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Impact of Organic Seed Priming Amendments and Botanicals on Seed Quality Parameters of French Bean (*Phaseolous vulgaris L.*)

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A B S T R A C T

The current experiment was conducted to evaluate the Performance of Organic amendments and botanical treatments on seed quality parameters of French bean under stimulated environmental conditions. An experiment was conducted in 2021 at postgraduate seed testing laboratory, Department of Genetics and Plant Breeding Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The French bean Cultivar Arka Bold seeds were used for priming. Organic treatments are designated as Panchagavya 2%, 4%,6%,8%, Agniasthra 2%,4%,6%,8% and Botanicals treatments are Tulasi leaf extract 5%, Aloevera leaf extract 5%, Vinca rosea leaf extract 5% and also did hydroprming treatment using distilled water respectively. Seeds were soaked in organic, botanicals and in distilled water for duration of 6 hours followed by shade drying. The results were obtained and it was found that all the treatments showed significant effect on quality parameters. The highest was found in panchgavya of all doses followed by tulasi leaf extract found to be best in Germination percentage, Speed of Germination, Root length, Shoot length, Seedling length, Seed vigour index-I, Seed vigour Index-II compared to control or untreated seeds which indicates the effect of organics and botanicals on physiological processes of the seeds. This study revealed that priming with organic amendments and botanicals can be effective in enhancing the seed quality parameters of french bean and they are low cost, effective and nature friendly and toxic free.

Introduction

India is the largest producer of legume crop in the world. Accounts for 25% Global production, 27% of world consumption and 14% of importer. Since ages, Pulses have been well integrated into the farming system of our country as the farmer could produce them by using their own seeds and family labour without depending on much external inputs. French bean it is a major vegetable crop where indigenous pulses are also preferred (Kay

1979 and duke 1981). According to the Food and agricultural organisation (FAO) of united nations, India is the world leader in production of dry seed of French bean as well as green beans and vegetable production. Followed by brazil and Myanmar in dry seed of French bean. On the other hand china is world leader in production of green beans followed by Indonesia and then turkey (FAOATAT, 2010).

French bean (*Phaseolous vulgaris* L.) commonly known as Kidney bean, Common bean, Snap bean, Navy bean, Haricot bean, Dry bean in different parts of the world. French bean is mostly grown and popular in India. It is a dipliod (2n=22) belongs to the family leguminaceae. The primary centre of origin is southern Mexico and central America. But now it is widely cultivated in India and other parts of the world.

French bean is self pollinated crop, flowers are pink, white or purple with standard and reflexed and di-adalphous stamens. It is a annual plant (Wortmann 2006).

Stem is slender and twisted. Pods are slender curved or straight, borne mostly on axillary racemes. Leaves are large without leaflets, alternate and trifoliate. Seeds are non endospermic.

Seed priming is one of the primitive techniques used to enhance early seed emergence and initiates several processes involved in the seed germination (Asegedom *et al.*, 2001). Therefore seed priming boosts the imbibition and metabolic processes resulting in enhanced seed germination, uniform germination, seedling growth and development in both normal and stressed conditions (Ansari *et al.*, 2012).

Seed priming is a physiological method of controlled hydration and drying to enhance sufficient pre germinative metabolic process for rapid germination and it improves the quality of the seed by enhancing the seed germination due to enzyme activation, metabolic activities, biochemical process of cell repair, protein synthesis and improvement of the antioxidant defence system compared to unprimed. Different priming techniques like Hydropriming (soaking in water), Halo priming (soaking in inorganic salt solutions), Osmo priming (soaking in osmotic solution with low water potential), Nutri priming (soaking seeds in nutrients solutions rather than pure water), Bio priming (soaking in solution containing benificial microorganisms).

Solid matrix priming (seeds are incubated to solid insoluble matrix for a given time), Phyto priming (soaking seeds in botanical or leaf extracts), Organic priming (soaking in organic solutions).

Recent studies on paddy (Shankuntala *et al.*, 2012) found that organic priming enhances seedling vigour and enzyme activity, Panchagavaya on Okra, tomato and french bean showed miraculous result (Gayathri *et al.*, 2015) and (Dasarathan *et al.*, 2018) panchagvaya on okra found better germination and meristamatic growth (Kamatchi Kalal *et al.*, and Eskaiamma *et al.*, 2019) showed that panchagvaya priming seeds of leafy vegetables like fenugreek and amaranthus showed increased rate of germination rate, biomass and enhanced growth.

However, organic priming is more affordable so even small scale farmers can practise Keeping this into consideration need for its improvement for quality and yield. This can be achieved by maintaining the plant population by organic priming.

Materials and Methods

This experiment was conducted at the seed testing laboratory, Department of Genetics and Plant Breeding, Naini, Sam Higginbottom

university of Agriculture, Technology and Sciences, Prayagraj, (U.P) during rabi-2021 to evaluate "Impact of organic seed priming amendments and botanicals on seed quality parameters of French bean (*Phaseolous vulagaris* L.).

The French bean cultivar of Arka Bold seeds were treated with organics and botanicals to evaluate the seed quality parameters.

The seeds are subjected to different soaking intensities over a period of 6 hours followed by shade drying. One hundred seeds in each replication were placed on blotter paper. Laboratory experiment using a complete randomized design with four replications. Seed quality parameters were determined according to standard procedures prescribed in roll towel method in germination cabinets with application of standard temperature T20-100 degrees centigrade for 9 days at 95% relative humidity.

Quality parameters were taken as per ISTA standards such as Germination percentage, speed of germination, root length, shoot length, seedling length, fresh weight, dry weight, seedling vigour index-I, seedling vigour index-II. The data was collected on ten randomly selected healthy seedlings from each replication and different observation were recorded.

Panchagavya was prepared from cow products viz. Cow milk(5 L), ghee (2 L), curd (2 kg), cow urine (5 L) and cow dung (5 kg); Cow curd - 2 litres Tender coconut water - 3 litres Well ripened poovan banana – 12 nos ingredients were mixed together along with 15kg of jaggery in a circular container. The mixture was added with 15 L water and kept as such for 30 days. Fermentation took place by making the mixture to a fine concentrate giving out the sweet odour. The fermented liquid was filtered through cotton and the final volume of filtrate was made 1000 ml. The solution was stored in cool conditions.

Agniasthra solution

It is composed of 10 litre Local Cow Urine and1 Kg Tobacco, 500gm of Green Chilli, 500 Gram Local Garlic, 5 Kg Need leaves pulp (crushed in urine). Grind all the ingredients into fine paste and mix with cow urine. Boil this for four times. Leave it for 48 hrs, filter it and mix some water and sprinkle over the plants. You can save and use for 3 months. For the preparation of panchgaavya and agniasthra solutions for priming, Take 20 ml,40 ml,60 ml,80 ml of both panchagvaya and agniasthra solutions were mixed in 100ml of distilled water in each separate beakers to make 2%,4%,6%,8% doses of both solutions. For the preparation of botanicals, leaf extracts of tulasi, vinca rosea, aloevera were Horticulture Research Fileds, SHUATS. These leaves were shade dried and made into fine powder.5g of each powder dissolved in 100 ml of distilled water in 5% solutions. Aloevera leaf extract is made by grating the aloe extract, take 5g of aloevera with 100ml of distilled water to make the 5 % sloution.

Results and Discussion

Germination percentage

Priming with panchagavya of all doses showed better germination percentage highest germination was recorded in treatment T4 (panchagavya @8%)- (94.000%) par with treatments T3,T2,T1 panchagavya doses (6%.4%,2%) T3-panchagavya 6% (91.000), T2-panchagavya 4% (90.000%),T2 - panchagavya 2% (89.000%) followed by (Tulasi leaf extract @5 %) T9 - 87.750% when compared with control T0 Control - 77.000 which is lowest

Speed of germination

Priming with panchagavya of all doses

showed significant effect on speed of germination and highest was recorded in treatment T4 (panchagavya @8%)- (29.303) followed by treatments T3,T2,T1 panchagavya doses (6%.4%,2%) T3-panchagavya 6% (27.366), T2-panchagavya 4% (26.151),T1-panchagavya 2% (24.736) followed by (Tulasi leaf extract @5 %)- T9 24.729 when compared with control T0 Control - 18.197 which is lowest.

Root length

Priming with panchagavya of all doses showed better performance on root length and Highest was recorded in treatment T4 (panchagavya @ 8%)- (15.788cm) followed by treatments T3,T2,T1 panchagavya doses (6%, 4%, 2%) T3- panchagavya 6% (15.033 cm), T2 - panchagavya 4% (14.060 cm), T1-panchagavya 2% (13.488cm) followed by Tulasi leaf extract@5% T9 -13.140 cm when compared with control T0-10.188cm which is lowest.

Shoot length

Priming with panchagavya of all doses showed better performance on shoot length and highest was recorded in treatment T4 (panchagavya @8%)- 15.733 cm followed by treatments T3,T2, T1 panchagavya doses (6%.4%,2%) T3- panchagavya 6% (14.753cm), T2- panchagavya 4% (13.853cm), T1 panchagavya 2% (13.503cm) followed by (Tulasi leaf extract @5 %) T9- 13.225cm when compared with control T0 Control - 11.100 cm which is lowest.

Seedling length

Priming with panchagavya of all doses showed better performance on seedling length and highest was recorded in treatment T4 (panchagavy@8%) -31.520cm followed by treatments T3, T2, T1 panchagavya doses 6%,4%,2% T3-panchagavya 6% (29.785 cm), T2 – panchagavya 4% (27.913 cm),T1 - panchagavya 2 % (26.990 cm) Followed by (tulasi leaf extract@5%)T9 - 26.338cm when compared with T0-22.863cm which is lowest.

Fresh weight

Priming with panchagavya of all doses showed better performance on fresh weight and highest fresh weight was recorded in treatment T4 (panchagavya@8%) - 8.310g followed by treatments T3,T2,T1 panchagavya doses6%,4%, 2% T3- panchagavya 6 % (8.135g), T2 - panchagavya 4% (7.998g), T1-panchagavya 2 % (7.810g) Followed by (tulasi leaf extract@5%) T9 - (7.618g) when compared with T0-5.018g which is lowest

Dry weight

Priming with panchagavya of all doses showed better performance on dry weight and highest dry weight was recorded in treatment T4 (panchagavy@8%) - 3.033g followed by treatments T3, T2,T1 panchagavya doses 6%,4%,2% T3-panchagavya 6% (2.920g), T2-panchagavya 4% (2.833g), T1- panchagavya 2(2.775g) followed by (tulasi leaf extract@5%)T9 -(2.703g) when compared with T0-2.205g which is lowest

Seedling Vigour Index -I

Priming with panchagavya of all doses showed better performance on seedling vigour index-I and highest was recorded in treatment T4 (panchagavy@8%) -(2,962.100) followed by treatments T3, T2,T1 panchagavya doses 6%,4%,2% T3-panchagavya 6% (2,708.475), T2-panchagavya 4% (2,512.315),T1-panchagavya (2,402.045) followed by (tulasi leaf extract@5%) T9 -(2,310.730) when compared with T0-1,760.720 which is lowest.

Table.1 Mean Performance of seed quality parameters due to various priming treatments in French bean

S.no	Treatments	Germination Percentage	Speed of germination	Root length	Shoot length	Seedling length	Seedling fresh weight	Seedling dry weight	Seedling Vigour Index-I	Seedling Vigour Index-II
1	T0	77.000	18.197	10.188	11.100	22.863	5.018	2.205	1,760.720	163.418
2	T1	89.000	24.736	13.488	13.503	26.990	7.810	2.775	2,402.045	244.290
3	T2	90.000	26.151	14.060	13.853	27.913	7.998	2.833	2,512.315	253.610
4	T3	91.000	27.366	15.033	14.753	29.785	8.135	2.920	2,708.475	265.705
5	T4	94.000	29.303	15.788	15.733	31.520	8.310	3.033	2,962.100	284.985
6	T5	85.000	23.852	11.375	12.103	24.103	6.115	2.340	2,049.080	198.915
7	T6	86.000	24.022	11.795	12.373	24.540	6.480	2.425	2,111.005	208.565
8	T7	86.500	24.214	12.115	12.748	25.118	6.845	2.503	2,173.775	216.480
9	T8	86.500	23.628	12.605	12.955	25.403	7.075	2.570	2,197.645	222.280
10	T9	87.750	24.729	13.140	13.225	26.338	7.618	2.703	2,310.730	239.175
11	T10	84.000	23.778	10.825	11.823	23.813	5.890	2.253	2,000.270	189.185
12	T11	82.000	21.741	10.420	11.510	23.305	5.498	2.228	1,910.905	180.510
13	T12	87.500	24.407	12.635	12.900	25.535	7.338	2.633	2,234.620	230.380
Grand mean		79.98	24.31	12.574	12.967	25.940	6.933	2.570	2256.437	222.884
C.D		3.281	1.853	0.606	0.631	1.101	0.340	0.054	127.222	10.102
SE(m)		1.143	0.645	0.211	0.220	0.383	0.119	0.019	44.308	3.518
SE(d)		1.616	0.913	0.298	0.311	0.542	0.168	0.026	62.661	4.975
CV		2.638	5.308	3.356	3.390	2.957	3.419	1.453	3.927	3.157

Seedling Vigour Index-II

Priming with panchagavya of all doses showed better performance on seedling vigour index-II and highest was recorded in treatment T4 (panchagavya @ 8%) - (284.985) followed by treatments T3, T2, T1 panchagavya doses 6%,4%,2% T3-panchagavya 6% (265.705), T2-panchagavya 4% (253.610), T1-panchagavya (244.290) Followed by (tulasi leaf extract@5%)T9 - (239.175) when compared with T0- 163.418 which is lowest.

Microbes and growth promoters in panchagavya promoter's germination ability. In the present study also the presence of certain growth hormones interfere with germination ability. Panchagavya has been reported to contain micronutrients, macronutrients, many vitamins, essential amino acids, growth promoting factors and beneficial microbes. The higher root and shoot length may be due to the presence of easily available organic C, N, P, K. This availability is very much required for plant nutrition. Increase in the fresh weight and dry weight of different plant parts due to improved mobilization of nutrients. Rapid germination of seeds due to priming ultimately could lead to the production of larger seedlings. The results presented confirm that primed seed exhibit early vigour and produce significantly taller root and shoot and thereby heavier seedlings due to enhanced activity of alpha-amylase.

Similar results were observed and confirmed by Gayathri *et al.,* (2015), Saritha *et al.,* (2013), Pavan shinde *et al.,* (2019) and Kamatchi kalal *et al.,* and R. Esakiamma *et al.,* (2019).

From the present investigation it is concluded that pre soaking treatments with organic amendments and botanicals can be used for the enhancement of germination and vigour of the French bean. Organic priming with panchagavya of all treatment T4@8%,T3@6%,T2@4%,T1@2% doses found to be best among all the treatments followed by T9 treatment -tulasi leaf extract @5% and T0- control being the lowest. The experimental observations of increase in percentage of panchagavya dosage showed increase in germination and quality parameters which indicates the effect of organics and botanicals on physiological processes of the seeds. However percentage of doses varied for crop to crop. Organic amendments and Botanicals being cheap, nature friendly and easily available to farmers can be efficiently used for improving seed quality parameters.

Future scope

Further experiment need to be done on field condition for more better result and findings.

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