5.3 EXPLORING GRAZING & FERTILISER MANAGEMENT IN A PHALARIS PASTURE

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KEY MESSAGES

- Cumulative pasture production for 2023 significantly increased by 1.5–2 t DM/ha when a simple or intensive grazing rotation was implemented in comparison to continuous grazing.
- The capital phosphorus rate treatment produced 1.5 t DM/ha more than the maintenance phosphorus rate treatment cumulatively for 2023.
- Soil test results indicated that despite capital rates of phosphorus being applied in 2022 and 2023, Colwell P levels in all treatments were still below the target of 34 mg/kg.

Keywords: pasture, phalaris, grazing management, phosphorus

BACKGROUND

The Southern Farming Systems (SFS) Rokewood pasture trial site has an established old Australian phalaris pasture base. While the established pasture was persistent for a long period, the production was likely to be limited. One of the main limitations of Australian phalaris is that it is semi-winter dormant. Replacing the existing phalaris with a newer variety that is winter active would help boost production but can be costly to resow. This trial aims to evaluate management strategies to improve the productivity of the existing pasture.

Research shows that phalaris performs better under rotational grazing. This is particularly true for winter active varieties of phalaris. Research also shows that plant growth will be optimised when grazing is based on leaf stage, which requires short grazing periods of just a few days, before appropriate spelling to allow carbohydrate plant reserves to be restored as indicated by the regrowth of four new leaves per tiller. This can require additional management by livestock managers and may require smaller paddocks.

In this trial, three grazing strategies are being compared: continuous grazing (set-stocking), rotational grazing based on time (2 weeks grazing, 6 weeks spell) and an intensive rotation based on leaf stage (grazing at the 4-leaf stage and then spelling to allow leaf number recovery). These strategies aim to answer if the semi-winter dormant Australian phalaris can be improved by rotational grazing and if the extra effort to implement an intensive rotation is worth it.

The Rokewood pasture site is low in phosphorus levels and like all pastures, phalaris requires adequate levels of available soil phosphorus to be productive. The grazing strategies in the trial will be overlayed with two fertiliser treatments: maintenance phosphorus only versus capital application over three years to achieve an Olsen P of 15 mg/kg or Cowell P of 34 mg/kg for a soil with Phosphorous Buffering Index (PBI) of 140 plus annual maintenance application.

METHOD

Trial Layout

The trial evaluates two different factors: grazing strategy and fertility. Three adjacent paddocks were set up at the Rokewood pasture trial site on an old Australian phalaris pasture. The three paddocks were separated into the three grazing methods, with a paddock for continuous grazing, simple rotation (based on time), and intensive rotation (based on leaf stage). Each paddock was then split in two with one section receiving a maintenance rate of phosphorus fertiliser and the other section receiving a capital rate of phosphorus fertiliser.

Trial Management

Trial Input

Soil tests taken in 2021 when the trial was established showed phosphorus (Colwell P) levels of 13 mg/kg. An annual maintenance rate of 105 kg/ha of Single Superphosphate (SSP) was calculated and applied in autumn each year to the maintenance P treatments. The capital rate was calculated at 478 kg/ha of SSP and was applied annually for the past three years to try to achieve an Olsen P of 15 mg/kg or Cowell P of 34 mg/kg. Fertiliser inputs are detailed in Table 1.

Table 1. Trial inputs

Inputs	Date	Product	Rate/ha	Timing
Fertiliser – Capital P rate	19-May-22 26-May-23 24-Apr-24	Single superphosphate	478 kg	Autumn break
Fertiliser – Maintenance P rate	19-May-22 26-May-23 24-Apr-24	Single superphosphate	105 kg	Autumn break
Insecticide	12-Oct-21	Alpha duo	50 mL	RLEM Timerite application
Other	24-Feb-22 15-Feb-24	HY-MAL	110 ml / 10 kg of grain	Cricket baiting

Grazing

Stock movement has been monitored by 'Mobble' farm management app. Grazing treatments were imposed in July 2022 and dates of grazing recorded on Mobble. The intensive and simple grazing treatments where generally grazed for three days or until pastures were grazed down to roughly 5 cm before being spelled. The continuous grazing treatment had the gate left open to allow access for grazing at any time. The grazing days for each paddock is shown in Table 2.

The site was grazed with 16 Aussie white ewes (60kg) which lamb from July 30th with an annual DSE rating of 2.

Table 2. Grazing days for each paddock.

Paddock	Date In	Date Out	Total Grazing Days
Paddock 2 - Intensive	26-Jul-22	28-Jul-22	3
	02-Sep-22	04-Sep-22	3
	21-Nov-22	23-Nov-22	3
	14-Aug-23	16-Aug-23	3
	27-Sep-23	30-Sep-23	3
Total Intensive			15 days
Paddock 3 - Simple	28-Jul-22	30-Jul-22	3
	04-Sep-22	06-Sep-22	3
	23-Nov-22	25-Nov-22	3
	09-Aug-23	11-Aug-23	3
	13-Sep-23	15-Sep-23	3
	23-Oct-23	26-Oct-23	3
Total Simple			18 days
Paddock 4 - Continuous	Accessible year round	–	Approx. 250 days

Measurements

Pasture Production

Pasture cages were set up in each paddock to monitor growth and fixed quadrats established to monitor changes in pasture composition over time. The pasture cages were used to measure pasture production with a cut taken under each to get a representative subsample. Cuts were taken prior to the sheep entering for grazing or when pasture was approximately 10cm or 2000 kg DM/ha, cut to a residual height of 2cm. The continuous grazing cuts were taken at 8-10cm or after roughly 6 weeks during winter and autumn and 3-4 weeks during spring. The samples were used to calculate pasture production of each grazing method and fertiliser treatment.

Pasture Composition

Five fixed monitoring points were established in each treatment to monitor the phalaris presence and frequency of other species and weeds. Photos were taken of monitoring points annually with a 1 m^2 grid overlaying the photo to measure basal cover and bare ground. Photos were taken in September 2022 and November 2023 and will continue to be recorded in late winter each year.

RESULTS & DISCUSSION

Soil Fertility

In December 2023, soil tests indicated that phosphorous levels have risen since 2021 from Cowell P levels of 13 mg/kg up to levels of 17-26 mg/kg, shown in Table 3. Changes in fertility can vary over seasons and graphing the data over time will indicate the trends. It may be that nutrient transfer is occurring from the capital phosphorous area into the maintenance treatment. The capital phosphorous levels are consistently higher in 2023, but still below the target of 34 mg/kg.

Table 3. Colwell P levels for each treatment based on a soil test undertaken in 2023.

Grazing Type	Maintenance P (mg/kg)	Capital P (mg/kg)
Intensive Grazing	24	26
Simple Grazing	17	24
Continuous Grazing	22	26

Pasture Production - 2023

When comparing the pasture production data for the fertility treatments in 2023, initially the winter cuts showed that the maintenance treatment was significantly higher than the capital treatment, producing around 600 kg DM/ha more as seen in Table 4. For spring, the capital treatment was significantly more productive producing just under 2 t DM/ha more than the maintenance treatment. The summer measurement showed no significant differences between the fertiliser rates with both producing around 2 t DM/ha.
The cumulative production for the 2023 growing season resulted in the capital treatment producing significantly more than the maintenance treatment by around 1500 kg DM/ha, indicating a response in pasture production to the capital fertiliser application.

There were no significant differences in the winter measurements between the grazing strategies seen in Table 5. The simple rotation produced the highest at 1978 kg DM/ha while the continuous grazing system produced the lowest at 1520 kg DM/ha. The continuous grazing system was also significantly lower than the other strategies in spring with the intensive rotation producing the highest dry matter. Cumulatively, the intensive rotation was the highest producing with 9 t DM/ha for 2023 whilst the continuous grazing treatment was significantly lower than the other two treatments.

Table 4. Pasture production for P treatments.

P Treatment	Winter 2023 (kg DM/ha)	Spring 2023 (kg DM/ha)	Summer 2024 (kg DM/ha)	Cumulative 2023 + Summer (kg DM/ha)
Maintenance	2111 a	3462 b	1964 -	7582 b
Capital	1489 b	5442 a	2061 -	9037 a
LSD P=0.05	357.7	345.0	157.1	392.6
Standard Deviation	398.1	379.3	174.8	431.6
CV (%)	22.1	8.5	8.7	5.2

Means followed by the same letter do not significantly differ (p>0.05).

Table 5. Pasture production for grazing treatments.

Grazing Type	Winter 2023 (kg DM/ha)	Spring 2023 (kg DM/ha)	Summer 2024 (kg DM/ha)	Cumulative 2023 + Summer (kg DM/ha)
Continuous	1520 -	3475 b	2161 -	7188 b
Simple	1978 -	4703 a	1929 -	8669 a
Intensive	1903 -	5176 a	1947 -	9071 a
LSD P=0.05	438.1	422.5	192.4	480.9
Standard Deviation	398.1	379.3	174.8	431.6
CV (%)	22.1	8.5	8.7	5.2

Means followed by the same letter do not significantly differ (p>0.05).

Table 6. Pasture production for Grazing x P treatments.

Treatment	Winter 2023 (kg DM/ha)		Spring 2023 (kg DM/ha)		Summer 2024 (kg DM/ha)		Cumulative 2023 + Summer (kg DM/ha)	
Continuous Maintenance	1744	-	2844	c	1839	bc	6445	-
Continuous Capital	1296	-	4107	b	2483	a	7931	-
Simple Maintenance	2399	-	3330	c	1944	bc	7745	-
Simple Capital	1557	-	6077	a	1914	bc	9593	-
Intensive Maintenance	2191	-	4211	b	2109	b	8556	-
Intensive Capital	1614	-	6141	a	1786	c	9587	-
LSD P = 0.05	619.5		597.6		272.1		680.0	
Standard Deviation	398.1		379.3		174.8		431.6	
CV (%)	22.1		8.5		8.7		5.2	

Means followed by the same letter do not significantly differ (p>0.05).

Table 6 shows the production of each individual treatment in 2023. Cumulatively, there were no statistically significant differences between treatments. The two highest producing treatments were simple capital and intensive capital, with both producing 9.5 t DM/ha cumulatively.

The winter cuts showed no significant differences between treatments and in some cases the maintenance rate outproduced the capital rate. As Australian phalaris is a semi-winter dormant variety, it is likely that the pasture is less responsive to the treatments during this period when growth is slow. During spring when the Australian phalaris growth increases, the pasture was more responsive to the treatments. The pasture with capital fertiliser rates was able to utilise the extra phosphorus and a response was observed during spring.

As expected, an increase in cumulative production was observed in the two rotation-based grazing strategies when compared to the continuously grazed treatment. By rotationally grazing and allowing the pasture to spell, the residual energy stores of the plants are being protected and allowed to replenish. In set stocking where the first leaf is continuously grazed the plant is not given the opportunity to replenish its carbohydrates and will die off. Rotational grazing encourages tiller development which is beneficial to phalaris through winter and spring (Saul 2012).

Typically, a grazing rotation allows a higher stocking rate to be run, as there should be more pasture available. Research has shown rotationally grazed pastures allow 10-20% higher stocking rates as a result (Saul 2012). The stocking rates for each paddock were calculated using 'Mobble' data and can be seen in Table 6. The intensive grazing system had the highest stocking rate at 11.8 DSE/ha. While the intensive grazing paddock had less total grazing days than the simple grazing, it is half the size of the other paddocks. This was set up in this way to reflect an intensive rotation with smaller paddocks and more frequent rotations to optimise tiller growth and therefore had a higher stocking rate. By monitoring rotations more intensely and grazing based on leaf stage the risk of tillers dying off can be eliminated and production waste reduced, as plants only produce a set number of leaves before the old leaves start dying off (Clarke et al. 2021).

Table 7. Grazing days and stocking rate of each treatment.

Grazing Type	Total Grazing Days	Annual Stocking Rate (DSE/ha)
Intensive Grazing	15	11.8
Simple Grazing	18	7.1
Continuous Grazing	Approx. 250	10

CONCLUSION

The trial has shown early signs of pasture production increases in the Australian phalaris when managed under a rotationally grazed system. The simple and intensive grazing systems showed a significant increase in pasture production cumulatively for 2023, growing 1.5-2t DM/ha more than the continuous grazing system. A capital application of phosphorus fertiliser also increased pasture production significantly compared to maintenance rates although soil test results show that phosphorus levels in 2023 were still below target.

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