THE ACCESSION OF GRASSY WEED SEEDS INTO THE SOIL SEEDBANK OF GRASSLANDS

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ABSTRACT

Perennial grassy weeds of grasslands are usually characterised by substantial and long lived soil seedbanks. A comparison of the potential seed production and accession into the seedbanks of giant Parramatta grass (*Sporobolus indicus* var. *major* (Buse) Baaijens) and Chilean needle grass (*Nassella neesiana* (Trin. & Rupr.) Barkworth) revealed big differences in their potential annual seed production and in the proportion being incorporated into the seedbank. The potential seed production of giant Parramatta grass was about 668,000 seeds m^{-2} and only about 0.3% of these were incorporated into the seedbank. The figures for Chilean needle grass were 22,000 seeds m^{-2} and 42% respectively. Knowledge of these differences as well as other aspects of seedbank dynamics are essential for effective grassy weed management in grasslands.

KEYWORDS

Sporobolus, Nassella, seed production, management, temperate

INTRODUCTION

Perennial grassy weeds in northern New South Wales include giant Parramatta grass (*Sporobolus indicus* var. *major* (Buse) Baaijens; Andrews, 1995) giant ratstail grass (*Sporobolus pyramidalis* P. Beauv.; Andrews, 1995) and Chilean needle grass (*Nassella neesiana* (Trin. & Rupr.) Barkworth; Gardener *et al.,* 1996). Evidence to date suggests that the above species have substantial and long lived seedbanks so that re-colonisation can occur whenever gaps appear in the pasture cover.

Conventional control methods consist of the use of selective herbicides followed by establishment of competitive improved pastures (e.g. Campbell, 1983). This approach is usually only effective in the short term and re-invasion is common because of a lack of understanding of the soil seedbank dynamics of the species involved (Gardener *et al.,* 1996).

The aim of this study was to quantify and compare the proportions of the potential annual seed production being incorporated into the seedbank for giant Parramatta grass and Chilean Needle grass in northern NSW.

METHODS

Giant Parramatta grass. Potential seed production was estimated at Valla on the North Coast of NSW (30° 35' S, 153° 58' E) in a paddock heavily infested with giant Parramatta grass. The number of inflorescences per 1 m^2 quadrat was counted each month and the lengths of 20 of them selected at random and measured. Five inflorescences were cut each month from an adjacent site and the number of pedicels per length of inflorescence estimated by counting the pedicels in 1 cm sections cut from the top, middle and lower parts. Pedicel number was considered equal to potential seed production as each spikelet potentially contains one fertile floret.

Seed fall was estimated by placing four seed traps constructed from 10.4 cm diameter polythene pipe within each quadrat and emptying the traps and counting the seeds monthly. The seed bank size was estimated from eight soil cores taken from each quadrat site.

Chilean needle grass. Potential seed production was estimated in a paddock heavily infested with Chilean needle grass at Ben Lomond on the Northern Tablelands of NSW (30° 03' S, 152° 36' E) by multiplying the mean number of flowering tillers (40 x 0.25 m^2 quadrats) by the mean number of glume pairs per tiller estimated from 100 tillers. Glume pair number was considered equal to potential seed production as each spikelet potentially contains one fertile floret. The awns of Chilean needle grass seeds twist together causing the seeds to fall in a clump and so it was not possible to use seed traps to measure seed fall. Changes in the seedbank were measured by taking random soil cores (50 x 5.3 cm diameter by 5 cm deep) before and after seed fall.

Chilean needle grass also produces clandestine seeds or cleistogenes beneath the leaf sheath at each node on the flowering tillers. One hundred flowering tillers were removed from an ungrazed stand of Chilean needle grass, the leaf sheaths removed and the cleistogenes counted at each node. Corresponding seeds of panicle origin were also counted.

RESULTS

Giant Parramatta grass. Mean total potential production was 668,400 seeds m^{-2} and mean total seed fall was 146,000 seeds m^{-2} between November, 1991 and July, 1992. The seedbank increased from about 3,700 seeds m^{-2} to about 6,000, representing 1.6% of the seed fall and 0.3% of the potential seed production. In some quadrats the seedbank actually fell despite a massive potential input from seed fall.

Chilean needle grass. Mean annual potential seed production was 22,100 m^{-2} in the wet spring and summer of 1996/97 and the seedbank rose from about 2,000 seeds m^{-2} to about 11,200 m^{-2} over the summer representing about 42% incorporation. The mean number of cleistogenes produced per tiller was 7.3 ±0.5 compared with 26.6 ±0.7 seeds of panicle origin. Therefore, for every 100 seeds on a panicle, about 27 cleistogenes would be produced.

DISCUSSION

There were dramatic differences between the proportions of the annual potential seed production of these two species which ended up in the seedbank. The summers over which these data were collected represented good rainfall years and so the results represent high levels of potential seed production.

The seeds of giant Parramatta grass are tiny achenes (ca. 1 x 0.7 mm) with a mucilaginous pericarp which absorbs water enabling the seeds to become attached to animal's hooves and legs or to vehicles when the seeds are wet. These seeds then drop off when they dry out providing the species with a very efficient dispersal mechanism (Andrews, 1995). The causes of the massive losses between potential seed production, seed fall and accession to the seedbank are not known but could involve predation by birds and ants.

Chilean needle grass seeds are much larger (ca. 5 x 1.5 mm) with a sharp callus and antrorse hairs. These seeds also become attached to animals and vehicles providing the species with equally efficient dispersal mechanisms. The panicle seeds and cleistogenes represent a very flexible reproductive system, so that even if panicle seed production is prevented by close mowing or grazing, substantial numbers of cleistogenes will be produced with the potential for maintaining the seedbank.

These results emphasise the importance of detailed studies of the reproductive biology of individual weed species if their populations are to be effectively managed. Simple determination of the potential annual seed production is not an adequate estimate of the input into a weed's seedbank.

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