5.5 INTRODUCING SUB-CLOVER INTO AN ESTABLISHED PASTURE – YEAR 2 RESULTS

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KEY MESSAGES

- Introducing sub clover into an old Australian phalaris pasture boosted pasture production by about 1 t DM/ha over winter and early spring.
- The nutritive value of feed, specifically energy content, crude protein and NDF were all higher where clover was introduced into pasture in comparison to the control when measured in mid-October.
- Using GrazFeed modelling the highest animal intake and animal production was on the direct drill 16 kg/ha treatment (118 g/day) as it had the highest quantity of dry matter and clover percentage. The lowest was the control (22 g/day) with nearly 100 g daily lamb weight gain difference between treatments because of low pasture quantity & quality.

Keywords: pasture, phalaris, sub-clover, grazing, sowing methods, nitrogen

BACKGROUND

In 2022, a trial was established to evaluate the benefits of introducing sub-clover into a rundown Australian phalaris pasture. The 2022 SFS trial results book, reported on the best method of introducing clover and sowing rate and the first year of results. This article reports on the second year of the trial results and the benefits sub clover are having on pasture production.

METHOD

The design, establishment methods and first year trial management was previously reported in the 2022 trial results book.

Due to the low phosphorous content of the soil (23 mg/kg Cowell P, where 34 mg/kg is optimal for clover), a further capital application of SuPerfect fertiliser was applied at a rate of 313 kg/ha in Autumn of 2023.

The residual herbage was periodically grazed by Aussie White Sheep during the summer and then slashed to remove trash and encourage sub-clover's hard seeds to break down to enable germination. The stock were then removed following the autumn break to record pasture production through cutting and weighing herbage. Once cuts were taken, the trial was grazed by stock for a few days to keep the pasture at about 4 cm height before being again closed for pasture monitoring.

Emergence counts were taken on June 19th, 2023. A 50 cm x 50 cm quadrat was used to take four counts from each treatment.

Pasture production was measured using a ride on mower with a built-in weighing system to measure standing pasture in each plot. Cuts were collected on the following dates, 3 August 2023 (winter), 6 September 2023 (late winter), 6 October 2023 (early spring), 28 November 2023 (mid to late spring), and 23 January 2024 (summer). Pasture composition was assessed in a quadrat per treatment in June 2023.

RESULTS & DISCUSSION

Establishment

Sub clover establishment counts are displayed in Table 1 with the 2022 results following sowing. All treatments increased in average clover numbers and both direct drill treatments recorded significantly higher averages than the control. However, plant numbers were still lower than a desirable 200 pl/m² which would help reach pasture compositions of 30 % sub clover.

Table 1. Sub-clover seedling emergence numbers in plants/m² for each treatment in July 2022 and June 2023.

Treatment	Plants/m² July 2022		Plants/m² June 2023	
Direct Drill, 16kg/ha	33.9	a	63	a
Direct Drill, 8 kg/ha	15.6	b	52	ab
Broadcast, 16 kg/ha	4.9	c	47	ab
Broadcast, 8 kg/ha	5.8	c	35	b
Control	0	d	6	c
LSD P=0.05	6.12		16.41	
p-value	0.0001		0.0001	
CV (%)	18.7		26.2	

Pasture Production

Dry matter production was measured at multiple times during the growing season in 2023 and January 2024 which are shown in Table 2.

The direct drill 16 kg/ha treatment produced the highest total DM (3047 kg DM/ha), over 1 t DM/ha more than the control, while the direct drill 8 kg/ha treatment produced the second highest at 2743 kg DM/ha. The control which had low to nil clover content, produced the lowest total DM (2030 kg DM/ha). While total DM production was not statistically significant, there were statistical differences within seasons.

The direct drill 16kg/ha treatment produced the highest DM production for winter which was significantly different to all other treatments and significantly higher production compared to the control and broadcast 16kg/ha treatment in early spring. The higher growth is a result of active clover growth during this time and possibly extra nitrogen available carried over from the previous season which the phalaris utilised. From mid spring to summer, all measurements were statistically similar for all treatments. Rokewood only received Decile 2 rainfall for spring in 2023, thus reducing potential growth. Overall, the production data indicated that the addition of sub clover has improved the productivity of the established phalaris pasture and has shown the benefits of the direct drill sowing method particularly at high rates because of the extra plants and seed it created.

Table 2. Dry matter production (kg/ha) for each treatment taken during the growing season of 2023 and January 2024.

Treatment	Winter 2023		Early Spring 2023		Mid Spring 2023		Late Spring 2023		Summer 23/24		Cumulative Total - 2023 & Summer	
Direct Drill 16 kg/ha	644.8	a	574.3	a	102.5	-	1306.7	-	336.3	-	3047	-
Direct Drill 8 kg/ha	343.8	b	561.8	a	144.5	-	1226.7	-	336.3	-	2743.3	-
Broadcast 16 kg/ha	353.8	b	348.5	bc	124.8	-	1213.3	-	366	-	2493.7	-
Broadcast 8 kg/ha	287.3	b	413.3	ab	142.8	-	1340	-	378.8	-	2553.7	-
Control	137.5	c	214.3	c	158	-	1186.7	-	301.5	-	2030.3	-
LSD P=0.05	138.66		145.08		53.87		1240.8		54.74		1052.56	
p-value	0.0001		0.0007		0.261		0.998		0.0704		0.3375	
CV (%)	25.47		22.29		26		52.52		10.34		21.72	

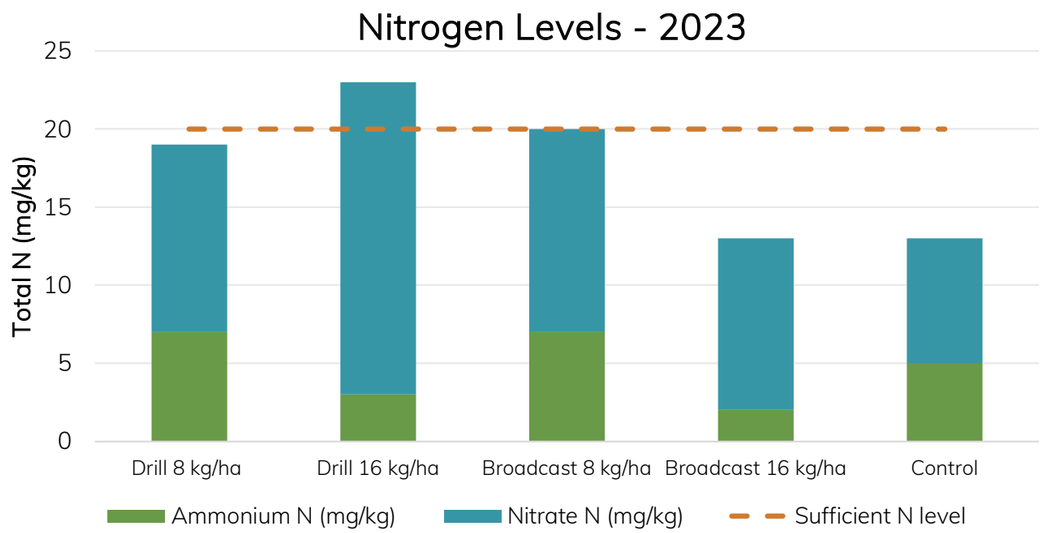

Figure 1. Nitrogen soil test results from 2023 with sufficient level of N required for plant growth.

Soil Nitrogen Levels

The soil was tested in mid-December 2023 to check soil nitrogen levels between treatments (Figure 1). The nitrogen fixed by clovers is utilised directly by clover plants but only becomes available to grasses when clover roots and associated nodules start to die off in mid spring. The ammonium N reflects the nitrogen component that will become available, and the nitrate N is readily available for plant uptake. The total N is a combination of the two sources and anything above 20 mg/kg is generally considered to be sufficient for plant growth. Both direct drill treatments indicated the presence of higher levels of nitrogen (19 to 23 mg/kg) compared to the control (13 mg/kg) which is likely a result of legume fixed nitrogen.

Feed Quality

Samples were tested for nutritive value on 11 October 2023 with the results shown in Table 3. Crude protein (CP) was highest in the drill 16 kg/ha treatment at approximately 18 %. When CP is above 15 % it would meet all weaner protein demands. The control pasture had the lowest CP of all treatments at 11 %, this would still be capable of meeting livestock lactation demands. The Neutral Detergent Fibre (NDF) is a measure of total fibre content and indicates the control was highest by about 6 % which would lessen feed intake in comparison to those treatments containing clover. Digestibility measurements were similar across treatments (62 to 63 %). The energy content was lowest on the control pasture at 8.8 MJ/kg DM and highest in the direct drill 16 kg/ha and broadcast 8 kg/ha treatments at 9.3 MJ/kg DM.

The increase in feed quality in the sub clover treatments has likely been caused by the sub-clover replacing some of the annual grasses of lower quality. In the vegetative phase, sub-clover is high in feed quality by providing highly digestible, high energy, and high protein feed. The clover N available for uptake by the grasses during spring, has likely increased the amount of N in the leaves which is used to estimate CP.

Modelled Animal Production

Animal production was modelled using GrazFeed. It was modelled using a Border Leicester x Merino, 3-year-old mature ewe, weighing 60kg, pregnant to lamb in mid-July. The inputs were the clover assessment as % of dry matter in mid-June and dry matter figures from cuts taken in August 2023 (Table 4).

The highest animal intake and animal production was the direct drill 16 kg/ha treatment (118 g/day) as it had the highest quantity of dry matter and clover percentage. The lowest was the control (22 g/day) with nearly 100 g daily weight gain difference between treatments because of low pasture quantity & quality.

All the treatments that introduced sub clover to the system modelled higher livestock production whether it was a high or low rate, direct drilled or broadcast. The decisions of which method of introduction of sub clover would be determined by how quickly you want to change the pasture composition to meet production demands and the relative costs associated with the different methods.

CONCLUSION

The trial highlights the importance of having sub clovers in the pasture to boost pasture production through its addition of nitrogen, high quality feed and its ability to fill spaces that would normally be occupied by poorer quality weeds. Not only was there more pasture production, but the pasture was a higher quality, which together theoretically resulted in weight gains of nearly 100 g/day.

It also highlights that through simple management manipulations of introducing sub clover to a grass system, it can benefit the livestock and the soil. The decision of which method to use to introduce sub clover would be determined by how quickly you want to change the pasture composition to meet production demands and how to maintain the composition. This long-term trial will be continued in 2024 to explore the management techniques to increase sub clover content and manage pasture composition for production as well as investigate the economic viability of each method.

Table 3. Nutritive values for the different clover treatments.

Analyte	Drill 8kg/ha	Drill 16kg/ha	Control	Broadcast 16kg/ha	Broadcast 8kg/ha
Crude Protein (% of DM)	14.9	17.9	10.9	12.9	13.2
Neutral Detergent Fibre (% of DM)	45.9	45.4	56.3	49.3	48.8
Digestibility (DMD) (% of DM)	62.2	63.2	60.7	62	63.4
Est. Metabolisable Energy (Calculated) MJ/kg DM	9.1	9.3	8.8	9	9.3
Dry Matter (%)	28.5	25.9	32	28.4	31.1

Table 4. Pasture inputs for different treatments and the GrazFeed predictions on animal production.

	Pasture Inputs			GrazFeed Predictions			
Treatment	**Green DM (70%)**	**Dead DM (30%)**	**Clover % of DM content**	**Pasture Intake (kg/day)**	**Weight Gain (g/day)**	**Maternal Gain**	**Clean Wool (g)**
Direct Drill 8kg/ha	660.8	283.2	26.3	1.22	85	0	6.1
Direct Drill 16kg/ha	871.5	373.5	42.0	1.40	118	32	8
Control	516.6	221.4	1.0	1.05	22	-63	4.9
Broadcast 8kg/ha	667.8	286.2	13.1	1.21	84	-1	6
Broadcast 16kg/ha	620.9	266.1	25.4	1.18	73	-12	5.8

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