



Effect of seed priming on seed quality parameters of green gram seeds

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Abstract

A lab experiment was done to study about the effect of seed priming and storage containers on seed quality parameters of pulses seeds. The aim of this study was to access the effects of priming treatments of green gram seeds by treating them with water, NaCl, Moringa leaf extract, GA₃, *Rhizobium*, KH₂PO₄, and control. It revealed that the quality parameters namely germination (%), shoot length (cm), root length (cm), dry matter production (g/10 seedling) and vigour index were enhanced. Among the priming treatments, the Green gram seeds showed maximum germination % and vigour in GA₃ treated seeds. The advantages of seed priming is reducing the germination time and improving emergence and uniformity is well established.

Keywords: priming, GA₃, green gram, CO-8

Introduction

Pulses are the second most important group of crops worldwide. India's position in pulses is second in terms of production, consumption and acreage. Pulses are the major sources of dietary protein in the vegetarian diet of our country. Besides being a rich source of protein, they maintain soil fertility through biological nitrogen fixation in soil and thus, play a vital role in furthering sustainable agriculture Kannaiyan (1999) [10]. India is the largest producer and consumer of pulses in the world accounting for about 29 per cent of the world area and 19 per cent of the world's production Anil Kumar Singh. *et al.* (2015) [2]. The major legumes in Asia are chickpea, pigeon pea and mung bean.

Pulses are cultivated under irrigated as well as rainfed conditions mostly in tropical and sub-tropical countries for grains, green manuring, fodder and forage as sole crop, inter crop, mixed crop and in sequential cropping system. The area under pulses in the country is around 29.28 million hectares with a production of 22.40 million tonnes. The average productivity of the country is about 765 kg ha⁻¹ (Anonymous, 2022). In Tamil Nadu, pulses are grown in 164.07 thousand ha with an annual production of 85.12 metric tonnes and the productivity stands around 659 kg per hectare (Anonymous, 2022).

Green gram var CO 8 is short duration crop (55-60 days), released for synchronized maturity, suitable for single/mechanical harvest and it is resistant to yellow mosaic disease, stem necrosis and moderately resistant to root rot. It is also moderately resistant to aphids and stem fly. It is suitable for intercropping with maize and red gram. Green gram var CO 8 the average yield is lower due to its shorter duration and determinate growth habit. This may be improved by some physical manipulations and treating the crop with bio fertilizer which improves the nutrient availability thus may increase seed yield and quality of seeds.

Seed priming is a controlled hydration process that involves exposing seeds to low water potentials that restrict germination, but permits pre germinative physiological and biochemical changes to occur (Heydecker and Coolbear, 1977) [7] and (Bradford, 1986) [4]. Primed seed hastens rate of germination, more uniform emergence and reduced dormancy in many species (Khan *et al.*, 1992) [12]. Priming has been described by Caseiro *et al.* (2004) [5] as a pre plant physiological seed conditioning that can improve seed performance by reducing the time to germination and seedling emergence and also increasing the tolerance of seeds to stress conditions.

Materials and Methods

The experiment was conducted in order to determine the effective seed priming treatments of pulse seeds. Green gram seeds Var CO- 8 were collected and constituted the materials of this study.

Soaking duration for seed priming was standardized by soaking the green gram seeds were subjected to different solutions *viz.*, Water, NaCl (5%), Moringa leaf extract (1%), GA₃ (200 ppm), *Rhizobium* (5%), KH₂PO₄ (2%) were soaked for 6 1/2 hrs and dried back to its original moisture content.

The primed seeds were assessed for its seed quality parameters *viz.*, germination (%), shoot length (cm), Root length (cm) and dry matter production (g /10 seedlings⁻¹).

The germination test was conducted using three replications of 100 seeds from each sample in roll towel papers as per procedure described by ISTA (2010) [8]. At the end of 7th day numbers of normal seedlings were counted

and germination per cent was calculated. The shoot and root length of ten normal seedlings was recorded and expressed in centimeters (cm). The same 10 seedlings whose length was measured were dried in a hot air oven for 24 h at $103 \pm 1^\circ \text{C}$ and dry matter production ($\text{g}/10 \text{ seedlings}^{-1}$) was measured. The vigour index was calculated as per the formula given by Abdul Baki and Anderson (1973). The data were analyzed statistically adopting the procedure described by (Panse and Sukatme, 1985) [14]. AGRES software package was used for finding critical differences (CD) values. The critical differences (CD) were calculated at 5 per cent probability level. Wherever necessary, percentage values were transformed to arc sin values before carrying out the statistical analysis.

Results

Significant different was observed due to seed treatment on seed physiological parameters, viz Germination (%), Root length (cm), Shoot length (cm), Dry matter production ($\text{g}/10 \text{ seedling}^{-1}$) and Vigour index.

The highest germination percent was recorded on seeds primed with GA_3 (200 ppm) of 94 per cent and the lowest 70 per cent was recorded in NaCl (5%) primed seeds. The highest root length was observed in GA_3 (200 ppm) with 16.55cm and lowest was observed in KH_2PO_4 (2%) with 7.28 cm (Table 1). The longest shoot was recorded in GA_3 (200 ppm) priming with 25.95 cm and the lowest was observed in KH_2PO_4 (2%) priming with 19.36 cm irrespective of seed treatment (Table 1). The highest dry matter production was recorded with 0.20 $\text{g}/10 \text{ seedling}^{-1}$ followed by 0.18 $\text{g}/10 \text{ seedling}^{-1}$ in GA_3 (200 ppm) priming by hydro priming and the least in KH_2PO_4 (2%) with 0.11 $\text{g}/10 \text{ seedling}^{-1}$ (Table 1). GA_3 (200 ppm) treated seeds showed highest vigour index of 3995 and least was observed 1970 in NaCl (5%) primed seeds (Table1).



Plate 1: Effect of priming on seed quality parameters of green gram seeds

Table 1: Effect of different priming treatments of Green gram seeds Var CO 8

Treatments	Germination (%)	Shoot length (cm)	Root length (cm)	Dry matter production ($\text{g}/10 \text{ seedling}$)	Vigour index
T ₀ -Control	80	20.57	9.75	0.12	2425
T ₁ -Hydro	88	23.80	12.05	0.18	3154
T ₂ -NaCl (5%)	70	20.10	8.05	0.11	1970
T ₃ - GA_3 (200 ppm)	94	25.95	16.55	0.20	3995
T ₄ -Moringa leaf extracts (1%)	90	22.85	11.28	0.16	3071
T ₅ - KH_2PO_4 (2%)	78	19.36	7.28	0.10	2077
T ₆ -Rhizobium (5%)	84	21.98	10.70	0.14	2745
Mean	83	22.09	10.81	0.144	2776
sEd	2.13	0.37	0.17	0.21	67.73
CD (0.05)	4.58**	0.79**	0.38**	0.46**	45.30**

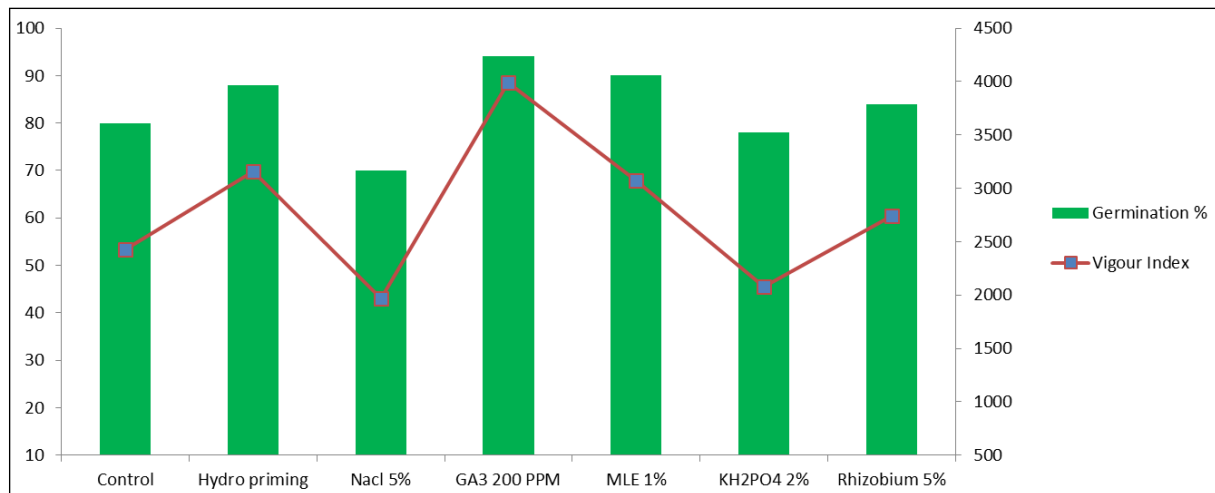


Fig 1: Evaluation of seed priming treatments of green gram seeds

Discussion

Seed germination is one of the most fundamental and vital phases in the growth cycle of plants as it decides the plant establishment and productivity. GA₃ recorded maximum germination among all the priming solutions in Green gram. It is one of the important growth regulator used to trigger germination.

GA₃ is most widely used plant growth regulator having tetracyclic, di-terpinoid compounds which increases stem elongation along with plant height, growth, dry matter accumulation as well yield (Subash *et al.*, 2015) [16], GA₃ activate the synthesis of proteins and other metabolites required by embryo for germination, the supply of GA₃ by pre sowing seed treatment would more than compensate the “hidden hunger” of growing crops (Jafri, 2009) [9].

Priming stimulates GA₃ metabolism leading to germination, thus inducing a similar response to described for some GA₃ treatments. Perhaps in undesirable condition, priming had a small effect on GA metabolism and exogenous application of GA₃ after priming may help to compensate for negative effect of unsuitable priming in the seeds, leading to a faster rate of dormancy release and significantly increased seedling growth.

GA₃ plays a crucial role as natural regulator in processes involved seed germination which will stimulate the production of hydrolytic enzyme such as α - amylase in aleuron layer of the seed. Aleurone layer is the layer that surrounds thin – walled cells with starch grains in starchy endosperm. Thus, when GA₃ stimulates hydrolytic enzymes, the stored food in starchy endosperms are broken down into soluble sugars, amino acids and other products which then transferred to growing embryo (Gupta & Chakrabarty, 2013) [6].

At higher concentrations, halo priming reduced germination, either because of the toxic effects of salt and chloride ions or because it increased osmotic pressure (Khan *et al.*, 2009) [11]. According to (Mohammedi GR, 2009), as osmotic potential increases, germination time increases and water uptake decreases. This has caused short roots and short seedlings, which have weak vigour and less ability to accumulate dry weight.

Conclusion

In this study, priming with GA₃ @ 200 ppm performed better than the other priming treatments. The process of cell enlargement, cell division, and activation of several enzymes involved in the germination process and growth of newly emerged seedlings may be enhanced by the exogenous application of plant growth regulators through seed priming, which could improve the seed quality parameters during the seedling stage. Additionally, our findings are somewhat consistent with those of Perveen *et al.* (2010) [15] for wheat and Tiwari *et al.* (2013) [17] for mungbean. This technology could be used to enhance the quality of pulse seeds.

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