Factors affecting phalaris persistence

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Abstract

Phalaris-based pastures were established with and without lime in 1992 as a part of a long-term pasture/crop rotation experiment, known as MASTER. Pasture feed on offer, botanical composition and basal area were monitored over 10 years. Lime improved the establishment of phalaris. However, phalaris basal area declined over time on both limed and unlimed treatments under the current grazing management. The decline of phalaris basal area was closely related to subsoil acidity and grazing pressure. It is suggested that lax grazing or a period of spell in autumn would be beneficial to the longevity of phalaris-based pastures on the southwest slopes of NSW.

Key Words

Acidity, basal area, grazing, pasture, subsoil

Introduction

Phalaris (*Phalaris aquatica*) is commonly sown in the high rainfall (550-800 mm) zone to increase summer feed supply for stock in southeastern Australia. Phalaris may reduce soil acidification through better use of nitrate (1) and water (2) in the soil profile. However, phalaris often does not persist long enough to guarantee graziers a reasonable return on the cost of establishment (3). The paper will discuss the possible factors affecting phalaris persistence under grazing conditions.

Materials and Methods

Phalaris-based pastures were established in 1992 with and without lime as part of a long-term pasture/crop rotation experiment, known as MASTER - Managing Acid Soils Through Efficient Rotations, at Book Book, 40 km southeast of Wagga Wagga in a 650 mm rainfall zone (4). An initial lime application of 3.7 t/ha was incorporated into 0-10 cm soil in 1992 to lift pH_{Ca} from 4.0 to 5.5 and a subsequent maintenance lime application of 2.6 t/ha was top-dressed at the start of phase 1 at 6 yearly intervals to maintain an average pH_{Ca} of 5.5 in the top 10 cm over the six year liming cycle (4). Pastures were rotationally grazed using merino wether hoggets with 2.5 weeks' grazing and 5 weeks' spell most of the year. However, a short rotation (one-week grazing and two-week spell) was used at the autumn break (April/May) and during the rapid growth period (September – October). This ensured that each plot in the grazing cycle was not over grazed early in the season and received a similar grazing pressure over the rapid growth period in spring. Stocking rates were manipulated to maintain similar liveweight and body condition on limed and unlimed treatments. Pasture feed on offer was measured using a falling plate meter (5) and pasture botanical composition was estimated 2-3 times each year using dry-weight-rank method (6; 7). Phalaris basal areas had been monitored on 3 permanent quadrats (1 x 1 m) at the end of summer each year since 1994. Deep soil cores were taken to 60 cm with 10 cm intervals and from 60 to 120 cm with 20 cm intervals in autumn at the start of phase 1 at 6 yearly intervals. All regressions were processed using GenStat 4.2.

Results and discussion

Lime improved the establishment and persistence of phalaris. The phalaris basal area on the limed treatment (14.5%) was much higher than the unlimed treatment (4.8%) in 1994 two years after establishment, which is in agreement with the finding in northeast Victoria (8). Phalaris persisted reasonably well on the highly acidic soils under the current grazing management, especially on the limed treatment. Ten years after establishment, the phalaris proportion was 32.1% in spring with basal area of 4.5% at the end of summer on the limed treatment (15.6% and 1.5% on the unlimed treatment). However, phalaris basal area declined over time on both limed and unlimed treatments under the current grazing management except for one limed plot where phalaris basal area increased. Greater loss of basal area was recorded on the limed treatment than on the unlimed treatment from 1994 to 2002. Ridley and Windsor (8) also found that phalaris with higher density at establishment decreased more than phalaris with lower density on the unlimed treatment in northeast Victoria.

Regression analysis showed that the declining of phalaris basal area was closely related to subsoil acidity and grazing pressure. There was a strong positive correlation between phalaris basal area and soil pH_{Ca} at 10-30 cm (Fig. 1), indicating subsoil acidity has a great impact on the persistence of phalaris. Phalaris would persist longer with higher productivity under better subsoil conditions.

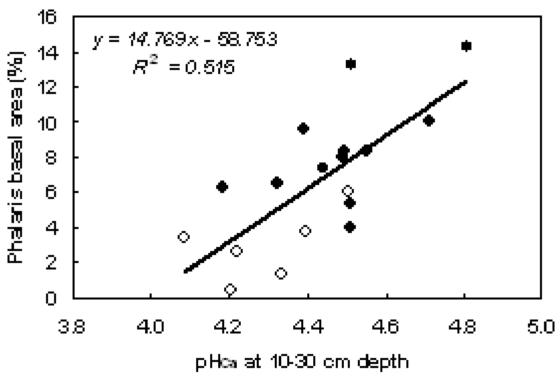

Fig. 1 Relationships between averaged phalaris basal area and soil pH_{Ca} at depths of 10-30cm (○ unlimed treatment; ● limed treatment)

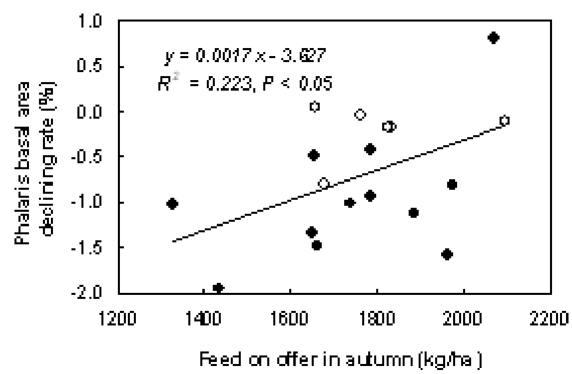

Fig. 2 Relationship between phalaris basal area declining rate and feed on offer in autumn (○ unlimed treatment; ● limed treatment)

Pasture feed on offer reflects the grazing pressure on the pasture. Results from the current experiment showed that grazing pressure in autumn has had more impact on the basal area declining than for any other season. The greater the grazing pressure (less feed on offer) in autumn, the steeper was the slope of basal area drops (Fig. 2). It is suggested that a phalaris-based pasture should be lax-grazed, or spelled if possible during autumn to improve the persistence of phalaris on the southwest slopes of NSW where winter rainfall is dominant. Virgona *et al.* (9) also found that phalaris needs a period of rest when buds are regenerating and tillers developing over autumn-winter in the summer-dry environments. In contrast, phalaris is very sensitive to grazing over spring-summer period where summer rainfall is dominant on the northwest slopes of NSW (10).

References

(1) Ridley A.M., White R.E., Helyar K.R., Morrison G.R., Heng L.K. and Fisher R. (2001) Euro. J. Soil Sci., 52: 237-252.

(2) Heng L.K., White R.E., Helyar K.R., Fisher R. and Chen D. (2001) Euro. J. Soil Sci., 52: 227-236.

(3) Virgona J.M., Bowcher A. (2000) Aust. J. Exp. Agric., 40: 299-311.

(4) Li G.D., Helyar K.R., Conyers M.K., Cullis B.R., Cregan P.D., Fisher R.P., Castleman L.J., Poile G.J., Evans C.M. and Braysher B. (2001) Aust. J Agric. Res., 52: 329-341.

(5) Li GD, Helyar KR, Castleman LJ, Norton G, Fisher RP (1998) Proc. 9th Aust. Agron. Con. 322-325.

(6) 't Mannetje L., Haydock K.P. (1963) J. British Grass. Soc., 18: 268-275.

(7) Jones R.M., Hargreaves J.N.G. (1979) Grass and Forage Sci., 34: 181-189.

(8) Ridley A.M., Windsor S.M. (1992) Aust. J. Exp. Agric., 32: 1069-1075.

(9) Virgona J.M., Avery A.L., Graham J.F. and Orchard B.A. (2000) Aust. J. Exp. Agric., 40: 171-184.

(1) Lodge G.M., Orchard B.A. (2000) Aust. J. Exp. Agric., 40: 155-169.