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Dry heat scarification of *Stylosanthes guianensis* seed

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Summary

Exposure of seeds of the four main varieties of *Stylosanthes guianensis* (cvv. Schofield, Cook, Endeavour and Oxley) to dry heat of 50°, 60°, 70° or 80°C for 6 h reduced the level of hardseededness by varying extents depending upon the cultivar, the temperature and the particular sample. None of the heat treatments affected viability and thus a decrease in hardseededness was associated with a corresponding rise in the level of germination.

Seed lots of Schofield, Cook and Endeavour may be scarified using dry heat (80°C for 6 h) when rapid germination is of paramount importance. The same heat treatment could be used for cv. Oxley (even though it is less effective) because of the characteristically low germination of untreated seed of this cultivar.

1. INTRODUCTION

Commercial varieties of *Stylosanthes guianensis* have a substantial role in Queensland pastures. In common with many tropical and subtropical leguminous species, these varieties (cvv. Schofield, Endeavour and Oxley) characteristically have substantial levels of hard-seededness (Butler and Rickert 1981).

The value of hard seeds during pasture establishment is uncertain depending upon rainfall, soil temperatures and the rate of breakdown of hardseededness. Hardseededness is often seen as an 'insurance policy' against 'false starts' to the season. However, if good rainfall occurs or conditions do not favour hard seed breakdown, the sowing of seed lots with high levels of hardseededness is wasteful of seed and may permit weed invasion.

Dry heat treatment to reduce the level of hardseededness is particularly well suited to large scale usage, is simple and can have a reasonable safety margin.

Hardseededness in *S. guianensis* has been shown to be sensitive to hot water (Stonard 1968; Butler and Rickert 1981). Exposure to dry heat has reduced the levels of hard seed in *S. humilis* (Holm 1973) and *S. hamata, S. scabra* and *S. viscosa* (Mott, McKeon and Moore 1976; Mott and McKeon 1979; Gilbert and Shaw 1979).

The aim of this work was to examine the effectiveness of several dry heat treatments in reducing hardseededness in four cultivars of *S. guianensis.*

2. MATERIALS AND METHODS

Four samples of seed of each of the four main cultivars of *S. guianensis* (cvv. Schofield, Cook, Endeavour and Oxley) were selected at random from samples submitted to Queensland Seed Testing Laboratory for routine seed testing. Seed was subjected to dry heat treatment (50°, 60°, 70° and 80°C for 6 h, and 70° and 80°C for 22 h) in small drying ovens.

Three replicates of 50 seeds were germinated on Ekwip U70 germination paper (moistened as required) at a constant temperature of 25°C. Germination counts were conducted after 4, 8 and 14 days. Approximate viability was determined by the summation of normal seedlings, abnormal seedlings, dormant (fresh ungerminated) seeds and hard seeds.

3. RESULTS

All results are shown in Table 1.

Table 1. Effect of dry heat exposures on germination, hardseededness and viability of four cultivars of *Stylosanthes guianensis*

Cultivar	Parameter	Untreated seed	6 h				22 h	
			50°C	60°C	70°C	80°C	70°C	80°C
Schofield	G.	29.0 (2.8)#	32.0 (1.4)	61.5 (4.5)	62.7 (4.1)	83.5 (1.9)	63.8 (4.1)	77.5 (2.7)
	H.S.	59.2 (3.4)	54.0 (2.1)	17.3 (2.5)	18.8 (3.1)	3.5 (1.3)	18.2 (2.8)	3.0 (0.8)
	V.	92.2 (1.7)	92.7 (1.2)	90.2 (2.0)	90.5 (1.3)	92.7 (1.4)	90.2 (1.1)	86.3 (1.8)
Cook	G.	24.7 (2.5)	31.2 (1.9)	53.2 (4.7)	64.0 (4.7)	72.0 (4.3)	61.3 (4.7)	69.5 (4.2)
	H.S.	47.7 (5.9)	42.5 (5.7)	22.8 (4.6)	7.7 (2.0)	1.8 (0.4)	9.0 (2.4)	1.3 (0.7)
	V.	75.8 (5.7)	78.0 (4.8)	79.8 (5.0)	76.7 (5.1)	78.5 (4.5)	73.2 (5.4)	76.2 (4.4)
Endeavour	G.	38.5 (2.0)	39.3 (2.8)	44.2 (3.6)	44.5 (2.6)	53.8 (3.1)	47.7 (3.7)	55.7 (3.1)
	H.S.	44.7 (4.3)	41.5 (5.5)	31.7 (6.3)	29.2 (5.7)	14.7 (3.7)	28.8 (6.4)	18.8 (4.8)
	V.	88.8 (2.5)	90.5 (2.1)	88.5 (3.1)	89.8 (2.2)	85.8 (3.2)	90.2 (2.8)	89.3 (1.9)
Oxley	G.	2.3 (0.9)	3.3 (1.2)	5.7 (1.5)	7.2 (1.1)	20.0 (2.3)	18.7 (2.5)	15.5 (2.5)
	H.S.	50.7 (2.7)	59.5 (2.7)	58.3 (2.2)	48.3 (2.8)	27.8 (3.2)	39.3 (3.6)	34.2 (2.7)
	V.	56.8 (3.7)	64.3 (3.4)	67.3 (2.9)	59.5 (2.8)	50.8 (3.8)	62.5 (3.4)	52.7 (4.3)

G = mean germination percentage.
H.S. = mean hard seed percentage.
V = mean viability percentage.
# = data in brackets are standard errors.

cv. Schofield

Viability was not substantially decreased in any sample for any treatment. Exposures to 50°C for 6 h were generally ineffective. Exposures to 80°C reduced hardseededness to less than 20% of that of the untreated seed and increased germination correspondingly. At 60° and 70°C, hardseededness was reduced to 20 to 50% of the original value.

cv. Cook

Viability was unaffected by any of the dry heat treatments. Exposure to 50°C for 6 h yielded inconsistent effects in that no response occurred in two samples and only small decreases in hardseededness occurred in the other two samples. Exposure to 80°C for 6 h reduced hardseededness to less than 10% of the original level in all samples. Although the effects of 70°C were greater than at 60°C, they were intermediate between those obtained at 50° and 80°C.

cv. Endeavour

None of the treatments influenced the level of viability. Exposure of 50°C was generally ineffective in overcoming hardseededness. Although all samples responded to temperatures of 60°C and higher, there was considerable variability in response between samples. However, 6-h exposures to 80°C reduced hardseededness to 10 to 50% of former levels.

cv. Oxley

There is a suggestion that viability was reduced for both 80°C exposures for one sample whereas the other samples were unaffected. Temperatures of 70°C and less were ineffective while exposures at 80°C were only partially effective in the sense that, while all samples responded, hardseededness was reduced by only 25 to 50%.

4. DISCUSSION

The data demonstrate that dry heat treatment can be used to reduce hardseededness (and promote germination) in the four cultivars of *S. guianensis* and indicate expected response levels.

Butler and Rickert (1981) reported that hot water treatment (55°C for 20 min) was less effective in reducing the levels of hardseededness of cv. Oxley than of cvv. Schofield and Endeavour. This difference also occurred under dry heat conditions.

There seem to be minor differences between cvv. Schofield, Endeavour and Cook but these are not statistically significant. However, the effectiveness of the 6-h exposure to 80°C was generally consistent over the three cultivars. This treatment reduced hardseededness to at least half and in most instances to 10% of the initial value, with corresponding increases in germination (that is, no loss of viability). The safety margin in time is considerable since 22-h exposures had similar effects to the 6-h exposures.

Although exposure to 80°C was only partially effective for cv. Oxley, the percentage germination of treated seed was four to ten times that of untreated seed. Consequently, such a treatment could improve the establishment chances of cv. Oxley under near ideal conditions, while still retaining a proportion of hard seed which might produce plants subsequently.

5. ACKNOWLEDGEMENT

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