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Performance of seed pelletization in *Acacia leucophloea* (Roxb.) under different soil types

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ABSTRACT

***Acacia leucophloea* seeds were pelleted with Diammonium phosphate (30g kg^{-1} of seed), commercial micronutrients mixture (19.7g kg^{-1} of seed), *Rhizobium* (50 g kg^{-1} of seed), Sevin (2g kg^{-1} of seed) and *Trichoderma viride* (4g kg^{-1} of seed). The pelleted seeds along with unpelleted control were evaluated in calcareous, sandy loam, acidic and sodic soils. Pelleted seeds registered significantly higher germination and seedling vigour compared to unpelleted control under all soil types. However, higher germination and seedling vigour were recorded in calcareous soil. In the acidic soil also pelleted seeds recorded significantly higher germination and seedling vigour than the unpelleted control. Hence, pelleting of seeds could be recommended for augmenting germination and seedling vigour under adverse soil conditions.**

Key words: *Acacia leucophloea*, germination, seed pelletization, *Rhizobium*, *Trichoderma*, seedling vigour.

INTRODUCTION

Acacia leucophloea (Roxb.) willd ex Del known as white barked *Acacia* belongs to the family Mimosaceae. It is a constituent of dry tropical thorn forests and tropical dry evergreen forests. The tree grows well in regions having high temperature and an average rainfall of 450-1500 mm per annum. It thrives on a variety of soils ranging from shallow and gravelly on hilly slopes to deep alluvial. The tree is common in dry regions of India and attains a height of 2.90m and a girth of 15.2cm in 5 years. It flowers during August-November and pods ripe in April-June. The ripe pods are beaten off the tree with a stick, on the ground previously swept clean. Pods are collected and spread in the sun to dry, and then beaten with a stick or wooden mallet to extract seeds. Seeds are dark brown, elliptical and rhomboidal in shape. For large scale afforestation programmes, aerial seeding is being increasingly adopted in India. For this purpose, the seeds should be pelleted to increase their ballistic properties while aerial seeding and to withstand adverse habitat and extreme situations. Pelleted seed increased the capacity of aerially sown seed to penetrate in standing vegetation compared to raw seed (Scott 1989). He also reported that nutrient seed coating can cause damage during germination or that they supply little nutrients to seedlings and the literature nevertheless contained numerous reports of cases in which the supply of nutrients by coatings has been substantial. Magini (1962) enlisted the advantages of pelleting such as (i) incorporation of fertilizer which will furnish to the young germinating seedlings (ii) plant growth regulators and bio-fertilizers to promote rooting or hasten the emergence and seedling growth, (iii) fungicides and insecticides are more effective when in direct contact with the seeds (iv) protection against rodents by adding unpalatable substances and (v) small seeds become larger and heavier which improves the ballistic property in aerial seeding. Protective measures to assist individual seeds after sowing are not practical and pelleting is the only possible mean of achieving some degree of protection (Anon. 1985). In this context, the effect of seed pelletization of *Acacia leucophloea* on germination and seedling vigour in different soil types were assessed.

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MATERIALS AND METHODS

The seeds of *Acacia leucophloea* were scarified using commercial sulphuric acid for 20 min and washed 4 or 5 times using tap water. The scarified seeds after shade drying were pelleted with following pelleting materials using gum acacia @ 30 ml kg^{-1} of seed as adhesive and gypsum @ 200g kg^{-1} of seed as the filler. The pelleting materials were diammonium phosphate (DAP) @ 30g kg^{-1} of seed to supply 0.5% of N and 1.5% of P_2O_5, commercial micronutrient mixture @ 19.7g kg^{-1} of seed to supply 0.1% of zinc, manganese and iron and 0.05% of

copper, boron and molybdenum, *Rhizobium* (commercial) @ 50g kg^{-1} of seed, sevin @ 2g kg^{-1} of seed and *Trichoderma viride* @ 4g kg^{-1} of seed.

For pelleting, the following treatment combinations were tried:

1. Unpelleted control
2. Sevin + *T. viride*
3. DAP + micronutrient mixture
4. *Rhizobium*
5. DAP + micronutrient mixture + *Rhizobium*
6. Sevin + *T.viride* + DAP + micronutrient mixture
7. Sevin + *T.viride* + *Rhizobium*
8. Sevin + *T.viride* + DAP + micronutrient mixture + *Rhizobium.*

Pelleting was done using a hand operated pelletizer. The seeds were first placed in the drum and rotated. While rotating, the adhesive was added intermittently and mixed thoroughly to give a uniform coating over the seeds. Then the gypsum was added and rotated until required size was obtained. The adhesive was then added for the second time. Subsequently pelleting material was applied and coated over the filler by rotating the drum of the pelletizer.

The pelleted seeds were germinated in different soil types such as calcareous, sandy loam, acidic and sodic soils in a germination room maintained at 25 ± 2°C temperature and 90 ± 5% relative humidity.

The design used was completely randomized design with four replications. In each replication 10 seeds were sown in tea cups. Twenty one days after sowing, counts were made and germination was expressed as the percentage of seeds producing normal seedlings. (ISTA 1985). Thereafter, ten random seedlings were dried in a hot air oven at 85°C temperature for 16 hrs and dry weight was recorded in mg $seedling^{-1}$. The vigour index was calculated as described by Abdul-Baki and Anderson (1973) using the equation. Vigour index = Germination percentage x Dry weight of seedlings (mg).

RESULTS AND DISCUSSION

The highest germination percentage of 86 was observed in calcareous soil followed by sandy loam soil (75%). Minimum germination of 34% was observed in the acidic soil. Among the treatments, DAP + micronutrient mixture (65%) followed by DAP + micronutrient mixture + *Rhizobium*, sevin + *T.viride* + DAP + micronutrient mixture and sevin + *T. viride* + DAP + Micronutrient misture + *Rhizobium* recorded higher germination of 64% while lower germination of 55% was noticed in unpelleted control (Table 1). Similar results were also recorded for dry weight of seedlings (Table 2). Seedlings grown in calcareous soil showed the highest vigour index followed by sandy loam soil. The vigour index was the lowest in acidic soil. Among the treatments, sevin +*T.viride* + DAP + micronutrient mixture exhibited greater vigour index compared to unpelleted control (Table 3).

Thus pelleted seeds registered significantly higher germination and seedling vigour than the unpelleted control under all soil types. However, the performance of pelleted seeds in terms of higher germination and seedling vigour was superior in

Table 1. Germination (%) of pelleted seed under different soil types in *Acacia leucophloea*.

Treatments	Soil types			
	Calcareous soil	Sandy loam soil	Acidic soil	Sodic soil
Unpelleted Control	82 (65.06)[1]	71 (57.46)	30 (33.20)	38 (38.05)
Sevin + *T. viride*	84 (66.77)	73 (58.74)	31 (33.81)	49 (44.43)
DAP + Micronutrient mixture	88 (69.87)	77 (61.40)	38 (38.05)	56 (48.45)
Rhizobium	84 (66.77)	74 (59.36)	32 (34.43)	50 (45.00)
DAP + Micronutrient mixture + *Rhizobium*	89 (70.69)	76 (60.71)	35 (36.27)	55 (47.88)
Sevin + *T. viride* + DAP + Micronutrient mixture	88 (69.87)	77 (61.40)	36 (36.86)	56 (48.45)
Sevin + *T. viride* + *Rhizobium*	83 (65.61)	73 (58.71)	34 (35.66)	52 (46.15)
Sevin + *T. viride* + DAP + Micronutrient mixture + *Rhizobium*	87 (69.04)	78 (62.09)	36 (36.86)	54 (47.01)
		SEd	CD (P=0.05)	
	Soil	0.644	1.278	
	Treatment	0.910	1.807	
	Soil x Treatment	1.821	NS	

[1]Figures in parentheses indicate arc sine transformation, SEd- Standard error deviation, CD- Critical difference

Table 2. Dry weight (mg) of seedlings of pelleted seed under different soil types in *Acacia leucophloea*.

Treatments	Soil types				
	Calcareous soil	Sandy loam	Acidic soil	Sodic soil	Mean
Unpelleted Control	10.9	11.3	10.9	11.1	11.0
Sevin + *T. viride*	11.1	11.4	11.3	11.5	11.3
DAP + Micronutrient mixture	11.7	11.6	11.6	11.9	11.7
Rhizobium	11.4	11.2	11.2	11.4	11.3
DAP + micronutrient mixture + *Rhizobium*	11.9	11.7	11.9	11.8	11.8
Sevin + *T.viride* + DAP + Micronutrient mixture	11.8	11.8	11.8	11.8	11.8
Sevin + *T. viride* + *Rhizobium*	11.3	11.2	11.3	11.4	11.3
Sevin + *T. viride* + DAP + Micronutrient mixture + *Rhizobium*	11.9	11.9	11.8	11.7	11.8
Mean	11.5	11.5	11.5	11.6	

	SEd	CD (P=0.05)
Soil	0.18	NS
Treatment	0.25	0.50*
Soil x Treatment	0.51	NS

SEd- Standard error deviation, CD- Critical difference

Table 3. Vigour index of pelleted seed under different soil types in *Acacia leucophloea*.

Treatments	Soil types				
	Calcareous soil	Sandy loam soil	Acidic soil	Sodic soil	Mean
Unpelleted Control	893	803	326	423	611
Sevin + *T. viride*	933	831	352	564	670
DAP + Micronutrient mixture	1029	896	441	664	757
Rhizobium	960	829	360	569	679
DAP + micronutrient mixture + *Rhizobium*	1059	889	417	649	754
Sevin + *T.viride* + DAP + Micronutrient mixture	1039	907	426	662	759
Sevin + *T. viride* + *Rhizobium*	939	817	384	593	683
Sevin + *T. viride* + DAP + Micronutrient mixture + *Rhizobium*	1047	926	427	631	758
Mean	987	862	392	594	

	SEd	CD (P=0.05)
Soil	15.55	30.87
Treatment	22.00	43.66
Soil x Treatment	43.99	87.32

SEd - Standard error deviation, CD- Critical difference

calcareous soil. The performance of pelleted seed in acidic soil was also good. The results of the study are in confirmity with the findings of Selvaraju (1992) who reported that pelleting of sorghum seeds with hydropolymer (ascorb) in combination with micronutrients and DAP registered the highest germination and seedling vigour. The performance of pelleted seed was superior in sandy loam soil. Similar results were also reported by Ponnuswamy (1993).

From this study it could be recommended that *A. leucophloea* seeds should be pelleted with DAP + micronutrient mixture + sevin + *T.viride* + *Rhizobium* for enhancing germination and seedling vigour under adverse soil conditions.

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