

## Phosphorus availability in natural and improved pasture under long-term grazing

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Phosphorus (P) availability is one of the most important limiting factors in pasture production in grazing areas of Australia. The distribution of nutrients within a paddock is modified by grazing and camping behaviour of livestock, particularly Merino sheep. Long-term continuous grazing results in significant transport of nutrients to small camp areas, with depletion occurring over the majority of the paddock (Hilder and Mottershead 1963). An experiment was conducted to determine the effect of long-term continuous grazing on P-availability in a natural and improved pasture.

### Methods

The study used 2 plots of a long-term pasture experiment on the CSIRO property, Chiswick, near Armidale, NSW. Two pasture treatments included unfertilised natural pastures dominated by *Poa sieberana* and *Themeda triandra* and improved pastures sown to *Phalaris aquatica* cv. Siroso and *Trifolium repens* cv. Haifa and fertilised annually with superphosphate to give application rates of 22 kg P/ha and 27 kg S/ha. Heavy stocking rates were imposed; 6.6 DSE/ha and 10 DSE/ha for natural and improved pastures respectively. The stocked plots had been continually grazed since 1976 except for periods of drought when all stock were removed. Soil samples (0-2.5 cm and 2.5-10cm depth) were taken along transects across the plot at 2, 4, 8, 16, 32, 64, 96, and 128 m intervals from the corner post which, in the case of the stocked sites, contained sheep camps. Available phosphorus (P) in soil was determined using the Colwell method.

### Results and discussion

Redistribution of available P occurred in both pasture systems in the 0-2.5 cm soil layer (Figure 1). However, the extent of redistribution was more marked in the natural pasture where P availability declined to 12% of the maximum by 16 m and maintained an equilibrium beyond this point. In contrast the decline in P-availability was less steep on the improved plot which indicates more even nutrient return and hence grazing pressure over the paddock. At the most distant point P-availability was 32% of the maximum compared with 11% in the natural pasture. There was no difference in the pattern of distribution of available P out from the camp for the 2.5-10 cm depth between the natural

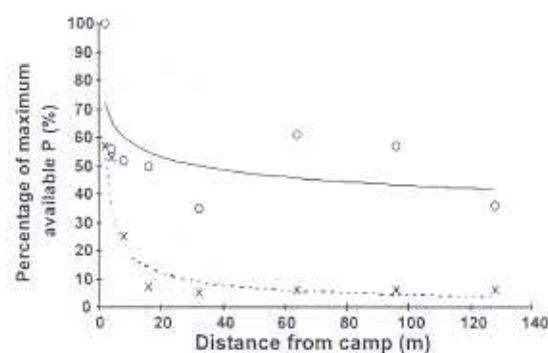


Figure 1: The availability of phosphorus (0-2.5 cm) as a percentage of the maximum recorded in each plot along a transect from the sheep camp in natural (x) and improved (o) pasture under long-term grazing conditions. Fitted lines in the form  $Y=aX^b$  for natural (broken line) and improved (solid line) pastures.

and improved plots. Both declined steeply at the start, with equilibrium reached by 16 m.

The more even nutrient distribution in the improved pasture may be a result of higher grazing pressure over the plot. Additionally, pastures in the improved plot are fertilised annually which maintains higher levels of palatability, grazing intensity and hence nutrient return over the paddock. Conversely, in the natural pasture, nutrient transfer over time results in dominance of plants of lower palatability and hence nutrient content at distant points in the paddock (Davidson 1985). Therefore, sheep will spend progressively more time in the camp and the area immediately surrounding it as time progresses as nutrient responsive and palatable plants such as barley grass tend to grow in these areas.

Better grazing management and strategic use of fertiliser may help to alleviate the extent of nutrient redistribution and long-term negative effects such as depletion of favourable perennial species through a combination of low nutrient status at points distant to the camp and over-grazing within the area immediately surrounding the camp.

### References

- Davidson, S. (1985). Sheep camps-a useful resource? *Rural Research*. 127, 8-11.
- Hilder, E.J. and Mottershead, B.E. (1963). The redistribution of nutrients through free-grazing sheep. *Australian Journal of Science*. 26(3): 88-89.