NZ GRASSLAND ASSOCIATION
Fuelled by Science, Tempered by Experience

GRASSLAND NEWS www.grassland.org.nz

April 2023

ISSN 1179-4216

Laurie Copland

Greetings

Last Spring I told my neighbours we must be due for a wet summer. The wet summer has meant a couple of cyclones that have devastated different parts of the country. My thoughts are with those who are recovering from this loss of homes, businesses and farms. My own area of Northland wasn't badly affected by Gabrielle , mainly wind damage, there wasn't the flooding.

I didn't back myself in my prediction. I'm now trying to get my pastures under control before winter. Being in Northland this means kikuyu and paspalum needs to be knocked back so the winter active grasses get a chance to grow before the 1st frosts. I haven't had any significant frosts for a couple of years, but the outlook is its going to be a cold winter.

After attending NZGA and other field days I'm convinced that profitable farmers are those that manage their pastures well, something for me to aspire to. So I'm spending time on the tractor following the finishing stock, a mob of breeding cows would be handy. I'll be lucky to get 20% of my hill country topped.

The pressure is on to get the farm ready for winter as in May I'll be attending the International Grasslands Conference in Kentucky US. It's also an opportunity for me to visit family in Pennsylvanian. Apparently, there will be about 15 kiwis attending the IGC, including 3 members who have been granted travel grants to attend. This is a joint grant from NZGA and the NZG Trust. Initially there were to be 4 attending, those going are Bia Anchao Oliverira, Lucella Jordan, and Matt Iremonger. The fourth had to pull out last month.

Ray Brougham Lecture Series 2023

In 2023 the NZ Grassland Trust awarded the Ray Brougham Trophy to Dr David Chapman for his Leadership, knowledge, and an astute ability to communicate pertinent research on ryegrass-white clover ecology, physiology, productive performance, persistence, nutrient cycling, and genetic improvement to the benefit of New Zealand dairy and sheep/beef farming systems.

This year the lectures return to a face-to face event and will be held in the following venues:

Ruakura	**11 July**
3.30 – 5.00pm	McMeekan Centre; Ruakura
Palmerston North	**12 July**
3.30 – 5.00pm	The Factory; Palmerston North
Lincoln	**19 July**
3.30 – 5.00pm	R2; Ross Building; Lincoln University
Invermay	**20 July**
3.30 – 5.00pm	George Holmes Room; Invermay

NZGA You Tube Channel

A quick reminder that our YouTube channel is building up a large number of videos, covering a wide range of topics. There are currently 87 videos - key note speakers, Levy orations, Ray Brougham award winners, NZGA presidents musings…

A highlight from the Invercargill conference was the talk given by Tangiroa Walker, Farm4Life. This hub provides education for young dairy staff (or edutainment) designed to appeal and educate. https://www.farm4life.co.nz/.

Take some time over the long weekend and browse through the collection. Im sure there will be something for everyone.

Don't know where to start? Check out the key note speakers from Invercargill.

Pasture persistence, recovery, and reseeding – do multi-species pastures stack up?

Jacqueline Rowarth, Adjunct Professor, Lincoln University, is a past president of NZGA
Marie Casey is the Executive Officer of NZGA

Pasture persistence this season has been under threat in unusual areas. The dry in Otago and Southland has been in marked contrast to the ongoing wet in the top half of the North Island – and then came the cyclones. The recent devastation in Northland, Coromandel and the East Coast has featured widely in the media, but the west coast has also struggled with the impact of the La Nina climate pattern The continued rain has resulted in 'deferred grazing' on dairy farms where it has been too wet to make hay or silage… the conditions have been very different from the norm.

Farmers and seed merchants are considering pasture renewal, while they stare at the bare land created by slips, slumps and floods, and the pasture deterioration in surviving areas.

Already questions are being asked about what might make the difference for the future. Short term measures such as annual ryegrass, oats or ryecorn can fill feed supply gaps quickly but permanent cover is the goal for the future. What has worked in the past might not be appropriate for the future, and multi-species options are being promoted by some.

Before the seed is ordered, consider the research that backs the approach, the conditions and management under which it was performed, and whether these are appropriate for New Zealand and your farm.

Choosing a pasture mix for an uncertain climate

Cyclone Gabrielle is a reminder that planning for climate change on farm happens every time the farmer makes a decision to fence a paddock, plant trees or renew a pasture as these actions will last for many years.

Post Cyclone Gabrielle there are three distinctly different scenarios that farmers are addressing. These are silt remediation, slip revegetation and flooding. (Note that for drought, material is available e.g. Beef+Lamb) Each of these has specific problems and potential solutions.

Silt

Where pasture have been damaged or lost due to high silt deposition there may be relatively high pH, low nutrient and organic matter, varying depths of deposition, and a wide range of sources (Litherland et al. 2007 a). For pastoral farmers recovering the silt into a functional pasture may be a two-step process using a stabilising crop before permanent pasture is established. Key to all decisions will be a soil test to understand the nutrient status of the soil.

In all cases of soil rebuilding, the fastest way (short of bringing in compost, of course...) to recover these areas will be via grazing, with dung and urine returns, as is normal for New Zealand agricultural systems. This is real regenerative agriculture because there has been a reduction in organic matter. However, unlike RA, nutrients (fertiliser) are likely to be required to enable plant growth and maximise photosynthetic potential.

Slips

Slip revegetation is likely to be further from farmers' minds and bank balances than dealing with silt, but will require thought at some stage. Fencing will take priority to secure stock and manage feed supplies. Previous research (Litherland et al., 2007 b) identified that the slip rubble will revegetate itself relatively quickly as the front apron of the slip is often high fertility. Adding further seed will be of limited value.

Weed ingress, particularly thistles can be an issue in recovering pastures and future control may be necessary. Use of simple pasture seed mixes will give ability to control weeds in future; using complex mixes will compromise options.

The actual slip face will recover slowly. Economically, adding fertiliser and seed to recover productivity is of little value in these areas of the farm. Environmentally, the benefits of revegetating these slip faces are unknown. Would using multispecies mixes add any extra value in these cases? Again, this is unknown, though current knowledge would suggest that no further advantage would be gained.

Floods

Recovery after a flood event is mostly about renewing pasture to soils which, once drained, recover quickly. Again, soil testing is a key requirement. Pasture mixes should be based on functionality, rather than diversity. This means that there should be a grass (or some series of grasses depending on environment) and legumes to fix nitrogen. Functional herbs such as plantain might be included in some areas. Garrett et al. (2020) demonstrated that the use of functional mixtures with a grass, legume, chicory and plantain provided the results that farmers expect, in that intake and performance was improved by combining these highly nutritious species.

What are important criteria for productive NZ pastures?

The challenge of choosing a pasture mix in the face of uncertainty means that on balance the species chosen will suit the ongoing farm system, the environment (temperature, moisture, and soil type), feed animals adequately and persist as expected (Stewart et al. 2022, DairyNZ cyclone recovery, Landwise).

Research at Lincoln University has shown that a simple mixture of grass, legume and herb is optimal for dry matter production and for metabolizable energy (Black et al. 2017, 2021). These researchers explain that studies suggesting increased number of species lead to increased production seldom include all possible monocultures and pairwise combinations of the constituent species used in the mixtures. This means that the results are difficult to interpret with respect to diversity effects (the difference between the yield of a mixture and the weighted average yield of the monocultures). Anecdotally, results from many of the multi species pasture 'research' has been variable with the grass

and legume species that suit the environment becoming dominant in 'multispecies mixtures' (Dairy Trust Taranaki field day 2023).

A functional mix of grass, a legume and a forb (plantain or chicory, for instance) will generally yield more than multi-species mix that may contain many annuals, and be easier to manage in terms of pasture quality.

Many of these criteria are covered by Stewart et al. (2022) in Chapter 2: Choosing a Pasture Mix. (https://www.grassland.org.nz/bookdetails.php?book=41.)

Where did the resistance and resilience story for multi-species pastures originate?

The Jena trials in Germany have been cited as proof of the benefits of multi-species pastures for both resistance and resilience. These trials were established in 2002 on land that had been under arable cropping for 40 years. Plots containing 1-60 species were sown, and then mown two or four times a growing season. Resistance (the degree of change after perturbations e.g., drought) and resilience (time until pre-perturbation levels are regained) of above-ground biomass production against drought was more affected by mowing than species richness – two mowing's allowed faster recovery than four (Vogel et al. 2012).

The yields from the experiments were given in g per m^2, limiting their use for agriculture. Although after drought, mowing twice a year appeared to have more DM standing than mowing four times a year, overall, mowing four times was associated with greater DMY than mowing twice across the growing season. In putting forward multispecies pastures as increasing resilience, it is important to remember that mowing reduces the impact of preferential grazing in real life and calls into question the 'variety' aspects of hyper-diverse pasture.

Do animals choose?

Another reason given for using multi-species pastures is allowing the animals choice for self-medication. The difference in behaviour between animals entering a ryegrass-white clover-chicory pasture, and a long multi-species pasture is clear. In the former the animals drop their heads and start grazing as they pass through the gate, fanning out across the pasture. In the latter they move around and are clearly searching for something. However, evidence of selection and self-medication, and improved growth rates, is lacking.

Meat and milk quality

Much has also been made of 'nutritive quality' and 'nutrient dense' food with respect to multi-species pastures. Research funded through the MPI SFFF fund on meat quality (Anon 2021) compared meat quality from stock from nine regenerative and nine conventional farms in the upper North Island. There were no significant differences in quality factors between conventionally and regeneratively produced meat. The researchers commented that a difference might have been obtained if the pastures being grazed on the regenerative farms had had more species; only nine species were present (in comparison with eight on the conventional farms) whereas regenerative seed merchants recommend '40 or more'… for yield and resilience and variety for the animals.

The increase in omega 3 and 6 fatty acids, and the ratio between them are often highlighted in organic versus grain fed meat and milk because they are considered to be beneficial to human health. However, pasture-fed meat and milk is known to be high in these omega 3 and 6 fatty acids (compared with grain-fed diets) with only small variations created by grazing herbs rather than grass/legume combinations (Mangwe et al. 2020). Further, research on the Canterbury Plains has failed (at least so far) to report any difference in milk quality parameters between regenerative and conventional paired farms (Align farms regenerative-study). Although some differences have been found between milk from cows fed ryegrass versus milk from cows fed plantain, whether the differences have beneficial effects for humans has yet to be established (Marshall et al. 2022).

Soil organic matter

Multi-species pastures have been promoted as increasing soil carbon and hence organic matter. Again, the Jena trials in Germany are the source the information. Changing from arable to grassland changes management in a manner generally beneficial to soil carbon, but even so it took four years before renewed C storage was detected after the C loss due to the conversion of the site from a cropland to an experimental grassland (Steinbeiss et al. 2008). Species richness did appear to be linked to increased C storage in the top 10 cm. The starting point was approximately 13 tonnes of carbon /ha to 30cm depth (in contrast to NZ soils averaging 100 tonnes/ha) and authors acknowledged that continuing accumulation beyond that 'normal' for grasslands was not guaranteed.

A 1% increase in soil organic carbon in New Zealand is approximately 1 tonne. Research published last year (Berthelin et al. 2022) explained that at least 90% of plant residues added to soils to increase their carbon content over the long term are mineralized relatively rapidly and are released as carbon dioxide to the atmosphere. This means that farmers would have to apply to their fields 10 times more organic carbon annually than what they would eventually expect to sequester. Over time, because of a well-known sink saturation effect, the multiplier might increase significantly above 10, up to a point when no net carbon sequestration takes place any longer… This aligns with the question asked in the Jena soils research.

Further, although much is made of the water holding capacity of organic matter, a review of research (Minasny & McBratney 2018) found the relationship between adding organic matter and increasing available water capacity is not as dramatic as sometimes suggested. An increase of 1 % in soil organic carbon (1.72 % organic matter) could increase available water by between 0.7 % and 2 %. The greatest increases were reported in the lightest soils. Increasing soil organic matter in the top 30 cm of soil by 1.72 % (60 t/ha soil organic matter; 34.8 tonnes of carbon) was considered to have the potential to increase available water capacity by

2 – 6 mm, which is about a day of evapotranspiration (ET) on a normal summer day; in a Fohn wind on the Canterbury Plains, ET can be 9-10mm per day.

34.8 tonnes of carbon a year x 10 EXTRA, that is – beyond that which the roots and litter are already providing - is unlikely to be achieved economically.

Conclusions

There is a significant body of readily available NZ research on pasture production, pasture mixtures, legumes and herbs, fertility, organic matter, completed over many years (see Journal of NZ Grasslands and Research and Practice Series). Persistence of pastures has been recognised as an ongoing challenge (Resilient Pastures Symposium R&P17), exacerbated by a rapidly changing climate.

Cyclone Gabrielle highlights the challenges of adapting to ongoing climate disruption and understanding the key principles of pasture production and resilience are critical.

References

Anon. 2021. We are what we eat. Our Land and Water, 4p. https://ourlandandwater.nz/wp-content/uploads/2022/11/RPF15_NewGround_we-are-what-we-eat.pdf

Berthelin, J.; Laba, M.; Lemaire, G.; Powlson, D.; Tessier, D.; Wander, M.; Baveye1, P.C. 2022. Soil carbon sequestration for climate change mitigation: Mineralization kinetics of organic inputs as an overlooked limitation. *European Journal of Soil Science 73*: e13221.

Black, A.D.; Anderson, S.; Dalgety, S.K. 2017. Identification of pasture mixtures that maximise dry matter yield. *Journal of New Zealand Grasslands* 79: 97-102.

Black, A.D.; Myint, T.S.; Shampasivam A.; Yang, S. 2021. Plant diversity with species drilled in the same or alternate rows enhanced pasture yield and quality over 4 years *Resilient Pastures – Grassland Research and Practice Series* 17: 263-274.

Garrett, K.; Beck, M.R.; Marshall, C.J.; Fleming, A.E.; Logan, C.M.; Maxwell, T.M.R.; Greer, A.W.; Gregorini, P. 2021. Functional diversity vs. monotony: the effect of a multiforage diet as opposed to a single forage diet on animal intake, performance, welfare, and urinary nitrogen excretion, *Journal of Animal Science*, Volume 99, Issue 5, May 2021, skab058, https://doi.org/10.1093/jas/skab058

Litherland, A.; Brown, M.; Wilson, M.; Benn, D.; Stobie, L.; McNabb, I.; Hunt, C.; Kemp, P.; Valentine, I. 2007 (a). 2004. Silt Recovery - Lower North Island Storm Event 2004. SUSTAINABLE FARMING FUND: PROJECT 05/060.

Litherland, A.; Brown, M.; Wilson, M.; Benn, D.; Stobie, L.; McNabb, I.; Hunt, C.; Kemp, P.; Valentine, I. 2007 (b). Slip Recovery - Lower North Island Storm Event 2004. SUSTAINABLE FARMING FUND: PROJECT 05/060.

Mangwe, M.C.; Bryant, R.H.; Beck, M.R.; Fleming, A.E.; Gregorini, P. 2020. Grazed chicory, plantain or ryegrass–white clover alters milk yield and fatty acid composition of late-lactating dairy cows. *Animal Production Science* ***60***: 107-113. https://doi.org/10.1071/AN18537

Marshall, Cameron & Beck, Matthew & Garrett, Konagh & Castillo, A.R. & Barrell, Graham & Al-Marashdeh, Omar & Gregorini, Pablo. (2022). The effect of feeding a mix of condensed and hydrolyzable tannins to heifers on rumen fermentation patterns, blood urea nitrogen, and amino acid profile. Livestock Science. 263. 105034. 10.1016/j.livsci.2022.105034.

Minasny, B.; Mcbratney, A.B. 2018. Limited effect of organic matter on soil available water capacity. *European Journal of Soil Science.* 69: 39–47.

Steinbess, S.; Beßler, H.; Engels, C.; Temperton, V.M.; Buchmann. N.; Roscher, C.; Kreutziger, Y.; Baade, J.; Habekost, M.; Gleixner, G. 2008. Plant diversity positively affects short-term soil carbon storage in experimental grasslands. *Global Change Biology* 14: 2937–2949, doi: 10.1111/j.1365-2486.2008.01697.x

Stewart, A.; Kerr, G.; Rowarth, J. Stevens, D. 2022. Choosing a pasture mix. In: Pasture and forage plants for New Zealand. Ed. Casey, M. Grassland Research and Practice Series No. 8. Fifth edition. Pp 17-23.

Vogel, A.; Scherer-Lorenzen, M.; Weigelt, A. 2012. Grassland resistance and resilience after drought depends on management intensity and species richness. *PLoS One*: *7,* e36992.

Weisser, W.W.; Roscher, C.; Meyer, S.T.; Ebeling, A.; Luo, G.; Allan, E.; Beßler, H.; Barnard, R.L.; Buchmann, N.; Buscot, F.; Engels, C.; Fischer, C.; Fischer, M.; Gessler, A.; Gleixner, G.; Halle, S.; Hildebrandt, A.; Hillebrand, H.; de Kroon, H.; Lange, M.; Leimer, S.;, Le Roux, X.; Milcu, A.; Mommer, L.; Niklaus, P.A.; Oelmann, Y.; Proulx, R.; Roy, J.; Scherber, C.; Scherer-Lorenzen, M.; Scheu, S.; Tscharntke, T.; Wachendorf, M.; Wagg, C.; Weigelt, A.; Wilcke, W.; Wirth, C.; Schulze, E-D.; Schmid, B.; Eisenhauer, N. 2017. Biodiversity effects on ecosystem functioning in a 15-year grassland experiment: Patterns, mechanisms, and open questions. *Basic and Applied Ecology 23*: 1-73.

A massive slip near Tiniroto, Tairāwhiti, from the air as experts assessed the damage from Cyclone Gabrielle, on 18 February, 2023. Photo: RNZ/ Kate Green

Dr Syd Easton died suddenly in early February after experiencing heart problems while helping a working group to plant a natural area near his home.

Herrick Sydney Easton grew up on a farm, graduated from Massey University in 1970, and joined DSIR as a researcher. After graduating Syd joined DSIR, and in 1972 won an NRAC Fellowship for PhD study overseas. He worked within an INRA research team in France and completed his PhD in plant quantitative genetics at University of Paris XI. He had to submit his doctorate thesis and undertake his interview in French and managed both with aplomb. In 1985 Syd secured a visiting professorial fellowship and spent a further year in France.

Syd's plant breeding achievements have been marked by a progression of successful cultivars, some of them breaking new ground. He bred the first New Zealand lucerne cultivar, Grasslands Oranga, combining grazing tolerance, resistance to bacterial wilt and resistance to blue green aphid. He bred the first late-flowering New Zealand-adapted perennial ryegrass cultivar, Grasslands Impact, combining good early spring growth with significantly later reproductive development than the earlier norms, thus enabling better forage quality in late spring. The major plant breeding companies now all have similar types of cultivars and together they account for probably 60% of proprietary perennial ryegrass seed sold in New Zealand. Syd developed several other successful ryegrass cultivars including Grasslands Samson which is still being sold 30 years later. He also developed tall fescue cultivars, including Grasslands Advance, with radically improved palatability characteristics combined with improved seedling vigour. In 1987 Syd participated, along with the late Margot Forde, in a significant collection of forage germplasm from southwest Europe that provided key germplasm for NZ forage breeding programmes, and in particular those developing late flowering perennial ryegrass.

He made an important contribution in the understanding of fungal endophyte and ryegrass interactions. Through his innovation and leadership he led the multi-disciplinary AgResearch endophyte research programme Within the endophyte team, he made key contributions in understanding the genetics of the interaction between the host plant and the endophyte. As team leader and participating scientist, Syd gained recognition from international peers, primarily in the USA, for these contributions in both grass breeding and endophyte technologies.

Syd had at least 11 herbage cultivars successfully licensed and commercialised, and he was a key part of the team (and for much of the time the leader) that developed the successful endophyte products 'Endosafe', AR1, AR37, 'Max-P', ('Max-Q' in USA). Syd. along with the wider team. won the AgResearch Technology Prize in 2014 for the development and commercialisation of AR37 – a novel endophyte technology which has been independently valued to have contributed over $3 billion to the NZ economy.

Syd's development of measurement techniques and documentation of genetic variation for potentially valuable novel traits is detailed in 130 refereed and significant publications, and he was named as the inventor on 13 patents and/or Plant Variety Rights.

Syd held professional positions on the Executive of the New Zealand Grassland Association, the Science Advisory Committee for New Zealand Foundation for Research, Science and Technology, the Forage Technical Committee of NZ Plant Breeding Research Association, was an AgResearch-appointed member on the Board of Grasslands Innovation Ltd, and a Trustee of New Zealand Germplasm Trust.

Towards the end of his time at AgResearch Syd was the Section Manager for Forage Improvement, a role he held for 6 years before moving into an Emeritus position in his retirement.

His successful career was recognised by NZ Grassland Trust by awarding him the Ray Brougham Trophy at Tauranga in 2013, to acknowledge 40 years of leadership in forage breeding and endophyte technology.

The respect with which Syd was held resulted in a tall fescue cultivar bred by AgResearch being named 'Easton' and commercially released in 2010. This was developed from 'Grasslands Advance' for the NZ market and contained the AR584 (MaxP) endophyte providing it with increased resistance to several insect pests.

Coming from a farming family Syd connected with farmers and understood the value of highly supportive farmers and agricultural professionals who were able to critique, understand the value of and use the technologies and knowledge delivered from the science research he was involved with. Like many others in the agricultural research profession, he gained immense satisfaction from seeing technologies resulting from his research being used on New Zealand farms.