



Carbon in Diverse Pastures

Improving diversity in pastures for increased soil carbon and productivity.
Trial Update June 2020.

Reason for Trial

Low species diversity common in sown pastures can limit opportunities to increase soil carbon due to low diversity in plant root structure and lower root mass in soil. Higher diversity within sown pasture may also improve pasture production and livestock nutrition, though it can also increase complexity in managing the pasture.

This trial aimed to locally investigate and demonstrate opportunities in sowing highly diverse pastures.

The trial is expected to be complete in May 2023.



Two-species pasture (left) and diverse pasture (right).

Jetsonville, January 2020.

Trial Establishment

Four trials were established in different farming areas: Hagley; Rosevale; Jetsonville; and Fingal Valley. As of June 2020, the Fingal Valley trial has been re-established due to dry conditions in 2019 and has not yet been assessed.

For the other farms, the paddocks were renovated and sown down in autumn 2019, with each paddock divided into two treatments – high diverse pasture species mix and a simple species mix. (see Table 1 for seed blends used at each farm).

Field Tests

Initial soil tests including labile, organic and total carbon were taken for each plot. Further soil tests will be done towards the end of the project for comparison, due to the time usually required to demonstrate an increase in soil carbon.

Dry matter production was assessed using a rising plate meter, undertaken prior to grazing and also following grazing at one site.

Feed tests to evaluate feed quality were taken during different seasons.

Results

Pasture production, measured in dry matter (DM) for the three farms, was higher in the

diverse pasture zones than in the simple pasture zones.

Rosevale

Rosevale dry matter data were captured both pre and post grazing (see Figure 1 & 2 for more detail). Over 9 grazing events, an extra 1396 kg/ha of dry matter was consumed by cattle on the diverse plot compared to the standard side - an extra 174 kgDM/ha for each grazing period. This approximates to an extra 9 – 10 kg/livestock gain/ha in the diverse pasture. Basing cattle liveweight prices at around \$3.50/kg, the diverse pasture provided an extra \$30 – \$35 for every graze.

Note: these figures do not factor in pasture wastage for both treatments due to trampling by livestock/urine patches, etc. and the many other factors affecting liveweight gain, i.e. cold/wind exposure.

Landholders would normally factor in the difference in cost of the two seed mixes, and consider the time taken to gain a return on investment. In the Rosevale trial, the seed cost difference was small (Diverse \$243/ha vs. Standard \$234/ha, GST inclusive).

Feed quality was almost the same for both diverse and standard plots from 3 tests taken. The average estimated metabolisable energy (ME) was 11.3 Mj and 11.4 Mj respectively. Crude protein was also very similar.

Jetsonville

The Jetsonville site appeared uniform across the board. There were some early establishment issues with pink weed, however, judicious grazing and targeted

herbicide application to minimise damage to pasture herbs has worked well.

The clovers and particularly Tonic plantain are currently doing very well, especially with a good autumn break. The pasture has a good balanced composition, with grasses (60%) and clovers/herbs (40%).

Four dry matter measurements were captured pre-grazing over the year (see Figure 3) and the diverse pasture treatment produced an extra 1134 kg/DM/ha over the four readings. This equates to 280 kg/DM extra for every grazing period. Converting these numbers to weight gain (beef) and dollar terms, the more diverse pasture provided an extra \$54 per graze, based on quantity of feed and without factoring in associated issues affecting cost of production. Three feed tests were taken throughout 14 months with ME similar for both, averaging 11.7 for diverse plots and 11.8 for standard side. Crude protein levels were for diverse (26%) and standard (29%).

The cost of the seed varied considerably between the two treatments with the diverse price at \$450/ha and the standard at \$220. The cheaper priced *Barberia* short rotation ryegrass (20kg/ha), used on the standard treatment, was the main reason for the price difference.

Hagley

After initial pasture establishment, there were some localised infestations of capeweed and erodium species in both treatments. The landholder was able to spray out the capeweed in the standard plot, however, was unable to in the diverse plot due to potential detrimental effects on the young broadleaf species. This is commonly one of the main



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obstacles for farmers when trying to control certain weeds within a diverse species pasture.

With an excellent autumn break in 2020 the paddock, particularly the diverse pasture, has grown a lot of feed. Its vigorous growth has also assisted in containing the localised infestation of capeweed and in some sections outcompeted it. Another dry summer will likely favour the capeweed infestation, especially on the drier rises.

Unlike the other two farms, fat lambs have been grazing this site.

Four dry matter measurements were gathered just prior to each grazing (see Figure 4). The diverse pasture produced an extra 728 kg/DM/ha compared to the standard side. This equated to 242 kg/DM/ha for every grazing period. In terms of weight conversion (fat lambs) and dollar return, there was an extra \$61 made per graze for the more diverse pasture.

Three feed tests were taken at intervals through the year, with very similar results, except for the Neutral Detergent Fibre testing (NDF), where the more diverse pasture had a lower percentage than the standard - 38% & 44% respectively. NDF measures for levels of fibre such as cellulose and lignin, that the animal does not properly utilise, so consumption and utilisation of the fodder in the rumen is improved when feed NDF matches the required minimum for the class of livestock.

Metabolisable energy (ME) levels were very similar in this trial; diverse (12.5), standard (12.4) and crude protein; diverse (23.5%), standard (21%).

Summary

For the three trial sites where pasture was successfully renovated, over the first year's monitoring, the diverse pasture blends have consistently shown an increase in dry matter production. This should result in increased livestock weight gain or carrying capacity, which in turn results in improved productivity and profit.

The higher volume of above ground vegetative matter produced should result in an increased below ground root mass. Add to this a more diverse range of species in the pasture, to utilise the varied niches within the soil profile (e.g. tap & fibrous roots), and the result should be a more effective and increased soil carbon cycling system.

One of the main stumbling blocks for farmers adopting diverse pastures on their farms is a restricted ability to control broadleaf weeds when required. Early planning, utilising previous crop rotations effectively, a targeted weed control approach and good bed preparation are all key factors for establishing a highly diverse pasture with minimal weed issues, especially in the short to medium term.

Another barrier for some farmers to adopt more long-term diverse pastures is the added cost of seed. But, from early trial results, the increase in production from more diverse treatments negates the cost of purchasing a broader pasture seed mix to some extent.

As the project progresses, measuring of below ground root mass will begin to assess contrasts between the treatments.

The first year for these treatments has now passed. How the treatments perform in terms of productivity and persistence, during various climatic conditions, will be seen over the next three years.



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Table 1. Pasture blends

| Rosevale | Diverse | Standard | Comment |
|-----------------------|---|---|---|
| Blends | Wintas 2 perennial ryegrass (8.5 kg/ha) | Marsden long rotation ryegrass (11 kg/ha) | Heavier sowing rate due to broadcasting |
| | Victoca perennial ryegrass (3) | Wintas 2 perennial ryegrass (11) | |
| | Coloured Brome (6) | Rubitas red clover (6) | |
| | Uplands Cocksfoot (1.5) | | |
| | Australian Phalaris (1.4) | | |
| | Huia white clover (1.4) | | |
| | Rubitas red clover (1.5) | | |
| | Trikkala sub clover (1.5) | | |
| | Arrowtas clover (1.4) | | |
| | Lusa Persian clover (1.4) | | |
| | Chicory (1.4) | | |
| Total kg/ha | 29 | 28 | |
| Jetsonville | Diverse | Standard | Comment |
| Blends | Impact 2 perennial ryegrass (4 kg/ha) | Barberia medium rotation ryegrass 20 kg/ha) | Early establishment issues with pink weed |
| | Bealey perennial ryegrass (5) | Storm white clover (5) | |
| | Hummer Fescue (6) | | |
| | Savvy Cocksfoot (2) | | |
| | Astrid red clover (3) | | |
| | Storm white clover (2) | | |
| | Puna Chicory (3) | | |
| | Tonic Plantain (3) | | |
| | Arrowtas clover (1.4) | | |
| | Lusa Persian clover (1.4) | | |
| | Chicory (1.4) | | |
| Total kg/ha | 28 | 25 | |
| Hagley | N/A Diverse | Standard | Comment |
| Not available to date | | | |



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Figure 1: Dry matter (kg/DM/ha) for 9 grazings - Rosevale

Note: not all pasture for both sides is eaten due to livestock wastage through trampling, etc.

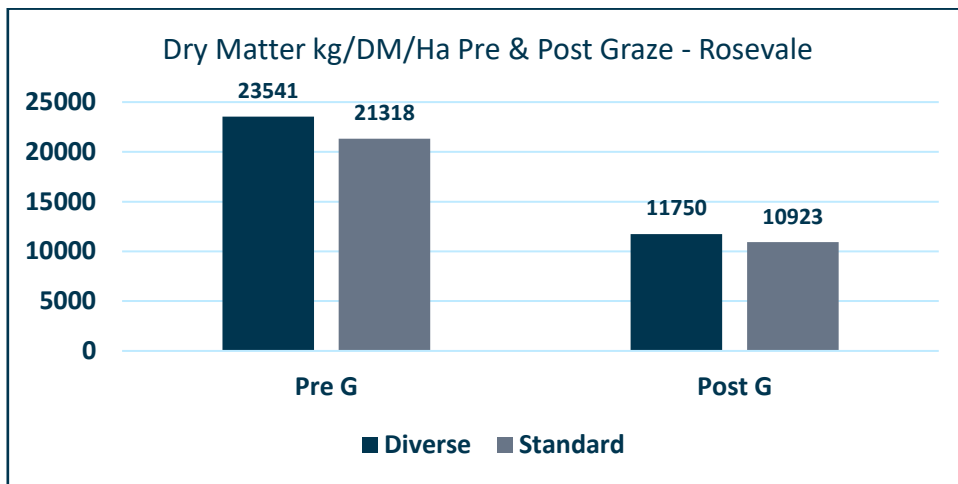
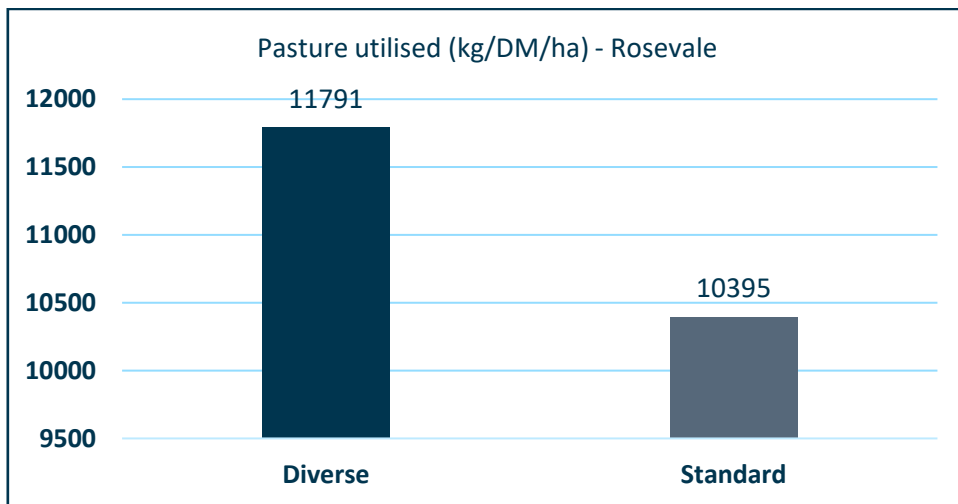


Figure 2: Dry matter utilised over 9 grazings – Rosevale



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Figure 3: Data from four measurement taken through the year – Jetsonville

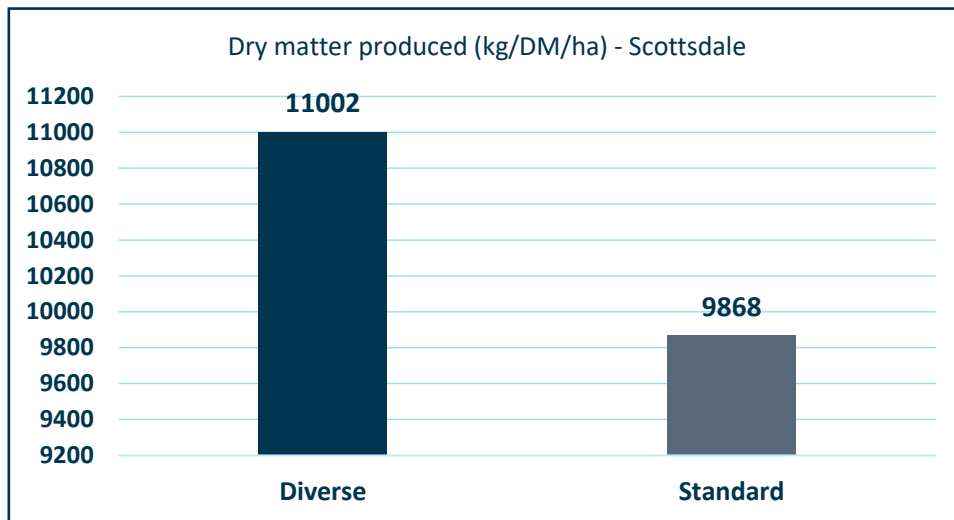
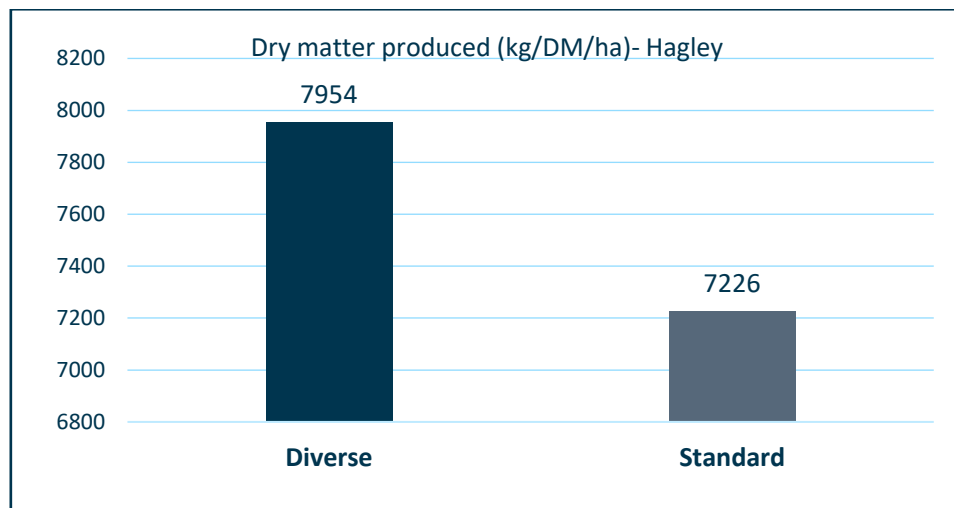


Figure 4: Data from four measurement taken through the year – Hagley



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