

Seed softening in *Hedysarum* spp. – new temperate forage legumes with great potential

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Abstract

The pattern and degree of seed softening in a number of lines of three *Hedysarum* spp was determined at the soil surface during the first year following seed set. Initial hard seed % was low in all species with *H. coronarium* and *H. flexuosum* having higher levels than *H. carnosum*. However, seed of *H. coronarium* and *H. flexuosum* softened rapidly between 15 January and 26 February 2001. *H. carnosum* displayed a slower more constant rate of softening. Residual hard seed levels were lower than those observed previously for annual medics in the subtropics. However, variation between lines enabled harder seeded germplasm to be identified.

Key Words

Hedysarum, forage, legume, pasture, hard seed, seed softening

Introduction

Hedysarum coronarium (sulla) and *H. carnosum* are short-lived perennials and *H. flexuosum* is believed to be an annual. All are non-bloating, anti-helminthic, high quality forage legumes adapted to deep, fertile alkaline soils (1), and originate in the Mediterranean (2). Sulla is regarded as a promising phase pasture legume for Australia.

Hardseededness (seed coat impermeability) in legumes is a mechanism to develop a soil seed bank and spread seed germination over several subsequent growing seasons (3). This attribute is important in ley and phase farming systems, where the regeneration of legumes in subsequent years is a key factor in the success of those systems (3). The pattern of seed softening is important in annuals as it determines the plant's ability to avoid unsuccessful establishment during 'false breaks' and a reduction of the soil seed bank. Hardseededness is of lesser importance in perennials. However, higher hard seed levels will ensure desirable recruitment in subsequent seasons, particularly in short-lived perennial legume pastures. The aim of this experiment was to determine the pattern and degree of seed softening in *Hedysarum* spp. These are important selection criteria in the development of new cultivars.

Methods

Seed was harvested on 7 December 2000 from 54 lines of the three *Hedysarum* spp. grown at Oakey, Qld. Seeds were extracted from pods and germination tests carried out to determine the initial % hard seed. Remaining hard seeds were separated into lots of 50 and placed in mesh bags on the surface of a black earth at Kingsthorpe on 15 January 2001. Four germination tests were carried out in the laboratory at 6 weekly intervals from this time until 1 July 2001 to measure changes in % hard seed over the summer-autumn period. However, due to dry conditions during seed set there were too few seeds in 30 of the lines, and number of samplings were reduced accordingly for those lines. The design of the experiment was an unbalanced and incomplete factorial of 54 lines by 4 sampling dates, arranged in two

blocks. The data were subjected to an analysis of variance in Genstat and adjusted means were generated.

Results

The average initial hard seed % of all lines within the three species was: *H. coronarium* – 62.1 (41 lines); *H. carnosum* – 52.6 (5 lines); *H. flexuosum* – 63.3 (8 lines). In *H. flexuosum* and *H. coronarium* the greatest proportion of seed softened between 12 January and 22 February with reducing amounts thereafter. This contrasted with the lower and more constant rate with *H. carnosum* (Fig. 1).

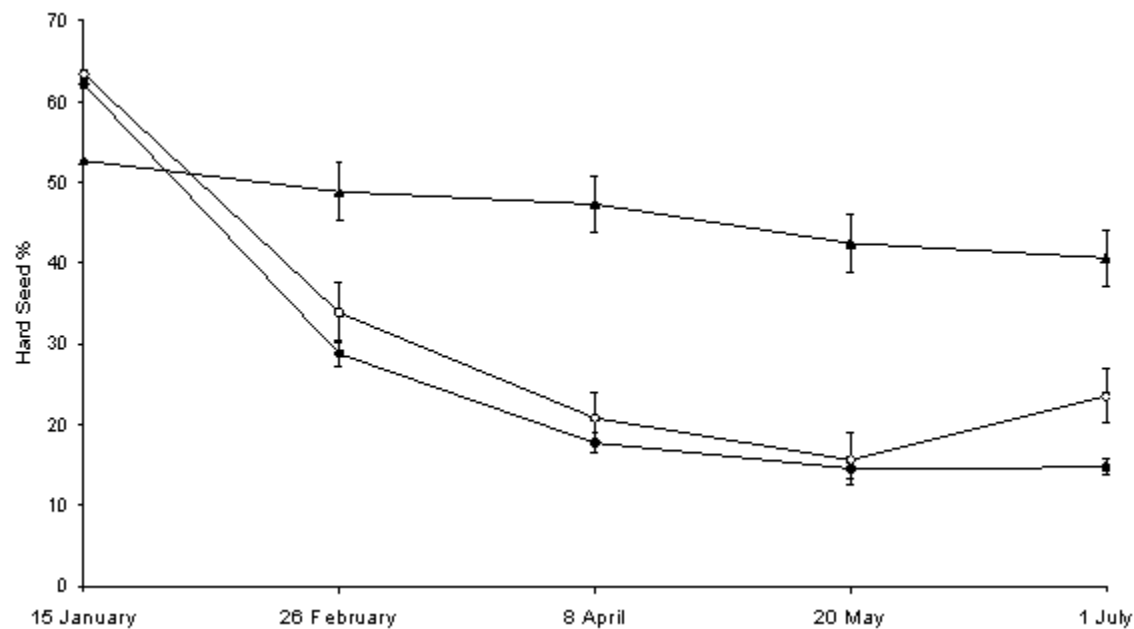


Figure 1: Pattern of seed softening of *Hedysarum coronarium* (●), *H. carnosum* (▲), and *H. flexuosum* (○) under field conditions.

Levels of residual hard seed after the softening period varied greatly between accessions within each species. Softest and hardest lines were: *H. coronarium* - HS22 (1.1%) and HS57 (32.4%); *H. carnosum* - HC03 (20.1%) and HC02 (58.1%); *H. flexuosum* - HF04 (16.7%) and HF01 (39.8%).

Conclusion

The summer softening pattern of *H. coronarium* and *H. flexuosum* limits the protection of seed against false breaks in mediterranean environments. However, in the subtropics, this pattern of seed softening may be more advantageous, enabling regeneration to occur on the last of the summer rains. The more constant rate of softening in *H. carnosum* and a much lower reduction in hard seed during summer may provide protection in a range of environments.

Hedysarum spp. displayed much lower levels of hardseededness than annual medics in a comparable subtropical environment (4). The dry conditions during seed development may have contributed to the low levels of hard seed observed (5, 6). However, the variability within each species will enable hardseeded germplasm to be selected for cultivar release in current and future breeding programs (7).

References

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