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INFLUENCE OF SEED HARDENING ON GROWTH AND SEED YIELD ATTRIBUTES IN BRINJAL (*SOLANUM MELONGENA* L.)

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Abstract

A field experiment was conducted during June 2017 in the experimental farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalainagar, Chidambaram, Tamil Nadu, to study the influence of seed hardening on growth and seed yield attributes in brinjal (*Solanum melongena* L.) *c.v.* Annamalai. The field experiment was laid out in a Randomized Block Design with three replications. The principles of this study, is to assess the seed quality as an impact by the seed hardening. The seeds were collected from the Vegetable Research Station, Palur in Cuddalore District. The collected seeds were cleaned and soaked in different plant growth hormones *viz.,* GA_3, IBA, Panchagavya and inorganic chemicals *viz.,* NaCl, $CaCl_2$ and KNO_3 and Water. All the hardened seeds recorded significantly higher growth and seed yield attributes over the control. The seeds hardened with plant growth hormones recorded higher value than inorganic salts and water. Among them, Panchagavya hardened seeds recorded significantly the highest values for growth characters *viz.,*plant height (107.97cm), number of branches per plant (15.74), days to first flowering (67.28), days to 50% flowering (78.19) and dry matter production (135.32) and seed yield contributing characters *viz.,* number of fruits per plant (28.96), fruit length (12.72cm), fruit girth (17.09cm), fruit weight (98.21g), fruit yield per plant (2.42 kg), seed yield per fruit (2.09 g) and seed yield per plant (60.53g) followed by GA_3 which recorded the growth attributes *viz.,* plant height (105.60 cm), number of branches per plant (15.20), days to first flowering (69.45), days to 50% flowering (80.42) and dry matter production (133.87 mg/plant) and yield parameters *viz.,*number of fruits per plant (28.13), fruit length (12.42cm), fruit girth (16.71cm), fruit weight (96.62g), fruit yield per plant (2.28 kg), seed yield per fruit (2.01g), and seed yield per plant (56.54g) than the other treatments and control**.** Among the seed hardening treatments, panchagavya hardened seeds exhibited better results for growth and seed yield attributes compared to control. Hence, this study expressed clearly that the seed hardening with Panchagavya stands first, followed by GA_3 and IBA enhanced the growth and seed yield attributes in brinjal.

Key words: Brinjal, Seed hardening, GA_3, Panchagavya, KNO_3, IBA, Growth attributes and Seed yield

Introduction

Eggplant, (*Solanum melongeena* L.) otherwise called aubergine or brinjal. In many countries, the brinjal is an important vegetable crop. It is a resident of India. The eggplant was cultivated in developing nations *viz.,* India, Japan, Indonesia, China, Bulgaria, numerous African nations, Italy, France, and USA. India contributes 12,987 thousand metric tons to the global production of brinjal and ranks second after China with an area of 680 thousand hectares (NHB, 2015).

In Tamil Nadu, brinjal is grown under rainfed as well as irrigated condition. In Cuddalore District, it is cultivated in a 207 ha area with production of 3,413 Mt. Chidambaram comes under the coastal region of Cauvery delta. The cultivated area was said to be slightly salinity and the availability of water table also low. This makes the farmers to shift over to hardy vegetable crops than the regular crops like paddy and pulses. Among the vegetable crops, solanaceous vegetables have high demand in our state as well as in the country. Brinjal is one of the most important edible and nutritious vegetable crop. The need for the crop is a year round owing to the versatility of its usage, both in edible and medicinal property. Annamalai brinjal hold the first place than other available varieties. Annamalai brinjal was developed at the Department of Horticulture, Faculty of Agriculture, Annamalai University.

Pre sowing seed hardening treatments will provide

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initial nourishment for germinating seeds. It also helps to achieve uniform stand in the field. Pre sowing seed treatments have done in order to impart resistance against stress conditions (Balamurugan *et al.,* 2003).

The panchagavya is cheaper ecofriendly organic preparations made by cow products, namely dung, urine, milk, curd and ghee. The panchagavya is an efficient plant growth stimulant that enhances the biological efficiency of crops. It is used to activate soil and to protect the plants from disease and also increase the nutritional quality of fruits and vegetables.

By keeping afore said in view the following experiment was conducted with various seed hardening products *viz.,* GA_3-, IBA, Panchagavya, NaCl**,** $CaCl_2$**,** KNO_3 and water compared along with the control.

Materials and Methods

A field experiment was conducted in the Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalainagar, Chidambaram, Tamil Nadu, during June 2017**.** Genetically pure seeds of brinjal were obtained from the Vegetable Research Station, Palur, Cuddalore District, was used in this study. Seeds were hardened with plant growth hormones, inorganic salts, water and compared with control.

Treatments details:-

The experiment was comprised of eight treatments involving one as a control (without hardening) as detailed below:-

T_1 - GA_3- @ 100 ppm (soaking seeds for 6 hours)

T_2 – IBA @ 100 ppm (soaking seeds for 6 hours)

T_3 - Panchagavya @ 3% (soaking seeds for 30 minutes)

T_4 - NaCl @ 2% (soaking seeds for 6 hours)

T_5 - $CaCl_2$ @ 2% (soaking seeds for 6 hours)

T_6 - KNO_3@ 2% (soaking seeds for 6 hours)

T_7 – Water (soaking seeds for 6 hours)

T_8 – Control (without soaking)

Observations were recorded for growth attributes and seed yield attributes from five randomly selected plants from each treatments replication wise.

Growth attributes:-

Days to first flowering

The number of days taken from the date of sowing to anthesis of first flower in the first flower cluster was recorded and expressed in numbers.

Days to 50% flowering

Number of days taken from sowing to 50 per cent flowering in the total population was recorded and the mean value was expressed as days to 50% flowering in whole numbers.

Number of branches per plant

The branches arising from the primary and secondary stem were counted at the time of the last harvest and expressed in numbers.

Plant height (cm)

The height of the plant from the ground level to the tip of the main stem was measured at the time of the last harvest and expressed in centimeters.

Dry Matter Production

Five randomly selected plant samples were collected, washed, air dried to obtain constant weight. Oven dried at $80^0C \pm 5^0C$ for 48 hours till reaching a constant weight. Estimation of dry matter was recorded at harvest stage the DMP was calculated and expressed in kg ha^{-1}.

Seed yield attributes:-

Number of fruits per plant

The number of fruits per plant was recorded at each harvest and the total number of fruits of all the harvest was recorded as fruits per plant and expressed in numbers.

Fruit length (cm)

Randomly selected five fruits were measured from blossom end to pedicel end (polar diameter) with measuring scale and expressed in centimeter.

Fruit girth (cm)

Fruit girth was recorded by measuring the circumference of randomly selected five fruits at the broadest portion using measuring tape and expressed in centimeter.

Fruit weight (g)

The weight of five randomly selected fruits in each replication was measured and the mean weight of the fruit was expressed in grams.

Fruit yield per plant (kg)

The weight of fruits per plant was recorded at each harvest and the total weight after all the harvest was recorded a yield per plant and expressed in kilogram.

Seed yield per fruit (g)

The weight of the seeds per fruit was recorded as seed yield per fruit and expressed in gram.

Seed yield per plant (g)

The weight of the seed per plant was recorded at each harvest and the total weight after all the harvest

was recorded as a seed yield per plant and expressed in gram.

Statistical Analysis

The experiment comprised of eight treatments including control with three replications of each. The experiment was laid out in a Randomized Block Design. The data's collected from the field experiment for growth and seed yield parameters were statistically analyzed using ANOVA as suggested by Panse and Sukhatme (1985). The critical difference (CD) was computed at 5% probability.

Results and Discussion

Growth attributes:-

Drought resistance of the plant is one of the very important factors to get the highest yield. Though, this is largely depends on the genetic makeup of the variety, Pre-sowing Seed treatments like hardening also practiced to defy the ill effects of drought on the emergence and growth of the crop. (Balamurugan *et al.,* 2003). In the present study, highly significant difference was noticed due to hardening with organic as well as inorganic products for all the evaluated growth and seed yield attributes.

Among the growth traits, seeds hardened with panchagavya (3%) registered higher values for plant height (107.97cm), number of branches per plant (15.74), days to first flowering (67.28 days), days to 50% flowering (78.19 days) and dry matter production (135.32 mg/plant) followed by GA_3 and IBA which are on par with each other. Seeds hardened with chemicals *viz.,* NaCl, $CaCl_2$ and KNO_3 showed minor variations in all growth characters and said to be on par with each other. On the other hand seeds without hardening (control) recorded minimum values for all growth traits studied *viz.,* plant height (98.15 cm), number of branches per plant (13.46), days to first flowering (76.44 days), days to 50% flowering (87.46 days) and dry matter production (126.16 mg/plant). (Table 1).

The studies clearly represent that there was significant improvement in seed hardening with panchagavya. Plant height and number of tillers were more with the seeds hardened with panchagavya (3%). Nearly 9.08 % increase in plant height and 14.4% increase in the number of branches per plant was noticed over the control. This may be due to the action of panchagavya contains many macronutrients, essential micronutrients growth promoting factors like IAA, GA and beneficial microorganism which increases the cell division and cell elongation. Besides this, the presence of cytokinin also influences the growth rate of brinjal crop. Similar findings were reported by Natarajan, (2002), Sreenivasa *et al.,* (2010) and Vallimayal and Sekar (2012). Seed hardening with GA_3 and IBA was the next best treatment and resulted in significantly higher values for plant height (105.60cm and 105.36cm) and number of branches (15.20 and 15.12) respectively. This could be due to the application of hormone which have a great effect on root development and root proliferation, which leads to more absorption of nutrients from the soil leads to increase plant height and number of branches. These results are in concordance with the findings of Alvarez *et al.,* (1989), Hussain *et al.,* (2004) and Stefancic *et al.,* (2005).

Minimum days to first flowering (67.28 days) and 50% flowering

Table 1: Effect of seed hardening on growth attributes in brinjal.

Treat ments	Plant height (cm)	Number of branches per plant	Days to first flowering	Days to 50% flowering	Dry Matter Production (mg/plant)
T_1	105.60	15.20	69.45	80.42	133.87
T_2	105.36	15.12	69.56	80.61	133.61
T_3	107.97	15.74	67.28	78.19	135.32
T_4	102.80	14.66	72.08	83.09	130.88
T_5	102.85	14.72	71.93	82.96	131.03
T_6	102.94	14.87	71.74	82.79	131.24
T_7	100.48	14.08	74.26	85.28	128.52
T_8	98.15	13.46	76.44	87.46	126.16
S.Ed.±	1.08	0.24	1.01	1.01	0.63
CD (P=0.05)	2.31	0.52	2.16	2.16	1.34

Table 2: Effect of seed hardening on seed yield attributes in brinjal.

Treat ments	Number of branches per plant	Fruit length (cm)	Fruit girth (cm)	fruit weight (g)	fruit yeild/plant (g)	Seed yeild per fruit (g)	Seed yeild plant (g)
T_1	28.13	12.42	16.71	96.62	2.28	2.01	56.54
T_2	28.09	12.38	16.54	96.59	2.25	2.00	56.18
T_3	28.96	12.72	17.09	98.21	2.42	2.09	60.53
T_4	27.25	11.97	15.87	95.03	2.07	1.88	51.23
T_5	27.27	12.01	15.99	95.09	2.10	1.91	52.09
T_6	27.3	12.07	16.16	95.14	2.13	1.93	52.69
T_7	26.43	11.67	15.66	92.68	1.94	1.76	46.52
T_8	25.63	11.36	15.26	90.28	1.78	1.61	41.25
S.Ed.±	0.36	0.14	0.16	0.63	0.05	0.03	1.27
CD (P=0.05)	0.76	0.29	0.34	1.34	0.11	0.06	2.72

(78.19) was registered with the seeds hardened with panchagavya. The reason could be due to the presence of some beneficial microorganism like Azospirillum, Pseudomonas, Azatobacter and Phosphobacteria which are help full in the fixation of N and P in soil. Nitrogen is essential components of plants, protein and chlorophyll, which is necessary for growth and flower formation. These findings are in line with the results of Pathak and Ram (2002), Naik and Sreenivasa (2009), Ali *et al.,* (2011), Saritha *et al.,* (2013) and Sarkar *et al.,* (2014).

Dry matter accumulation showed positively significant results for seed hardening with panchagavya (135.32 mg/plant) followed by GA_3 and IBA which are on par with each other. This may be due to the stimulated growth by increasing the amount of endogenous promoters *viz.,* auxin, gibberellin and cytokinine accompanied by a decrease in the content and activity of inhibitors present in panchgavya (Ali *et al.,* 2011, Sarkar *et al.,* 2014, Ragavandra *et al.,* 2014 and Sivakumar, 2014).

The next best treatment like GA_3 and IBA showed nearly 5.75% and 5.57% increase over the control in dry matter production. This may be due to the increased endogenous GA activity leads to increase nitrogen uptake and regulation of different metabolic process on accumulation of chlorophyll leads to shoot up in dry matter production. Similar findings were reported by Abbas and El-Saeid, (2012). Amin *et al.,* (2006).

Seed yield attributes:-

The increment in yield characters was more pronounced with the seeds hardened with panchagavya followed by GA_3 and IBA. The yield traits *viz.,* number of fruit per plant, fruit length, fruit girth, fruit weight, fruit yield/plant, seed yield per fruit and seed yield per plant were showed 11.49%, 10.69%, 10.76%, 8.07%, 26.44%, 22.96% and 31.85% respectively over the control. (Table. 2) This may be due to the presence of macro nutrients, essential micronutrients, many vitamins, required amino acids, growth promoting substances and beneficial microorganisms in panchgavya which act as an essential plant growth stimulant that enhanced the biological efficiency of crop plants, quality of fruits and yield. A similar report was made by Natarajan, (2002), Somasundaram *et al.,* (2003), Vennila and Jayanthi (2008), Sarkar *et al.,* (2014) and Singh *et al.,* (2018).

Seed hardened with GA_3 and IBA observed as the next best hardening treatment by registered the higher values for all yield contributing traits over control. This may be due to the increased photosynthetic activity and consequences of increased translocation and accumulation of microelements in plant organs by the GA_3 and IBA. Besides this, IBA retard chlorophyll destruction and increase the biosynthesis or stabilize the thylakoid membrane which retard senescence by altering the permeability of membranes. This finding was on par with the report of Chhun *et al.,* (2004), Da Silva, (2006) and Loannidis *et al.,* (2009).

Conclusion

From the study, it is concluded that brinjal seeds hardened with panchagavya 3% suggested as the best ecofriendly treatment followed by GA_3 (100ppm) and IBA (100ppm). This may be recommended for the farmer for further commercial exploitation in Brinjal.

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