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Enhancing pungam (*Pongamia pinnata* L. Pierre) seed quality by fortification treatments

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Abstract : To improve the vigour and viability potential of Pungam (*Pongamia pinnata* L. Pierre) seeds, specially for elite seeding production in the nursery, the seeds can be enriched with nutrients and growth regulators by presoaking treatments. To standardise these methods, the bulk seeds of pungam, after harvesting, drying, cleaning and grading were fortified with various nutrient solutions for 4h at various concentrations. The results revealed that presoaking of seeds in 2 per cent potassium dihydrogen phosphate (KH_2PO_4) solution improved the viability of seeds to 18.6 per cent compared to control. In another experiment, when the seeds were treated with different growth regulators at various concentrations for 4h, recorded maximum germination of 86 per cent both in GA3 200 ppm and water. This showed that instead of going for growth regulator treatment were water soaking gave the improved vigour and viability, which was to the tune of 7.5 per cent over untreated control.

Keywords : Pungam (Pongamia pinnata), seed fortification, vigour, viability

Introduction

Fortifying the seed is a process of seed enrichment with nutrient solution or growth regulators either with or without drying back to original moisture content (Palani *et al.*. 1995). Now - a - days, application of nutrients to the soil is a problem because of leaching of majority of the nutrients in the soil without having pronounced effect on the target ie.. seed. A survey made by the Indian Council of Agricultural Research in India showed a very high incidence of nutrient deficiencies in the soils. the seed may or may not absorb it. So, by providing the nutrients to the seed itself will improve the viability and vigour of the seed. Application of growth and development of seedlings under nursery condition in forestry (Bhatnagar and Singh, 1981), because of their major role in enhancing the root and shoot growth. Pungam (Pongamia pinnata), the bio-diesel tree, assumes paramount importance in the present afforestration programme. Improving the vigour and viability potential of this species by way of fortification treatment will fetch a lot of advantage for the nursery people, who are involving large scale multiplication of the elite seedlings that are used in the afforestation programme.

Materials and Methods

1. Seed Fortification with Nutrients

Bulk seeds of Pungam collected from the plus frees of Vannanparai plantations, Coimbatore district form the materials and the study was conducted at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore. The Collected seeds were dried. Cleaned and graded. Then the seeds were fortified for 4 h in equal volume of the following nutrient solutions.

KCl 1% - F_1: KCl 2% - F_2: KH_2PO_4 2% - F4: KNO_3 1% - F_5: KNO_3 2% - F_6: DAP 1% - F_7: DAP 2 % - F_8: Water - F_9: Control - F_{10}.

After the stipulated duration soaking of the seeds were drained off the solution and subjected to germination test with four replicates of 100 seeds each in sand medium (ISTA, 1993) in germination room maintained at

Table 1. Effect of fortification with nutrients on seed quality of Pungam

Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	Vigour index
F_1-KCl 1%	67 (54.94)	13.7	18.6	2177
F_2-KC1 2%	72(58.05)	14.1	19.4	2410
F_3-KH_2PO_4 1%	83 (65.65)	17.3	23.1	3345
F-$KH_2PO_4$2%	86 (68.03)	17.3	20.8	3266
F_5-KNO_3 1%	76 (60.67)	15.7	20.1	2711
F_6-KNO_3 2%	77(61.34)	14.3	20.6	2685
F_7-DAP 1%	65 (53.73)	11.2	18.0	1905
F_8-DAP 2%	68(55.55)	13.0	16.5	1996
F_9-Water	71 (57.42)	13.1	19.0	2279
F_{10}-Cortrol	70(56.79)	13.0	18.7	2208
CD (P=0.05)	(2.10)*	0.73*	1.03*	63.4*

(Figures in parentheses indicate transformed values)

Table 2. Effect of fortification with growth regulators on seed quality of Pungam.

Treatments	Germination (%)	Root length (cm)	Shoof length (cm)	Vigour index
G_1 - GA_3-200ppm	86 (68.03)	21.6	16.6	3285
G_2 - IAA-200 ppm	84 (66.42)	19.6	16.0	2990
G_3 - IBA-200 ppm	80 (63.43)	19.0	16.1	2808
G_4 - Kinetin 200 ppn	64 (53.13)	16.7	14.9	2022
G_5 - Riboflavm 200 ppm	85 (67.21)	19.6	16.7	3086
G_6 - Thiamine 200 ppm	75 (60.00)	17.2	15.3	2438
G_7 - GA3100ppm + IAA 100 ppm	80 (64.43)	19.1	15.5	2768
G_8 - GA3 100 ppm + Kinetin 200 ppm	81 (64.16)	17.8	14.8	2641
G_9 - Water	86 (68.03)	21.4	16.1	3225
G10-Control	80(63.45)	20.1	15.2	2930
CD (P=0.05)	(3.16)*	0.92*	0.89*	131.5*

(Figures in parentheses indicate transformed values)

25 ± 2°C temperature and 90 ± 5% RH. 21 or 28 days should be verified with ISTA standards after sowing, germination count was recorded based on the normal seedlings in each replication the root (cm) and shoot length (cm) were measured and the vigour index was calculated. The observed data were statistically analysed adopting the procedure described by Panse and Sukhatme (1967).

2. *Fortification with Growth Regulators*

A portion of the seeds collected for previous experiment were soaked in the following growth regulators for 4h in equal volume of solution. Water soaked and unsoaked seeds served as control.

GA3 200 ppm - G1 : IAA 200 ppm - G2 : IBA 200 ppm - G3 : Kinetin 200 ppm - G4 : Rivoflavin 200 ppm - G5: Thiamine 200 ppm - G6: GA3 100 ppm + IAA 100 ppm - G7 : GA3 100 ppm + Kinetin 100 ppm - G8: Water - G9 : Control - G10.

After soaking, the seeds were air dried and subjected to the quality assessment as that of the previous experiment.

Results and Discussion

Seed fortification is a seed enrichment technique by which the seeds are invigorated. In the present study with seed fortification of Pungam, seeds were enriched with various nutrient solutions at different concentration (Table 1). Among the various treatments, seeds soaked with KH2PO4 2 % solution gave maximum germination of 86 per cent, which was on par with the treatment KH_2PO_4 1% (83%) and registered 18.6% increased viability over untreated control. The water soaked seeds registered 71 per cent, which was on par with the control (70%). Similarly the highest root length (17.3 and shoot length (23.1 cm) and vigour index (3345) were recorded by KH2PO4 1% which were almost on par with KH_2PO_4 2%. The next best was the treatment with KNO_3 1%. The beneficial effects of enhanced germination and vigour of the seedling due to fortification of the seeds with nutrient solutions like KNO_3 and KH_2PO_4 have been demonstrated by several authors (Vanangamudi and Kulandaivelu, 1989 and Kajamaideen *et al.* 1990). Similar results due to KNO_3 treatment were also reported in loblolly pine (Biswas *et al.* 1972), Peltophorum ferugeneum (Mukhopadhyay *et al.* 1990), Casuarina equsetifolia (Kajamaideen *et al.* 1990). Albizia lebbeck (Roy, 1992) and Acacia nilotica (Palani *et al.* 1995). Such an increase in germination and vigour was observed in the present study with the seeds fortified with KH2PO4 (1 and 2%) and KNO3 (1 and 2%). The promotion of germination and vigour through fortification with KNO3 might be due to conversion of nitrate within the seed, enhancement of pentosphosphate pathway through inhibition of catalase and incrase of ixidation of NADPH2, qualitative and quantitative shifts in protein synthesis raise in oxygen level.

Growth regulators have attracted much attention in the recent years for their role in growth and development of plants. It plays major role in controlling different phases of plant life including shoot and root growth, differentiation of plants, initiation of cambial activity, Xylem differentiation and annual ring formation. Several scientists have demonstrated the use of growth regulators such as GA3, IAA, IBA etc. for the induction of shoot and root elongation of the seedlings in order to obtain elite seedlings as well as to reduce the nursery period in different tree species.

In the present study, the seeds presoaked with various growth regulators (Table 2: Fig. 1) significantly exhibited a difference in their germination levels. Among them GA3 200 ppm (86%), water (86%), Riboflavin 200 ppm (85%) and IAA 200 ppm (84%) recorded the increased values. Which were all on par. Whereas, growth regulators *viz.* thiamine 200 ppm and kinetin 200 ppm registered the lower values of 75 per cent and 64 per cent, respectively which was lower than the control (80%). The results clearly showed that mere water soaking of Pungam seeds performed almost equal to the growth regulator *viz.* GA3, IAA and riboflavin.

Hence, it is recommended that for improving the vigour and viability potential of Pungam seedlings expecially in nursery, the seeds can be presoaked either with water or GA3 200