Response to superphosphate by pasture grazed by sheep in a cell system

R.N.D. Reid, and G.P. Richardson

Department of Primary Industry and Fisheries, NewTown, 7008 Tasmania.
Impact Fertilisers, Moonah, 7009 Tasmania.

Abstract

A "wagon wheel" cell system, sown to sub-clover/perennial grass pasture and intensively grazed by sheep, was used to evaluate the benefit of superphosphate application. Five paddocks were treated with 250 kg/ha of superphosphate and a similar area was left untreated. Although seasonal conditions were poor, superphosphate treated pasture was observed to recover more rapidly from grazing, and average pasture growth rates were 45% greater than in the untreated pasture.

Key Words

Superphosphate, cell grazing, sheep, pasture, soil testing.

Cell grazing involves high intensity mob grazing with long recovery periods between grazings. Cell grazing is thought to allow pasture plant roots to grow at greater depth in the soil and exploit nutrients to depth, consequently no additional fertiliser should be required (2). Tasmanian soil phosphorus levels are inherently low and thus superphosphate has been a regular part of pasture maintenance under conventional grazing systems. With approximately forty Tasmanian sheep producers using some form of cell grazing, and a further fifty interested in adapting some form of the system, the question of fertiliser requirements for such a grazing system is often raised. This paper reports on preliminary results from a comparison of fertilised and unfertilised paddocks in one grazing system.

Materials and methods

Five paddocks, with a total area of 34 ha (6.8 ha/paddock), in a 'wagon wheel' cell,or central

watering point system, grazed by 1000 crossbred lambing ewes, at daily stocking rates averaging 147 ewes/ha for two or three day grazings, at an overall total cell area stocking rate of 8 DSE?s/ha, were treated with 250 kg/ha of single superphosphate (8.8% total P and 11% S). An equivalent area of five paddocks within the same cell was left untreated. To ensure they were not limiting pasture growth, the total area was treated with a basal dressing of trace elements (Cu, Mo, B, and Zn). A further two untreated 7 ha paddocks within the cell between the treated and untreated paddocks were used as runoff areas to minimise nutrient transfer. The pasture had not been topdressed with fertilisers for 6 years. Soils were sampled for analysis in April prior to fertiliser application, and again in October sampled at a range of depths to assess the change in P down the profile. Four exclosure cages per paddock were used to monitor and assess pasture availability and growth. The cages were moved after each measurement. Pasture within these was measured using the falling plate technique (3) and calculations made based on separate callibration cuts for both treatment areas. The pasture contained perennial ryegrass, cocksfoot, and subterranean clover in a 500 mm annual rainfall area of the Southern Midlands of Tasmania. The mob was moved when the pasture was assessed by the farmer to be near 1000 kgDM/ha available. The farmer monitored each paddock by recording total grazing days, to allow calculation of dry sheep days/ha throughout the year.

Results and discussion

The pasture cage results are summarised in Table 1. A dry autumn and cold winter meant the

growth rates were very low for an extended period. As the temperature and daylength began to increase in the early spring the season dried out quickly and the growth rates again slowed significantly. Despite these very poor seasonal conditions, the ?plus fertiliser? area showed responses over three of the four periods, including an early spring response of 50% to applied fertiliser over thirty three days. Although not detected on the grazing charts used to record grazing days, the farmer had commented that the treated areas recovered from grazing in half the time of the untreated paddocks.

Table 1. Pasture growth rates after grazing by treatment over time.

Date	Nil Fertiliser (kg/ha/day)	Plus Fertiliser (kg/ha/day)
15 May - 26 June (42 days)	3.0 [a]	8.1 [b]
26 June - 27 August (62 days)	3.0 [a]	4.0 [a]
27 August - 29 September (33 days)	12.5 [a]	25.0 [b]
29 September - 30 October (31 days)	15.0 [a]	12.0 [b]

Within row means with different superscripts differ significantly (P<0.05)

The expected time for P responses is in the autumn, winter and early spring. These results show responses in each period records were taken, except the last, when the grasses were going to seed, and growth rates were falling due to moisture stress. It is common to measure growth rates of 60-80 kg/ha/day in these pastures in October and November under adequate moisture. The April soil test results for the area averaged pH(w) 5.8, P(Colwell) 21 mg/kg and K 300 mg/kg. Soil tests were also taken in October at a range of depths to examine any changes in fertility down the sandstone derived profile. Table 2 summarises the results from these tests. At the depths sampled there is little change in fertility down the profile. The lower October values than those in April may partly be due to plant uptake of phosphorus in early spring.

Table 2. October Colwell P soil test values by depth of soil profile.

Depth (mm)	Nil Fertiliser (mg/kg P)	Plus Fertiliser (mg/kg P)
75?	9 [a]	11 [a]
115	8 [a]	9 [a]
150	10 [a]	9 [a]

Within row means with the same superscripts do not differ significantly (P<0.05)

The even gradation in extractable P down the profile indicates that depth does not have a significant effect on phosphorus availability in this soil type. The cell being studied has been under this regime for three years and has had some time for the pasture to equilibrate to the extended spelling periods. If there was to be better access to soil nutrients down the profile associated with an increase in root depth due to extended spelling from grazing, there should not be the significant response to applied superphosphate already achieved at this early stage of the project.

Transfer of nutrients to camp sites can be significant under continuous grazing (1). With high stocking densities used under cell grazing systems such as this, there would be expected to be a far more even distribution of phosphorus and all other nutrients across paddocks than would be found under set stocking or continuous grazing management systems. The project will continue for at least a further two years.

Conclusion

These early results show that superphosphate improves pasture growth in a cell grazing system. Provided these results are confirmed and translate into improved animal production, further work is needed to evaluate methods for predicting the requirements for fertiliser containing P and S in such intensively managed grazing systems.

References

1. Hilder, E.J. 1964. *Proc. Aust. Soc. Anim*. *Prod.* **5,** 241-248.

2. Savory, A. 1988. In: Holistic Resource Management. *Island Press*: Washington, D.C. p. 92.

3. Powell, T.L. 1974. *N.Z. J. Exp Agric*. **2,** 237-241.