forced to graze the bottom stemmy stratum. **Therefore, animal performance declines when the top leafy stratum has been grazed across the area of the pasture (horizontal utilization of the pasture, see diagram 1) irrespective of the height of the bottom stemmy stratum.**

PUP is proven to work

PUP grazing has been found to be a successful grazing management strategy for beef cattle grazing tropical pastures, lambs grazing ryegrass and more recently the experiment conducted with dairy cows at the Gatton Research Dairy during December 2016 on lucerne pastures. Two long-term grazing trials conducted on tropical pastures and ryegrass found that when 10 % of the pasture remained un-grazed resulted in 30 % more liveweight gain of steers or lambs when compared to the traditional rotational grazing system where a greater grazing intensity is used. PUP grazing has also been found to increase milk production in dairy systems.

The experiment conducted with dairy cows at the Gatton Research Dairy during December 2016 on lucerne pastures (Image 1, Table 1), showed that when the **proportion of un-grazed pasture (PUP)** was about 10 % of the pasture area offered, pasture intake was about 9 kg DM/cow/day (T1 and T2 in Table 1). However, when PUP declined to less than 3 %, intake decreased to less than 7 kg DM/cow/day which was due to the cows being forced to graze down into the bottom stemmy stratum (T3 and T4 in Table 1). As mentioned above, this resulted in a reduction in milk production per cow.

So how do we assess the proportion of pasture not to offer the cows?

This proportion of un-grazed pasture is normally associated with faecal contamination which was low for the grazing experiments mentioned above (i.e. 3 to 10 % of the pasture area). Cattle strongly reject contaminated areas of the pasture. When all the top leafy stratum of the un-contaminated areas has been consumed, cows actually prefer to graze the bottom stemmy stratum of un-contaminated areas rather than grazing leaves around the faecal and urine patches, which results in the reduction in intake, diet quality and animal performance described above (see Image 4). Therefore, contaminated areas should be taken into account when using PUP grazing. If you count 10 un-grazed patches out of 100 steps, then that is 10 % extra area we need to allocate to ensure the cows are fully fed. If we do not allocate extra, we will certainly diminish their intake for the day.

In some cases the contaminated areas could be as high as 20 to 30 % of the paddock depending on stocking rate and the time the cows have previously spent on the pasture. For example, if the contamination is 20 % of the pasture area, then the target horizontal utilisation of the pasture should be 80 % of the total pasture area. Consequently, the general target of the new grazing management strategy is to achieve 100 % horizontal utilisation of the un-contaminated pasture and 0 % horizontal utilisation of the contaminated patches. This rule will result in the cows grazing the top leafy stratum, without being forced to graze the bottom stemmy stratum, and achieve the target pasture intake of high forage quality.

Image 4 - Cows avoiding contaminated pasture, demonstrated by the long leafy patches around the faecal matter and surrounding harder-grazed area. Kikuyu pastures at Gatton Research Dairy March 2016.

- Cows avoided contaminated areas



Pre-grazing



Post-grazing PMR herd

Pasture utilisation

If PUP grazing strategy is applied correctly, dairy cows should never graze the poor quality bottom stemmy stratum. The residual leaf material left behind after grazing fuels the plants' regrowth allowing for a fast regrowth of the pasture. This strategy may result in greater pasture growth and utilisation of a pasture across a season in comparison with the traditional management of a pasture of greater grazing intensity. The traditional management was based on grazing intensely, leaving low pasture residues, resulting in a more intense defoliation. The two long-term grazing trials using beef steers grazing Buffalo grass (*Axonopus Catherinensis*) in Argentina or lambs grazing ryegrass in Brazil showed that overall pasture utilisation in total kilograms of dry matter per hectare per season was higher for PUP grazing than for the traditional management of more intensive grazing. This is still to be tested for the pastures used by the northern dairy systems in Australia. However, if the bottom stemmy stratum accumulates excessively over time, pasture growth and utilisation may be compromised by virtue of the pasture ultimately losing density over a season. Therefore, pasture residues need to be reduced to five to six cm every couple of grazings to maintain future plant structure and improve overall utilisation on an ongoing basis. Some options for managing residual pasture, without forcing cows to graze harder, is to slash or mulch periodically or use a secondary herd such as dry cows or heifers to control the residue heights.

Conclusions

By targeting 100 % horizontal utilisation of the un-grazed un-contaminated pasture and 0 % utilisation of the contaminated pasture for milking cows, the new grazing management strategy called “PUP grazing” achieves the following:

1. Milking cows are never forced to graze the bottom stemmy stratum which is of poor nutritional quality.
2. Milking cows consistently graze the top leafy stratum which is of higher quality allowing you as a manager to achieve target pasture intakes irrespective of the height of the bottom stemmy stratum (Diagram 2).
3. The potential for high pasture growth and utilisation as green leaf remains post grazing.
4. When excess residues are accumulated they should be reduced mechanically or grazed by dry or young stock but never with milking cows.

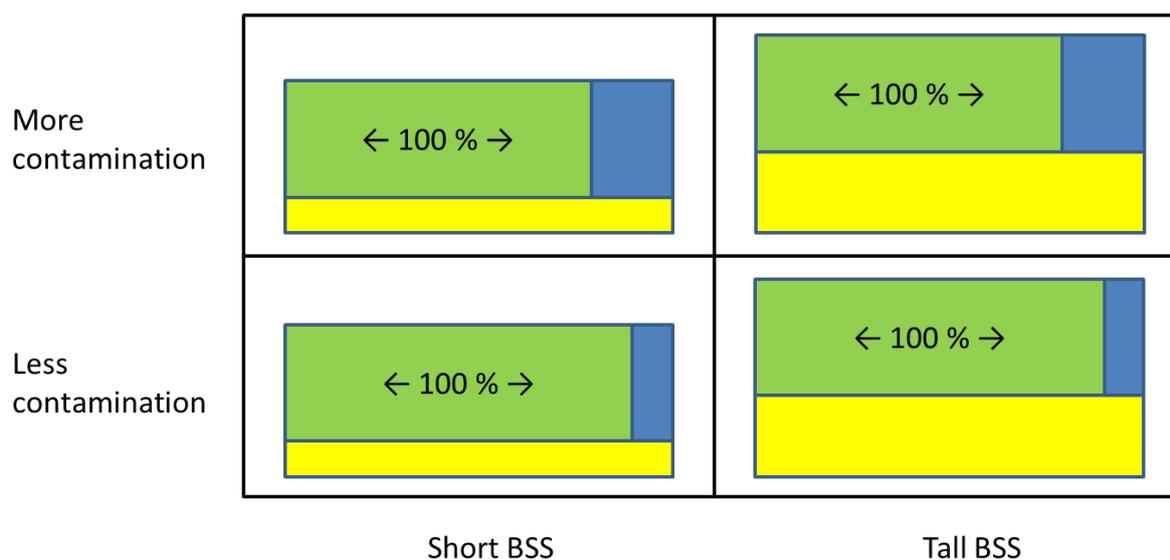


Diagram 2. Targeting 100 % horizontal utilisation of the un-contaminated pasture and 0 % utilisation of the contaminated pasture consistently allow the milking cows to graze the top leafy stratum without forcing them to consume the bottom stemmy stratum (BSS) regardless of the height of the BSS. Green and blue boxes represent un-contaminated and contaminated top leafy stratum respectively. Yellow boxes represent the BSS.

Next article

The last article of this series (Part 3) will be published in the next edition of Northern Horizons and will cover the practical applicability of the new grazing management strategy.

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