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Effect of different seed treatments on germination in royal palm

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Abstract
The study was conducted to find out "Effect of different seed treatments on germination in royal palm" at farm of Horticulture Section, College of Agriculture, and Nagpur in 2019-2020. Completely Randomized Design was used consisting twelve treatments and three replications. Treatments were control, hot water, brine solution 2%, cow dung slurry, H_2SO_4 for 10, 20 and 30 min, GA_3 500, 1000 and 1500 ppm, KNO_3 0.2 and KNO_3 0.3 %. The results revealed that significantly minimum days to germination (days), maximum germination percentage (%), maximum root length (cm), maximum number of roots plant^{-1}, maximum root volume (ml) were recorded with GA_3 1500 ppm.

Keywords: GA_3, H_2SO_4, KNO_3, seed germination, royal palm

Introduction
Palms belong to the family Arecaceae, which includes about 2400–2600 species of evergreen trees, shrubs and lianas, most of which occur in the tropics and subtropics (Corner, 1966; Moore and Uhl, 1973) [4]. Roystonea genus consists of 11 species of palm tree that commonly called royal palm, Palma real, yagua. *Roystonea regia* commonly known as the Cuban royal palm or the Florida royal palm species of palm that is native to Mexico, parts of Central America and the Caribbean, and southern Florida. A large and attractive palm. It has been planted throughout the tropics and subtropics as an ornamental tree. Although it is sometimes called *R. elata*, the conserved name *R. regia* is now the correct name for the species.
It is ideal for landscaping street, typical residential landscapes. Royal Palm is placed in the in the subfamily Arecoideae and the tribe Roystonea. All palms have hypogeal germination since the seed is not raised above soil (Tillich, 2007) [10]. Seed dormancy is a common occurrence in palms from various origins (Baskin and Baskin, 2001) [1]. This is true heat loving palm but survive in cooler climate. Seed dormancy is due to seeds contain immature embryos or small embryos and covering layers or integuments restrict water inhibition, gas presence penetrability, leaching of inhibition of growth regulators etc. Due to nature of seed coat which impermeable to water, generally seeds do not imbibe sufficient moisture for germination. Hard seed coats are reason for causing impermeable to water. Such type of seed coats develops during the last stage of seed development. In case of mechanically dormant seeds integuments are very hard and do not allow embryo to grow or expand. So, seeds are scarified with hot water, acid.

Material and Methods
The experiment was carried out at farm of Horticulture Section, College of Agriculture, Nagpur during 2019-2020. Nagpur is situated at 20^{0}10' North latitude and 79^0 19' East longitudes at the elevation of 321.26 meter above mean sea level (MSL). Nagpur is characterized by hot, dry summer and fairly cold winter. The present experiment was laid out in Completely Randomized Design with 12 treatments replicated thrice. The seeds were obtained from Maharaj Bag and Telenkhedi garden, Horticulture section College of Agriculture, Nagpur during the month of April- May 2019. The seeds were cleaned by rubbing all extraneous materials and then dipped in water. All the floating seeds were discarded and only the healthy seeds which were settled down were taken for use in these studies (Yocum, 1961) [12]. Black colour poly bag (4x8 inches size) were filled with soil, FYM and cocopeat in the ratio 1:2:1.Irrigation was provided to seeds sown in poly bags using water can and maintained the proper moisture level. The poly bags were watered every day and then required till germination takes place with the help of watering can. Timely and suitable plant protection measures were applied to protect the plants from pest and disease incidence.

The plants were protected from rotting by drenching of Bavistin @ 2 g 5 lit^{-1}water.The treatments were T_1 Water soaking, T_2 Hot water treatment, T_3 Brine solution 2%, T_4 Cow dung slurry, T_5 H_2SO_4 - 10 min, T_6 H_2SO_4 –20min, T_7 H_2SO_4 - 30 min, T_8 GA_3- 500 ppm, T_9 GA_3 -1000 ppm, T_{10} - 1500 ppm, T_{11} KNO_3 - 0.2% and T_{12} KNO_3 - 0.3%.

Observations on days to germination (days), germination per cent (%) at 90 DAS, number of roots plant^{-1} 120 and 150 DAS, length of root (cm) 120 and 150 DAS, root volume(ml) at 150 DAS and root collar diameter (cm) at 150 DAS were recorded and analyzed statistically as per the method suggested by Panse and Sukhatme (1967) [8].

Results and Discussion

The treatment T_{10} GA_3 -1500 recorded significantly minimum days to germination (61.63 days) as compared to other treatments, and it was found statistically at par with the treatments T_7 - H_2SO_4 for 30 min. (62.91days), T_6 - H_2SO_4 for 20 min (64.59 days), T_9 GA_3 - 1000 ppm (64.72 days), T_8 GA_3 - 500 ppm (65.19 days), whereas, maximum days to germination was recorded in control i.e. T_1- water soaking (87.18 days). Vidyasagaran *et al.* (2016) [11] observed that GA_3-100 ppm treatment required minimum days to germination in Christmas palm.

According to table 1 the treatment of T_{10} GA_3 -1500 ppm recorded significantly maximum germination per cent (84.84%) as compared to other treatments, and it was found statistically at par with the treatments T_7 i.e. H_2SO_4 for 30 min. (83.21%), T_9 i.e.GA_3 (81.39 %), T_8 i.e. GA_3 - 500 ppm (80.76 %) whereas, minimum germination percent was recorded in control i.e. T_1 water soaking (30.47 %). Nagao *et al*. (1980) [6] recorded GA_3 @ 1000 ppm accelerated seed germination of *Archontophoenix alexandrae* and *Ptychosperma macarthurii*. Odetola (1987) [7] revelead that GA_3 promote seed germination in ornamental palm. H_2SO_4 was found effective for breaking seed dormancy and germination in *Hyphaene dichotoma*. (Kher *et* and Natraj, 2015) [3].

At 120 days after sowing maximum number of roots plant^{-1} was recorded with treatment T_{10} i.e. GA_3 -1500 ppm (4.13) which was found significantly superior over all the treatments under study. Whereas, T_1 i.e. water soaking treatment recorded minimum number of roots plant^{-1} (1.07). Maximum number of roots plant^{-1} (7.53) was recorded with treatment T_{10} i.e. GA_3 -1500 ppm which was found significantly superior with all the treatments under investigation and T_1 i.e. water soaking treatment recorded minimum number of roots plant^{-1} (1.89) at 150 days after sowing. At 120 days after sowing maximum length of root (12.26 cm) was recorded with treatment T_{10} i.e. GA_3 -1500 ppm which was found significantly superior over all the treatments. Whereas, minimum length of root was recorded in T_1 i.e. water soaking (2.91 cm). This might be due the fact that an application of gibberellic acid increases the activity of enzymes-hydrolase enzymes that convert starch into simple sugars that will be used for root growth.

Maximum length of root was recorded with treatment T_{10} i.e. GA_3 -1500 ppm (22.46 cm), it was found significantly superior with all the treatments under study and minimum length of root was recorded in treatment T_1 i.e. water soaking (5.54 cm) at 150 days after sowing. Suradinata *et al*. (2015) [9] conducted experiment on effect of concentration and length time of soaking seed in Gibberellic Acid (GA_3) on germination and growth of Christmas Palm. Maximum length of root was recorded with GA_3 @ 200 ppm soaking for 48 hours. Significantly maximum root volume (8.01 ml) was noticed in treatment T_{10} i.e. GA_3 -1500 ppm this treatment was significantly superior over all the treatments except treatment T_9 i.e. GA_3 –1000 ppm which was found statistically at par (7.40 ml) and minimum root volume (3.48 ml) was recorded with T_1 i.e. water soaking.

The treatment of T_{10} i.e. GA3-1500 ppm recorded significantly maximum root collar diameter (3.21 cm) compared to all other treatments. Whereas, minimum root collar diameter was recorded in water soaking i.e. T_1 (1.25 cm).

Table 1: Effect of different seed treatments on seed germination in royal palm.

Treatments	Days to germination of seed (days)	Germination %	Number roots plant^{-1}		Length of root (cm)		Root volume (ml) 150 DAS	Root collar diameter (cm) 150 DAS
			120 DAS	150 DAS	120 DAS	150 DAS		
T_1 – control (water soaking)	87.18	30.47 (33.44)	1.07	1.89	2.91	5.54	3.48	1.25
T_2 -Hot water	82.66	60.98 (51.32)	2.20	2.73	3.77	10.23	4.40	1.51
T_3- Brine solution 2%	77.91	63.61 (52.87)	2.87	3.13	4.18	11.52	4.76	1.75
T_4- Cow dung slurry	77.00	65.66 (54.10)	3.00	4.47	4.94	13.28	4.94	1.90
T_5-H_2SO_4- 10 min	68.51	77.84 (61.90)	3.10	5.47	7.00	15.54	5.78	2.28
T_6-H_2SO_4-20 min	64.59	79.28 (62.90)	3.19	5.89	7.85	16.64	6.18	2.52
T_7-H_2SO_4- 30min	62.91	83.21 (65.89)	3.27	6.10	8.06	17.66	6.50	2.64
T_8-GA_3-500 ppm	65.19	80.76 (63.96)	3.53	6.53	9.79	18.31	6.80	2.73
T_9- GA_3- 1000 ppm	64.72	81.39 (64.42)	3.60	6.87	10.05	19.63	7.40	3.83
T_{10}- GA_3- 1500 ppm	61.63	84.84 (67.07)	4.13	7.53	12.26	22.46	8.01	3.21
T_{11}- KNO_3-0.2%	70.47	74.89 (59.94)	3.07	5.18	6.04	14.13	5.02	2.19
T_{12}- KON_3- 0.3%	69.06	76.72 (61.17)	3.09	5.30	6.70	15.22	5.36	2.24
SE(m)±	1.69	1.52	0.13	0.18	0.31	0.51	0.27	0.09
CD at 5%	4.93	4.44	0.38	0.52	0.92	1.50	0.80	1.25

Conclusion

Maximum germination per cent, minimum days to germination, number of roots palnt^{-1}, length of root, root collar diameter, root volume were recorded with seed treatment of GA_3 – 1500 ppm.

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