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Eco-Friendly Prospect of Organic Seed Treatments on Physiological and Biochemical activities in Black gram

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ABSTRACT: In the current experiment, the influence of seed priming with botanical leaf extract on the growth and yield parameters of black gram was investigated in department of Seed Science and Technology, Adhiparasakthi Agricultural College, Kalavai during 2021. All the treatments irrespective of their dosage, performed better in all the physiological and biochemical properties of seeds than control in the varieties. In a field experiment, priming treatments for the black gram seeds namely, priming with 1% different leaf extract were applied before they were sowed alongside dry seeds (the control). The findings showed that, regardless of the dosage, all therapies, performed better in all the physiological properties of seeds than control in the varieties. Among the treatments, Botanical leaf extract Seeds treatments with Pungam leaf extract 1% significantly maintained its superiority with higher germination percentage (93), root length (18.35 cm), shoot length (23.45 cm), seedling length (41.80 cm),dry matter production (0.275 g seedling-10), vigour index I (3887) and vigour index II (25.58), dehydrogenase enzyme activity (1.328 OD value), lower electrical conductivity (57.8) and followed by T4 (90 %) with Treatment of Prosopis leaf extract 1% and Eucalyptus leaf extract 1%, Arappu leaf extract 1% which were on par with each other. The control group had the lowest value, though. However, the current findings showed that 1% Pungam leaf extract is used to improve the characteristics of black gram's growth.

Keywords: Black gram; organic seed treatments; Arappu, Pungam, Prosopis, Neem, Eucalyptus physiological and Bio chemical.

INTRODUCTION

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. Pulses are the second most important group of crops worldwide and India ranks first in terms of pulses production, consumption and acreage. In India, black gram occupies 12.7 per cent of total area under pulses and contribute 8.4 per cent of total pulses production. Even though, the country continues to face endemic shortage in pulses.

Low productivity, which may be caused by inadequate soil moisture, subpar agricultural yield, and deficient soil fertility, is the main restriction in Black gram. To solve these issues, seed priming is administered as a pre-sowing therapy to help plants endure the harsh weather. Nutrient applications to dry ground are troublesome; but, by providing the nutrients to the seed itself as a pre-sowing treatment, the viability and vigour of the seed will be improved, and this will result in good yield (Vijaya, 1996). The ingredients used in botanical seed treatments come from natural sources. It is a liquid, all-natural preparation that treats seeds and encourages root growth. In the root zone, it also encourages naturally occurring microorganisms. In both light and heavy rain, it has demonstrated its dependability 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 to maximize productivity and improve the bottom line.

Among the several botanicals, leaf extract has been pharmacologically proved to contain appreciable amount antioxidant property with high nutrient content contains Bukhari *et al.* (2008). Therefore, leaf extract can be

used as a potential source of natural antioxidants which can be attempted for seed treatments for vigour, viability and storability maintenance in their commercial form. To increase seed performance in terms of uniformity of germination and rate of germination, seed priming is a frequent method (De Lespinay *et al.*, 2010). Seed priming is the technique of controlling germination by controlling seed moisture content and temperature in order to optimize the potential of the seed. Heydecker (1972) stated that deterioration of vigour in stored seeds was associated with the weakening of cell membrane. Increased leachate was related to low metabolic activity of seed. Parrish and Leopold (1978) reported that changes in seeds of soybean after accelerated ageing showed subsequent loss of vigour and increased the leakage of electrolytes. Hence the present study was undertaken to evaluate the various botanical leaf extract treatments on biochemical and physiological growth characters of black gram VBN 6.

MATERIALS AND METHODS

The present study was carried out by using genetically pure seeds of TNAU (Black gram) VBN 6 obtained from National Pulses Research Centre, Vamban, Pudukkottai District and Department of Pulses, Centre for Plant Breeding and Genetics, Adhiparasakthi Agricultural College, Kalavai respectively constituted the base materials for this study. The botanical leaf extract seed treatments to the seeds. The field studies on seed physiological and biochemical were carried out at the Department of Seed Science and Technology, Adhiparasakthi Agricultural College, Kalavai during 2022. Design: Factorial Randomized block Design, Replication: Four

Preparation of plant leaf extract. Fresh leaves from the plants in question were separated, collected, and dried in the shade. Using a mortar and pestle, the shade-dried leaves were ground into a powder. Then, using a balance, precisely weigh 1g of leaf powder and dissolve it in 100 ml of distilled water that has already been calibrated in the beaker to create 1% leaf extract. Muslin cloth was used to filter the leaf extract to get rid of undesirable particles and leaf fragments. The bulk seeds of black gram [*Vigna mungo* (L.) Hepper] cv. VBN 6 were graded for uniformity and then imposed to various botanical treatments four botanicals *viz.*, Arappu leaf extract, Neem leaf extract, Pungam leaf extract, Prosopis leaf extract and Eucalyptus leaf extract.

The following seed treatments were imposed

Treatments

T_0	-	Control ,
T_1	-	Arappu leaf extract 1%
T_2	-	Neem leaf extract 1%
T_3	-	Pungam leaf extract 1%
T_4	-	Prosopis leaf extract 1%
T_5	-	Eucalyptus leaf extract 1%

The following observations were evaluated in order to explore the impact of botanical leaf extract on seedling quality in the field and laboratory.

In an experiment employing a factorial randomized block design with four replications, the influence of pre-sowing seed priming with different leaf extracts on growth and yield characters in black gram was examined. Germination (%), Root length, Shoot length, Dry matter production, and Vigor index I and II using the method proposed by Abdul-Baki and Anderson (1973) were observations on growth and seed yield characteristics that were noted.

Biochemical attributes

Electrical Conductivity. Four replicates of fifty seeds from each genotype and container were drawn, prewashed well with distilled water and then soaked in 75 ml of distilled water for 6 h duration at room temperature. After soaking, the seed steep water was decanted to obtain the seed leachate. Using digital conductivity meter with a cell constant of one the electrical conductivity of the seed leachate was measured and the mean expressed as $\mu S\ cm^{-1}$ (Presley, 1958).

Dehydrogenase Enzyme Activity. Seeds were selected randomly and preconditioned by soaking in water for 6 h. Then the seeds were bisected longitudinally into two halves and were steeped in (0.1 %) 2, 3, 5 triphenyl tetrazolium chloride solution and kept in dark for 2 h at 40°C for staining. After staining, the excess solution was drained and the seeds were washed thoroughly with distilled water and transferred to a test tube containing 5 ml of methyl cello solve (2 methoxy ethanol) the test tubes were closed air tight and allowed to remain in an incubator in darkness, overnight for extracting the red colored formazon. The colored solution was decanted and the color intensity was measured using Cary UV spectrophotometer at 470nm and methyl cellosolve as the blank. The OD value obtained was reported as total dehydrogenase activity **(**Kittock and Law 1968). The data obtained from different experiments were analyzed by the 'F' test of significance following the methods described by Rangaswamy (2002). Wherever necessary, the per cent values were transformed to angular (Arc-sine) values before analysis. The critical differences (CD) were calculated at 5 per cent probability level. If the F test is non-significant it was indicated by the letters "NS".

RESULTS AND DISCUSSION

The analysis of variance for seedling characters was presented in Table 1. Analysis of variance revealed that the differences among six treatments were highly significant for seedling characters, viz., germination per cent, root length, shoot length, seedling length, seedling dry weight, seed vigour index I and seed vigour index II. The data presented in the table showed mean performance and range of treatments for seed quality parameter and biochemical activity in Table 1-3.

Table 1: Influence of botanical leaf extract treatments on seedling quality characteristics in black gram cv.VBN 6.

Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)
T_0- Control	74	15.00	18.43	33.43
T_1- Arappu leaf extract 1%	80	16.32	20.04	36.36
T_2- Neem leaf extract 1%	86	17.25	21.08	38.33
T_3- Pungam leaf extract 1%	93	18.35	23.45	41.80
T_4- Prosopis leaf extract 1%	90	18.09	22.82	40.91
T_5- Eucalyptus leaf extract 1%	81	17.02	20.76	37.78
Mean	**84**	**17.01**	**21.10**	**38.10**
SEd	1.282	0.178	0.331	0.432
CD(p=0.05)	2.734**	0.379**	0.706**	0.922**

Table 2: Influence of botanical leaf extract treatments on seedling quality characteristics in black gram cv.VBN 6.

Treatments	Drymater production (g)	Vigour index -I	Vigour index - II
T_0- Control	0.185	2473	13.69
T_1- Arappu leaf extract 1%	0.201	2908	16.08
T_2- Neem leaf extract 1%	0.229	3296	19.69
T_3- Pungam leaf extract 1%	0.275	3887	25.58
T_4- Prosopis leaf extract 1%	0.251	3681	22.59
T_5- Eucalyptus leaf extract 1%	0.211	3060	17.09
Mean	**0.225**	**3218**	**19.12**
SEd	0.0041	42.453	0.185
CD(p=0.05)	0.0087**	90.487**	0.395**

**- Significant at 5% level; T – Treatments; **- Significant at 5% level; T – Treatments

Table 3: Influence of botanical leaf extract treatments on biochemical activity in black gram cv.VBN 6.

Treatments	Electrical conductivity (µS cm^{-1})	Dehydrogenase activity (OD value)
T_0- Control	68.0	1.051
T_1- Arappu leaf extract 1%	62.0	1.112
T_2- Neem leaf extract 1%	60.2	1.218
T_3- Pungam leaf extract 1%	57.8	1.328
T_4- Prosopis leaf extract 1%	58.9	1.226
T_5- Eucalyptus leaf extract 1%	60.9	1.212
Mean	**61.3**	**1.191**
SEd	0.203	0.003
CD(p=0.05)	0.401	0.006

**- Significant at 5% level; T – Treatments

Botanical leaf extract Seeds treatments with Pungam leaf extract 1% recorded higher germination percentage (93), root length (18.35 cm), shoot length (23.45 cm), seedling length (41.80 cm),dry matter production (0.275 g seedling-10), vigour index I (3887) and vigour index II (25.58) whereas the lowest value was observed in control (Table 1, 2). The reason for higher germination of pungam leaf extract treated seed may be greater hydration of colloids and higher viscosity of protoplasm and cell membrane that allows the early entrance of moisture that activates the early hydrolysis of reserve food materials in the seed as compared to untreated seeds. These bio contents might synergistically interact with amino acids especially tryptophan to form the indole acetic acid (IAA) in germinating seeds to bring about enhancement in seedling growth (Lu *et al*., 2002).

All the treatments irrespective of their dosage, performed better in all the physiological and biochemical properties of seeds than control in the varieties. Among the treatments, Botanical leaf extract Seeds treatments with Pungam leaf extract 1% significantly maintained its superiority with higher germination percentage (93), root length (18.35 cm), shoot length (23.45 cm), seedling length (41.80 cm),dry matter production (0.275 g seedling-10), vigour index I (3887), vigour index II (25.58), electrical conductivity and dehydrogenase enzyme activity (57.8) and (1.328 OD value) followed by T4 (90 %) with Treatment of Prosopis leaf extract 1% and Eucalyptus leaf extract 1%, Arappu leaf extract 1% which were on par with each other. whereas the lowest value was observed in control. To overcome the adverse Seedling establishment is given as a presowing seed treatment

which act as a boon to the farmers in dryland agriculture. Applications of nutrients to the dryland is a problematic one, by giving the nutrients to the seed itself as pre-sowing treatment will improve the viability and vigour of the seed and that will give good yield (Vijaya, 1996).

Pungam leaf has trace amounts of the minerals GA3 and nitrogen (5.6%), phosphorus (P205-0.9%), potassium (K2 0-3.1%), and calcium (Ca 0-1.0%). (Nadeem Binzia, 1992). According to Christansen and Foy (1979), calcium acts as an enzyme cofactor in the germination process by enhancing protein synthesis, which may also account for the increased germination (1979). Cell wall extension and higher metabolic activities may be to blame for the longer shoots and roots in seeds treated with botanical leaf extract (Afzal *et al.,* 2009). According to Rathinavel and Dharmalingam (1999), the increase in dry weight was attributed to improved lipid utilization and enzyme activity caused by the presence of bioactive substances like auxin in pungam leaf extract as well as the development of seedlings to reach autotropic stage, which allowed them to produce relatively more dry matter with an increase in vigour index. Tamilmani (2012) observed similar findings for black gram, and Prakash *et al.* (2006) reported similar findings for rice. The increase in dry weight with botanicals treatment may be due to the faster growth and development of seedling and hike in vigour index (Sathiya Narayanan *et al.*, 2016). Benefits of seed treatment with prosopis and pungam leaf extracts has already been reported by Khan *et al.,* (2006) in wheat and Renugadevi *et al.* (2008) in cluster bean. Physiologically active substances may have activated the embryo and other associated structures which results in absorption of more water due to cell wall elasticity and development of stronger and efficient root system which leads to the increase of higher vigour index (Basra *et al.,* 2005). Similar observation was made by Anbarasan and Srimathi (2016) in red gram. Seeds treated were found to record low electrical conductivity in the seed leachate which implies on the probable role of seed treatments in curing the damaged membranes. The probable reason for low electrical conductivity in the seeds presumed to be the quenching of free radicals, which consequentially restore the membrane integrity. The dehydrogenase enzyme activity is a good stable metabolic marker to estimate the degree of vigour in seeds and have positive association with vigour and viability of seeds (Saxena *et al.,* 1987). The outcomes were consistent with Kavitha's (2002) findings in black gram. This might be because the seed tissues are unable to convert tetrazolium chloride into the insoluble formazon. Similar findings were made in pearl millet by Menaka (2003), who stated that as the age of the seed increased, so did the activity of the enzyme responsible for the seed's respiration. Extract from a pungam leaf hardening enhanced the plant's growth characteristics by triggering the biosynthesis of nucleic acids, proteins, and hydrolytic enzymes, which in turn improved cell division, cell enlargement, and metabolic activity. Hardening also accelerated the plant's photosynthetic process, which increased the plant's ability to absorb more nutrients through effective and robust roots.

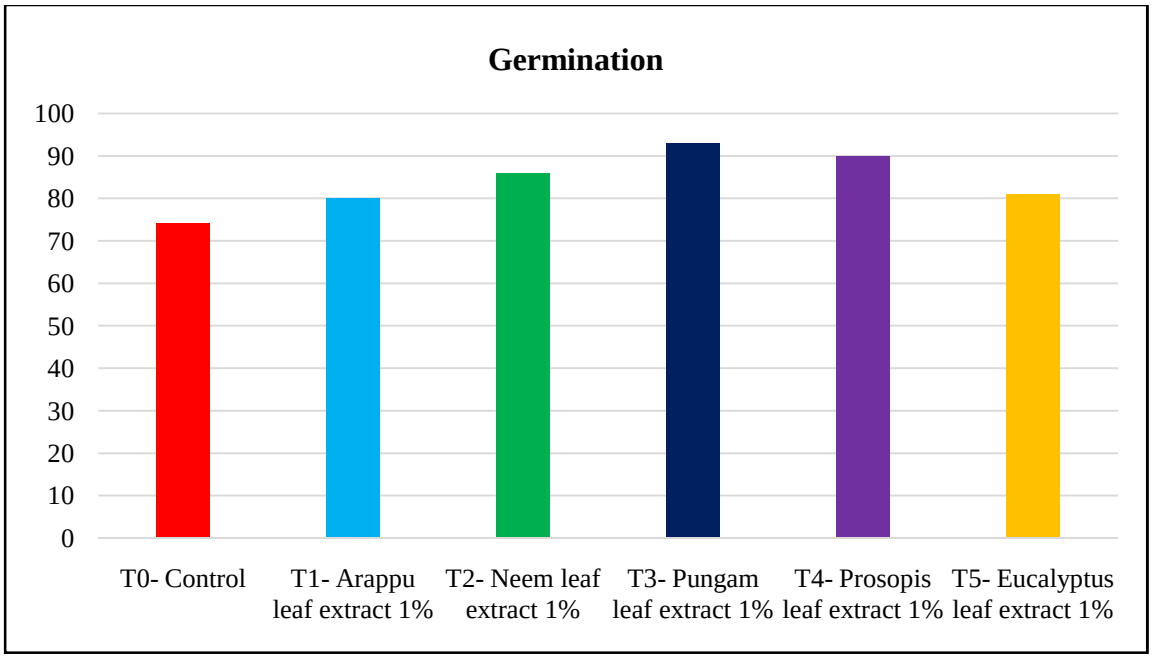

Fig. 1.

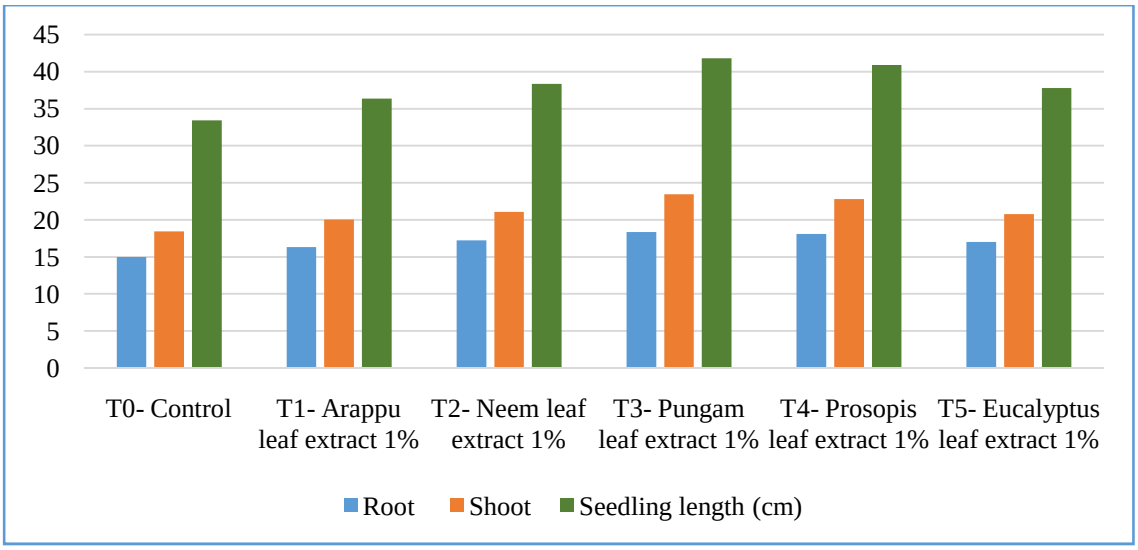

Fig. 2.

CONCLUSION

According to the study, organic treatments for seeds improved the plant's ability to photosynthesize as well as nodulation, both of which are crucial for increased productivity. Additionally, organic leaf extract is reported to increase the soil's ability to hold water in the area where roots grow and increase the delivery of nutrients to seeds that are germination. Pungam leaf extract has demonstrated energizing effects on characteristics that were sustained in the field were of seedling quality. Chemicals are expensive and a natural hazard when used as pelleting materials, whereas botanicals are less expensive, readily available to farmers, safe to handle, and simple to produce. But the current findings showed that 1% Pungam leaf extract is used to improve the vigour qualities and growth characteristics of black gram.

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Conflict of Interest. The results furnished in this paper were from my own research and there were no any conflicts from other research scholars or scientists.

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