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Effect of Biopriming on Seed Germination, Growth and Biomass of Waras (*Heterophragma quadriloculare* Roxb.)

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***Abstract*:** Present investigation was undertaken during the year 2019-2020 at College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India to ascertain effect of biopriming on seed germination, growth and biomass *Heterophragma quadriloculare*. The seed priming treatments comprised of application of Azotobactor, Potassium Mobilizing Bacteria: Pseudomonas Trichoderma 2 %, alone and in combination. Germination (%), survival (%), mean daily germination, peak value and germination value were not significantly influenced by different biopriming treatments. Significantly maximum plant height (30.18 cm), collar diameter (8.10 mm), number of leaves (28.46), fresh root weight (29.93 g plant^{-1}), dry root weight (9.85 g plant^{-1}), fresh shoot weight (24.45 g plant^{-1}) and dry shoot weight (10.12 g plant^{-1}) in response to with application of Azotobactor + KMB + PSB + Pseudomonas + Trichoderma 2 % (0.4 % Each)] followed by Azotobactor + PSB + KMB 2 % (0.66 % Each)] and the minimum was in control.

Keywords: Biopriming, Growth, Seed germination, Survival

Heterophragma quadriloculare Roxb. K. Schum belongs to Bignoniaceae and is a large deciduous tree endemic to Peninsular India. It is commonly known as Waras (Satani et al 2016). In India it is distributed in Western Deccan peninsulas and extremely rare in Bastar in Madhya Pradesh (Anonymous 2010). In Gujarat it is found in southern regions like Dangs, Vyara, Rajpipla, Vansda National Park, Waghai and Chhotaudepur of Gujarat. This species has less area of occupancy in the forests and in Gujarat state, it is listed in the vulnerable (VU) category. The plant is astringent, diuretic, and possesses antimicrobial, and anti-catarrhal properties. The plant contains a flavonoid glycoside, rutoside; coumarins, herniarin, umbelliferone and saponins. A related species, *H. hirsuta* L. is distributed in (Himalayas, from Kashmir to Kumaon up to 3000 m) and possesses Umbelliferone, scopoletin and herniarin (Khare 2007).

Bio-priming is a new technique of seed treatment that integrates biological (inoculation of seed with beneficial organism to protect seed) and physiological aspects (seed hydration) of disease control. It is recently used as an alternative method for controlling many seed and soil borne pathogens. It is an ecological approach using selected fungal antagonists against the soil and seed borne pathogens. Biological seed treatments may provide an alternative to chemical control. Seed priming is used as a tool to increase the speed and uniformity of germination and improve final growth. Therefore, seed priming alone or in combination with a low dosage of fungicides and/or biocontrol agents can be used to improve the rate and uniformity in the emergence of seed and reduce damping-off disease (Singh et al 2016).

Therefore, the current research aimed to investigate the effects of biopriming on seed germination, growth, and biomass of Waras (*H. quadriloculare*).

MATERIAL AND METHODS

The present investigation was carried out during the year 2019-20 at College of Forestry, Navsari Agricultural University, Navsari, Gujarat located 12 kilometers from the Arabian Sea coast at an elevation of roughly 11 above msl, at 20^{0}58' N latitude and 72^{0}54' E longitude. Completely Randomized Design was used as a statistical design to evaluate treatment effect. *H. quadriloculare* seeds were collected from natural population by the roadside of the Netrang to Rajpipla forest division in Gujarat. Pre-sowing soaking treatment was given to fresh seeds. Biopriming treatments were: T_1: Control, T_2: Azotobactor 2 %, T_3: Potassium Mobilizing Bacteria (KMB) 2 %, T_4: Phosphate Solubilizing Bacteria (PSB) 2 %, T_5: Pseudomonas 2 %, T_6: Trichoderma 2 %, T_7: Azotobactor + PSB + KMB 2 % (0.66 % Each), T_8: Pseudomonas + Trichoderma 2 % (1 % Each) and T_9 [Azotobactor + KMB + PSB + Pseudomonas + Trichoderma 2 % (0.40 % Each]. The seeds were mixed in respect to various treatments, then left at room temperature for six hours. Seeds were then sown into polybags @ 1 seed per polythene bag as per experimental details in the Net House Complex, College of Forestry, Navsari Agricultural

University, Navsari, Gujarat, India. The data was collected on seed germination (up to 30 days) and biomass (at 180 DAS) for further investigation.

RESULTS AND DISCUSSION

Germination attributes: The germination (%), survival (%), mean daily germination, peak value and germination value of *H. quadriloculare* was not significantly influenced by different bio primer treatments (Table 1).

Growth attributes: Growth and biomass parameters were significantly influenced by different bio primers. The plant height (30.18 cm), collar diameter (8.10 mm), number of leaves (28.46), fresh weight of root (29.93 g plant^{-1}), dry weight of root (9.85 g plant^{-1}), fresh weight of shoot (24.45 g plant^{-1}) and dry weight of shoot (10.12 g plant^{-1}) were significantly maximum in treatment T_9[Azotobactor + KMB + PSB + Pseudomonas + Trichoderma 2 % (0.40 % Each] (Table 2). The second-best treatment in order to response of different growth and biomass parameters was T_7-Azotobactor + PSB + KMB 2% (0.66 % each). This increase in seedling biomass production may be strongly correlated with improved accumulation of N and P due to AM fungi and PSB inoculation, respectively (Zambrano and Diaz 2008, Rathakrishnan et al 2004, Seema et al (2000). Maharana Rashmiprava et al (2018 a,b) observed that applying biofertilizers to *Gmelina arborea* seedlings at the nursery stage enhanced their fresh and dry biomass as well as the biomass of their individual sections (shoot, root, and leaves) in comparison to uninoculated seedlings.

The seed biopriming with *T. harzianum* treatment had the highest average seedling fresh and dry weight of the germinated seeds and was noticeably superior to the other treatments (Deshmukh et al 2016).

Seedling quality index (SQI) and seedling vigor index (SVI): The data in that the maximum seedling quality index (SQI) and seedling vigor index (SVI) was achieved (when plants were treated with Azotobactor + KMB + PSB + Pseudomonas + Trichoderma 2 % (0.40 % Each) 4.10 and 7321.13, respectively) followed by Azotobactor + PSB + KMB 2 % (0.66 % Each) (2.65 and 6528.00, respectively) (Fig. 1a & 1b).

Minimum SQI (1.27) and SVI (3478.13) were registered in response to Trichoderma 2 %, T_7: Azotobactor + PSB + KMB 2 % (0.66 % each) and control. It may be due to good establishment and adherence of bacteria on the seed before planting, so they can properly colonize the seed and affect these traits. The results are in line with Balasubramanian et al (2018), Moeinzadeh et al (2010), Ayswarya (2008).

Table 1. Effect of biopriming on germination attributes of *H. aquadriloculare*

Treatments	Germination (%)	Survival (%)	Mean daily germination	Peak value	Germination value
T_1	78.33	73.33	1.74	9.50	16.71
T_2	85.00	70.00	1.89	9.44	17.78
T_3	80.00	70.00	1.78	8.49	15.28
T_4	78.33	63.33	1.74	7.90	13.75
T_5	80.00	76.67	1.78	10.27	18.39
T_6	80.00	68.33	1.78	9.03	16.17
T_7	86.67	65.00	1.93	11.08	21.94
T_8	85.00	68.33	1.89	12.22	23.21

Table 2. Effect of biopriming on seedling growth and biomass attributes of *H. aquadriloculare*

Treatments	Plant height (cm)	Collar diameter (mm)	Number of leaves/plant (mm)	Root fresh weight (g/plant)	Shoot fresh weight (g/plant)	Root dry weight (g/plant)	Shoot dry weight (g/plant)
T_1	15.08	6.26	12.16	9.84	7.98	2.82	2.50
T_2	21.50	7.07	21.03	17.76	14.90	4.69	4.44
T_3	20.68	6.99	19.61	16.83	14.45	4.15	4.40
T_4	20.39	6.78	20.45	15.75	11.85	4.09	4.20
T_5	20.35	6.43	17.61	14.51	10.76	3.57	3.04
T_6	21.70	6.32	11.79	13.61	8.59	3.01	2.76
T_7	20.50	7.21	26.63	22.02	17.98	5.40	5.19
T_8	20.29	6.50	14.84	14.48	11.60	3.81	3.51

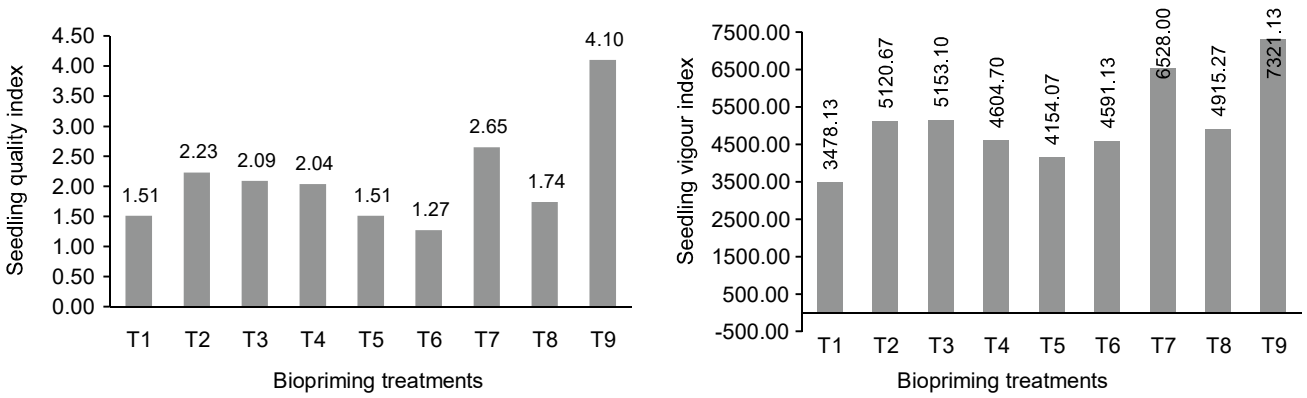

Fig. 1. Effect of biopriming on seedling quality index and seedling vigor index of *H. aquadriloculare*

CONCLUSION

Different bioprimer treatments applied singly or in combination with one or more other bioprimers improved the species growth and biomass metrics. Compared to controls, each bioprimer improved the growth and biomass indices. However, none of the different bioprimers had a substantial impact on the germination characteristics. Individually applied bioprimers produced a noticeable improvement over the control. However, when compared to control, the combination of the various bioprimers, namely Azotobactor + KMB + PSB + Pseudomonas + Trichoderma 2% (0.40% Each), produced the best outcomes for the plants' growth, biomass, and vigour indices. For this reason, a variety of bioprimers can be combined to create high-quality seedlings in forest nurseries that will support the conservationist approach.

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