

Original Research Article

INFLUENCE OF PRE-SOWING SEED TREATMENTS WITH BIOFERTILIZERS AND PLANT GROWTH REGULATORS ON GROWTH, YIELD AND YIELD ATTRIBUTING TRAITS OF FIELD PEA (*Pisum sativum* L.) var. RACHNA

ABSTRACT

The field experiment entitled “Influence of Pre Sowing Seed Treatments with Biofertilizers and Plant Growth Regulators on Growth, Yield and Yield Attributing traits of Field pea (*Pisum sativum* L.) var. ‘RACHNA’” was conducted during Rabi 2021-22 at Field experimental centre at Genetics and Plant Breeding Naini Agricultural Institute, SHUATS, Prayagraj, (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Block Design with thirteen treatments including control which were replicated thrice. The treatments are as follows, TO- Control, T1, T2, T3- Rhizobium - 10%, 15%, 20%, T4, T5, T6- Azospirillum – 5%, 10%, 15%, and T7, T8, T9- Gibberellic acid (GA₃)-50ppm, 75ppm, 100 ppm, T10, T11, T12- NAA -10 ppm, 15ppm, 20ppm respectively. The experiment results revealed that seeds treated with T9-Gibberellic Acid-100% ppm gave better results followed by T3-Rhizobium@ 20 % and T12-NAA @20 ppm

than other treatments viz, Field emergence (80.06), Plant height (94.75cm), Days to 50% flowering (68.71), Days to Maturity (120.98), number of branches per plant (7.24), number of pods per plant (20.86), number of seeds per pod (4.55), seed yield per plant (17.44 g), seed yield per plot (1.78 kg), biological yield (32.30 q/ha), seed index (7.35

g), Seed index (23.91), Harvest index (34.24 %) were recorded significantly higher compared to other treatments.

Key words: Field pea, Seed treatments, Rhizobium, Azospirillum, GA₃, NAA.

INTRODUCTION:

Besides serving as an important source of protein for a large portion of the global population, pulses contribute to healthy soils and climate change mitigation through their nitrogen fixing properties. Stagnant productivity coupled with declining availability has created substantial demand supply gap, forcing heavy import bill on the exchequer and affecting

nutritional security of majority of the population for whom pulses are the one of the cheapest sources of protein. India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. Pulses account for around 20 per cent of the area under food grains and contribute around 7-10 per cent of the total food grains production in the country. Though pulses are grown in both Kharif and Rabi seasons, Rabi pulses contribute more than 60 per cent of the total production. The area under pulses has increased from 19 million ha. in 1950-51 to 25 million ha. in 2013-14, indicating an increase of 31 per cent whereas the production of pulses during the same period has increased from 8.41 million ha. to 19.27 million ha. an increase of over 100 per cent.

Field pea is an annual cool season grain legume or pulse crop and majorly grown in rabi season and third most popular rabi pulse of India after chickpea and lentil. Pea is a commonly grown leguminous vegetable in the world with Botanical name *Pisum sativum* L. Family Leguminaceae, Chromosome no $2n=14$, origin South West Asia

In India, the field pea (*Pisum sativum*) is a widely grown pulse crop. After Russia, India is the world's second-largest producer of peas. Protein, carbs, vitamins A and C, calcium, and phosphorus are all abundant in pea. It is frequently used in human diets around the world and has high levels of tryptophan and lysine, two amino acids that are relatively low in cereal grains. It also contains a low amount of fibre, about 21–25

percent protein, 62.1 percent carbohydrates, and 1.8 percent fat, making it an excellent livestock feed. It is crucial for advancing sustainable agriculture in addition to sustaining soil fertility through nitrogen fixation in association with symbiotic Rhizobium present in their root nodules. Thus apart from meeting its own nitrogen requirement, pea crop is known to add 50-60 kg residual nitrogen ha⁻¹ in soil (Erman *et al.*, 2009)

Field pea can be cultivated on a variety of soil types, from light sandy loams to heavy clays, but any soil must have sufficient drainage because field pea cannot stand up to wet or soggy conditions. The ideal pH range for soil is 5.5 to 6.5. Field peas are primarily consumed by humans or fed to cattle. The stems of the annual herbaceous field pea can reach a length of 2 to 4 feet. A leaf is made up of one to three pairs of leaflets and a branching tendril at the end. The leaves are a light green colour with a whitish bloom. The plant matures into a prostrate vine.

Field pea (*Pisum sativum* L.), is found in Asia, Africa, Europe, North America, and Australia. The top countries for field pea production are China, the Russian Federation, Ukraine, India, France, Canada, and the United States, with a combined contribution of about 75% to the global production of 90–95 million tonnes. In terms of production, India is ranked fifth, behind the Russian Federation, Ukraine, China, and Canada. Field pea grows on 0.62 million hectares in India and produces 0.56 million tonnes of food annually with an average

productivity of 906 kilos per hectare (Prasad, 2004).

Pea is an important pulse crop grown in India. India is the world's fifth-largest producer. Other major pea producers are the United States, China, France, and the United Kingdom. Uttar Pradesh, Bihar, Haryana, Punjab, Himachal Pradesh, Orissa, and Karnataka are the principal pea-growing states in India. With a yield of 0.71 million tonnes, it is grown on 0.78 million hectares in India. (2010 annual report) The Gujarat state produces pulse crops on around 7.84 lakh ha and 6.02 lakh tonnes of land, respectively (DoA, 2011).

OBJECTIVES

1. To evaluate the Influence of Pre-Sowing Seed Treatments with Biofertilizers and Plant Growth Regulators on growth, yield and yield Attributing traits of Field Pea (*Pisum sativum*. L).
2. To Evaluate the different pre-sowing treatments suitable for field pea.

MATERIALS AND METHODS:

Variety Details: Rachana: Developed from Kanpur, U.P., it is resistant to powdery mildew. The crop takes 120-130 days to mature and may produce 22-30 q/ha seeds which are round and white.

The present research on "Influence of Pre Sowing Seed Treatments with Biofertilizers and Plant Growth Regulators on Growth, Yield and Yield Attributing traits of Field pea (*Pisum sativum* L.) var. 'RACHNA" was made to identify the effect of seed Pre Sowing treatments of different kinds on seed quality

parameters of Field pea and to find out suitable seed Pre Sowing method for Field pea. The experiment was conducted in *Rabi* season and laid out in Randomized Block Design with thirteen treatments including control which were replicated thrice. The treatments are as follows, T0- Control, (T1, T2, T3, - Rhizobium – 10%, 15%, 20%), (T4, T5, T6, – Azospirillum – 5%, 10%, 15%), (T7, T8, T9, – GA₃ – 50ppm, 75ppm, 100ppm) (T10, T11, T12-NAA - 10ppm, 15ppm, 20ppm) respectively.

Methodology:

Mode of Action of Rhizobium: Rhizobium are known to form colonies on the root surface stimulating biological nitrogen fixation and providing nitrogen to the leguminous crops and hence considered as a significant process for improving yield and soil fertility. Rhizobium-mediated symbiotic nitrogen-fixing systems can fix a significant quantity of nitrogen by acclimatizing with varied ecological conditions.

Mode of Action of Azospirillum: Under certain environmental and soil conditions, Azospirillum can positively influence plant growth, crop yields and N-content of the plant. This plant stimulatory effect exerted by Azospirillum has been attributed to several mechanisms, including biological nitrogen fixation and auxin production. The contribution of biological nitrogen fixation in this plant response, however, has often been questioned. Moreover, azospirilla do not excrete significant amounts of ammonium under diazotrophic growth. Therefore, other factors, such as production of plant growth-promoting

substances and increase in the rate of mineral uptake by plant roots have been taken into account to explain the plant yield enhancement and could even be more important in establishing the plant response.

Mode of Action of GA₃: Gibberellins (GAs) are plant hormones that regulate various developmental processes, including stem elongation, germination, dormancy, flowering, flower development, and leaf and fruit senescence. GAs are one of the longest-known classes of plant hormone.

Mode of Action of NAA: NAA is a synthetic plant hormone in the auxin family, NAA has been shown to greatly increase cellulose fiber formation in plants when paired with another phytohormone called gibberellic acid. Because it is in the auxin family it has also been understood to prevent premature dropping and thinning of fruits from stems.

RESULTS AND DISCUSSION:

Pre – harvest observations:

Plant height: the seeds treated with GA₃ (100ppm) in T9 varied significantly and recorded higher plant height among other treatments with 98.11 cm and statistically at par values are observed in T3 (96.92 cm). The lowest was observed in control with 91.15 cm. According to **Tsegay et al. (2018)** studied effect of GA₃ (50, 100, 150 ppm) to assess the effect of GA₃ on seedling growth parameters. They revealed that when pigeon pea seeds treated with GA₃ 100 ppm plant height increased. These results were similar to our findings to

increase Plant height at harvest when seeds treated through best one of GA₃ @ 100 ppm.

Days to 50% flowering: T9 seeds treated with GA₃ (100 ppm) flowered earlier than other treatments (63.40 DAS) and T3 performed at par with T9 (66.67 DAS). The highest days to 50 % flowering was observed in control (T0) with 73.73 DAS. **Sisodia et al. (2018)** investigated safflower crop seeds treated with Gibberellic acid (3ppm,5ppm, 10ppm & 15ppm) to reveal the effect of these plant growth regulators on yield and yield contributing traits. They reported when seeds treated with Gibberellic acid 15ppm days to 50% flowering, field emergence, number of leaves per plant increased than compared to other treatments.

Number of branches: the seeds treated with GA₃ (100ppm) in T9 varied Significantly more number branches per plant were observed in T9 with 8.00 branches and T3 with 7.60 branches per plant is statistically on par with T9. The lowest number of branches per plant were observed in control with 6.73 branches. **Thejeshwini et al. (2019)** conducted an experiment to study the effect of GA₃, and IAA and their frequency of application and proved that 100ppm of GA₃ and 200ppm of IAA produced the maximum number of branches (6.22 and 4.78) among their respective treatment was ascertained. These results were similar to our findings to increase number of Branches when seeds treated through best one of GA₃

Days to maturity: significantly early maturity was observed in T9 in seeds treated with GA₃ (100ppm) at 117.86 days to maturity and T3

performed statistically on par with T9 (119.53) and the higher number of days to maturity was observed in control (123.73). The crop has matured sooner than the other treatments because the days to 50% flowering have been shortened and days to maturity only depend on the days to 50% flowering.

Gangaraju et al. (2019) in a field experiment with seven priming techniques on black gram cultivars (Rashmi and DU-1) The variety Rashmi hydrated with 50 ppm GA, and surface drying at room temperature (12 hours) was exhibited good results with respect to plant growth via field emergence (89.33 and 88.67 % speed of emergence (21.0 and 2000), plant height at 30 DAS (38.33 and 38.00 cm), 60 DAS (38.47 and 56.40 cm) and at harvest (67.00 and 64.00 cm), number of branches per plant (10.27 and 9.93), and minimum number of days to maturity (68.33 and 67.00), followed variety by the DU-1 Hydrated with 50 ppm GA.

YIELD ATTRIBUTES:

Number of pods per plant:

the seed treatments varied significantly among them. The seeds treated with GA3@100ppm in T9 was significantly higher among all other treatments with 23.53 pods and T3 was statistically at par with T9 with 22.73 Pods. The lowest number pods were obtained in control with 18.60 pods.

Number of seeds per pod: Significantly higher number seeds per pod were obtained in T9 GA3 @ 100ppm (5.33) and statistically at par values were observed in T3 with 5.13 seeds per pod. The control had performed lowest of all

treatments with 3.66 seeds per pod. **Sumeet et al. (2018)** reported that that the foliar application of plant growth regulators (Kinetin, GA3 and NAA) positively affected different growth and seed yield parameters such as plant height, number of primary branches, days to flowering, number of pods/plants, number of seeds/pod and 100-seed weight which ultimately contributed to increased growth, yield and seed quality parameters on the Pusa Pragati garden pea variety. Among the three growth regulators, GA3 gave the best results, particularly at 75 ppm for seed yield and quality parameters.

Seed yield per plant: T9 @ GA3 100 ppm had performed better and is significantly higher (23.36g) over all other treatments and statistically at par values were obtained in T3 with 22.33 g and the lowest seed yield was observed in control with 15.73 g.

Seed yield per plot: The seeds treated with GA3 @100ppm in T9 was significantly higher among all other treatments with 334.03g and T3 was statistically at par with T9 (322.03g). The lowest Seed yield per plot were obtained in control with 193.34g. By increasing the number of seeds per pod and the number of pods per plant, This might be due to Increase in number of pods per plant and high photosynthetic Rate during seed development. The similar findings were Reported by Similar findings were reported by **R. V. Sathavahana and L. Edwin (2022)** in lentil, **Mazed et al. (2015)** in chickpea, **Moosavi et al. (2014)** in soybean, **Setareh Rastin et al. (2013)** in red bean, **Rao et al., (2012)**.

CONCLUSION:

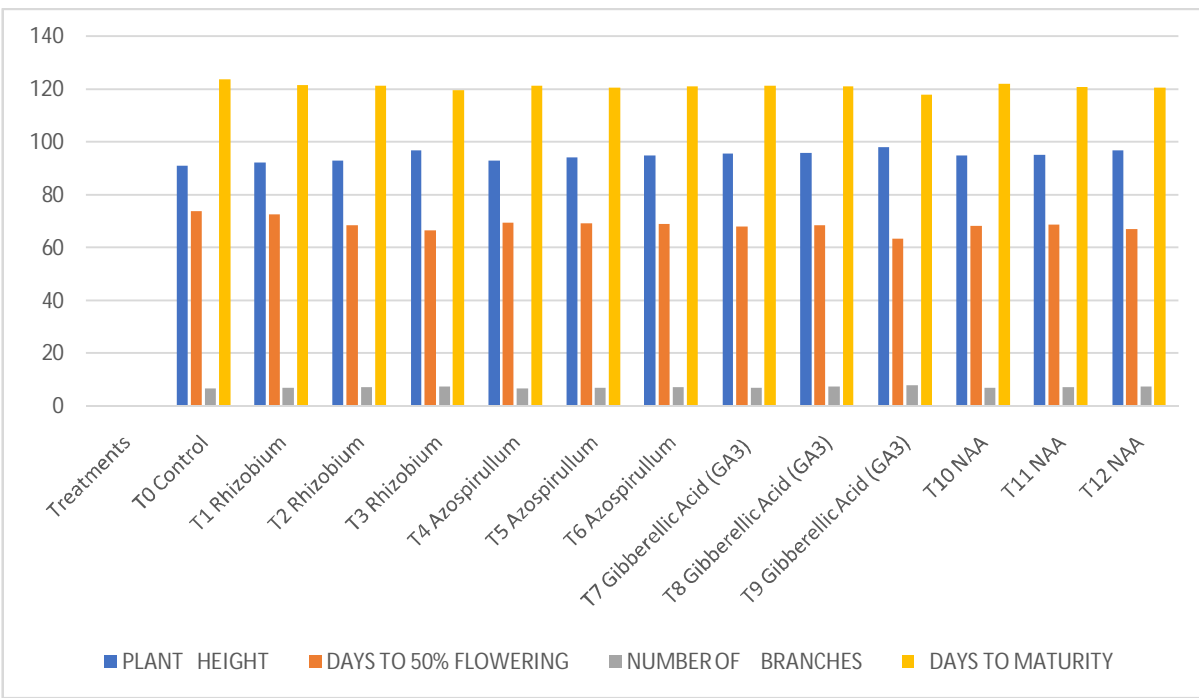
It is concluded that seeds treated with Gibberellic Acid(GA₃) @ 100ppm was found to be more desirable for producing significantly higher seed yield per plant (23.36g), seed yield per plot (334.03g). Findings are based on research done in one season in Prayagraj (Allahabad) U.P. further trails may be required for considering it for the recommendation.

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Table and figure 1: Influence of Rhizobium, Azospirillum, Gibberellic Acid(GA₃),NAA on plant height, days to 50 % flowering, number of branches, days to maturity.

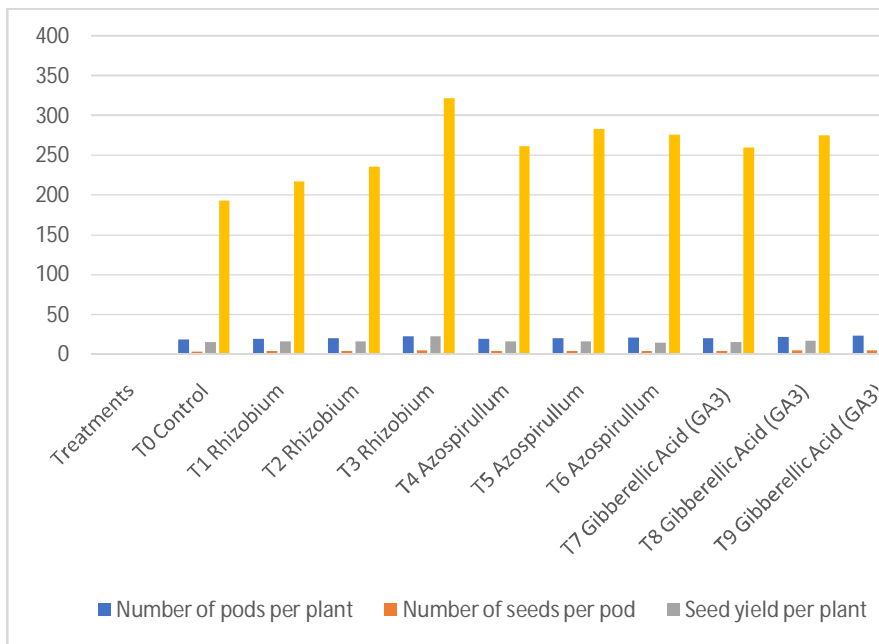
	TREATMENT	PLANT HEIGHT	DAYS TO 50% FLOWERING	NUMBER OF BRANCHES	DAYS TO MATURITY
T0	Control	91.15	73.73	6.73	123.73
T1	Rhizobium	92.21	72.66	7	121.46
T2	Rhizobium	92.88	68.46	7.26	121.4
T3	Rhizobium	96.92	66.66	7.6	119.53
T4	Azospirillum	93.05	69.53	6.86	121.26
T5	Azospirillum	94.23	69.26	7.13	120.6
T6	Azospirillum	95	68.93	7.33	121
T7	Gibberellic Acid (GA ₃)	95.71	68	7.07	121.33
T8	Gibberellic Acid (GA ₃)	95.79	68.46	7.4	121.2
T9	Gibberellic Acid (GA ₃)	98.11	63.4	8	117.86
T10	NAA	94.94	68.4	7.06	121.93
T11	NAA	95.13	68.73	7.33	120.8
T12	NAA	96.7	67.06	7.4	120.66
	S. Em (±)	0.58	0.56	0.44	0.19
	CD (p=0.05)	1.70	1.62	1.28	0.55



UNDER PEER REVIEW

Table and figure 2: Influence of Rhizobium, Azospirillum, Gibberellic Acid(GA₃),NAA on number of pods per plant, number of seeds per pod, seed yield per plant, seed yield per plot..

	TREATMENT	Number of pods per plant	Number of seeds per pod	Seed yield per plant	Seed yield per plot
T0	Control	18.6	3.66	15.73	193.34
T1	Rhizobium	19.73	4.33	16.43	218.10
T2	Rhizobium	20.67	4.2	16.46	236.07
T3	Rhizobium	22.73	5.13	22.33	322.03
T4	Azospirillum	19.46	4.53	16.8	261.60
T5	Azospirillum	20.20	4.4	16.36	283.57
T6	Azospirillum	21.46	4.6	15.4	275.63
T7	Gibberellic Acid (GA ₃)	20.46	4.6	16	260.03
T8	Gibberellic Acid (GA ₃)	21.73	5	17.5	275.60
T9	Gibberellic Acid (GA ₃)	23.53	5.3	23.36	334.03
T10	NAA	19.80	4.2	16.7	267.10
T11	NAA	20.33	4.4	15.36	283.90
T12	NAA	22.53	4.8	18.33	293.97
	S. Em (±)	0.36	0.13	0.40	4.55
	CD (p=0.05)	1.06	0.39	1.18	13.28



UNDER PEER REVIEW