Effect of Age of Seeds of Sifton Bush (*Cassinia arcuata* R. Br.) on Germination and Regeneration

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Sifton bush (*Cassinia arcuata*) is a native shrub that has spread widely in New South Wales, particularly after the 1981 drought, and become a weed in many situations (Campbell, 1977, 1990*a*, 1990*b*; McGowen *et al.*, 1990). One of the major difficulties in controlling the weed is that it regenerates profusely from seed in the soil after ploughing, spraying, slashing or burning. To understand the dynamics of this regeneration from seed, investigations were conducted to ascertain the longevity of seed stored in a laboratory and the recruitment of seedlings in the field over time.

Methods

Germination in the laboratory

Seed samples were collected from Orange and Boorowa in May 1987, 1988 and 1989, stored in a metal container in a laboratory and germinated at annual intervals from 1987 to 1993. The 1987 seeds have been germinated each year for six years, the 1988 seeds for five years and the 1989 seeds four years. Thus the percentage germination values given in Figure 1 for 1, 2, 3 and 4 year old seeds are the means of the six seed samples, the value for five year old seed is the mean of four samples and the value for 6 year old seeds is the mean of two samples. Germination was carried out in petri dishes (4 replications) under constant fluorescent light (20 $Em^2.s$) and temperatures of 17 to 26°C.

The effect of age of seed on rate of germination was ascertained in germination tests in 1993 by recording the time taken for 50% of the final germination of seed samples collected near Orange from 1987 to 1992, *ie.*, seed samples that were from 1 to 6 years old.

The effect of age of seed on seedling vigour was ascertained by observing the growth of seedlings from the six year old seeds (collected near Boorowa in 1987) in petri dishes for 2 weeks after germination in 1993.

Regeneration from seed in the field

The number of seedlings to establish on 48 x 0.25 m^2 permanent quadrats was recorded on a 0.5 ha area at Mullion Creek on 14 occasions in the four years following slashing of a heavy infestation of sifton bush in April 1989. After slashing, no additional seeds were distributed onto the quadrats.

Results

Germination in the laboratory

By averaging the germination of the six samples of seed collected, it was evident from Figure 1 that the viability of seed stored in the laboratory increased in the first two years after collection, then declined slowly in the third and rapidly in the fourth year to very low levels in the fifth (9.9%) and sixth years (2.25%).

Increasing age of seed resulted in slower germina-

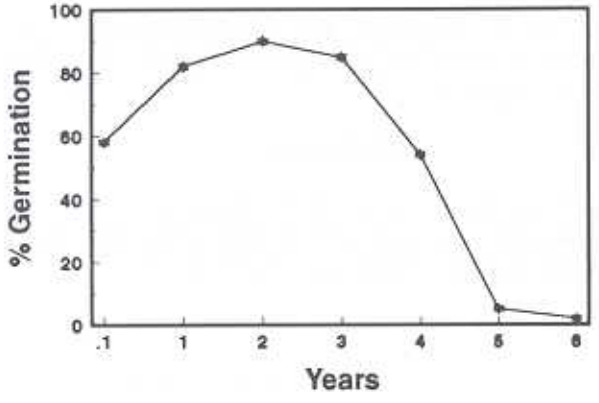

Figure 1: Effect of age on germination capacity (%) of sifton bush seed.

tion (Table 1) and seedlings with diseased or malformed radicles. For example, in seedlings from six year old seed there were 36% malformed radicles (few hairs and mis- shapen tips), 37% diseased radicles, and only 27% normal. In contrast, over 90% of radicles from one year old seeds were normal

Regeneration from seed in the field

There was an annual decline in the number of new seedlings/m^2 to establish in the field each year from germinations of seed stored in the soil prior to slashing in 1989 as shown by the following data: 1989, 170/m^2; 1990, 63/m^2; 1991, 35/m^2; 1992, 0. The seeds germinated, almost exclusively, in late autumn and winter. Despite adequate rain, regeneration was only recorded once in other seasons, *ie.* 1.0 seedlings/m^2 in February 1990.

Discussion

The viability of sifton bush seeds stored in the laboratory under conditions favourable for survival declined substantially within 4 to 6 years after seed set. However, after six years, the viable seed (2.25% germination) remaining would be sufficient to cause reinfestation of the area because of the large numbers of seeds in the soil six years earlier which based on the experiment on seedling recruitment in the field was estimated to be approximately 500/m^2. In the field, it appeared all seeds had died in the three years after seed set because there was no seedling recruitment from soil in the field

Table 1: Effect of age of sifton bush seed on rate of germination.

Age of seed (years)	Time (days) to reach 50% of final % germination
1	5.9
2	5.2
3	6.6
4	8.1
5	16.4
6	23.5

in the third year. However no soil samples were taken to prove that the seeds in the soil were not viable. Seedlings could have established but died soon after. This possibility is supported by the observations that, as the seeds age, the vigour of their seedlings declines (slower germination and increasing proportions of malformed and diseased seedlings) which could contribute to their death soon after germination in the field.

Experiments have recently been set down to examine the longevity of sifton bush seed in the soil and to measure the vigour of seedlings from old seeds (five and six years old) compared to that from young (one year old) seeds.

Conclusion

It appears possible that the seeds of sifton bush present in the soil in the field will die in three to six years after removal of the mature plants. Thus, by preventing the introduction of new seeds to the control area and by removing regenerating seedlings before they set seed, the seed bank of sifton bush should be exhausted in three to six years after removal of the original infestation.

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