

Original Research Article

Effects of seed invigoration treatments with bio-priming on germination, vigour and seedling growth in black gram (*Vigna mungo* L.)

ABSTRACT

A study had been conducted in black gram to observe the effect of different seed invigoration treatments with bio-priming for seed germination, seedling growing and vigour. The variety of black gram i.e., Uttara, was selected and seed had been treated with control (T₁); Seeds soaked in distilled water/ hydropriming (T₂); *Rhizobium leguminosarum* 10% (T₃); *Rhizobium leguminosarum* 15% (T₄); *Rhizobium leguminosarum* 20% (T₅); *Rhizobium leguminosarum* 25% (T₆); *Rhizobium leguminosarum* 30% (T₇) respectively. Treated seeds were grown in different glass plate nad patri plate at Department of Plant Physiology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India. Seed invigoration with *Rhizobium leguminosarum* at 20% followed by T₄ was found very effective for seed germination with vigorous seedlings. Higher seed germination percentage (82.60%), shoot length (17.89 cm), root length (12.99 cm), seedling fresh weight (1.87 g), seedling dry weight (0.19 g), seedling vigour index I (2393.62) and seedling vigour index II (15.96) results were observed for the seed bioprimered with *Rhizobium leguminosarum* at 20%. Seed treatment with *Rhizobium leguminosarum* at 20% recorded better performance than rest the treatments for all characters observed. The present investigation clearly depicted that the germination, vigour and seedling growth revalidated seed lots can be improved by pre-sowing and invigoration treatments.

Key words: Bio priming, Black gram, Germination, *Rhizobium leguminosarum*, seed priming, vigour

INTRODUCTION:

Blackgram, scientifically known as *Vigna mungo* L. Hepper, is a popular legume crop that plays a significant role in the agricultural landscape. Also called black lentil or urad dal, blackgram is cultivated primarily for its nutritious seeds, which are a staple food in many

countries around the world. Blackgram is an annual plant belonging to the Fabaceae family and is native to the Indian subcontinent. It is a warm-season crop that thrives in tropical and subtropical regions, making it an essential component of the agriculture sector in countries such as India, Pakistan, Bangladesh, and Myanmar. India is the world's largest producer as well as consumer of black gram (Raju, 2019). In India, black gram is third most important pulse crop grown under rainfed, rice fallow, irrigated conditions and during kharif, rabi and summer seasons, which matures in 90-100 days and it enriches soil with nitrogen (Swaminathan *et al.*, 2020). Cultivating blackgram requires well-drained soil and a warm climate, with temperatures ranging between 25 to 35 degrees Celsius. The primary reasons for pulses' low production, according to Sathiya *et al.* (2017), include the use of inferior seed, poor crop management, and cultivation in dry, marginal soils. Farmers often rotate blackgram with other crops to enhance soil fertility and prevent the build-up of pests and diseases.

From a nutritional standpoint, blackgram seeds are a rich source of protein, dietary fibre, vitamins (particularly B vitamins), and minerals such as iron, potassium, and magnesium. Its consumption provides various health benefits, including improved digestion, increased energy levels, and support for muscle and tissue repair. In traditional medicine, blackgram is believed to possess antioxidant and anti-inflammatory properties, contributing to overall well-being. Besides its nutritional significance, blackgram holds cultural and culinary importance in many cultures. It serves as a primary ingredient for preparation of dahl and for different food preparations like idli, dosa and non-fermented foods (Sivasubramanian *et al.*, 2015), with rice flour.

Compared to existing field application systems, seed treatments with bioagents offer affordable and comparatively non-polluting delivery systems for protective chemicals. When applied to seeds, bioprotectants have the potential to boost plant growth as well as protect and colonise roots. However, compared to chemical seed treatments, biological agents have a tendency to be less consistent and effective. There is a need for seed treatment methods that will increase the effectiveness of biological agents, and "bioprimer" is one such effort in this area. Many soil and seed-borne ailments may be successfully controlled by treating seeds with bio-control and priming substances (Taylor and Harman, 1990).

Seed priming with distinct bio-priming methods like different bio agent can be done to enhance the germination, vigour as these are vital stage of a plant life. Accordingly, this

investigation was thus undertaken to assess the achievements of different bio-priming treatments on black gram seed in relation to its germination and seedling growth.

MATERIALS AND METHODS:

The laboratory experiment was carried out in seed testing laboratory, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India during 2022 following Complete Randomized Design with three replications. Black gram seed (Variety: Uttara) was collected from All India Coordinated Research Project (AICRP) on MULLaRP, ICAR, Kanpur for this investigation. Seed priming was done with the solution of different concentration of *Rhizobium leguminosarum*. Dry seed was considered as control (T₁); Seeds soaked in distilled water/ hydropriming (T₂); *Rhizobium leguminosarum* 10% (T₃); *Rhizobium leguminosarum* 15% (T₄); *Rhizobium leguminosarum* 20% (T₅); *Rhizobium leguminosarum* 25% (T₆); *Rhizobium leguminosarum* 30% (T₇). Seeds were soaked eight hours for each treatment. The soaked seeds were then removed from the solution and dry for certain period of time. After that, seeds were placed for germination on standard germination papers using the Petri plate and glass-plate methods, and incubated for 7 days at 25 degrees Celsius with a relative humidity of 95% in a germinator. Different seed quality parameters like germination percentage (%), shoot length (cm), root length (cm), seedling fresh weight (g), seedling dry weight (g), seedling vigour index I (Abdul-Baki and Anderson, 1973), and seedling vigour index II (Abdul-Baki and Anderson, 1973) observations were recorded.

RESULT AND DISCUSSION:

Germination percentage

Significant responses were noticed in the priming treatment of *Rhizobium leguminosarum* solution with different concentration of under laboratory condition. T₅ (82.60%) recorded highest germination percentage followed by T₄ and T₂, while lowest germination percentage was recorded for T₁ (77.33%) preceded by T₃ and T₇ respectively. But non-significant difference was observed in between T₁ and T₆, T₇; T₂ and T₃, T₄, T₆, T₇; T₃ and T₆, T₇; T₄ and T₅, T₆; T₆ and T₇ (Table-1). This result is in agreement with Choudhury

and Bordolui (2022b). Similar kind of experiment on chickpea was observed by Malathi and Doraisamy (2004).

Vigour Index-I

Vigour Index-I showed a significant difference between priming treatments with varying *Rhizobium leguminosarum* concentration and duration. T₅ (2,393.62) was determined to have the highest value, followed by T₄ and T₆, respectively. But it was lowest for T₁ (1658.76), which was preceded by T₇ and T₂ (Table-1). Although the vigour index varied significantly, some non-significant differences between T₁ and T₇; T₂ and T₃; T₄ and T₅ were also seen. This result corroborates the findings of Ladumor and Singh, 2022 in black gram; Ray and Bordolui (2022a) in tomato.

Root length (cm)

Significant difference was observed in root length for this bio priming. Maximum root length of seedling was observed for T₄ (12.99 cm) followed by T₆ and T₅ respectively, while it was minimum for T₇ (8.08 cm) preceded by T₁ and T₃ (Table 1). Although T₁ and T₃ showed non-significant difference among themselves. The results are in agreement with the fact that root and shoot length increased in seeds due to priming as compared to non-primed seeds reported by Demir and Oztokat (2003); Choudhury and Bordolui (2022a).

Shoot length (cm)

In case of shoot length, the longest shoot length of seedling was recorded for T₅ (17.89 cm) followed by T₄ and T₃ while shortest shoot length was observed in T₁ (12.16 cm) preceded by T₇ and T₂. Significant difference was noted for shoot length in overall though non-significant difference was observed in between T₂ and T₇; T₃ and T₄; T₆ and T₂, T₃, T₄, T₇ (Table-1). The result corroborates the findings of Mendez *et al.*, 2017.

Fresh weight (g)

For this bio priming with *Rhizobium leguminosarum*, non-significant difference was observed in the fresh weight of the seedling. The seedling's fresh weight was discovered to be at its most for T₅ (1.87g), followed by T₄ and T₆, and at its lowest for T₁ (1.11g), which was preceded by T₇ and T₂ (Table-2). Ray and Bordolui (2020) reported similar kind of experiment in marigold.

Dry weight (g)

In terms of dry weight, the maximum dry weight of seedling was recorded for T₅ (0.19g) followed by T₆ and T₃ while minimum dry weight was observed in T₇ (0.12 g) preceded by T₁ and T₄ (Table-2). Non-significant difference was noted for dry weight in overall. This result corroborates the findings of Ray and Bordolui (2022b) in tomato

Vigour Index-II

Due to priming with different concentrations of *Rhizobium leguminosarum*, the vigour index II showed non-significant difference between them. Lowest Vigour index-II was observed in T₇ (9.52) preceded by T₁ and T₄. While, T₅ (15.96) showed the highest germination index followed by T₆ and T₃ (Table-2). Similar type of result was observed by Sujaya *et al.* (2018).

Table 1: Effect of priming on germination percentage, root length, shoot length and vigour index-I of Black gram

Treatment	Germination Percentage (Tr value)	Shoot length (cm)	Root length (cm)	Vigour Index-I
T ₁	77.33 (61.55)	12.16	9.29	1,658.76
T ₂	79.76 (63.25)	14.05	10.38	1,948.85
T ₃	77.95 (61.98)	15.79	10.00	2,008.89
T ₄	81.50 (64.51)	15.94	12.99	2,358.17
T ₅	82.60 (65.32)	17.89	11.09	2,393.62
T ₆	79.43 (63.01)	15.16	12.23	2,175.31
T ₇	79.12 (62.79)	13.74	8.08	1,727.24
SEm (±)	0.53	0.47	0.26	50.60
LSD (0.05)	1.62	1.43	0.79	154.98

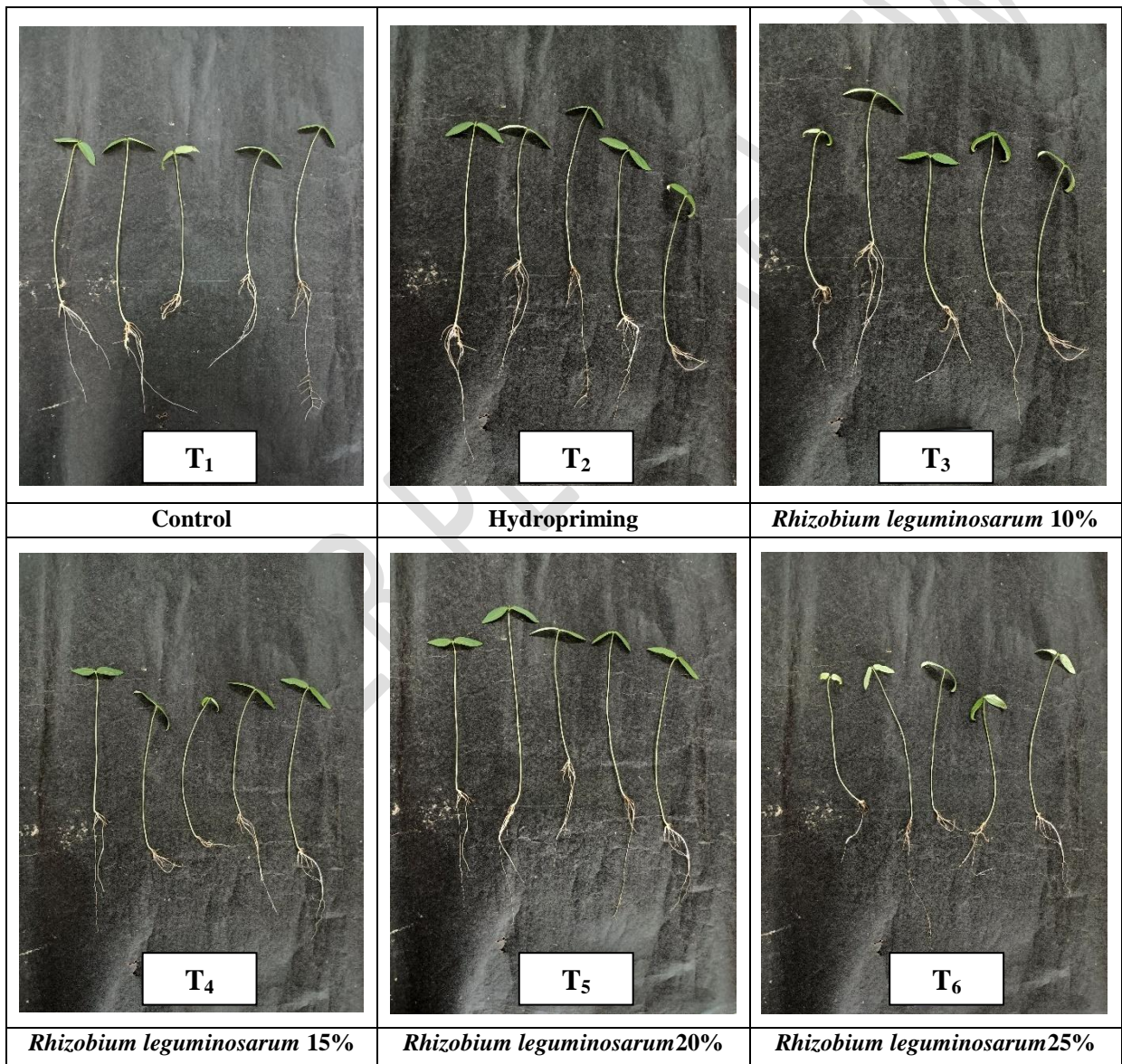
Note: Control (T₁); Seeds soaked in distilled water/ hydropriming (T₂); *Rhizobium leguminosarum* 10% (T₃); *Rhizobium leguminosarum* 15% (T₄); *Rhizobium leguminosarum* 20% (T₅); *Rhizobium leguminosarum* 25% (T₆); *Rhizobium leguminosarum* 30% (T₇).

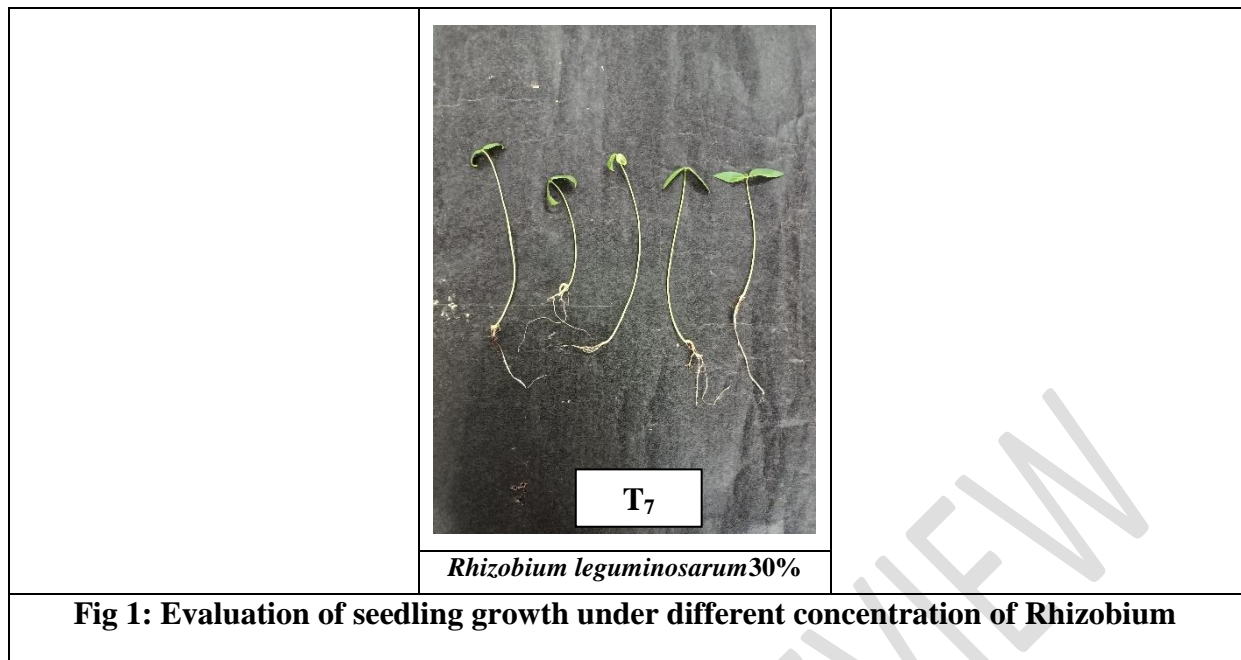
Table 2: Effect of priming on fresh weight, dry weight, and vigour index-II of Black gram

Treatment	Fresh weight (g)	Dry weight (g)	Vigour Index-II
T ₁	1.11	0.13	10.30
T ₂	1.47	0.15	12.25

T ₃	1.56	0.16	12.47
T ₄	1.77	0.14	11.42
T ₅	1.87	0.19	15.96
T ₆	1.73	0.17	13.75
T ₇	1.43	0.12	9.52
SEm (±)	0.22	0.02	1.40
LSD (0.05)	N/A	N/A	N/A

Note: Control (T₁); Seeds soaked in distilled water/ hydropriming (T₂); *Rhizobium leguminosarum* 10% (T₃); *Rhizobium leguminosarum* 15% (T₄); *Rhizobium leguminosarum* 20% (T₅); *Rhizobium leguminosarum* 25% (T₆); *Rhizobium leguminosarum* 30% (T₇).





CONCLUSION:

A higher level of hormones, such as gibberellins, may have been activated in seeds treated with *Rhizobium leguminosarum* @ 20%, which would have inspired the action of specific enzymes that aided in early germination, such as amylase. As a result, assimilations of starch would have been simpler to obtain. The best germination rate occurs when pre-germination metabolic processes are completed during seed priming, preparing the seed for germination. In order to improve blackgram performance, pre-sowing treatment with 20% *Rhizobium leguminosarum* for 8 hours is advised since it outperforms other treatments, including control, in terms of improving seed germination and seedling vigour.

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