

5.3 INTRODUCING SUB-CLOVER INTO AN ESTABLISHED PASTURE

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KEY MESSAGES

- Direct drilling sub-clover resulted in better establishment numbers than broadcasting when sown at both 8 kg/ha and 16 kg/ha seeding rates.
- High amounts of dry litter in the pasture leading into the autumn break negatively impacted the germination of the sub-clover as the trash insulates and slows the breakdown of the hard sub-clover seed.
- Further assessments of the trial will investigate how to manage the seedbank to achieve a pasture with 30-40% sub-clover content.

Keywords: pasture, phalaris, sub-clover, grazing, establishment

BACKGROUND

Phalaris based pastures are commonly used in livestock systems across the High Rainfall Zone of Victoria. This is due to its benefits such as persistence and drought tolerance, high production, and being highly competitive when trying to control weeds. However, a disadvantage of phalaris based pastures is that they can dominate the pasture and cause a reduction in legume content. Consequently, reduced pasture quality and production can be observed (Watson et al. 2000).

With a grass dominant pasture, there is a high demand for nitrogen to support growth. Application of nitrogen fertiliser or increase of clover content are management options used to increase pasture productivity. Sub-clovers ability as a legume to fix nitrogen in the soil, as well as being high quality feed for livestock makes it an important tool in any pasture mix. The SFS Rokewood pasture site is an Australian phalaris dominant pasture with very little clover present. This may be a consequence of previous grazing management and/or cricket damage.

The aim of the trial is to measure the benefits of re-establishing the legume content into the phalaris dominant pasture and evaluate what strategies are most effective in ensuring good clover establishment.

METHOD

Treatments

Five treatments were set up in 60 metre strips and then further subdivided into four 5 m x 15 m plots for assessments, shown in Figure 1.

On May 11th 2022, Paraquat was applied at 835 mL/ha to suppress the dominant phalaris before sowing.

Sowing occurred on May 17th 2022, at two sowing rates, 8 and 16 kg/ha. Two different sowing methods were used, a tyned Baker Boot drill or via broadcasting with SuPerfect fertiliser. There was also a control treatment with no sub-clover sown. A mix of two Yannicum sub-clover cultivars, Yanco (mid maturing) and Rouse (mid-late maturing) were used for all treatments.



Figure 1. Trial layout

Trial Management

SuPerfect fertiliser was applied at a rate of 313 kg/ha at sowing in 2022 and a further application of 313 kg/ha was applied in March 2023. Metarex slug bait was applied at 5 kg/ha during the pre-emergence and early emergence stages of the sub-clover establishment in 2022. The paddock was periodically grazed by Aussie White Sheep during the growing season to keep the pasture at about 4 cm height.

Data Collection & Analysis

Seedling establishment counts were recorded for each plot using a 50 cm x 50 cm quadrat. A count was recorded on 29th July 2022 and 19th June 2023. Pasture biomass was collected in early summer using a ride on mower with a built-in weighing system to measure standing pasture in each plot. A hand cut sub sample was also taken and weighed and dried to measure moisture content. The two measurements were used to determine Dry Matter production.

RESULTS & DISCUSSION

Establishment

Seedling emergence counts recorded on 29th July 2022 (Figure 2), showed the best treatment for sub-clover establishment was direct drilling at 16 kg/ha, this established an average of 34 plants/m². The 8 kg/ha direct drill plots averaged 16 plants/m². When the seed was broadcast, averages of 5 plants/m² at the 8 kg/ha sowing rate and 6 plants/m² at the 16 kg/ha sowing rate were recorded. No sub-clover seedlings were found in the nil control strip.

Sub-clover sown at a rate of 10 kg/ha is expected to result in 90 plants/m² at 50% establishment and 50 plants/m² at 25% establishment, 6-8 weeks after sowing (Nie & Saul 2006). Establishment numbers for 2022 suggest this was below 25% establishment across the trial, even in the 16 kg/ha sowing rate treatments. When the counts were recorded it is likely that seedlings had been eaten or killed off, as seedlings are susceptible to grazing and insect attack. Slugs were present at this stage with the high levels of trash likely increasing slug pressure, the trial was baited to try and mitigate slug damage during emergence.

The 8 kg/ha sowing rate treatments reflected a commonly used rate, while 16 kg/ha is a higher rate than would typically be used. Figure 2 demonstrates no increase for the higher rate broadcast treatment for seedling establishment in 2022 and was still lower than targeted. For the direct drill treatment, the first year showed by doubling the seeding rate from 8 to 16 kg/ha, the average plants/m² roughly doubled. However, the following year saw a less significant gap between the two rates, suggesting that how the clover is managed to promote build-up of the seedbank has a bigger impact on future

establishment than initial seeding rate. Therefore, producers may not benefit from spending more on seed and can still get good establishment in the following season from a standard seeding rate if grazing is managed correctly.

As an annual, sub-clover needs to build up a large seedbank in the soil to re-establish each year. A pasture with 40% sub-clover content by late winter requires successful germination of 20-30 kg/ha of seed. Additionally, sub-clover only allows 10-20% of the seed bank to germinate each year as a survival trait, meaning to germinate 20-30 kg/ha of seed, you need 200-300 kg/ha of seed in the soil (Miller et al. 2020a). Even with below target establishment, correct management over a few years can progressively build up the seed bank to the desired level.

The second counts recorded on June 19th, 2023, also displayed in Figure 2, showed an increase in average plants/m² for all treatments with the direct drill sown at 16 kg/ha treatment, averaging the highest at 63 plants/m². Both direct drill treatments recorded higher averages than broadcasting treatments and the control.

As expected, by June 2023, the seedbank across the trial had increased and there was a response in establishment the following year. However, the plants/m² numbers did not reach the recommended level required to achieve 40% sub-clover content within the pasture which is 200-300 plants/m². It is likely that low numbers in the trial were the result of grazing management and the build-up of excess litter over summer, leading into the autumn break shown in Figures 3a & 3b. Large amounts of dried off biomass within the paddock at the time of the autumn break was a result of above average spring rainfall and the paddock not being effectively grazed, resulting in high levels of litter.

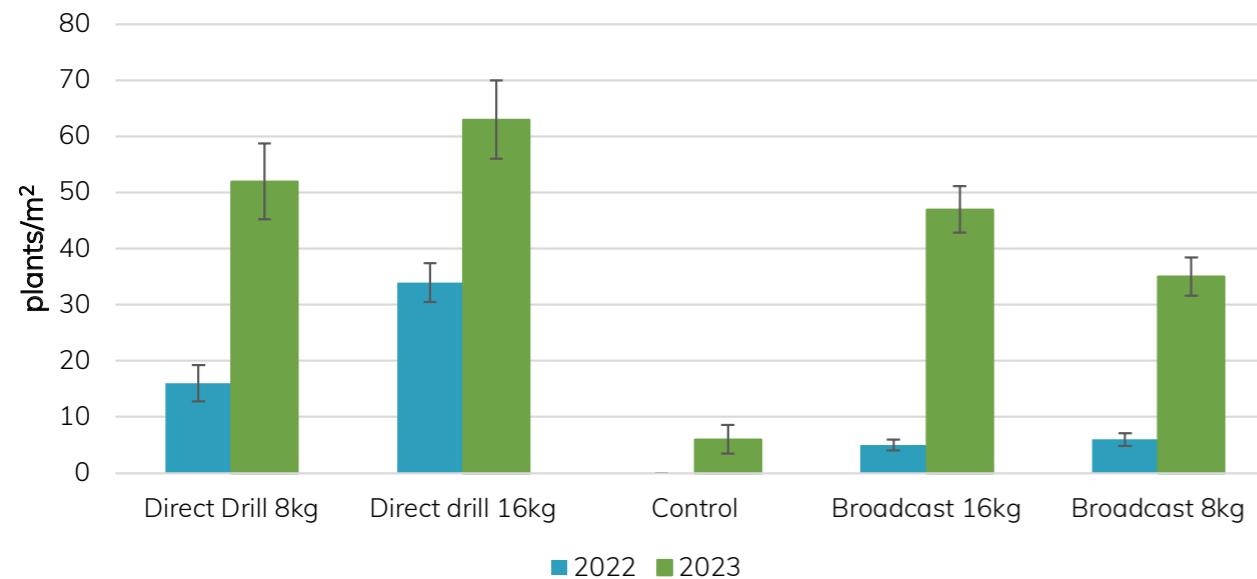


Figure 2. Sub-clover seedling emergence numbers in plants/m² for each treatment in July 2022 and June 2023.



Figure 3a & 3b. 3a (left): Photo of dried off biomass in trial paddock. 3b (right): Photo of litter in Broadcast 8kg/ha treatment. Photos: Lisa Miller from 16th May 2023.



Figure 4a & 4b. 4a (left): Direct drill 8 kg/ha treatment. 4b (right): Direct drill 16 kg/ha treatment. Photos taken on 19th June 2023.

The site reached decile 8 rainfall by the start of November 2022, which was very conducive of high phalaris production making it difficult for the sheep to graze it down quick enough to reach an adequate level of pasture biomass that would benefit clover establishment.

The hard seededness of sub-clover is broken down by fluctuations in temperature, which is negatively impacted by high levels of trash or litter that sits on the surface and reduces the variation in temperature (Miller et al. 2020b).

There were some sub-clover plants found in the control which are likely a result of burr being spread by stock from adjacent sub-clover plots.

Direct Drill vs Broadcast

Direct drilling is an advantageous sowing method due to its limited soil disturbance, providing less weed problems and good seed to soil contact. The direct drill treatments in the trial had the highest seedling establishments in both years when compared to broadcasting. Visual increases in clover content could also be seen in the direct drill plots, as shown in Figure 4a & 4b.

Broadcasting seed can be effective when other methods, such as direct drilling, are not suitable for example in rocky or untrafficable paddocks. However, it is likely to produce a much lower germination percentage than drilling due to poor soil to seed contact. The broadcast treatment results reflected this in Figure 2 as well as visual indications of poorer establishment in Figure 5a & 5b. This is partly because of ant predation of surface seed, or the radicle (first root) drying out on the surface during germination due to poor soil to seed contact and reduced moisture availability.

Directly comparing the two sowing methods in this trial would suggest that direct drilling could reduce seed costs for producers. In this instance direct drilling 8 kg/ha of seed outperformed broadcasting 16 kg/ha of seed in terms of seedling establishment in both years.

Phalaris Production

The pasture biomass cuts taken on 21st of December 2022, showed no real pattern of increased pasture production comparatively across the treatments with all having averages in the range of 2-2.25 t DM/ha. These results are likely due to the sub optimal



Figure 5a & 5b. 5a (left): Broadcast 16 kg/ha treatment. 5b (right): Broadcast 8 kg/ha treatment. Photos taken on 19 June 2023.

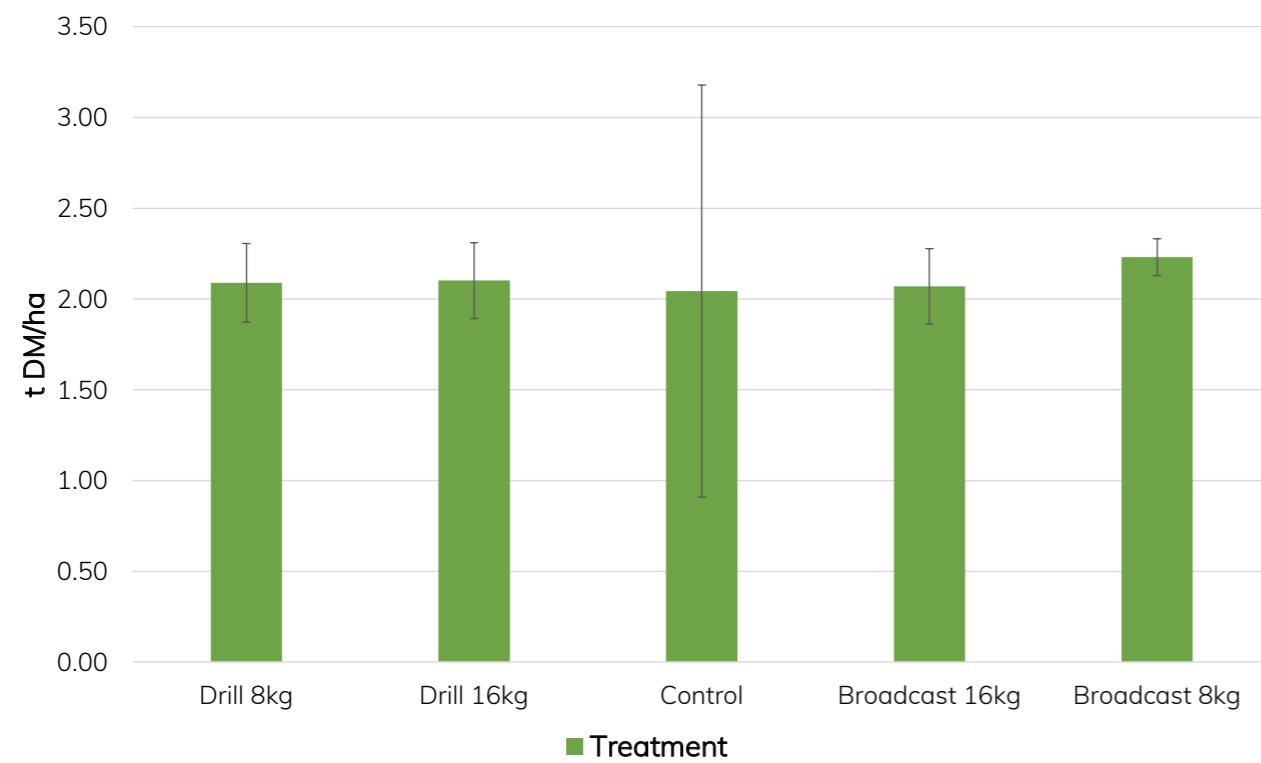


Figure 6. Pasture biomass averages for each treatment recorded on 21st December 2022 with standard error bars of the mean.

establishment of the sub-clover as it is still building up the seed bank to reach the 30-40 % clover content within the pasture. Established phalaris pastures can become extremely dense and crowd out clover and therefore grazing down to around 1000-2000 kg DM/ha is advised before the autumn break to promote good re-establishment of clover (Nie & Saul 2006). Further measurements will be recorded to monitor annual changes in pasture composition, along with further biomass cuts to observe benefits of establishing sub-clover within the pasture.

Additional questions asked by graziers about whether herbicide is needed to be applied prior to establishing clover if pastures are grazed short, will also be investigated.

There was high variability in the amount of dry matter recorded in the control, likely because of uneven grazing, as stock may have preferentially grazed where clover had been sown.

CONCLUSION

The trial highlights the importance of producers using good management practices to achieve a well-established sub-clover pasture mix. Phalaris can prove tricky to gain a good balance due to its dominant nature because it is erect and can shade out the lower growing clover. The trial demonstrated potential benefits in terms of good clover establishment when using a direct drill system over broadcasting and the importance of building up the clover seedbank in the soil.

To utilise that seedbank, reducing trash levels prior to the autumn break is vital for the breakdown of clover seed coating. The trial will continue to monitor the persistence of the clover in the pasture and further assessments will be used to measure the changes in the pasture composition. This will aim to provide further information on how to establish sub-clover in an existing pasture and provide producers with more productive pastures.

ACKNOWLEDGMENTS

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REFERENCES

Miller L, Brogden J, Nicholson C (2020a) 'How do I optimise sub-clover based pastures?' (Meat and Livestock Australia) available at [how-do-i-optimise-sub-clover-based-pastures \(mla.com.au\)](http://how-do-i-optimise-sub-clover-based-pastures (mla.com.au)) [verified 12 July 2023]

Miller L, Brogden J, Nicholson C (2020b) 'How do I maximise sub-clover establishment in existing pastures?' (Meat and Livestock Australia) available at [how-do-i-maximise-sub-clover-establishment \(mla.com.au\)](http://how-do-i-maximise-sub-clover-establishment (mla.com.au)) [verified 12 July 2023]

Nie Z and Saul G (2006) Greener pastures for south-west Victoria. 2nd edition. Victorian Department of Primary Industries.

Watson RW, McDonald WJ & Bourke CA (2000) Phalaris Pastures. Agfact P2.5.1 second edition. Available at Phalaris Pastures (nsw.gov.au) [verified 12 July 2023]