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NOTES

EFFECT OF CHEMICAL PRETREATMENT ON THE GERMINATION AND DEVELOPMENT OF *DICHROSTACHYS CINEREA* SEEDLINGS

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Dichrostachys cinerea (L.) Wight & Arn. ssp. *africana* Brenan & Brummitt (Fabaceae) belongs to a small genus of the sub-family Mimosoideae. It is a widespread shrub/tree found in the tropical savanna of Africa and the only known member of the genus in Nigeria.

The plant commonly grows 8 m high as a tree or sometimes as a shrub, often with low branches and a dense canopy of branchlets (Keay 1989). This multipurpose tree is well known for its fodder, tanning and fuel uses, as well as its sand stabilisation.

Germination improvement in hard coat seeds has been achieved by various methods, including the application of chemicals, which are not necessarily growth regulators, or promoters of metabolic activities within the cells. The effectiveness of such chemicals may vary with species and concentration. They are usually stimulatory to growth in seed at low concentrations or low osmotic potentials. However, these stimulatory effects are reversed with increasing concentrations (Pandaya & Bighela 1973, Gill *et al.* 1982, Mayer & Poljakoff-Mayber 1989, Eze & Ahonsi 1993).

This study examined the effect of chemical pre-treatments on germination vigour and seedling development in *D. cinerea*, an indigenous but under-exploited tree of the African Savanna region.

Seeds were collected from Gieri, Adamawa State in the Sudan Savana vegetation belt (12° 20'E, 9° 14' N), Nigeria, and stored at constant temperature 28 ± 3 °C. A seedlot of 3600 seeds was divided into four units of 900 seeds. Each unit was further divided into three sub-samples of 300 seeds for the 1, 10 and 20% salt solution treatments, conducted in five replicates of 20 seeds. The experiment was carried out under the prescribed exposure times of 10, 15 and 20 min.

The four chemicals used were $KMnO_4$, H_2O_2, NaOCl and NaCl. Treated seeds were thoroughly washed with distilled water. A set of untreated seeds served as control. Treated and untreated seeds were placed on moist filter paper in Petri dishes, following a completely randomised design (Gill & Bamidele 1981). The whole experimental set-up was placed under continuous white light (750–1000 lux) at constant temperature (30 ± 2 °C). Watering was done daily using distilled water. Germination and seedling height were recorded at 3-day intervals for 30 days.

Seedlings were grouped into vigour categories based on germination and seedling height (Marunda 1990). The final records were taken after 30 days. The vigour index for growth was estimated by calculating the germination energy–percentage maximum daily germination (Seward 1980).

Statistical analysis using the least significance difference (LSD) multiple range test on a complete randomised design was carried out on height data for seedlings raised from pre-treated seeds to test for treatment effect difference. The pre-treatment effects are associated with *F*-ratio based on pre-treatment difference at 5% level of significance.

Table 1. Germination percentage after 30 days, germination energy after 8 days and vigour categories based on germination and height after 30 days in $KMnO_4$, H_2O_2, NaOCl and NaCl pre-treatments

Pre-treatment	% germination				Germination energy				High vigour*				Low vigour**			
	$KMnO_4$	H_2O_2	NaOCl	NaCl	$KMnO_4$	H_2O_2	NaOCl	NaCl	$KMnO_4$	H_2O_2	NaOCl	NaCl	$KMnO_4$	H_2O_2	NaOCl	NaCl
1% soln., 10 min	20	43	13	14	05	18	05	09	13	22	06	10	05	21	07	04
1% soln., 15 min	31	52	10	23	05	20	03	17	20	46	08	13	11	06	02	11
1% soln., 20 min	42	53	10	31	28	22	10	18	31	45	09	24	11	08	01	07
10% soln., 10 min	33	55	13	20	15	28	04	07	10	48	05	13	23	07	08	07
10% soln., 15 min	30	45	28	52	10	22	16	08	12	41	10	10	18	04	08	11
10% soln., 20 min	28	43	51	20	15	20	28	07	08	17	35	13	20	26	16	07
20% soln., 10 min	10	32	29	32	03	08	14	12	04	24	20	24	06	08	09	08
20% soln., 15 min	18	30	41	44	05	10	22	15	12	17	20	26	06	13	21	18
20% soln., 20 min	15	19	16	30	10	09	05	13	10	10	08	18	06	09	08	12
Control	12	12	12	11	06	05	08	06	04	05	06	05	08	07	06	06

Experimental mean height = 6.45 cm after 30 days.
* above experimental mean height.
** below experimental mean height.

Table 1 shows germination percentages achieved after 30 days and germination energies at 9-day period. The 1% $KMnO_4$, 20 min; 10% H_2O_2, 10 min; 10% NaOCl, 20 min and 10% NaCl, 15 min pre-treatments recorded higher germination percentages (42, 55, 51, 52% respectively) than other pre-treatments. The percentages reveal the proportion of the pre-treated seeds that reached the emergent stage but not the time taken to reach the stage. The distribution of germination is shown by the germination energy.

Table 1 also shows the vigour categories attained by the pre-treatment. The pre-treatments with high germination percentages also recorded high germination energies; most of the germination was within the first 8 days.

Variance analyses on the seedling height data suggest treatment difference at 5% of significance. The comparison of mean heights showed that seedlings of higher vigour were recorded for the 1% $KMnO_4$, 15 and 20 min; 20% $KMnO_4$, 15 min; 10% H_2O_2, 10 min; 1% H_2O_2, 20 min; 1% NaOCl, 20 min; 20% NaOCl, 15 min; 10% NaCl, 20 min; and 1% NaCl, 20 min (Tables 2a,b).

Table 2a. Comparison of treatment mean heights for *Dichrostachys cinerea* seedlings raised from $KMnO_4$ and H_2O_2 pre-treated seeds

Pre-treatment ($KMnO_4$)	Ranked mean	LSD (H) + mean	Pre-treatment (H_2O_2)	Ranked mean	LSD (H) + mean
Control	6.00 a	8.58	Control	5.80 a	6.66
10% $KMnO_4$, 10 min	6.60 ab	9.18	20% H_2O_2, 20 min	7.00 b	7.86
10% $KMnO_4$, 20 min	6.60 ab	9.18	20% H_2O_2, 15 min	7.40 bc	8.26
20% $KMnO_4$, 10 min	6.80 bc	9.38	20% H_2O_2, 10 min	7.80 cd	9.66
20% $KMnO_4$, 20 min	7.10 cd	9.68	1% H_2O_2, 10 min	8.20 de	9.06
1% $KMnO_4$, 10 min	7.25 de	9.98	1% H_2O_2, 15 min	8.60 ef	9.46
10% $KMnO_4$, 15 min	7.40 ef	9.98	10% H_2O_2, 20 min	8.85 fg	9.71
1% $KMnO_4$, 15 min	8.50 g	-	10% H_2O_2, 15 min	8.90 gh	9.76
20% $KMnO_4$, 15 min	9.20 g	-	1% H_2O_2, 20 min	10.50 i	-
1% $KMnO_4$, 20 min	9.30 g	-	10% H_2O_2, 10 min	11.18 i	-

**Means followed by the same letter(s) are not significantly different at 5% (LSD) multiple range test (F = Ratio = 21.16)

Table 2b. Comparison of treatment mean heights for *D. cinerea* seedlings raised from NaOCl and NaCl pre-treated seeds

Pre-treatment (NaOCl)	Ranked mean	LSD (H) + mean	Pre-treatment (NaCl)	Ranked mean	LSD (H) + mean
Control	5.60 a	7.00	Control	6.00 a	6.93
10% NaOCl, 10 min	7.20 b	8.60	10% NaCl, 15 min	7.00 b	7.93
1% NaOCl, 10 min	7.50 bc	8.90	10% NaCl, 10 min	7.20 bc	8.13
20% NaOCl, 20 min	7.60 bc	9.00	1% NaCl, 10 min	7.60 cd	8.53
10% NaOCl, 20 min	7.60 bc	9.00	20% NaCl, 10 min	8.00 de	8.93
20% NaOCl, 10 min	7.80 de	9.20	20% NaCl, 20 min	8.60 ef	9.53
10% NaOCl, 15 min	8.00 ef	9.40	1% NaCl, 15 min	8.60 ef	9.53
1% NaOCl, 15 min	8.40 fg	9.80	20% NaCl, 15 min	8.80 fg	9.73
20% NaOCl, 15 min	8.60 h	-	1% NaCl, 20 min	9.00 gh	9.93
1% NaOCl, 20 min	9.20 h	-	10% NaCl, 20 min	9.45 i	-

**Means followed by the same letter(s) are not significantly different at 5% (LSD) multiple range test (F = Ratio = 17.56)

The stimulatory effect of the chemicals probably resulted from osmo-conditioning—a reversal of the initial osmotic inhibition created by the low osmotic potentials of the salts, when the treated seeds were washed in water; the decomposition and release of oxygen to the seed embryo by the H_2O_2; or the oxidant action of the halogen moiety of the hypochlorite (Ching & Parker 1958, Okonkwo & Nwoke 1975, Mayer & Poljakoff-Mayber 1989). The low germination results show that chemical pre-treatment does not have a strong effect on the germination of *D. cinerea* seeds. Gill and Bamidele (1981), Gill *et al.* (1982) and Eze and Orole (1987) recorded similar low results for chemical pre-treated *Dialium guineense, Cassia multifuga, Parkia clappertoniana* and *Prosopis africana* seeds. The untreated seeds of *D. cinerea*, however, appear to have a low initial germination energy, as shown by the lowest growth vigour values in the control treatments. Hence, some pre-treatment may be required to offset the primary dormancy and should be further investigated for large-scale seedling programmes.

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