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Botanical seed invigoration as a sustainable approach to improve growth and yield in blackgram

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Abstract

Black gram seeds when invigorated with botanicals in order to estimate their response on quality, growth and yield parameters. Leaf extracts like 6% Pungam leaf extract, 6% Adathoda leaf extract, 6% Prosopis leaf extract, 6% Neem leaf extract, 6% Thulasi leaf extract, and 6% Papaya leaf extract were used for the present study against control. Higher values for germination percentage (94 %), root length (15.18 cm), shoot length (26.35 cm), seedling length (41.53 cm), seedling dry weight (0.47 g), vigour index I (3903.82), vigour index II (44.18), electrical conductivity (0.608), field emergence (94%), plant height (40.10 cm), days to 50% flowering (32.60), number of branches/plant (5.21), number of trifoliate leaves/plant (13.48), number of pods/plant (32.87), seed yield/ha (1251.53 kg) and 100 seed weight (6.21) were observed in 6% Prosopis leaf extract against control.

Keywords: Adathoda, muslin cloth, prosopis, pungam, distilled water

Introduction

Pulses, “the wizard of the health” play a crucial role in supplying all the dietary proteins and they are considered as the second most important human protein source. Pulses are the rich reservoir of both macro and micro nutrients (Kaur *et al.*, 2024) [2]. Among the pulses, Black gram [*Vigna mungo* (L.) Hepper]; Fabaceae is one of the most valued pulses having its origin in India. Pre sowing seed treatment helps to accelerate germination, breaking dormancy and also protect against early stage pests and diseases. Botanical seed treatment is derived from natural sources based on botanical ingredient. It is a liquid, natural seed treatment and root growth promoter formulation. It also stimulates indigenous microbes in the root zone. It is proved to be a reliable performer in low and high rainfall areas and in all soil types. It is an affordable and effective way to optimize early growth and yield potential. It is also one of the lowest financial investments through which a grower can make maximize productivity. Among the several botanicals, leaf extract has been pharmacologically proved to contain appreciable amount of antioxidant properties with a high nutrient content (Bukhari *et al.*, 2008) [4]. Therefore, leaf extract can be used as a potential source of natural antioxidants which can be attempted for seed treatments to improve vigour, viability and storability maintenance in their commercial form. Nutrients play a vital role in increasing the growth in pulses. Apart from the genetic makeup, the physiological factors viz., insufficient portioning of assimilates, poor pod setting due to the flower abscission and lack of nutrients during critical stages of crop growth play a major role in declined black gram production. Hence this study was taken that, botanical seed invigoration as a sustainable approach to improve growth and yield in black gram VBN 11.

Materials and Methods

Genetically pure seeds of black gram, VBN11, a base material were brought from National pulses research centre, Vamban, Tamil nadu. The fresh leaves of Pungam, Prosopis, Adathoda, Papaya, Thulasi and Neem were collected separately and shade dried. The shade dried leaves were powdered using pestle and mortar. From this whole powder, 6 g of leaf powder should be exactly weighed using weighing balance. The 6g powder is dissolved in 100 ml of distilled water which was measured already in a beaker to make 6 % leaf extract. The leaf extract was filtered by using muslin cloth to remove unwanted materials and leaf debris.

The seeds were soaked in equal volume of 1:1 leaf extract for 4 hours along with water. The soaked seeds were dried back to original moisture content. In Thiruvallur, Polivakkam village the Field trial was conducted at a farmers field. In the PG Laboratory of Department of Genetics and Plant Breeding, Annamalai university, the laboratory experiment was carried out. The technique of random sampling was adopted for recording various characters in black gram.

T₀: Control (Without treatment)

T₁: 6% Pungam leaf extract

T₂: 6% Adathoda leaf extract

T₃: 6% Prosopis leaf extract

T₄: 6% Neem leaf extract

T₅: 6% Thulasi leaf extract

T₆: 6% Papaya leaf extract

Results and Discussion

The seeds hardened with 6% prosopis leaf extract recorded higher values for initial seed quality parameters viz., germination percentage (94 %), root length (15.18 cm), shoot length (26.35 cm), seedling length (41.53 cm), seedling dry weight (0.47 g), vigour index I (3903.82), vigour index II (44.18), electrical conductivity (0.608) against control (Table 1). Botanical leaf extract i.e., prosopis @ 10% showed positive impact on hiked initial seed quality parameters that might be due to the biochemical changes like activation of enzymes that further involves in the modification of cellwall and gibberellins (Macovei *et al.*, 2010) [10]. When compared to untreated seed, in case of prosopis treated seed, the greater colloidal hydration and greater viscosity of protoplasm occurs and here the cell membrane allows the early entry of moisture that can activates the early phase of hydrolyzing the reserved food. These findings were in conformity with the findings of Hussain *et al.* (2015) [7]. Increase in germination may be due to the seed hardening which induces the hyper alert to the per-germinative metabolism that imprint in seeds as a “sort of stress memory” (Chen and Arora, 2012) [5]. Higher root length, shoot length, seedling length and seedling dry weight may be due to the effect of released nutrients from prosopis leaf extract that protects tissue decay of storage organ by hydrolysis. These similar results were exactly coincides with the findings of Shehzad *et al.* (2012) [13]. These biocontents may also synergistically interact with Amino Acids especially in the formation of IAA (Indole acetic acid) in germinating seeds in order to bring the enhancement in

seedling growth. Similar results were reported by Kamaraj and Padmavathi (2012) [9] in green gram. Physiologically active substances present in the prosopis leaf extract have activated the embryo and other associated structures that results in absorption of more water due to cell wall elasticity and results in the development of stronger and efficient root system, that leads to the hike in vigour index. (Basra *et al.*, 2006; Farooq *et al.*, 2005) [1, 6].

The seeds hardened with prosopis leaf extract showed significantly higher values for the growth and yield parameters viz., field emergence (94%), plant height (40.10 cm), days to 50% flowering (32.60), number of branches/plant (5.21), number of trifoliate leaves/plant (13.48), number of pods/plant (32.87), seed yield/ha (1251.53 kg) and 100 seed weight (6.21) against control (Table 2). Rapid and uniform field emergence is the two main essential pre-requisites to the increase in yield. This uniformity in field emergence was achieved by the prosopis hardened seeds. According to Niranjanamurthy *et al.* (1991) [11], uniformity and percentage of seedling emergence was by the prosopis leaf extract which supplies the bio active materials such as gibberellins to the seed that plays an important role in seed emergence. The increase in plant height is due to the gibberellin translocation to the plant aerial parts, which is more enough to increase the hypocotyl size and the subsequent increase in first nodal height hence it is perfect and that shows positive effect on plant height (Renugadevi and Vijayageetha, 2006) [12]. The increase in yield parameters would be due to the allelopathy chemicals present in the prosopis leaf extract that helps in triggering the gibberellins synthesis that further improves the germination percentage by quickening all the other further process, so consequently leads to the increase in better crop growth and development.

The prosopis leaf extract hardened treatments have improved the plant growth during crop early stage with the increased vigour and strong root system that in turn have favoured the available soil moisture derivation and the nutrients enabling the good growth and further results in the greater yield (Jegathambal, 1996) [8]. Hence it is proved from the present study, in order to obtain the maximum profit pre sowing invigoration is one such technological highlight focused for the betterment of the crop. Here among all the treatments seed hardened with 6% prosopis leaf extract is recommended for the quality seed production and productivity in black gram.

Table 1: Botanicals on seed quality parameters in Blackgram cv. VBN 11

Treatment	Germination %	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Seedling dry weight (g)	Vigour index I	Vigour index II	Electrical Conductivity (dSm ⁻¹)
T ₀	81.00 (64.90)	12.00	22.00	34.00	0.33	2754.00	26.73	0.754
T ₁	91.07 (70.00)	13.60	24.64	38.24	0.40	3479.84	36.40	0.659
T ₂	85.29 (67.21)	14.50	25.89	40.39	0.35	3433.15	29.75	0.736
T ₃	94.00 (79.99)	15.18	26.35	41.53	0.47	3903.82	44.18	0.608
T ₄	93.00 (76.50)	14.83	26.13	40.96	0.43	3809.28	39.99	0.627
T ₅	86.38 (67.00)	14.23	26.00	40.23	0.36	3459.78	30.96	0.712
T ₆	88.00 (69.00)	13.16	25.68	38.84	0.39	3417.92	34.32	0.683
Mean	88.29	13.93	25.24	39.17	0.39	3465.40	37.75	0.682
SED	0.356	0.137	0.199	0.195	0.006	3.081	0.146	0.004
CD (P = 0.05)	0.771	0.297	0.431	0.422	0.018	6.673	0.316	0.008

Table 2: Botanicals on growth and yield parameters in Blackgram cv. VBN 11

Treatment	Field emergence (%)	Plant height (cm)	Days to 50% flowering	No of Branches/plant	No of Trifoliate leaves/plant	No of Pods/plant	Seed yield/ha (kg)	100 seed weight
T ₀	76.00	31.40	41.20	3.97	9.16	28.02	906.90	4.44
T ₁	78.33	35.87	40.11	4.33	11.27	31.24	1154.90	4.94
T ₂	81.26	36.40	37.05	4.51	12.83	31.68	1180.57	5.63
T ₃	94.00	40.10	32.60	5.21	13.48	32.87	1251.53	6.21
T ₄	92.00	38.86	35.00	4.87	13.01	32.46	1237.69	5.81
T ₅	87.51	34.00	38.83	4.70	12.52	30.93	999.79	4.42
T ₆	90.00	33.12	37.68	4.42	12.00	30.26	1112.38	5.22
Mean	85.59	35.68	37.49	4.57	12.03	31.07	977.68	5.24
SED	0.135	0.053	0.042	0.004	0.015	0.067	3.078	0.020
CD (P = 0.05)	0.298	0.117	0.093	0.009	0.034	0.147	6.780	0.044

Conclusion

Prosopis leaf extract @ 6% hardened seeds recorded higher seed quality, plant growth and yield parameters in black gram. For better quality seed production in black gram the usage of 6% prosopis leaf extract is confirmed and it can be recommended for quality seed production in black gram.

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Conflict of Interest

There is no such conflict of interest

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