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Why hold a Pasture Persistence Symposium?

Graham Kerr (Chair LOC)

Pasture underpins the New Zealand economy, and poor pasture persistence is a major issue currently confronting dairy, sheep and beef farmers through many areas of New Zealand. Things have been particularly grim in the last 3 years in the northern North Island pastures badly affected by dry summers, combined with damaging black beetle numbers and widespread usage of an inappropriate endophyte.

There has always been a degree of dissatisfaction with pastures. I heard complaints about Ellett in the 1980s, Yatsyn in the 1990s and Bronsyn in the 2000s. Farming systems have evolved greatly in recent years and the pressure put on pastures, particularly during times of poor growth, has increased accordingly.

For example, when I grew up in the Waikato in the 1970s, a family could make a comfortable living milking 150 cows. Those cows were Jerseys, weighing 400kg on a good day, stocked at the old 'cow to the acre', or 2.5/ha. Today, to make a similar living, you need 400 cows. They're bigger – probably 450-500 kg Jersey-Friesians, stocked at 3 cows to the hectare. The New Zealand sheep industry has seen parallel increases in flock size, stocking rate, ewe size, lambing percentages and carcase weights.

Another change in farm systems has been the movement from hay to silage. I remember hay was deemed ready to cut when the seed could be knocked out of the seedheads. Not ideal in terms of feed quality! But it did build a ryegrass 'soil seed bank' from which new plants arose after adverse events such as drought.

I also believe we have under-estimated the affects novel endophytes are having on pasture palatability. The consequence of removing the 'anti-grazing' effect of the old Standard or Wild endophyte is that we can more easily over-graze.

Some blame persistence problems on 'new cultivars', but it is not that simple. We need to improve our plant breeding, but we also need to look at pest and soil affects, better farm systems, how we establish and manage pastures, and the use of alternative species.

NZGA organised this Symposium to bring together many of NZ's top pastoral scientists, along with farmers, consultants and agribusiness people to provide information and to discuss persistence issues.

We hope, as well as defining the persistence issues and providing good information on solutions in the excellent Proceedings, that the Symposium will be the start of a wider programme to help farmers improve the persistence of their pastures in which we all take part.

'Changes in pastoral farming practices and pasture persistence – a review'

Dr Dave Clark, DairyNZ

"In ryegrass/white clover dairy pastures reliance on vegetative propagation appears to be inadequate to maintain sward stability…. Currently, the ryegrass plant losses are replaced by the regular and increasing practice of pasture renovation by direct drilling" (L'Huillier & Aislabie, 1988). This indicates that ryegrass persistence in Waikato dairy pastures was a problem with 'old' cultivars 25 years ago, and is not just a recent phenomenon. Although single factors can influence pasture persistence, defined here as maintenance of a desired species through time without major intervention, it is more likely that several factors interact to determine the productive life of a ryegrass-based pasture, e.g. the effect of insect predation on plants with low tiller birth rates due to drought. This article summarises a paper on recent changes in dairy farming practice that may be influencing ryegrass persistence (Clark, 2011).

Climate

Farmers attribute much of the problem of persistence to climatic conditions with summer-autumn droughts, wet winter-early spring and high summer temperatures being the main concerns for ryegrass and white clover survival. In the past six years much of the northern North Island has been affected by summer-

autumn droughts, with especially serious droughts in 2005 and 2008 in the Waikato. Despite increased supplementary feeding and drought management strategies such as early culling and once daily milking, many pastures have been grazed below recommended residuals with obvious effects on 'pasture pulling', weed ingress and slow recovery in the subsequent year.

Ryegrass and white clover both have shallow root systems, especially in compacted soils, which make them susceptible to drought. Poor summer growth can lead to lower residuals and pasture pulling, and increase susceptibility to insect depredation, especially if ryegrass has low endophyte status or contains AR1 endophyte in areas where black beetle (*Heteronychus arator)* is present. Drought makes it difficult for daughter tillers to become established, and because these form the basis for winter and spring growth, long term effects are possible; gaps will allow weeds (e.g. *Poa* spp.) to become established in autumn. Higher summer temperatures (e.g. average daily maximum air temperatures between January-March 2008 were 2-3^{O}C above average in the Waikato) are unlikely to be affecting ryegrass survival *per se* but they encourage the early germination and growth of C4 weed grasses, such as smooth switchgrass and summer grass which can compete strongly against establishing ryegrass tillers and white clover stolons.

Stocking rate

Stocking rates have increased nation-wide from 2.4 to 2.85 cows/ha (+18.7%) from 1990 to 2008, with the highest stocking rate for unirrigated regions in the Waikato (3.0 cows per ha). Milksolids per cow has increased by 22% from 1991 to 2009 but milksolids per ha has increased by 48% over the same period showing the importance of increased stocking rate. Increased stocking rates, however, can lead to many changes in soil and plant properties, these include increased bulk density, reduced macroporosity, changed soil fauna, decreased N fixation, soil surface disturbance leading to tiller and stolon death, and plant burial with long-term effects on DM yield and subsequent weed invasion. Increased stocking rate also increases the number of urine and dung patches with both increasing and decreasing DM yield and changing in pasture composition depending on nutrient concentrations.

Increasing stocking rates from 2.3 to 7.0 cows per ha in a recent experiment at DairyNZ's Scott Research Farm showed good perennial ryegrass and white clover persistence and yield at all stocking rates. Importantly, grazing management and inputs were used to ensure correct grazing residuals were maintained especially during summer and autumn.

Supplementary feeding

Maize grown for silage for the dairy industry has increased from 3000ha in 1994 to 72000ha in 2008 and palm kernel expeller use has increased from zero in 2000 to 1.4m tonnes in 2010. These imports have supported higher stocking rates, longer lactations and higher per cow production; in addition, they have increased nutrient loading on farms that use them. Only rarely do supplements lead to zero substitution rates which implies that they have a 'pasture sparing' effect which may lead to either less overgrazing or higher pasture residuals. It is unlikely that either stocking rate or supplement use *per se* lead to reduced ryegrass persistence.

Pasture management

Some have questioned the current grazing recommendation to leave a residual of 1500 kgDM/ha at each grazing because of effects on ryegrass survival. This recommendation has been demonstrated over many years by the Lincoln University Demonstration Farm with optimum water and nutrient inputs; although major pasture renovation has not been necessary, it is not possible to conclude that such residuals have no effect on ryegrass persistence. There will be little opportunity for natural reseeding when grazing residuals are around 1500 kgDM/ha in late spring. Another consequence of maintaining lower pasture residuals throughout the year may be the incursion of new C4 grass weeds, e.g. yellow bristle grass (*Setaria pumila).*

Pasture conservation and topping

Increased pasture utilisation has meant that opportunities to conserve surplus feed have decreased. The recognition that late, high yielding pasture silage crops often have very low metabolisable energy (ME) content has led to the practice of taking early silage crops of high quality with little seed content. Much less hay is made, so these sources of seed are reduced on many dairy farms. The value of high ME leafy pasture for high milksolids yield is now well accepted and topping, often before grazing, is practised, especially in late spring-summer to avoid 'clumpiness' and seed head formation. This practice will reduce seed input from a ryegrass tiller population that has survived local environment and management.

There have been changes in both cultivation and direct drilling technology in the past 20 years. Cultivation used to be 'plough-several disc passes-roll' whereas now it is more likely to be 'plough-power harrow-roll' before sowing. After cropping, or from run-out pastures, herbicides are used to kill existing vegetation and then new pasture seeds are direct-drilled. Some problems remain the same, namely, excessive ryegrass seed rates and sowing white clover seeds deeper than 13mm.

Major progress has been made in cultivar availability and selection for specific sites. The recent debate on the merits of cultivars containing either AR1 or AR37 endophyte provide, however, ample evidence that cultivar selection for a particular site is a complex decision with risks attached. The use of novel endophyte pastures has led to recommendations that a seedbed is prepared that is free of resident ryegrass. This allows a sward of 100% sown ryegrass to be established thus maximising novel endophyte benefits, but it also introduces the risk that there are no resident

ryegrass seeds to 'fill the gaps' if there is a partial failure of the sown ryegrass.

The 'modern' sown ryegrass is blamed for poor persistence but the problem could have existed in the past, without being recognised. Recent cultivars infected with novel endophytes are more palatable to cows and sheep than ryegrass containing 'wild' endophyte, resulting in lower grazing residuals where strict management is not practised.

Fertiliser

Annual urea fertiliser use has increased from 18 600t in 1990 to 433 300t in 2007 with much of this increase applied to dairy pastures. The effect of N fertiliser input on the performance of grazed ryegrass-white clover swards is complex. In most circumstances total DM yield and tiller density will increase, with increased ryegrass DM response more than compensating for any white clover yield decrease.

The white clover decrease is dependent on many factors, but white clover can be maintained at 200 kgN/h/yr with the correct grazing management. Where N fertiliser use leads to increased stocking rate there is likely to be an increased area affected by urine with a direct negative effect of urine on white clover population density, stolon length and N fixation and an indirect effect due to lower clover content.

There is no indication that ryegrass persistence on dairy farms will be compromised by low Olsen P levels, with a high percentage of farms close to, or above, those required for maximum DM yield. Intra-paddock variability in nutrient levels may even increase as average nutrient levels rise, thereby influencing ryegrass persistence by creating patches of low nutrient content that will favour the ingress of other grasses.

Conclusions and Implications

This brief review of farm management changes that might have impacted on pasture persistence leads to the conclusion that there is a primary (1º) subset of factors that entrain a progressive decline in ryegrass and white clover density; and a secondary (2º) subset that are broadly consequent on the initial damage caused by primary drivers.

The primary subset is hypothesised to include: soil type (water holding capacity and texture), summer rainfall (total and distribution), plant nutrient status (especially N) and plant population survival mechanisms (tiller dormancy, birth and death rates, seed production and establishment, endophyte status). These factors and, critically, their interactions, are responsible for the persistence characteristics of New Zealand ryegrass-based pastures.

The 2^{o} subset includes: pests (e.g. black beetle, Argentine stem weevil and clover root weevil and root knot nematodes), diseases (e.g. crown rust and clover viruses), weeds and high grazing intensity (pugging and pasture 'pulling'). These 2^{o} factors will rarely initiate a decline as a single factor but can interact with other 1^{o} and 2^{o} factors to lead to catastrophic losses of plants in weakened pastures.

For example, upper North Island ryegrass pastures have suffered major losses in tiller density in the past three years but the worst losses have occurred where AR1 endophyte ryegrasses on free draining light ash or peat soils have been exposed to low summer rainfall with intermittent showers breaking tiller bud dormancy leading to tiller death. Black beetle larvae feed on roots and the adults on tillers, from December to March, and high grazing pressure leads to serious pasture pulling; without renovation pasture gaps will provide sites for *Poa* spp and broadleaf weeds to invade and spring grazing management will have led to low or zero ryegrass seed input.

Assuming irrigation is not available, the following actions are required to protect the pasture feed source:

Correct plant species and cultivar selection on vulnerable soils – alternative species such as tall fescue containing MaxP endophyte should be considered where ryegrass has failed on several occasions. Where low water holding capacity soils, occasional summer drought and insect predation coincide, then AR37 endophyte should be sown; and greater diversity achieved by sowing plantain or chicory to give alternative, high quality feed sources should ryegrass production decline for any reason. In more extreme conditions Phalaris may have a place because dormancy during drought increases plant survival.

Tiller replacement - N fertiliser should be specifically used in early summer (25-40 kgN/ha) to ensure the establishment of daughter tillers from existing reproductive tillers. Grazing management immediately after autumn rains should be aimed at establishing new tillers by avoiding grazing as much of the farm as possible for a two week period, based on the observation that summer-autumn tiller establishment is better under infrequent grazing. Winter pasture management should avoid high pasture covers that lead to basal shading and hence tiller death.

Ryegrass cultivar development - should specifically enhance tiller bud dormancy in drought conditions.

References

Clark, D.A. 2011. Changes in pastoral farming practices and pasture persistence – a review. In: Pasture persistence. Grassland Research and Practice Series 15: 7-13.

L'Huillier, P.J.; Aislabie, D.W. 1988. Natural reseeding in perennial ryegrass/white clover dairy pastures. Proceedings of the New Zealand Grassland Association 49: 111-115.

No single solution to pasture persistence but some management practices will help

Rob Brazendale (DairyNZ) and Gary Walton (Beef + Lamb NZ)

Messages from the farmer workshop at the recent Pasture Persistence symposium

Lack of persistence has many overlapping causes, and there is no stand out solution.

Causes of poor pasture persistence include:

- insect damage, e.g., Clover root weevil, Black beetle, drought
- use of an inappropriate endophyte (e.g. AR1 in upper North Island)
- drilling annual ryegrasses into perennial pastures
- increased feed demand on pastures
- reduced natural re-seeding, resulting from plant breeding and management for pasture quality
- poor soil structure and low fertility.

Grazing management

Grazing management can make a difference. Pastures replace themselves naturally through tillering of grasses and stolon growth of clovers.

November is a critical period. Seed-heads appearing in October/November die when grazed or cut. New tillers must replace them. A high tiller replacement rate before summer improves persistence.

Some grazing management practices assist this process and some slow it down. Grazing management practices that enhance tiller replacement rate include:

- November/December nitrogen applications of 20 - 25kgN/ha
- avoid grazing pastures below 4 cm residual other than in winter.

Grazing management practices that reduce tiller replacement rate are:

- High pre-grazing covers (more than 3,000kg DM/ha), or allowing hay/silage paddocks to get too long before harvesting. New tillers don't get enough light and die.
- Hard and frequent grazing events during drought conditions.

Further reading: DairyNZ Farm fact 1-20 *How do pastures grow?*

Insect management

Manage insect pests to minimise their impact – they cannot be eliminated.

- Select appropriate endophytes
- Use treated seed at sowing
- Use crops to break insect cycles
- Some crop sequences reduce insect populations (e.g., Turnips, Maize, Chicory), while others attract insects, (e.g. annual ryegrasses).

Further reading: *Pasture Renewal Best Practice Guide*


Clover root weevil

Plant nutrition

Soil fertility status of individual paddocks must be known before pasture renewal.

Plan to do a soil test before starting the renewal process.

Pasture species other than ryegrass and white clover

Where ryegrass persistence is a problem due to summer dry and/or insect challenges options such as tall fescue and lucerne can be considered.

Alternatives to ryegrass have different seasonal production patterns that need to be understood if current production is to be matched or improved.

Discuss options with your seed company representative or farm consultant.