EFFECT OF SOME PRE-TREATMENTS ON SEED GERMINATION AND SUBSEQUENT DEVELOPMENT OF *ACACIA LONGIFOLIA* SEEDLINGS

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Abstract. *In persuance of the objectives of a training programme in GDR, the senior author was assigned the task of investigating the dormancy in* Acacia longifolia *seed and subsequent growth of the seedlings under glass house conditions.*

The study was carried out at the Department of Biology, Dresden Technical University, Dresden from March to June, 1979. The good seeds (out of the lot imported from Holland) were subjected to seven pre-sowing treatments including hot and cold water, GA_3 and P_5. The pre-treated seeds were germinated on filter papers in the Jacobsen apparatus. From these, 60 seedlings per treatment (15 for each of the 4 replications) were randomly picked and transplanted ment (15 for each of the 4 replications) were randomly picked and transplanted stayed till the end of the experiment.

The results of the study indicated that hot water treatment not only markedly increased the germination percentage but it also led to shortening the germination period of the species seed. This teatment excelled all others tested on this score. GA_3 at a concentration of 200 ppm significantly enhanced the length of transplant roots, while P_5 had no significant influence on all the characters observed. Similarly, CO_2—gas exchange level of transplants was found to be of the same magnitude in different treatments.

Introduction. *Acacia longifolia* (Andr) Willd. is a native tree of Queen's Land, New South Wales, Victoria, Tasmania, and South Australia. It is used for beautifying the landscape, and as a low windbreak in exposed coastal areas of its native habitat. On sand dunes it may assume a prostrate form.

Usually it is propagated by seeds. The impervious seed coats must be softened before sowing by pre-treating the seed. Hot water is one of the presowing treatments which is used to overcome dwarfing of dormant epicotyls (Wimbush, 1936, Li, 1974; Avegard, 1968). GA_3 is also known to enhance the germination percentage in some kinds of dormant seeds besides increasing the rate of germination and stimulating seedling growth to overcome dwarfing of dermant epicotyls (Bacheiard, 1967; Martin, 1968; West, 1970; Vogt, 1970; Shanmugavela, 1970; Fedoreva, 1971). The response to GA_3 may be variable

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depending upon interactions with other factors and accordingly Hartmann (1968) proposed that large scale use of this substance should be preceeded by preliminary trials.

The current experiment was undertaken to study the effect of some of the pre-sowing treatments on seed germination and subsequent development of the seedlings of *Acacia longifolia*, with special emphasis on breaking the seed dormancy.

Materials and Methods. This study was carried out in the Forestry Section of the Department of Biology, Dresden Technical University, Dresden (GDR); it was started in March, 1979 and completed by June, 1979.

The seeds were imported form SETROPA Company, Holland. A purity test was run on these seeds and those found empty were discarded using the floating method (Saatcioglu, 1961). To the good seeds, the following treatments were applied:

(i) Hot water: As the temperature of water reached to 100°C, the heat was withdrawn following which seeds were soaked in the gradually cooling water for 24 hours.
(ii) P_5 100 (1.25 g $K_3PO_4 . 3H_2O$ + 10 gr KNO_3 + 24 h soaking in 100 ppm of GA_3).
(iii) P_5 200 (1.25 g $K_3PO_4 . H_2O$ + 10 gr KNO_3 + 24 h soaking in 200 ppm of GA_3).
(iv) GA_3 100 ppm (24 h soaking).
(v) GA_3 200 ppm (24 h soaking).
(vi) Cold water: The seeds were soaked in the cold water for 24 hours.
(vii) Control: The seeds were untreated.

400 seeds per treatment, replicated four times with 100 seeds per replication, were sown on filter papers and placed in the Jacobsen apparatus. When sufficient number of seeds had germinated, 60 seedlings per treatment with 15 seedlings for each of the replications were randomly picked and transplanted in pots containing alluvial soil. These were then put in the growth chamber for one month whereafter they were shifted to the glass house. The following responses were observed: (i) germination percentage during 60 days from the date of sowing, (ii) survival percentage of transplants, (iii) plant height, (iv) root length, (v) fresh weight of leaves+branches+stem, (vi) dry weight of leaves+branches+stem, (vii) fresh weight of roots, (viii) dry weight of roots, and (ix) carbon dioxide gas exchange analysis. The responses from serial numbers (ii) to (viii) were recorded at the end of the experiment, while that of (ix) determined when the transplants were two months old.

The microclimatic conditions in respect of average relative humidity, and maximum and minimum temperature prevailing in the glass house during the

experimental period were as under:

Month/year	Relative humidity %	Temperature (°C)		
		Max.	Min.	Mean
March, 1979	72.3	23.1	17.1	19.7
April, 1979	82.8	21.1	15.7	18.2
May, 1979	87.6	21.7	15.3	18.6
June, 1979	87.0	24.0	18.2	21.6

The statistical analysis of the data was done according to the completely randomized design, followed by the Duncan's new multiple range test.

Results and Discussion. 1. *Germination percentage:* The results presented in Table 1 and Fig. 1 showed that the hot water treatment had a highly significant effect on this response. The Duncan's new multiple range test further revealed that treatment 1 (Hot water) was significantly better in performance than all other treatments tested. This finding is almost similar to the ones of Gupta and Thapliyal (1974), Gratkowski (1973) and Li (1974) who observed that soaking the seed in boiling water and then allowing it to soak until the water cooled to room tempearture, was a practical method for promoting seed germination in *Acacia mearnsii* de Wild. and *Acacia melanoxylon* R. Br. in India, *Ceanothus sanguineus* in Oregon (U.S.A.) and *Acacia confusa* in China. However, there were no significant differences between the remaining treatments.

It is worth noting that the germination percentage of seed subjected to hot water treatment reached as high as 92% in a time lag of 30 days as against 72-78% attained in 60 days in the other treatments.

2. *Survival percentage.* The treatments had no signifcant effect on this character which varied from 79.5 to 93.5%, the highest value was recorded on the plants of treatment 1 (Hot water), while the lowest one was in the case of plants subjected to treatment 3 (P_5 200).

3. *Height of plants:* The pre-sowing treatments failed to affect plant height which showed a range of 9.3 to 14.0 cmID. The plants of treatment 1 (Hot water) had the tallest height, while those originating from cold water treatment were the shortest in height. The differences in plant height between treatments may, however, be attributed to the differences between the transplanting dates as is true of treatment 1 in which seedlings were transplanted one week earlier than those in other treatments, because they germinated earlier and so could not be retained for long on filter-dishes.

4. *Length of roots:* This response was significantly affected by the treatments. The results (Table 1 and Fig. 1) clearly indicate that treatment 5

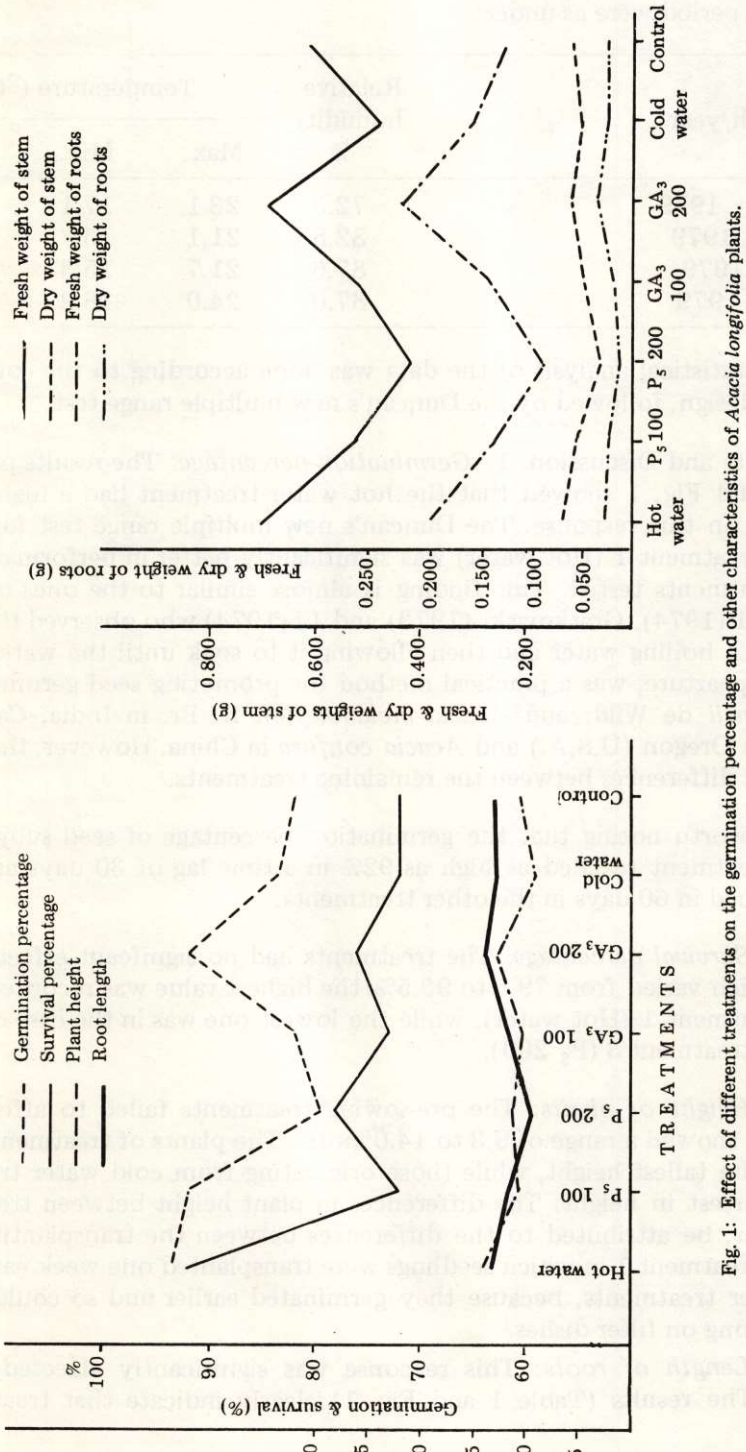

Fig. 1: Effect of different treatments on the germination percentage and other characteristics of *Acacia longifolia* plants.

Table 1

Effect of different treatments on the germination percentage and various growth characteristics of Acacia longifolia *seedlings (means appearing in col. Nos. 4 to 9 are based on 60 transplants with 15 taken from each of the 4 replications).*

	Treatment	Germination percentage (%)	Survival percentage (%)	Plant height (cm)	Length of roots (cm)	Fresh weight of leaves+ branches+ stem (g)	Dry weight of leaves+ branches+ stem (g)	Fresh weight of roots (g)	Dry weight of roots (g)
1.	Hot water	92 a*	93.50	14.0 a*	13.1 ab*	0.700	0.132	0.194	0.025
2.	P_5 100	72 b	91.75	10.8 a	11.5 ab	0.526	0.102	0.133	0.024
3.	P_5 200	78 b	79.50	11.1 a	9.5 b	0.416	0.063	0.084	0.012
4.	GA_3 100 ppm	73 b	81.75	10.3 a	11.5 ab	0.517	0.086	0.132	0.017
5.	GA_3 200 ppm	76 b	91.75	12.8 a	13.8 a	0.683	0.110	0.216	0.031
6.	Cold water	72 b	83.25	9.3 a	12.8 ab	0.471	0.094	0.151	0.021
7.	Control	72 b	81.75	10.8 a	13.0 ab	0.603	0.105	0.120	0.020

*Treatment means followed by the same lower case letters in each column are not significantly different from one another at the 5% level of signifcance (p 0.05) according to the Duncan's new multiple range test.

(GA_3 200 ppm) promoted a significant increase in the length of roots as compared with treatment 3 (P_5 200), however, the differnces among the remaining treatments including treatment 3 were not significant. GA_3 200 ppm, therefore, appears to be a promising treatment for the purpose of accelerating root length of the species seedlings.

5. *Fresh and dry weight of leaves+branches+stem, and roots:* The fresh and dry weight of individual plants as well as of roots (Table 1 and Fig. 1) showed no significant differences among treatments. However, the fresh weight of leaves +branches+stem per plant was maximum (0.700 g/plant) for the plants in treatment 1 (hot water), while those of treatment 3 (P_5 200) had the lowest fresh weight (0.416 g/plant). The trend of dry weight of leaves+branches+stem as affected by the different treatments was almost similar to the one of fresh weight; maximum dry weight was recorded in respect of the plants subjected to treatment 1 (hot water), while that of plants in treatments 5, 7, 2, 6, 4 and 3 ranked serially in decreasing order of magnitude with treatment 3 (P_5 200) having minimum dry weight of 0.063 g/plant.

On the other hand, treatment 5 (GA_3 200 ppm) appeared to perform better (Table 1 and Fig. 1) than all the remaining treatments on the basis of both the fresh and dry weights of roots. Next in the ranking order was hot water treatment 1, with treatment 3 (P_5 200) occupying the lowest position on this score. There were, however, no significant differences among treatments in these characteristics individually.

6. *Carbon dioxide gas exchange:* The CO_2-gas exchange for the two months old transplants, with 15 transplants from each of the 4 replications, was measured by a infrared gas-analyser (Zentsch and Tesche, 1968). The climatic conditions in the growth chamber were: day-time air temperature of 25°C, relative humidity of 50%, air temperature during night of 20°C, relative humidity 75%. and light intensity 19000 Lux (day length 14 hr).

The pre-treatments failed to influence the net photosynthetic rate and clash respiration of the transplants; these responses were found to be in the range of 6.27 to 11.7 mg CO_2 g^{-1} h^{-1} and 4.25 to 9.40 mg CO_2 g^{-1} h^{-1} , respectively. These results compare favourably with those obtained in respect of *Quercus rubra, Convolvulus* and other species (Zelawski and Walker, 1976).

Conclusions. The following conclusions may be drawn from this study:

(i) Hot water has a highly signifcant effect on the germination percentage of *Acacia longifolia* seeds.
(ii) Hot water hastens seed germination substantially as compared with the other pre-treatments tested on *Acacia longifolia* seed.
(iii) GA_3 at 200 ppm has a significant effect on promoting root length of the transplants of *Acacia longifolia.*

(iv) P_5 upto 200 had no significant effect on any of the characteristic observed on the transplants.

(v) The CO_2-gas exchange of the transplants of *Acacia longifolia* does not show any differences between the individual treatments studied.

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