Effect of cropping rotation on weed incidence and botanical composition of ensuing pastures at Oolong in SE NSW

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Abstract

Use of a short cropping phase to offset the cost of re-establishing a perennial grass pasture in a high rainfall environment has many potential advantages. Here we report on the results of a number of cropping rotations that included combinations of canola, faba beans and wheat for 1-3 years, on weed incidence, particularly annual ryegrass, and early botanical composition of the newly sown pasture. Results suggest that (i) three years of cropping was insufficient rotation length to provide a weed-free seedbed for the pasture, and (ii) rotation per se did not appear to appreciably influence weed presence. The implications of this study are that annual ryegrass infestation is highly likely even in non-cropping environments such as the NSW tablelands, and that stringent crop husbandry needs to be practised to ensure there is no replenishment of the seedbank during the cropping phase.

Key Words

Crop/pasture integration, acid soils, liming, pasture weeds, perennial pastures

Introduction

The tablelands of NSW are elevated (600-100 m ASL), medium-high rainfall (600-1000 mm) areas that traditionally support perennial pastures. Maintenance of these perennial pastures in a highly productive state is needed to ensure that livestock potential is optimised, as well as assisting with the management and partitioning of water (4) in these high recharge environments. But pasture sowing on the tablelands is an expensive exercise especially when perennial species are included in the sowing mix. These higher rainfall areas are often associated with low pH soils (1) that preclude active growth of many of the perennial species considered for inclusion in the sowing mix (eg. phalaris, chicory). The application of lime to increase soil pH adds considerably to the cost of pasture establishment, but inclusion of a short-term cropping program between the old and new pasture phases would assist in offsetting the costs of lime and re-establishment. In addition, herbicide use during the cropping phase should be expected to result in a ‘cleaner’ seedbed (3) for the following newly sown pasture.

Methods

Oolong (lat. 34?46’S, long. 140?10’E) is one of two sites comparing rotation type and length, and lime application rate and incorporation method on weed incidence and presence in pastures planted in the first year following the final crop in the rotation. Rotation type included wheat, canola, canola/ wheat, wheat/canola/wheat, wheat/faba beans/wheat, canola/faba beans/wheat, and rotation length was for 1-3 years. There were three lime application rates (0, 2.2, 4.4 t/ha), each incorporated to three different extents (nil, surface, deep) in year 1. Controls, where new pasture was sown directly into the old degraded pasture phase or preceded by a chemical fallow only, were sown in each of years 1-4 (1998-2001), or not sown at all (degraded pasture). Experimental design was method of incorporation as the main plot, split for lime rate, and further split for rotation type and length. Plot size was 25 x 4 m. All treatments were replicated 3 times. Weed incidence in the pasture in the first six months after sowing was estimated by identifying and recording all seedlings present within a 90 x 10 cm quadrat. Ten quadrats

per plot were evaluated in 1998-2000, and 6 quadrats per plot in 2001. Later estimates of weed species were on a herbage mass basis (BOTANAL) estimated seasonally.

Results

Rotation length had little effect on total weed incidence, though there was a decrease as rotation length increased from one to two years (Table 1). Rotation type appeared to have a greater effect, with lower weed numbers where canola was the initial crop. A similar trend was apparent at the high lime application rate where numbers for *Vulpia* spp. and *L. rigidum* were 2-5 x and 2 x lower, respectively (data not shown). Rotation length increased % vulpia, and decreased % *L. rigidum,* but rotation type appeared to have little effect. At the high lime application rate, % *Vulpia* spp. and % *L. rigidum* were lower (17 vs 7%, 55 vs 42%, respectively – mean of 6 rotations). *Bromus* spp. was generally at a lower level compared to the other annual grasses, except for the W, W/C/W and W/F/W (plant numbers), and W rotations (% composition).

Table 1: Effect of rotation length and rotation type on a) incidence and b) proportion of vulpia, brome and annual ryegrass in pastures sown the year after a crop in the absence of lime. Assessments were conducted 5 months and 6-8 months, respectively after the pasture was sown.

	Rotation											
	Plants/m^2						%total DM					
	W	C	C/W	W/C/W	W/F/W	C/F/W	W	C	C/W	W/C/W	W/F/W	C/F/W
Vulpia spp.	119	38	22	380	208	156	8	0	7	39	19	26
Bromus spp.	29	2	5	8	12	4	7	0	1	1	2	1
L. rigidum	50	90	10	20	36	22	67	78	69	29	48	40

[1] W wheat, C canola, F faba beans

Discussion

Increasing rotation length from 1 to 3 years was not effective in reducing contamination of the new pasture with annual grasses. This may be due to insufficient time to exhaust the seedbank, or more likely to recharge of the seedbank during each crop rotation as indicated by the increase in *Vulpia* spp. (limited longevity in seedbank) as rotation length increased. These plant numbers were sufficiently high to result in domination of the new pasture by *L. rigidum* for 1- and 2-year rotations, and by both *L. rigidum* and *Vulpia* spp. for the 3-year rotations. The marginal decrease in % *L. rigidum* when lime was applied compared to the large decrease in % *Vulpia* spp. resulted in *L. rigidum* becoming the dominant annual grass weed in the newly sown pasture. Therefore for many of these rotations, there is a high likelihood of establishment failure, and seemingly no advantage to crop/pasture integration in a high rainfall environment. Grazing management has been successful in minimising this problem (data not presented).

Conclusion

If a cropping program is to be successfully utilised in offsetting the costs of pasture re-establishment on the tablelands, then greater care in ensuring that seeding of volunteer annual grasses within the cropping phases does not occur, needs to be emphasised. This is line with current thinking that long-term benefit

to the crop/pasture system needs to address weed seed elimination rather than just taking an economic threshold approach (2).

References

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