Response of different pre-sowing seed treatments with Biofertilizers, Biostimulants and Botanicals on growth, yield and yield attributing traits in chickpea (*Cicer arietinum* L.) *var*. desi himmat

ABSTRACT

Legumes are the richest protein sources of human diet, livestock of people in poor areas, green fodder to animals and are also used as green manure crops. The present study entitled, "Response of different pre-sowing seed treatments with Biofertilizers, Biostimulants and Botanicals on growth, yield and yield attributing traits in chickpea (*Cicer arietinum* L.) *var*. desi himmat", was carried out in rabi 2021-2022 at crop research farm, SHUATS, Prayagraj with rhizobium, vermiwash, neem and tulsi leaf extracts of varying concentrates at duration of 12hrs. in three replications with randomized block design with an objective to assess the effect of these priming treatments on chickpea and to find the promising pre-sowing treatment. The results depicted that priming is an alternate strategy to improve the growth, yield and it recorded significant variation for all the parameters that were studied on comparison to the untreated control (T_0). Seed priming with T_5-Vermiwash at 10% for 12 hrs. recorded field emergence of 90% and 35.00 pods per plant, 1.66 seeds per pod, 14.70 g seed yield per plant, 24.79 g of 100 seed weight, 37.65 g of biological yield per plant and 39.08 % of harvest index. Thus, priming with T_5-Vermiwash at 10% for 12 hrs. was found so productive on chickpea and can be suggested for cultivation on commercial scale.

Keywords: Neem leaf extract, rhizobium, tulsi leaf extract and vermiwash.

INTRODUCTION

Legumes are the richest protein source of human diet and livestock in poor areas besides they are used as green manures and green fodder to animals. Chickpea (*Cicer arietinum* L.) is the most important Rabi season self-pollinated pulse crop, with the chromosomal number (2n = 2x = 16) and it is the third most widely cultivated legume crop after dry bean (*Phaseolus vulgaris* L.) and field pea (*Pisum sativum* L.) belonging to the family Fabaceae.

The *chick pea* production in India has gone up from 38.55 to 122.29 lakh tonnes during 2000-01 to 2018-19, while the area has also gone up from 53.85 to 109.21 lakh ha, whereas, the yield has steadily increased from 744 kg/ha to 1077kg/ha during the same period. In India, Madhya Pradesh holds the highest share of 39% chickpea production followed by Maharastra (14%), Rajasthan (14%), Andhra Pradesh (10%), Uttar Pradesh (7%) and Karnataka (6%) **(Preeti varma *et al.*, 2021)**. Seed is the main edible part of the plant and

is a rich source of protein (23.3- 28.9%), carbohydrates (61.5%), fats (4.5%) and minerals (phosphorus, calcium, magnesium, iron, zinc).

Seed enhancement includes priming, hardening, pelleting, encrusting, film coating *etc.,* but excludes the treatment for the control of seed-borne pathogens**.** Organic seed priming *viz.,* treatment with Panchagavya, Beejamrutha, Jeevamrutha and botanicals provides resistant to high temperature and low moisture especially in semi-arid tropics. These organic priming compounds are mainly prepared from cow dung, cow urine, cow ghee, jaggery, tender coconut and ripened bananas. It encourages quicker germination, greater seedling vigour resulting in increased crop productivity. Priming helps the plants to cope with the adverse effects of unfavorable environmental conditions **(Ali *et al.,* 2020)**.

Botanical seed treatment is extracted from naturally occurring sources based on the botanical ingredients and have synergistic effect on early and uniform seed germination and enhances tolerance to the pest and diseases during the early crop growth stages. *Ocimum sanctum* is commonly known as tulsi or Holy basil comprises essential bioactive or phytochemical components such as oleanolic acid, rosmarinic, ursolic acid, eugenol, carvacrol, linalool, and β-caryophyllene essential for plant growth and yield. *Azardiractin* is the main pesticidal component of the neem. Neem products are naturally available materials, cheaper and also safe for microorganisms; its usage in agriculture is increasing extensively because of beneficial effects on plants **(Nelakurthi Venkata Praveen *et al.,* 2020).**

Earthworms play a vital role in plant growth and productivity. It contains several enzymes, vitamins, auxins and cytokinins along with nutrients phosphorous, calcium and potassium that enhances resistivity of crops and increases productivity **(Tiwari *et al.,* 2018)**. It plays an important role in growth of plants and its development contribute to initiation of rooting, root growth, plant development, promotion of growth rate of the plants.

Application of PGPR to seed through seed bio-priming enhances plant performance under stress environments and consequently enhances plant yield both directly and indirectly. Helpful bacteria in rhizosphere are of two types: (a) bacteria forming symbiotic association through particular assemblies and (b) free-living bacteria present in the neighbourhood of plant province which are mainly known as plant growth-promoting rhizobacteria (PGPR). **Belal *et al.,* (2013)** reported that strains of rhizobia are capable of tolerating abiotic factors like salinity and drought by preserving its capability to nodulate and fix atmospheric nitrogen.

MATERIALS AND METHODS

The present study was conducted at during Rabi 2021-2022 at Crop Research Farm, Naini Agriculture Institute, SHUATS, Prayagraj. The soil type was a bit sandy loamy in texture, low in organic carbon and potassium and rich in available nitrogen and phosphorous. Thirteen treatment combinations of three replications in randomized block design comprising of rhizobium, vermiwash, neem and tulsi leaf extracts of varying concentrates *viz.*, rhizobium at 8%, 10% and 15% for 12 hrs., vermiwash at 8%, 10% and 15% for 12 hrs., neem leaf extract at 5%, 10% and 15% for 12 hrs., and tulasi leaf extract at 5%, 10% and 15% for 12 hrs. were prepared and treated with seeds of desi himmat chickpea variety for duration of 15 mins and later seeds were sown in the main field.

RESULTS AND DISCUSSION

The results on effect of rhizobium, vermiwash, neem and tulsi extract solutions on plant growth and yield attributes were represented in the table 01. The results were statistically analysed using analysis of variance (ANOVA) which is applicable to the randomized block design.

Field emergence (%)

Seed priming with vermiwash at 10% for 12 hrs. (T_5) recorded maximum emergence of 20.00% on 4th day after sowing; The treatment T_7- *Neem leaf extract* at 5% for 12 hrs. significantly recorded maximum of 54.00% and 91.00% at 7 DAS and 10 DAS. The untreated control (T_0) recorded least emergence of 13.00%, 42.00% and 84.00% at 4, 7 and 10 DAS respectively. According to **(K. Sundararasu *et al.*, 2016)** vermiwash contains nutrients like auxins, cytokinins, bacteria, fungi and nutrients like calcium, phosphorous that enhance germination. Similar trends of increased emergence % due to organic priming were in harmony with the earlier research findings of **(Pandit S. Rathode *et al.*, 2016).**

Plant height (cm)

Effect of the treatment T_2- *Rhizobium* at 10% for 12 hrs. was found significant and recorded 23.11 cm plant height at 30 DAS, priming with vermiwash at 10% for 12 hrs. (T_5) shown maximum of 37.32 cm and 71.16 cm height at 60 DAS and at time of harvest. The untreated control (T_0) recorded the minimum height of 16.29 cm, 27.99 cm and 62.39 cm at 30 DAS, 60 DAS and at harvest respectively. According to (**Tripathi and Bhardwaj, 2014)** vermiwash contains nitrogen in the form of mucus and nitrogen excretory substances that stimulates hormones and enzymes for plant growth. These results are comparable with the earlier research findings of **(H. G. Harshitha *et al.*, 2021).**

Days to 50% flowering

Minimum number of 63.33 days was taken by treatment T_2-*Rhizobium* at 10% for 12 hrs. for which in at least 50% of flowers get opened while priming with T_6- *Vermiwash* at 15% for 12 hrs. took 70.67 days for the same. Similar trends for days to 50% flowering were found by earlier research works of **(S. Jaffar Basha *et al.*, 2021).**

Days to 50% pod setting

The least number of days for 50% pod setting was shown by the treatment T_2-*Rhizobium* at 8% for 10 hrs. of 71.33 days and treatment T_6-*Vermiwash* at 15% for 8 hrs. took 78.33 days for 50% pod setting which was maximum amongst the treatments. The days taken for 50% pod setting are in compatible with the earlier findings of **(Dan Singh Jakkar *et al.*, 2016).**

Days to maturity

Priming with T_8- *Neem leaf extract* at 10% for 12 hrs. and T_{11}- *Tulsi leaf extract* at 10% for 12 hrs. recorded the minimum days for maturity of 106.33 days and 106.67 days respectively; T_6-*Vermiwash* at 15% for 12hrs. recorded 113.00 days which was maximum amongst treatments. Vermiwash being enriched with NPK, micro nutrients, plant growth hormones, microbes and enzymes enhances the growth and thereby shows effect on maturity**.** These results are in agreement with earlier findings of **(Dikhshat kumar *et al.*, 2020).**

Number of pods per plant

Effect of priming with T_5-*Vermiwash* at 10% for 12 hrs. significantly recorded maximum of 35.76 pods per plant amongst treatments and untreated control (T_0) shown minimum of 25.20 pods plant^{-1} respectively. Timely supply of nutrients with effect of vermiwash enhances the yield parameters *viz.,* number of pods, pod length and seed-bearing capacity of the pods **(Jijo George *et al.*, 2019).**

Number of seeds per pod

Soaking of chickpea seeds with Vermiwash at 10% at 12 hrs. (T_5) shown maximum of 1.66 seeds in each pod and the untreated control shown average of 1.33 seeds in each single pod respectively. These results concur with the previous research findings of **(Mebrahtu Gebremariam *et al.*, 2021).**

Seed yield per plant (g)

Seed priming with T_5-*Vermiwash* at 10% for 12 hrs. significantly recorded the maximum of 14.70g of chickpea seeds per plant and minimum yield of 7.08 g was recorded by the untreated control (T_0)

respectively. Organic priming enhances the growth and yield of the pulses; which are highly sensitive to the salinity and alkalinity factors through timely supply of nutrients and proper hormonal balance **(Jalla Manjunadh *et al.*, 2021)**.

Seed index (g)

Significantly, the maximum hundred seed weight of 24.79 g was recorded with T_5- *Vermiwash* at 10% for 12 hrs. while the minimum of 19.50 g was shown by untreated (T_0) Control. Similar trends of 100 seed weight were recorded by earlier research works of **(Dikhshat kumar *et al.*, 2020).**

Biological yield per plant (g)

Seed priming enhanced the biological yield per plant amongst the treatments; the maximum was recorded of 37.65 g was with T_5- *Vermiwash* at 10% for 12 hrs. while the minimum of 22.15 g was shown by the treatment T_0- Control. Seed priming enhances the metabolic activities of the seed and resistance against to the diseases and pests, hence increases the dry matter content of the plants **(Arjunsharma *et al.*, 2006).**

Harvest index (%)

Maximum harvest index of 39.08% was recorded by priming with T_5- *Vermiwash* at 10% for 12 hrs. and minimum of 32.02% was shown by the untreated control (T_0) respectively. These results were in conformity with the earlier research findings of **(S. Jaffar Basha *et al.*, 2018).**

CONCLUSION

The results depicted that priming with organics, botanicals and bio-stimulants shown significant variation with the untreated control for all the growth and yield parameters that were recorded and further analyzed. Of all the treatments, effect of the treatment T_5-*Vermiwash* at 10% for 12 hrs. found to be promising with highest seed yield and harvest index; so, it can be recommended for cultivation on commercial scale.

COMPETING INTERESTS

Authors have declared that no competing interests exists.

Table 01. Response of Chickpea *var.* desi himmat to rhizobium, vermiwash, neem and tulasi leaf extract solutions.

TREATMENTS	FIELD EMERGENCE (%) AT 4 DAS	FIELD EMERGENCE (%) AT 7 DAS	FIELD EMERGENCE (%) AT 10 DAS	PLANT HEIGHT AT 30 DAS (cm)	PLANT HEIGHT AT 60 DAS (cm)	PLANT HEIGHT AT MATURITY (cm)	DAYS TO 50% FLOWERING	DAYS TO 50% POD SETTING
T_0	13	42	84	16.29	28.11	62.39	65.00	73.00
T_1	16	46	86	19.68	31.44	64.92	67.00	75.00
T_2	17	48	87	23.11	36.77	67.24	63.33	71.33
T_3	15	45	84	17.22	30.75	65.99	67.67	74.67
T_4	16	46	83	18.10	33.61	68.38	66.33	73.00
T_5	20	52	87	22.56	37.32	71.16	68.67	75.33
T_6	17	47	83	21.16	35.18	69.01	70.67	78.33
T_7	19	54	91	22.33	36.78	69.43	66.33	74.67
T_8	18	48	86	16.84	27.99	63.98	63.67	74.00
T_9	19	49	87	20.69	32.22	66.26	64.67	72.00
T_{10}	17	49	87	20.97	31.38	66.66	66.33	72.67
T_{11}	20	52	89	21.29	32.96	68.35	63.33	71.67
T_{12}	17	47	85	19.89	31.26	66.43	67.00	73.67
GRAND MEAN	17	48	86	20.01	32.75	66.94	66.15	73.79
F TEST	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. Em	0.73	0.84	0.53	0.27	0.37	0.90	0.88	0.89
S. Ed	1.03	1.20	0.76	0.39	0.52	1.27	1.24	1.25
C.V.	7.36	3.05	1.08	2.39	1.96	2.33	2.31	2.09
T. value	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06
C.D.	2.13	2.47	1.56	0.80	1.08	2.63	2.57	2.59

Cont..

TREATMENTS	DAYS TO MATURITY	NUMBER OF PODS PER PLANT	NUMBER OF SEEDS PER POD	SEED YIELD PER PLANT (g)	SEED INDEX (g)	BIOLOGICAL YIELD (g/plant)	HARVEST INDEX (%)
T_0	109.33	25.00	1.44	7.08	19.50	22.15	32.02
T_1	107.33	28.00	1.48	8.53	20.28	25.80	33.05
T_2	108.33	31.00	1.31	9.78	23.85	27.79	35.20
T_3	108.00	28.00	1.35	9.05	23.23	27.42	33.00
T_4	109.33	30.00	1.37	9.53	22.86	31.45	30.29
T_5	109.67	35.00	1.66	14.70	24.79	37.65	39.08
T_6	113.00	32.00	1.48	11.28	23.72	32.03	35.22
T_7	110.67	35.00	1.60	13.79	24.55	36.08	38.22
T_8	106.33	27.00	1.41	9.02	22.84	26.55	33.98
T_9	109.67	28.00	1.44	9.36	23.11	31.48	29.72
T_{10}	108.67	31.00	1.33	8.99	21.33	27.31	32.97
T_{11}	106.67	32.00	1.39	9.91	22.06	26.94	36.79
T_{12}	109.67	30.00	1.31	8.31	20.77	25.51	32.54
GRAND MEAN	108.97	32.66	1.43	9.95	22.53	29.09	34.01
F TEST	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. Em	0.88	0.42	0.03	0.27	0.23	0.64	0.71
S. Ed	1.25	0.59	0.05	0.38	0.33	0.90	1.01
C.V.	1.41	2.38	4.58	4.76	1.83	3.82	3.66
T. value	2.06	2.06	2.06	2.06	2.06	2.06	2.06
C.D.	2.58	1.23	0.11	0.79	0.69	1.87	2.09

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