Plant Archives Vol. 17 No. 2, 2017 pp. 1383-1387 ***ISSN 0972-5210***

EFFECT OF BOTANICAL SEED PRIMING ON SEED QUALITY CHARACTERS IN BLACKGRAM [*VIGNA MUNGO* (L.) HEPPER] cv. CO 6

J. Gunasekar, A. Kamaraj* and S. Padmavathi

Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Chidambaram - 608 002 (Tamil Nadu), India.

Abstract

Laboratory experiment was conducted to study the effect of seed priming using botanical leaf extract on seed quality characters of blackgram. The present study will emphasize on the effect of seed priming using various leaf extracts like moringa, prosopis, neem, pungam and arappu on seed and seedling quality characteristics like germination percentage, speed of germination, root length, shoot length, seedling length, dry matter production, vigour index-I and vigour index-II of blackgram CO 6. The results concluded that blackgram seeds should be primed with 1% prosopis leaf extract for 4 hours @ 1/3rd volume of solution to enhance the seed and seedling characteristics under adverse environmental conditions. In addition, blackgram seeds may also be primed with 1% moringa leaf extract to get the similar results.

Key words : Blackgram, leaf extract, prosopis, pungam, moringa, seed priming, seed quality.

Introduction

Blackgram [*Vigna mungo* (L.) Hepper] 2n=2×22 popularly known as urdbean, containing about 26 per cent protein, which is almost three times that of cereals and belonging to the family Fabaceae. It ranks fourth among the major pulses cultivated in India. Black gram supplies a major share of protein requirement of vegetarian population of the country. It is consumed in the form of split pulse as well as whole pulse, which is an essential supplement of cereal based diet. In India, black gram occupies 12.7 per cent of total area under pulses and contribute 8.4 per cent of total pulses production. Among the pulses, the urdbean or blackgram is grown both as pure and mixed crop along with maize, cotton, sorghum and other millets. Every adult needs a minimum consumption of 80g and 47g of pulses as per WHO and Indian Council of Medical Research respectively to meet the daily protein requirement. In India, area under blackgram cultivation is about 3.24 lakh hectares, production is 1.95 lakh tonnes and productivity is 604 kg ha^{-1}. The low productivity is due to the fact that pulses are grown mostly in marginal and rain fed areas. The main constraint in raising the productivity levels of pulses in dry land agriculture is the inadequacy of soil moisture and poor fertility status of the soil. The low productivity is also due to the lack of quality seed of high yielding varieties/hybrids (Karivaratharaju and Ramakrishnan, 1985). To overcome the adverse environmental conditions like low rainfall & low soil moisture which prevent the germination & seedling establishment, seed priming is given as a presowing seed treatment which act as a boon to the farmers in dryland agriculture. Botanical seed treatment is extracted from naturally occurring sources based on botanical ingredients. It is a liquid formulation which is effective against problems that occur in cold wet soils especially limited disturbance and no-till operations and areas of low moisture. It has synergistic effect on early and uniform seed germination and enhance tolerance to pest and disease during early crop stage. It controls soil and seed-borne fungal disease. Seed priming has presented promising and even surprising results for many seeds including legume seeds (Knypl and Khan, 1981) and Bradford, 1986). The direct benefits of seed priming in all crops are faster emergence, more and uniform stands, less need to re-sow, more vigourous plants, better drought tolerance, earlier flowering, earlier harvest and higher seed yield. The present study will emphasize

Author for correspondence : E-mail : a.kamaraj@yahoo.co.in

on the effect of seed priming with various leaf extracts on seed and seedling characteristics of blackgram CO 6.

Materials and Methods

The present investigation was carried out by using genetically pure seeds of blackgram cv. CO 6 obtained from Tamilnadu Agricultural University, Coimbatore, Tamilnadu, India. Laboratory analysis was conducted at the Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Chidambaram. The bulk seeds were cleaned manually to remove unwanted material from the seed lot and was graded using BSS 8 × 8 sieve for uniformity. After cleaning and grading the seeds were first, pre-conditioned by keeping the seeds in between two layers of moist gunny bag for one hour to avoid soaking injury. After preconditioning, the seeds were soaked in respective priming solutions at 1/3rd volume of seeds for four hours. Then the seeds were air dried under the shade to bring back to their original moisture content and used for sowing (Renganayaki and Ramamoorthy, 2015).

Preparation of plant leaf extract

The fresh leaves of the concerned plants were collected separately and dried under shade. The shade dried leaves were powdered using mortar and pestle. Then exactly weigh one gram of leaf powder using weighing balance and dissolved in 100 ml of distilled water which was measured already in the beaker to make 1% leaf extract. The leaf extract was filtered by using muslin cloth to remove unwanted material and leaf debris.

Treatment details

T_0 – Control

T_1 – *Moringa* leaf extract 1%

T_2 – *Prosopis* leaf extract 1%

T_3 – *Neem* leaf extract 1%

T_4 – *Pungam* leaf extract 1%

T_5 – *Arappu* leaf extract 1%

Germination test was conducted with 4 × 100 seeds some each treatment was carried out in sand media in a germination room maintained at a temperature of 25 ± 1°C RH of 96 ± 2% with diffused light. The final count based on normal seedling was recorded on seventh day and the mean germination was recorded in percentage (ISTA, 1999). Observations can be recorded on germination percentage, speed of germination, root length, shoot length, seedling length, dry matter production, vigour index-I and vigour index-II. The data were statistically analysed using ANOVA.

Results and Discussion

Seed priming is one of the presowing seed treatment techniques, which had a significantly positive effect on different aspects of seed and seedling quality characteristics under laboratory and field condition. In this present laboratory study, seeds were evaluated for their physiological quality and morphological qualities. The germination percentage was ranged from 95% to 84% which were significantly different over the various seed priming treatment. *Prosopis* leaf extract 1% primed seed (T_2) recorded the highest germination (95%) whereas untreated seed (T_0) recorded the lowest germination (84%). Higher germination and 22.91% increase in germination percentage recorded by T_2 over control (T_0) might be due to the biochemical changes like enzyme activation involved in cell wall modification, gibberellins like substances biosynthesis (Lee *et al*., 1998; Lee and Kim, 2000; Basra *et al*., 2005) were released during the phase II of germination which triggers the synthesis of hydrolytic enzymes that causes the early availability of high energy compounds and vital biomolecules to the seedling germination (Renugadevi and Vijayageetha, 2006; Basra *et al*., 2006). Increase in germination indices may be due to the priming treatment that induces activation of the pre-germinative metabolism might imprint in seeds a sort of "Stress memory" or "Priming memory" (Chen and Arora, 2012) and also due to the activation of gibberellin biosynthesis, protein synthesis, enzyme activation in cell wall modification for radicle protrusion and antioxidant mechanisms to combat DNA damage (Macovei *et al*., 2010).

Among the seed treatments *Prosopis* leaf extract 1% primed seed (T_2) recorded the highest speed of germination (26.50) and the untreated seed (T_0) recorded the lowest speed of germination (20.50). Higher speed of germination and 29.26% increase in speed of germination (T_2) recorded over the control (T_0), which might be due to the presence of growth promoting substance present in *prosopis* leaf extract 1%, which migrates into the seeds might have brought this positive effect. Early germination and increase in speed of germination may be due to the role of calcium as an enzyme cofactor in germination process by increase in protein synthesis as reported by Christansen and Foy (1979) and also the greater hydration of colloids and higher viscocity of protoplasm and cell membrane that allows the early entrance of moisture, which can activates the early phase of hydrolyzing the reserve food material in the seed when compared to untreated seed (T_0). This findings was in conformity with previous works of

Table 1 : Effect of botanical seed treatment on germination and seedling characters in blackgram cv. CO 6.

Treatment (T)	Germination (%)	Speed of germination	Shoot length (cm)	Root length (cm)
T_0	84.00 (66.42)	20.50	17.70	16.90
T_1	93.00 (74.66)	25.00	19.90	17.70
T_2	95.00 (77.08)	26.50	20.20	18.10
T_3	88.00 (69.73)	23.50	19.10	17.50
T_4	90.00 (71.56)	24.00	19.80	17.90
T_5	86.00 (68.02)	22.50	18.80	17.00
Mean	89.00 (71.24)	23.67	19.25	17.51
SEd	0.2567 (0.2553)	0.1881	0.0648	0.0965
CD (P=05)	0.5596 (0.5566)	0.4102	0.0917	0.2104

(Figures in parenthesis indicate arcsine transformed value)

Table 2 : Effect of botanical seed treatment on seedling length (cm), dry matter production (g seedling^{-10}), vigour index I and vigour index II in blackgram cv. CO 6.

Treatment (T)	Seedling length (cm)	Dry matter production (g seedling^{-10})	Vigour index I	Vigour index II
T_0	34.60	0.1140	2906.40	9.57
T_1	37.60	0.1240	3496.80	11.53
T_2	38.30	0.1330	3638.50	12.63
T_3	36.60	0.1200	3220.80	10.56
T_4	37.70	0.1220	3393.00	10.98
T_5	35.80	0.1170	3078.80	10.06
Mean	36.76	0.1217	3289.05	10.89
SEd	0.2614	0.0005	6.4766	0.1044
CD (P=05)	0.5698	0.0010	14.1190	0.2276

Merwade (2000), Rathinavel and Dharmalingam (2000), Hussain *et al*. (2015).

Prosopis leaf extract 1% primed seed (**T_2**) recorded the longest shoot length (20.20cm) and the control (**T_0**) recorded the shortest shoot length (17.70cm). *Prosopis* leaf extract 1% primed seed (**T_2**) recorded the longest root length (18.10cm) and the untreated seed (T_0) recorded the shortest root length (16.90cm). *Prosopis* leaf extract 1% primed seed (**T_2**) recorded the maximum seedling length (38.30cm) and the untreated seed (**T_0**) recorded the minimum seedling length (34.60cm). Higher values for seedling length and 10.69% increase in seedling length, 7.10% increase in root length and 14.12% increase in shoot length was recorded by **T_2** over the control (**T_0**). The increase in root length and shoot length might be due to the fertilizing effect of *prosopis* leaf extract resulting from the nutrient release from damaged or decayed tissue of storage organ by hydrolysis (Orr *et al*., 2005). The similar results were reported by (Suma, 2005; Farooq *et al*., 2008 and Shehzad *et al*., 2012).

Prosopis leaf extract 1% primed seed (**T_2**) had the heaviest dry matter production (0.1330g) and the untreated seed (**T_0**) recorded the lowest dry matter production (0.1140g). Higher dry matter production and 16.66% increase in dry matter production was recorded by **T_2** over the control (**T_0**). Increase in dry weight was claimed due to enhanced lipid utilization and enzyme activity and also due to the presence of bioactive substances like auxin in *prosopis* leaf extract (Rathinavel and Dharmalingam, 1999) and also due to the greater early vigour and higher germination percentage because of which the seedling had reached autotrophic stage well in advance than control (Srimathi *et al*., 2007) thus enabling them to produce relatively more quantity of dry matter which discerning the cause for the hike in dry matter production by priming treatment.

Prosopis leaf extract 1% primed seed (**T_2**) had the maximum values for vigour index I (3638.50) and the untreated seed (**T_0**) recorded the minimum vigour index I (2906.40). *Prosopis* leaf extract 1% primed seed (**T_2**) had the maximum values for vigour index II (12.63) and the untreated seed (**T_0**) recorded the minimum vigour index II (9.57). Higher vigour index and 25.18% increase in vigour index I and 31.97% increase in vigour index II was recorded by T_2 over the control (**T_0**). This increase in vigour index might be due to the beneficial effect of *prosopis* leaf extract seed priming which induces the growth promoting substances and translocations of secondary metabolites to the seedling growth. One of the functions of seed priming was increase the extra-embryo enzyme activity responsible for weakening the endosperm.

An alternate suggestion was given by Liptay and Schopfer (1983) the ability of embryo cells to initiate the metabolism necessary for extension growth is of prime importance. 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 (Rangaswamy *et al*., 1993; Basra *et al*., 2006 and Farooq *et al*., 2005). Priming affects the lag phase of germination and causes early DNA replication (Bray *et al*., 1989), increased RNA and protein synthesis (Fu *et al*., 1988), greater ATP availability, faster embryo growth (Dahal *et al*., 1990) and repair of deteriorated seed parts (Saha *et al*., 1990). The cumulative effect of nutrition of *prosopis* leaf extract and priming had enhanced the germination indices, seedling length and seedling vigour as evident from the improved seedling qualities.

Thus from the present study, it could be concluded that blackgram seeds should be primed with *Prosopis* leaf extract 1% for 4 hours @ 1/3rd volume of solution to enhance the seed and seedling quality characteristics under adverse environmental conditions. In addition, blackgram seeds may also be primed with *Moringa* leaf extract 1% to get the similar results.

Conclusion

The study reveals that seeds primed with *Prosopis* leaf extract 1% for 4 hours (**T$_2$**) recorded higher values for germination percentage (95%), speed of germination (26.50), shoot length (20.20cm), root length (18.10cm), seedling length (38.30cm), dry matter production (0.1330g seedling^{-10}), vigour index I (3638.50) and vigour index II (12.63). The increase in seed quality characters was due to the presence of bioactive substances, cumulative effect of nutrition of *Prosopis* leaf extract. Hence, the seeds primed with *Prosopis* leaf extract 1% is recommended to enhance the seed quality characters of blackgram.

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