

Influence of pre-sowing seed treatments with Botanical and organics on yield attributing traits and seedling parameters of cluster bean (*Cyamopsis tetragonoloba* L) variety: RGC1066

ABSTRACT

The current global scenario firmly emphasizes the need to enhance eco-friendly agriculture practices for sustainable agriculture. Chemical agriculture has made an adverse impact of the health care of not only soil but also the beneficial soil microbial communities and the plants cultivated in these soil. This eventually has led to a high demand of botanical and organic produce by the present day health conscious society and periodic attempts are being made by farmers all over the world to depollute. Application of heavy doses of chemical fertilizers and pesticides are being used by the farmers to get a better yield of various agricultural crops. These chemical fertilizers and pesticides decreased soil fertility and causes health problems to the consumers. The new approaches to the use of botanical and organic amendments in farming have proven to be effective means of improving soil structure, enhancing soil fertility and increasing crop yields. Botanical and organics play vital role in increasing soil fertility and increase yield. The study was designed to check the response of botanical and organics on yield and seedling quality parameters such as field emergence percent, plant height (30, 60, 90 DAS), days to 50% flowering, number branches per plant, number of pods per plant, number of clusters per plant, days to maturity, seed yield per plant, seed yield per plot, harvest index, germination percentage, speed of germination, root length, shoot length, seedling length, seedling dry weight, seedling fresh weight, seedling growth rate, root: shoot ratio, seed metabolic efficiency, mobilization efficiency, vigour index-I, vigour index-II, electrical conductivity. For this experiment the seeds of RGC1066 variety collected from department of genetics and plant breeding, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj during 2021-2022, to find out the influence of pre-sowing seed treatments with botanical and organics, seeds treated with panchagavya, beejamruth, jeevamruth, neem leaf extract and vermiwash at different concentrations viz 2, 3, 5, and 10% for 12hours along with control (no treatment). It is found that all treatments showed improved performance than untreated seeds, but it was observed that seeds treated with panchagavya@10% for 12 hours performed better in comparison to other treatments. This study can be helpful to reach new horizons of research in the field of sustainable agriculture, natural resource conservation and seed technology to overcome with the germination problem and improving crop growth and yield eventually.

Keywords: cluster bean, panchagavya, beejamruth, jeevamruth, neem leaf extract, vermiwash, sustainable agriculture.

1. Introduction

Botanical and organic farming is drawing attention of the world since past few years. It is environment friendly, sustainable way of farming with zero use of chemicals. Adoption to ecofriendly and sustainable farming practices like use of botanical and organic treatments can

not only reverse the declining trend in the global productivity but also will help in environment protection (**Naikwadeet al., 2012**). Botanical and organic seed treatments reduce the use of chemicals and protect plants from seed borne diseases and pest. Organic seed treatments like panchagavya, beejamruth, jeevamruth, vermiwash and botanical seed treatments viz, neem leaf extract showed better results in yield and seedling parameters in cluster bean, which are made from locally available ingredients in the farm. These are rich in source of beneficial microorganisms and nutrients which help in the plant growth, help in getting good quality yield, increase in the germination percent in laboratory.

Cluster bean (*Cyamopsis tetragonoloba* (L). crop with a chromosome number of $2n=2x=14$ which is popularly known as guar, chavlikayai, guari, and khutti. It is a self-pollinated crop belonging to the family Fabaceae (**Kalyani, 2006**). The cluster bean is an annual, erect, herbaceous and robust legume. It has indeterminate growth habit and can grow up to 0.4 to 4.0 m. with a life cycle of 80 to 160 days; it has a deep taproot system with well-developed lateral roots. Roots are covered with light colored root nodules. Flowers borne in clusters giving the common name cluster bean, flowers pass through an array of from white to deep blue from the bud stage to petal drop, pods are linear, erect, clustered, beaked, compressed with double ridges on the dorsal side and single ridge on the front side. Pods are larger, fleshy and glabrous. A pod varies single and double seeded to twelve seeds and seeds are light gray, purpled coloured. The importance of guar has increased considerably in recent years due to the general ecological trend of utilizing polysaccharides of renewable plant origin in different industrial applications. Recently, galactomannans have also been used in the production of water proof biocide films (**Das et al., 2011**). On the other hand guar is considered as an excellent soil improvement crop, like other legumes, with respect to available nitrogen which improve yield of improvement crop, like other legumes, with respect to available nitrogen which improve yield of succeeding crops. It is used as an adsorbent in waste water treatment and in textile industry as a flocculating and exchanging agent. In waste water purification, guar gum is used as a gelatinizing agent (**Mathur et al., 2006**). The nutritional values per 100 gm of raw cluster bean is one of the most important and potential vegetable cum industrial crop grown for its tender pods for vegetable purpose and for endospermic gum (30-35%) (**Kumar and Singh, 2002**).

2. Materials and methods

RGC1066 cluster bean seeds (*Cyamopsis tetragonoloba* L.) variety was collected from the department of genetics and plant breeding, Sam Higginbottom University of Agriculture Science and Technology, Prayagraj were used to study under field conditions during Kharif, 2021-22. The climatic conditions recorded from the university meteorological station. The mean values of temperature, relative humidity, rainfall and wind speed were 33.85°C, 83%, 20.22mm, 14km/h respectively. Botanical and organic treatments were prepared as follows. Panchagavya was prepared from cow products viz, cow milk (2^{1/2}lit), ghee (1/2lit), cow urine (2^{1/2}lit), curd (1kg), cow dung (2^{1/2}kg) from locally available ingredients were mixed thoroughly along with (5kg) jaggery this mixture was added with 5lit of water and kept for fermentation for 30 days. After fermentation the fermented liquid was filtered through cotton and the final volume of filtrate was made 1000 ml. The solution was stored in refrigerator. 7 % solution was used for treatments.

Beejamrutham(**Protocol given by Palekar, 2006**) was prepared by using local cow dung(5kg) was taken in a cloth and bound by tape and was submerged in 20liters of water in separate container and kept stable for overnight. After 12 hours, this bundle of cow dung was squeezed thrice, 1kg of soil was dissolved in cow dung extract by stirring it well. To this 5liters of desi cow urine and lime water was added and mixed well. The seeds were immersed in beejamrutham solutions of different concentrations (2%, 5% and 10%) for 12 hours then dried in shed and later used for study.

Jeevamrutham was prepared by taking 125 g fresh cow dung, 375 ml cow urine(old), 50 g black jaggery , 50 g pulse flour and 2.5 g live soil mixed with 5 l of water. Solution was kept for 2-7 days in shade for fermentation. During fermentation, the solution was stirred daily. The lid of the container should be kept loose (Palekar, 2006). After fermentation The seeds were immersed in jeevamrutham solutions of different concentrations (2%, and 5%) for 12 hours then dried in shed and later used for yield and seedling quality parameters.

Neem leaf extract was prepared by collecting fresh leaves of neem plant, washed, dried under shade. The shade dried leaves were powdered using pestle and mortar. Then 30grams of leaf powder was taken using weighing balance and dissolved in 100ml of distilled water which was measured already in the beaker to make 3% leaf extract. The leaf extract was filtered by using muslin cloth to get rid of unwanted material and leaf debris. Seeds were soaked in the leaf extract at room temperature for 4hrs. the seeds were dried under shade and used for germination.

Vermiwash may be collected from the vermicompost units as a byproduct liquidextract. The coelomic fluid of earthworm is called as vermiwash.

After preparation of **Seeds soaking in the solution:**

solutions of Panchagavya, Beejamrutham, Jeevamrutham, Neem leaf extract, Vermiwash the selected crop variety (RGC1066) cluster bean seeds were soaked in required solution for 12 hrs at 25⁰C temperature. Untreated seed is called as control. After 12 hours of soaking, the solution is drained out from the beakers and pre-soaked were air dried to original weight and then seeds were sown in field for occurring field observations. after successful yield , the harvested seeds after a period of storage were used for germination in laboratory under controlled condition in the Department of Genetics and plant breeding.

The field parameters were collected from the Randomized block design with three replications. Observations on field viz, field emergence, plant height (30, 60, 90days), days to 50% flowering, number of branches per plant, number of pods per plant, number of clusters per plant, days to maturity, seed yield per plant, seed yield per plot, harvest index the data was collected and statistically analyzed using anova. the seedling quality parameters were collected from the complete randomized design with four replications. Observations on laboratory conditions are germination percent, speed of germination, root length, shoot length, seedling length, seedling growth rate, fresh weight of seedling, dry weight of seedling, root: shoot ratio, seed metabolic efficiency, Mobilization efficiency, vigour indices, electrical conductivity the data was collected and statistically analyzed using anova.

3. Results and discussion.

According to the findings, all the characteristics analyzed were influenced by the treatment and the difference between control (untreated seeds) and treated seeds in table 2& was entirely relevant. Researchers are recommending several pre sowing seed management techniques with the benefit of protection of soil fertility, production and high yield of crops and resistance to pest and diseases through seed borne. In the field experiment revealed that the panchagavya @10% for 12 hours recorded higher values for the yield and seed quality trails viz., field emergence(94.44%), plant height 30, 60,90 DAS (21.74cm, 40.81cm, 60.53cm) Kumaraveluet *al.*,(2009) it also shows best performance in days to 50% flowering(42days)Beaulah(2001), number of branches per plant(7.37), number of pods per plant(93.06), number of clusters per plant(8.33)Natarajan (2002), highest seed yield per plant(26.53g) and seed yield per plot with(852.05g) same results was observed by somasundaram (2003).panchagavya @10% also showed beat results in seed quality parameters like highest germination percent by (91%), speed of germination (25.52), highest root and shoot length was observed by T3 (11.50cm, 15.41cm)similar results were observed by Jayanth kumaret *al.*, (2017). Panchagavya also showed best results in seedling fresh weight and dry weight (5.58g, 0.473g) reported by Bagul *et al.*,(2018).Jayanth (2017) reported that panchagavya used to bring highest results in seedling growth rate, seed metabolic efficiency and vigour indices because of panchagavya contains beneficial microbes which naturally increases growth and yield of crops. Highest seed metabolic efficiency was recorded by the T3-panchagavya @10% compared to other seed treatments and crontro(untreated seeds) (0.627%),mobilization efficiency with(235.0%), and also shows best results in the vigour index-I and vigour index-II with(1959.3 & 31.26).

3.1 Growth Attributes:

The field emergence was found to significant and maximum was observed in T3-panchagavya@10% (94.4%) whereas minimum was observed in **T0- Control** (66.7%).The plant height@ (30, 60, at harvest) was found to significant and maximum was observed in T3-panchagavya@10% (21.74 cm, 40.81 cm, 60.53 cm) whereas minimum was observed by **T0- Control** (15.55 cm, 32.45 cm, 50.74 cm). The maximum number of branches per plant was observed by **T3-Panchagavya @ 10%** (7.37) whereas minimum number of branches per plant by **T0- Control** (3.8). similar results were also reported by **Balakrishnamurthyet al.**, (2006), **Anjuna, S and Vijayalakshmi, C.N (2014)**, **Vennila et al.**, (2008),**Sunil et al.**,(2012), **carol Lyngdonet al.**, (2017), **Patel et al.**, (2013), **Swaminathan et al.**, (2007), **Gopal et al.**, (2017).

3.2 Reproductive attributes:

Among thirteen treatments the days to 50% flowering found to be significant and the lowest days was reported in T3-panchagavya@10% (42.00) and it was followed by T₂-panchagavya @5% (42.66) and T₃.panchagavya @10 % (44.66).highest days to 50% flowering was found in untreated seeds (56.33). Days to maturity was found to be significant and least days was reported in **T3-Panchagavya @ 10%**(90) and maximum days to maturity was observed in **T₀ – Control** (107.3).

3.3 Yield attributes:

The Number of pods per plant was found to significant and maximum was observed in T3-panchagavya@10% (81.26) whereas minimum was observed in **T0- Control** (55.26).The Number of clusters per plantwas found to significant and maximum was observed in T3-panchagavya@10% (8.33) whereas minimum was observed in **T0- Control** (4.93).The **seed yield per plant**was found to significant and maximum was observed in T3-

panchagavya@10% (26.53g) whereas minimum was observed in **T0- Control** (13.32g).The Seed yield per plot was found to significant and maximum was observed in T3-panchagavya@10% (852.05g) whereas minimum was observed in **T0- Control** (333.31g).The Biological yield was found to significant and maximum was observed in T3-panchagavya@10% (347.62g) whereas minimum was observed in **T0- Control** (140.77g).The Harvest index was found to significant and maximum was observed in T3-panchagavya@10% (146.93%) whereas minimum was observed in **T0- Control** (78.66%).**Balakrishnamurthy et al., (2006), Anjuna, S and Vijayalakshmi, C.N (2014), Vennila et al., (2008), Sunil et al.,(2012), carol Lyngdonet al., (2017), Patel et al., (2013), Swaminathan et al., (2007), Gopal et al., (2017).**

3.4 Correlation coefficient:

As stated in table 05 correlation coefficient revealed that seed yield per plot showed positive significant association with number of seeds per plant, harvest index, biological yield, number of clusters per plant, number of pods per plant, days to maturity, plant height at harvest, 50% flowering at both phenotypic and genotypic levels, indicating an increase in seed yield with an increase in these characters. Similar findings were reported by S.Bisht et al.,(2018) vigour index-I showed positive significant association with number of seed metabolic efficiency, mobilization efficiency, seedling dry weight, seedling fresh weight, seedling growth rate, vigour index-II, root length, shoot length, seedling length at both phenotypic and genotypic levels, indicating an increase in seed yield with an increase in these characters.

3.6 path analysis:

Path analysis revealed that positive direct effect with the seed yield per plant, harvest index, biological yield, days to maturity, plant height at harvest on seed yield per plot on both phenotypic and genotypic level.

Table:1 Treatment details.

S.no	Treatment	Botanical and organics	Percentage	Duration
1	T ₀	Control	-	-
2	T ₁	Panchagavya	3%	12hours
3	T ₂	Panchagavya	5%	12 hours
4	T ₃	Panchagavya	10%	12 hours
5	T ₄	Beejamrutham	2%	12 hours
6	T ₅	Beejamrutham	5%	12 hours
7	T ₆	Jeevamrutham	5%	12 hours
8	T ₇	Jeevamrutham	10%	12 hours
9	T ₈	Neem leaf extract	3%	12 hours
10	T ₉	Neem leaf extract	5%	12 hours
11	T ₁₀	Neem leaf extract	10%	12 hours
12	T ₁₁	Vermiwash	3%	12 hours
13	T ₁₂	Vermiwash	5%	12 hours

Table 2: Analysis of variance for field parameters evaluated in cluster bean

S.NO	CHARACTERS	MEAN SUM OF SQUARES		
		REPLICATION S (df=2)	TREATMENTS (df=12)	ERROR (df=24)
1	Field Emergence %	8.20	0.09**	0.02
2	Plant Height@ 30 DAS	1.62	7.48**	1.46
3	Plant Height@ 60 DAS	68.98	27.59**	8.23
4	Plant Height@ 90 DAS	79.38	35.06**	11.08
5	Number of Branches per plant	0.05	2.63**	0.86
6	Days to 50% Flowering	40.92	45.27**	14.67
7	Number of pods per plant	41.97	271.40**	23.12
8	Number of clusters per plant	2.63	2.41**	0.34
9	Seed Yield per Plant	5.88	43.96**	7.99
10	Seed Yield per Plot	3690.17	6665.16**	1858.48
13	Harvest index	1100.06	1792.04**	555.82

Table 3: Analysis of variance for laboratory parameters evaluated in cluster bean

s. no	Characters	Mean sum of squares	
		Treatments (df=12)	Error (df=26)
1	Germination percentage (%)	608.80*	58.28
2	Speed of germination(days ⁻¹)	47.33*	6.16
3	Root length(cm)	6.24*	0.09
4	Shoot length(cm)	13.04*	0.056
5	Seedling length(cm)	35.53*	0.083
6	Seedling fresh weight(g)	4.34*	0.32
7	Seedling dry weight(g)	0.036*	0.005
8	Root : Shoot ratio	0.020*	0.005
9	Seedling growth rate	0.707	0.036
10	Seed metabolic efficiency(%)	0.073*	0.015
11	Mobilization efficiency (%)	8977.0*	1789.07
12	Vigour index – I	73362.8*	34853.8
13	Vigour index – II	301.12*	25.60
14	Electrical conductivity(dsm ⁻¹)	0.101*	0.013

Table:4 Mean performance of cluster bean for field characteristics

1	Treatments	Field Emergence %	Plant Height 30 Das (cm)	Plant Height 60 Das (cm)	Plant Height At harvest (cm)	Days to 50% flowering (days)	No of branches per plant	Days to maturity	Number of pods Per Plant	Number Of Clusters per plant	Seed Yield Per plant	Seed Yield Per Plot	Harvest Index
1.	T ₀	69.44	15.55	32.45	50.74	56.33	3.80	107.3	55.26	4.93	13.32	333.31	78.66
2.	T ₁	80.55	16.11	35.21	58.98	46.33	5.60	92	70.60	6.40	19.78	469.72	103.94
3.	T ₂	66.66	16.62	34.06	55.76	42.66	5.86	95	78.46	7.06	23.91	669.92	143.61
4.	T ₃	94.44	21.74	40.81	60.53	42	7.37	102	93.06	8.33	26.53	852.05	128.67
5.	T ₄	80.55	15.68	34.08	56.04	44.66	6.20	90	70.26	6.06	18.32	547.91	105.10
6.	T ₅	74.99	16.09	35.37	58.40	45	6.40	100	81.26	7.33	24.63	680.46	125.47
7.	T ₆	83.33	17.07	35.13	58.69	47.33	5.73	96	81.20	7.06	17.67	570.23	96.92
8.	T ₇	88.89	16.82	40.66	59.51	45.33	5.00	97.3	72.53	6.06	20.11	610.43	116.27
9.	T ₈	83.33	17.16	32.82	60.03	48.33	6.27	99	75.46	6.83	26.52	640.18	146.93
10.	T ₉	91.66	17.29	32.72	59.09	46.66	5.27	95	78.00	7.06	22.23	448.55	81.59
11.	T ₁₀	91.66	17.71	40.72	59.14	51	5.87	94	70.08	6.04	18.13	480.22	75.14
12.	T ₁₁	75.00	17.32	35.42	50.97	51	6.20	105.6	60.04	5.04	22.37	763.95	94.72
13.	T ₁₂	75.00	16.52	34.95	52.97	49.33	7.33	96	76.04	7.00	21.78	489.7	82.13
Grand Total		1055.5	221.96	464.38	740.88	616.00	76.90	1268.6	963.70	87.03	275.52	7557.98	1379.16
F Test		S	S	S	S	S	S	S	S	S	S	S	S
SE(m)		0.09	0.70	1.66	1.92	2.21	0.53	2.07	2.78	0.33	1.63	24.89	32.85
SE(d)		0.13	0.98	2.34	2.72	3.13	0.76	2.92	3.98	0.47	2.31	35.20	46.46
C.D		4.44	7.07	8.03	5.84	8.08	15.06	3.67	6.49	8.66	13.34	22.25	22.22

Table:5 Mean performance of cluster bean for lab observations

I	Treatments	Germination percent (%)	Speed of germination (days ⁻¹)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Fresh Weight (g)	Seedling Dry Weight (g)	Root: shoot Ratio	Seedling growth rate	Seed Metabolic efficiency (%)	Mobilization efficiency (%)	Vigour index I	Vigour Index II	Electrical Conductivity(dsm ⁻¹)
1.	T ₀	40.5	11.48	6.44	8.44	14.90	1.45	0.144	0.61	1.73	0.201	68.75	482.48	4.464	1.311
2.	T ₁	82	21.94	9.90	13.14	23.06	3.51	0.290	0.86	2.70	0.342	143.75	1420.3	18.68	1.287
3.	T ₂	77	23.56	10.39	14.43	24.82	2.51	0.320	0.78	2.82	0.506	158.75	1529.2	19.592	1.288
4.	T ₃	91	25.52	11.50	15.41	26.92	5.58	0.435	0.89	3.71	0.627	215.0	1959.3	31.26	1.542
5.	T ₄	67.5	21.59	10.40	13.49	23.90	3.35	0.473	0.79	2.69	0.421	235.0	1290	25.46	1.644
6.	T ₅	70	22.29	9.67	14.46	24.17	2.51	0.375	0.84	2.77	0.438	185.0	1353.2	18.84	1.800
7.	T ₆	68.5	20.85	9.57	14.44	24.02	3.64	0.356	0.77	2.92	0.576	175.0	1314.1	19.21	1.562
8.	T ₇	57.5	18.13	10.80	14.23	25.04	4.60	0.440	0.73	2.90	0.478	217.5	1143	19.15	1.391
9.	T ₈	66	18.94	10.32	13.46	23.79	3.96	0.406	0.75	2.96	0.481	201.2	1255.3	17.65	1.449
10	T ₉	66.5	18.83	9.45	14.48	23.94	2.88	0.422	0.83	2.87	0.447	208.7	1273.4	22.11	1.548
11	T ₁₀	76.5	20.83	10.30	14.22	24.65	3.77	0.421	0.84	2.68	0.312	208.7	1508	23.13	1.660
12	T ₁₁	67	19.92	9.56	12.39	21.95	4.30	0.271	0.82	3.06	0.253	133.7	1176.1	11.9	1.461
13	T ₁₂	59.5	17.25	8.39	11.50	19.85	3.55	0.252	0.80	2.92	0.597	123.7	905.0	9.08	1.360
Grand mean		68.42	20.08	9.74	13.39	23.15	3.50	0.354	0.79	2.825	0.436	218.3	1277.6	18.50	1.484
C.V.		11.15	12.35	3.086	1.76	1.244	16.34	19.6	8.54	6.66	41.05	19.77	11.69	21.8	7.66
SE(m)		3.817	0.24	0.150	0.118	0.144	0.287	0.035	0.034	0.094	0.061	17.30	93.3	93.3	2.530
SE(d)		5.398	1.75	0.213	0.168	0.204	0.406	0.049	0.048	0.133	0.086	24.47	132.01	132.01	3.578
C.D		10.960	3.56	0.432	0.340	0.413	0.823	0.100	0.098	0.271	0.175	49.6	268.02	268.02	7.264

Fig 1. Phenotypic shaded correlation matrix for yield per plot

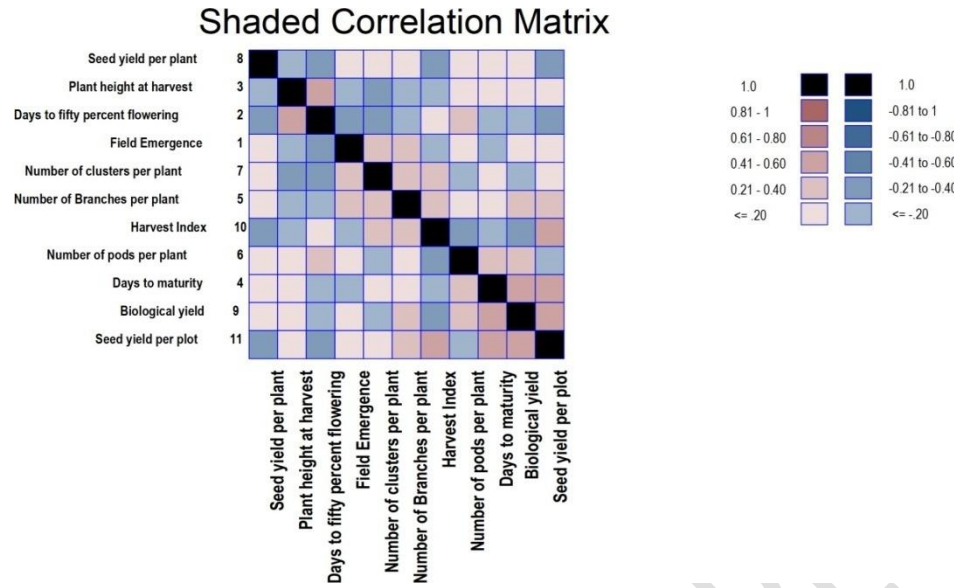
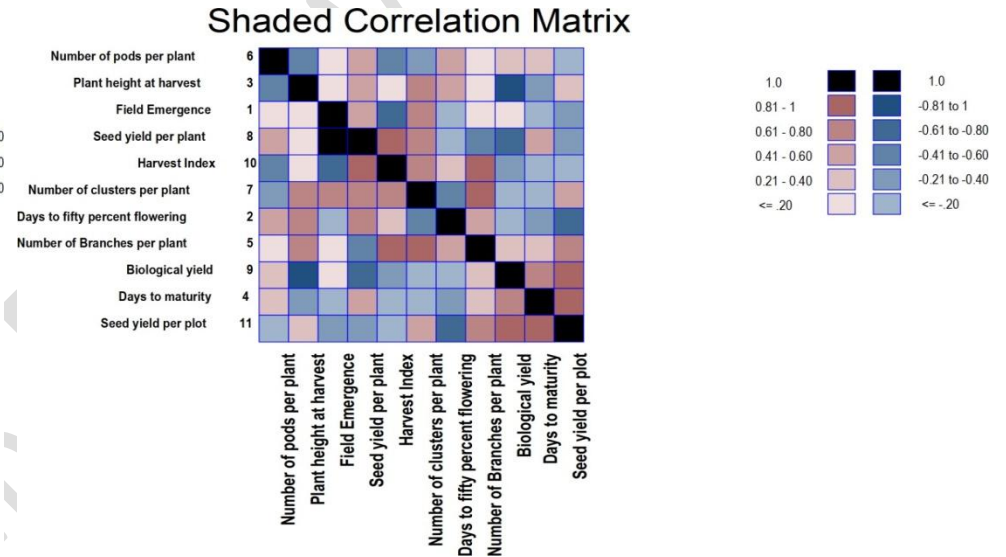


Fig 2. Genotypic shaded correlation matrix for yield per plot



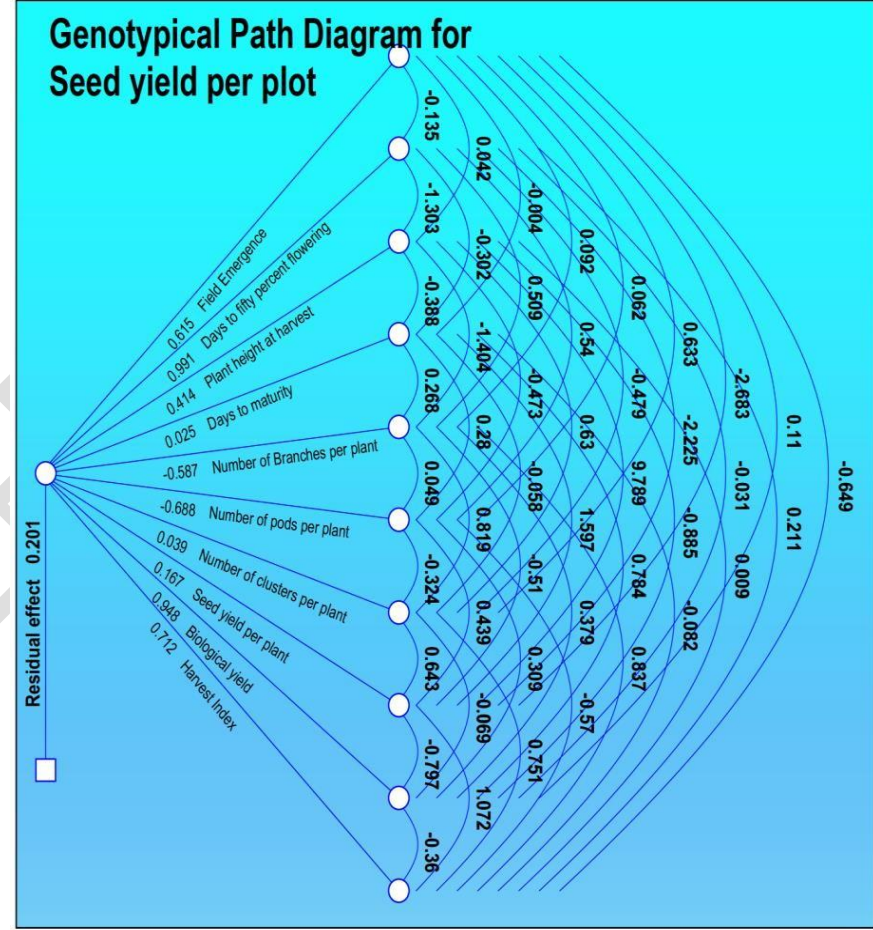
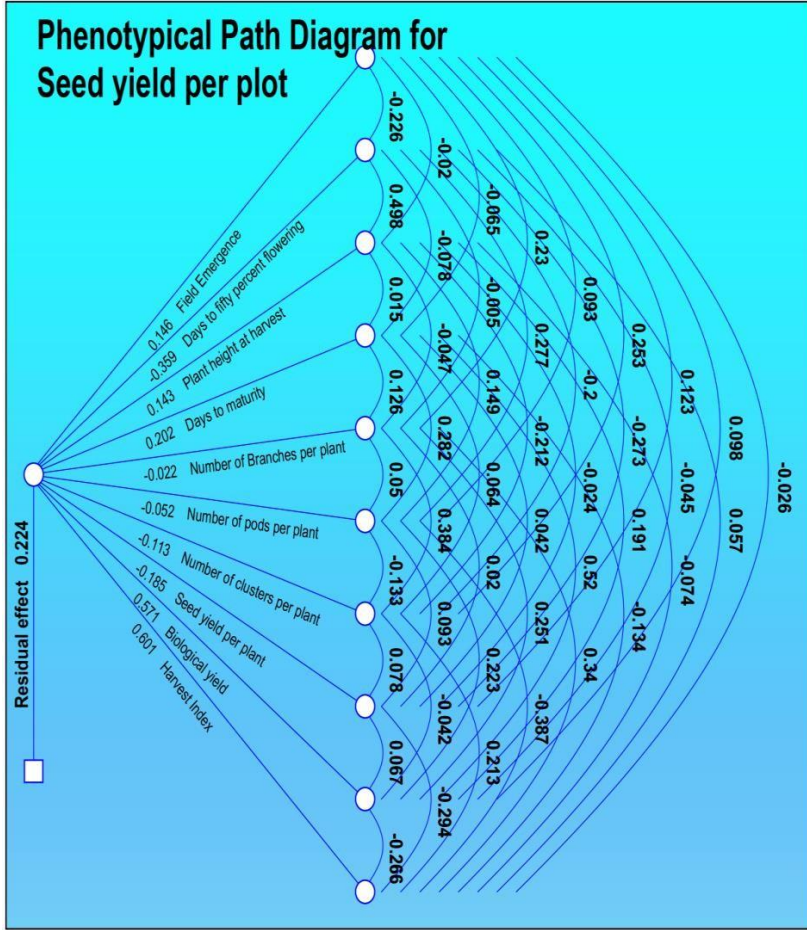
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Table:7 Phenotypic and genotypic PATH matrix for yield per plot

	FE	50 % F	PH(cm)	DM	NBPP	NPPP	NCPP	SYPP	BY	HI	YP
rp FE rg	0.6151	-0.0833	0.0256	-0.0022	0.0568	0.0381	0.3895	-1.65	0.0678	-0.3994	-0.2694
	0.1464	-0.0331	-0.002	-0.0095	0.0337	0.0136	0.037	0.018	0.0143	-0.0038	0.1906
rp 50%F rg	0.6151	-0.0833	0.0256	-0.0022	0.0568	0.0381	0.3895	-1.65	0.0678	-0.3994	-0.2694
	0.0811	-0.3594	-0.1791	0.0281	0.0019	-0.0997	0.0719	0.0982	0.0163	-0.0204	-0.269
rp PH rg	0.0172	-0.5392	0.4137	-0.1607	-0.5809	-0.1957	0.2608	0.841	-0.3662	0.0036	0.2277
	-0.0028	0.0712	0.143	0.0021	-0.0067	0.0213	-0.0303	-0.0035	0.0273	-0.0106	0.0503
rp DM rg	-0.0001	-0.0077	-0.0099	0.0254	0.0068	0.0071	-0.0015	0.0406	0.0199	-0.0021	0.946**
	-0.0131	-0.0158	0.003	0.2015	0.0254	0.0568	0.013	0.0085	0.1047	-0.0269	0.406*
rp NBPP rg	-0.0542	-0.2987	0.8247	-0.1576	-0.5873	-0.0291	-0.4812	0.2998	-0.2226	-0.4916	0.646**
	-0.0051	0.0001	0.001	-0.0028	-0.0221	-0.0011	-0.0085	-0.0004	-0.0055	-0.0075	0.331*
rp NPPP rg	-0.0426	-0.3718	0.3257	-0.193	-0.0341	-0.6884	0.2228	-0.3022	-0.2129	0.3927	-0.0763
	-0.0048	-0.0144	-0.0077	-0.0147	-0.0026	-0.0521	0.0069	-0.0049	-0.0116	0.0202	-0.1692
rp NCPP rg	0.0246	-0.0186	0.0245	-0.0023	0.0318	-0.0126	0.0389	0.025	-0.0027	0.0292	0.461*
	-0.0286	0.0227	0.024	-0.0073	-0.0435	0.0151	-0.1134	-0.0089	0.0048	-0.0241	0.0659
rp SYPP rg	-0.4474	-0.3711	1.6328	0.2663	-0.0851	0.0732	0.1073	0.1668	-0.1329	0.1788	-0.364*
	-0.0228	0.0506	0.0045	-0.0078	-0.0037	-0.0173	-0.0145	-0.1853	-0.0125	0.0546	-0.217
rp BY rg	0.2146	-0.0603	-1.7243	1.5268	0.7384	0.6022	-0.1348	-1.5523	0.948	-0.7014	0.811*
	0.0559	-0.0258	0.1092	0.2966	0.1433	0.127	-0.0242	0.0385	0.5707	-0.1518	0.549*
rp HI rg	-0.4623	0.1502	0.0062	-0.0582	0.596	-0.4061	0.5346	0.7631	-0.2564	0.712	-0.0693
	-0.0156	0.0342	-0.0446	-0.0803	0.2047	-0.2328	0.1279	-0.1771	-0.16	0.6014	0.431*
rp YP rg	-0.2694	-0.610**	0.2277	0.946**	0.646**	-0.0763	0.461*	-0.364*	0.811**	-0.0693	1
	0.1906	-0.2697	0.0503	0.406*	0.331*	-0.1692	0.065 9	- 0.217	0.549**	0.431*	1

Fig 3. Phenotypic path diagram for yield per plot

Fig 4. Genotypic path diagram for yield per plot



4. Conclusion

In summary, it was observed that panchagavya@10% for 12 hours had a positive effect on the yield traits and seedling quality parameters in cluster bean. Seed treatment with panchagavya@10% for 12 hours showed best results in Field emergence percentage, Plant height (30, 60& 90 DAS), Days to 50 % flowering, Number of branches per plant, Number of pods per plant, Number of clusters per plant, Days to maturity, Seed yield per plant (g), Seed yield per plot (g), Biological yield (g), Harvest index (%) and seed quality parameters like Germination percent (%), Germination Rate, Speed of Germination, Root length, Shoot length, Seedling length, Fresh weight of Seedling, Dry weight of Seedling, Seedling Growth Rate, Root: Shoot Ratio, Seed Metabolic Efficiency, Vigour Index-I, Vigour Index-II, Electrical Conductivity.

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