Seed ecology of *Microlaena stipoides* in grazing systems of south-eastern Australia

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Keywords: Population biology, perennial grass, recruitment, seed rain, phenology, seed bank.

Introduction

Microlaena stipoides var. *stipoides* (Labill.) R.Br. (Microlaena) is a tufted C_3 native Australian perennial grass with a short rhizome that can form dense lawns. Microlaena has a wide geographic distribution throughout southern Australia, particularly in the temperate, high-rainfall tableland areas (> 550 mm AAR) of south-eastern and western Australia where is considered to be important for the grazing industries because of its extended growing season in higher rainfall areas, persistence over many years and persistence through drought. Although *Microlaena* has an important role in the stability of grazed native pastures, little is known about this grass in grazed communities. This study focused on phenology, seed rain, seed bank, seed germination and seedling recruitment. The overall aim was to assess the likely importance of seeds for the maintenance of *Microlaena* within swards where it already exists.

Methods

The experiment was conducted at Chiltern (36°12'S, 146°35'E) in north-east Victoria, on an existing native grass pasture dominated by Microlaena (19% basal cover). The site was an acidic (pH_{CaCl2} 4.2), low fertility (Colwell P 10 mg/kg), Red Kurosol soil (Isbell 1996). The phenological development of *Microlaena* was recorded approximately fortnightly over an eighteen month period (December 2009 to July 2011).

Seed rain was measured with eight seed traps around 16 plants. Each seed trap was a PVC pipe (0.1 m diameter, 0.15 m deep) that was fitted into an augered hole. A 0.12 m diameter funnel was placed in the pipe. At the bottom of the funnel, the seed was caught in a delnet bag (60 mm by 80 mm). Bags in the seed traps were changed approximately fortnightly over an eighteen month period (December 2009 to July 2011). The seeds collected were placed into 9-cm disposable petri dishes with 1 sheet of Whatman No. 181 filter paper, moistened with 10 mL of distilled water. Germination was scored daily, and germinated seeds were removed from the dishes.

The soil seed bank was estimated by collecting 24 cores (50 mm diameter, 50 mm depth) in an area of approximately 1 m^2 around the 16 plants on 15 July 2010 (Yr 1) and 4 May 2011 (Yr 2). The soil samples were spread evenly over seed raising flats containing sand/peat mix (2:1) with a layer of vermiculite. The soil samples were in a glasshouse under natural light and modified day/night temperatures. Samples were kept moist for between 42 and 58 d. During each census, germinants were identified according to functional groups (*Microlaena*, broadleaf, sedges, grass and legume) and removed. At the end of each cycle water was withheld, the dry soil samples were thoroughly mixed and re-watered to initiate another cohort of germination. This cycle was repeated three times over a nine-month period.

Seedling recruitment was counted along four 100-m long transects by placing a quadrat (0.3 m by 0.3 m) on the ground every 5 m, resulting in a total of 80 quadrats. Within each quadrat, the number of *Microlaena* seedlings was recorded. Surveys were conducted in April 2010, May 2011 and September 2011.

Results

Ear emergence commenced in early November, with flowering occurring intermittently for 113 days and seed maturity and seed fall occurring in summer and autumn. Seed yields, seed bank, germination, and seedling recruitment are summarised in Figure 1.

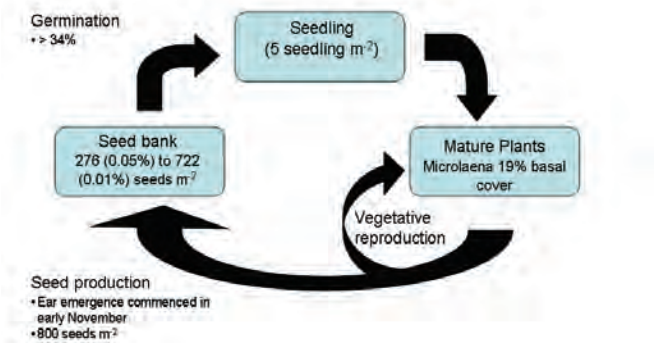

Figure 1. Flow chart for the dynamics of a Microlaena-dominated pasture in north-east Victoria.

Conclusion

Microlaena is known to persist in pastures in south-east Australia. The spread of this species in the sward would be related to both seedling recruitment and maintenance/ spread of adult plants. The production of seed allows *Microlaena* to spread within the pasture and maintain its genetic diversity. The precocious flowering of *Microlaena* indicates that it received the required environmental signals. *Microlaena* had two distinct periods of high seed rain, in early summer and then again in early autumn. These would be influenced by soil moisture.

Seedlings were found through the open paddock, indicating that dispersal did occur, however seedling density was low (5 seedlings/m^2). Seedling recruitment occurred in either autumn or spring in north-east Victoria. Seedlings were found close to mature plants, no more than 0.15 m away.

Microlaena had low numbers in the seed bank (< 1% of the total germinable soil seed bank) relative to the seed rain and with low seed germination rates. No significant accumulation of seed in the soil was detected. The above ground species composition was not reflected in the composition of the seed bank. Any seedlings of *Microlaena* that germinate from the seed bank would face immense competition from other species. With so many annual grass and sedge seedlings present in the seed bank, it suggests that any disturbance would result in a dramatic shift in botanical composition of the pasture. Since the success of this species is related to its occasional seedling recruitment and maintenance of adult plants through vegetative spread leaving *Microlaena* swards intact is important for maintaining pasture composition.

References

Isbell RF (1996) 'The Australian Soil Classification.' (CSIRO Publishing: Melbourne, Australia).

Waters C, Whalley W, Huxtable C (2000) 'Grassed up: guidelines for revegetating with Australian native grasses.' (NSW Agriculture: Dubbo).