***The future of tropical savannas symposium*, Townsville, Australia July 19-22,1994**

Effect of Fire and Heat on Seed Germination of *Desmanthus virgatus* Accessions.

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Introduction

Seed dormancy in perennial pasture legume farming systems plays an important role in the agroecology of tropical savannas.

Seed hardness in legumes is defined by the permeability of their seed coat to water. A complex of three structures in the seed coat (the strophiole or lens, the hilum and the microphyle) is involved in this process. After heating, the strophiole becomes raised, golden and permeable to water.

Seeds of some accessions of *Desmanthus virgatus* can germinate readily whenever adequate soil moisture is available. Seeds of other accessions of *Desmanthus virgatus* are capable of remaining dormant in the soil for as long as four years even when adequate moisture is present. Fire has been observed to promote a prompt germination of these dormant seeds.

Materials and Methods

In an experiment at JCU, Townsville, seedling recruitment of *D.virgatus* accessions CPI 37143, 78382, 83563, 38351 and Alligator Creek was recorded before and after a controlled fire. The soil temperatures during three separate fires were recorded using a dataloger with attached thermocouples buried at 0.0, 0.5, 1.0 and 3.0 cm deep.

The seed bank in $1m^2$ of soil surrounding plants of the above accessions and also CPI 78372, 78373, 67643, and TQ 88 was surveyed to a depth of 3 cm. After sieving, seeds from these seed banks were submitted to nine dry heat intensities ranging from room temperature to $140^{O}C$ in an oven. Three replicated germination tests were carried out in a controlled environment room set at $28^{O}C$ with 12 hours light and dark.

Results and Discussion

In four year old plants of accessions CPI 83563 and CPI 37143 no seedling recruitment had ever been recorded before the fire whilst 20 seedlings per plant and 13 seedlings per plant respectively emerged after the fire. The other accessions showed little response to fire.

The *D.virgatus* accessions showed large variation in soil seed bank reserves, ranging from 329 seeds/m^2 in CPI 37143 to 1,129 seeds/m^2 in CPI 78382.

Table 1 shows the maximum temperatures at four soil depths during three replicated fires. Soil surface temperatures reached $310^{O}C$ while at 0.5cm depth the temperature reached a maximum of $84^{O}C$ and less at 1 and 3cm depth.

Table 1. Effect of fire on soil temperature.

	0.0 cm	0.5 cm	1.0 cm	3.0 cm
Fire 1	310^{O}C	71^{O}C	47^{O}C	-
Fire 2	135^{O}C	84^{O}C	58^{O}C	43^{O}C
Fire 3	280^{O}C	74^{O}C	82^{O}C	63^{O}C
Average	242^{O}C	76^{O}C	62^{O}C	53^{O}C

Table 2 shows the germination of the accessions as effected by dry heat treatments. Three main trends can be identified. CPI 78372, 78373, 78382 and 83563 had germination enhanced by temperatures higher than 60^{O}C up to a maximum of 80^{O}C and decreasing with higher temperatures. CPI 37143, 67643, 38351 and Alligator Creek had similar trends to the former accessions but germination was enhanced by temperatures higher than 40^{O}C. TQ 88 showed wider tolerance to temperatures (>40^{O}C-100^{O}C) than the other accessions.

Table 2 Effects of heat on the germination % of *D.virgatus.*

	TEMPERATURE ^{O}C							
CPI	Room	40^{O}C	60^{O}C	80^{O}C	100^{O}C	120^{O}C	140^{O}C	LSD
37143	0.83	5.83	40.00	75.00	45.33	14.00	0.00	26.32
78372	6.67	4.00	15.33	50.00	51.33	8.67	0.00	24.26
78373	8.00	8.00	4.00	32.00	7.33	2.67	0.00	38.52
78382	4.00	4.67	5.33	68.00	18.67	33.33	0.00	29.39
Al.Cr	6.67	4.00	53.33	64.00	60.00	3.33	0.00	44.52
TQ88	16.00	18.67	72.00	79.33	43.33	9.33	0.00	42.23
83563	17.50	22.50	20.00	80.00	55.33	26.67	0.00	24.74
67643	10.00	13.33	41.67	66.67	18.67	10.00	0.00	22.76
38351	8.00	4.00	40.67	61.33	62.33	1.33	0.00	37.45

Conclusions

In a grass fire *Desmanthus virgatus* seeds on the soil surface would be destroyed. Germination of seeds at depth thus depends upon the accession and the depth at which the seeds are located.

These results will assist in the management of *Desmanthus virgatus* seedling recruitment and pasture sustainability.

References

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