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Full length Research paper

Influence of different pre-sowing seed treatments with organic, growth regulators & chemicals on growth, yield and yield attributing traits in field pea (*Pisum sativum L.*).

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The field experiment was conducted during rabi season in the year 2020-2021 at post graduate central research farm, Department of Genetics and Plant Breeding, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh.In order to study the different Pre-sowing Seed Treatments of Field pea var. IPFD 9-2. The experiment was laid out in Randomized block design (RBD) with 13 treatments and 3 replications. The treatments consists of T0- Control, T1- (Fym for 20hrs), T2- (Fym), T3- (GA3 @ 50ppm), T4- (GA3 @ 100ppm), T5- (CaCl2 @ 3% for 12hrs), T6- (CaCl2 @ 5% for 12hrs), T7- (NAA @ 50ppm for 12hrs), T8- (NAA @ 100ppm for 12hrs), T9- (KCl @ 3% for 12hrs), T10- (KCl @ 5% for 12hrs), T11- (IAA @ 50ppm for 12hrs), T12- (IAA @ 100ppm), . Pea seeds were subjected to growth and yield parameters and showed better results in T_8 (NAA@100 ppm for 12hours) than the treatment whereas minimum was observed in (control).

Key words: Field pea, Fym, Gibberellic acid, Indole acetic acid, Naphthalene acetic acid, CaCl2, KCl

INTRODUCTION

Field pea (*Pisum sativum L*.) is a self-pollinated crop and diploidy (2n=14) in nature. It is the most important annual cool season pulse crop and valued as high protein content food. It is widely grown in the cooler temperate zones and in the higher lands of tropical regions of the world. This crop is cultivated in wide range of soil types from light sandy loams to heavy clays but not tolerant to saline and water logged soil conditions. The optimum soil pH is 5.5-6.5. It is most important pulse crop in Ethiopia produced for long time in high and mild altitude areas by small farmers. It is rich in nutrition when fully matures and valuable as food legumes and often used in the manufacture of soups. Fresh green pea accepted as nutritious vegetable in the world.

Field pea is one of the genetic model legumes that was used to understand the basic concept of genetics (**Mendel,1865**). India is the second highest production in the world next to China. The pod of pea contains high amount of protein and carbohydrates. So that pea is consider as one of the most important sources of human food in the world **(Hussein *et al*., (2006)**. Pea has high level of amino acids, lysine and tryptophan which are relatively low in cereals. Pea contain 21-25% protein, carbohydrates and low fibre content and 86% of total digestible nutrients. Plant growth regulators (PGR), organic(FYM) and chemicals are utilized for seed treatment in this PGRs are known to improve physiological efficiency and enhance the source-sink relationship and stimulate the translocation of photosynthesis helps in seed germination, flowering and pod forming effectively .FYM is known to provide decomposable organic matter helps to increase in soil characters like water holding capacity, soil fertility to improve in seed germination .Chemicals also used as seed treatments helps in various benefits like improving

State wise production of field pea in tonnes:

State	Uttar Pradesh	Madhya Pradesh	Punjab	Jharkhand	Himachal Pradesh	West Bengal
Production %	2511.38	961.55	394.00	347.14	297.96	144.25

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emergence %, protection from seed borne diseases and soil borne pathogens and insect.

MATERIALS AND METHODS

Description of study area

The present study was conducted during rabi season in the year 2020-2021 at post graduate central research farm, Department of Genetics and Plant Breeding, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. Prayagraj is located in the south eastern part of Uttar Pradesh, India. This region has subtropical Climate with extreme of summer and winter. The temperature falls down to as low as 2-3^{0}c during winter season especially in the month of December and January.

Experimental design and treatments

The experimental design laid by randomized block design with three replications and treatments consists of :
T0-control
T1,T2-FYM for 20 hours
T3,T4- GA3(50&100ppm)for 12 hours
T5,T6-CaCl2(3 &5%concentration) for 12 hours
T7,T8-NAA(50&100ppm) for 12 hours
T9,T10-KCl(3 &5%concentration) for 12 hours
T11,T12-IAA(50&100ppm) for 12 hours.
Data of various parameters collected including field emergence, plant height at 30 and 60 days, days to 50%flowering, no. of pods per plant, no. of seeds per pod, seed yield per plant, seed yield per plot, biological yield, harvest index was data recorded. Field pea was harvested 90% of pods turns in brown colour. Five random plants were selected in each plot of all replications.

a) Field emergence :

$$\text{Field emergence} = \frac{\text{Number of seedlings emerged} \times 100}{\text{Number of seeds sown}}$$

b) Plant height (f)was taken in scale at 30 and 60 days then average value recorded.
c) Daily counts were taken from each plot to get to know the days taken to attain 50% flowering after flower initiation and recorded from the date on which 50% of flowering occurs.
d) Number of pods and number of seeds per pod from sample strands were counted and average value recorded.
e) Seed yield per plant and plot were weighed in weighing machine and results come in kilograms then data were recorded.
f) Biological yield refers to the total dry matter accumulation of a plant
Biological yield = seed yield + dry plant weight
g) Harvest index was obtained by
Harvest index = (economic yield / biological yield) x 100.

RESULT AND DISCUSSION

Result

The mean performance of different treatments showed different variations for parameters shown in table 2.

Growth attributes

Seed will be emerged significantly due to higher metabolic activity before sowing due to pre-sowing seed treatment that caused seeds get ready for germination early compared to untreated seeds. However, seeds were treated with NAA,GA3 & IAA solution showed early seed germination in field conditions. In field emergence percent was recorded higher in treatment T8 [NAA @ 100ppm for 12 hours (92.75)] followed by T12 [GA3 @100 ppm for 12 hours(90.48)] ,T3 [IAA @50 ppm for 12 hours (89.25)] .Whereas minimum was observed under T0[control (86.34)]. By treating with NAA showed will be effect on increasing the plant height also helps in vegetative propagation. NAA helps in root initiation thus increased in the plant height of pea and also seeds treated with CaCl2 increased plant height because calcium contain malfunctional nutrients in plant physiology which influences nutrient availability and uptake and helps to increase in cell wall strengthening and thickness. plant height at 30 days was recorded higher in T8[NAA @100ppm for 12 hrs (30.43)] followed T11 [IAA @50 ppm(28.66)], T5[CaCl2@ 3%(28.33)]. Whereas minimum was observed under T0 control(21.80).At the time of measuring plant height at 60 days, variations in plant heights were seen like NAA(T8) showed same variation but CaCl2(T5) showed less result in plant height.For plant height at 60 days was recorded higher in T8[NAA @100ppm for 12 hrs (72.83)] followed by T12 [IAA @100 ppm for 12 hours(69.03)], T7[NAA @50ppm for 12 hrs (68.73)]. Whereas minimum was observed in T0 control (66.46).days to 50% flowering in treated seeds takes less time to flower emergence due to early field emergence at the beginning and untreated seeds take more time to emerge. Days to 50% flowering was taken less days to flower initiate in T8[NAA @100ppm for 12 hrs (40.76 days)] followed by T12 [GA3 @100 ppm for 12 hours (42.20)], T6[CaCl2@ 5%(42.96)]. Whereas more days taken in T0 control (45.67). The application of these treatments to the seed, it significantly increases in plant height, early emergence, early flowering stage which encourages the cell division and cell elongation of plant comparing with untreated seeds. Seeds treated with Plant growth regulators showed

better result in plant growth .

Yield attributes

Number of pods per plant known that it is an important yield determinant. Pods were formed early in T8 (NAA) treatment due to early flower initiation and also NAA will prevent pod dropping but not in delaying of pod forming.Thus NAA showed good result in pod formation stage.Number of pods/plant in 5 randomly selected plants was recorded higher in T8[NAA @100ppm for 12 hrs (16.2)] followed byT12[GA3 @100 ppm for 12 hours(13.4)], T11 [IAA @50 ppm(13.3)], Whereas minimum was observed in T0 control(10.1).In yield attributes, seeds per pod is an important component.Application of NAA showed significant effect onnumber of seeds/podand also recorded higher in T8[NAA @100ppm for 12 hrs (42.23g)] followed by T12[GA3@100ppm for12 hours(40.73)].Whereas minimum was observed in T0 control (35.66). Finally seed yield per plot and plant is a cumulative function of various effect in yield parameters. It inferred that NAA decreases the dropping of flower, pod forming and increased in number of pods and seed yield.Seed yield/plant was recorded higherin T8[NAA @100ppm for 12 hrs (12.7g)] followed by T11[IAA @50 ppm(9.9)]. Whereas T0 control (7.4) recorded minimum respectively. Seed yield per plot was recorded higher in T8 [NAA @100ppm for 12 hrs (21.84g)] T12[IAA @100 ppm for 12 hours(17.59)], Whereas minimum was observed in T0 control (12.07).Biological yield is the outcome of all the biological and physiological processes occurring in plants. It shows efficiency of crop plants to convert photosynthates to dry matter. NAA have significant effect on biological yield. Biological yield was found higher in T8[NAA @100ppm for 12 hrs (870.4)] followed by T12[GA3 @100 ppm for 12 hours (778.9). Whereas minimum was observed in T0 control (524.5). Harvest index data presented in table 2 and showed how NAA effects on harvest index. HI is dependent on seed yield NAA increases pods per plant, by decreasing flower droppage and thus effects on harvest index. Harvest index was recorded higher in T8 (65.46), T12(64.80). Whereas minimum was observed in T0 control (59.57). However, by the application of growth regulators Naphthalene acetic acid shows better result in growth and yield parameters when compare to chemicals and fym. The use of growth hormones have proven to increase growth and yield in field pea.

Table-1 Analysis of Variance of growth & yield in field pea

Characters	Mean sum of square		
	Replications (df=2)	Treatments (df=12)	Error (df=24)
Field emergence percentage	0.73	9.74	0.86
Plant height at 30 DAS (cm)	0.08	12.86	2.0
Plant height at 60 DAS (cm)	0.01	6.27	0.43
Days to 50% flowering	3.43	4.36	0.34
No . of pods per plant	0.11	6.09	0.16
No . of seeds per pod	0.003	7.87	0.06
Seed yield per plant (g)	0.43	7.45	0.27
Seed yield per plot (g)	2.89	17.26	3.98
Biological yield	6861.81	22673.3	4567.5
Harvest index	0.61	5.77	1.63

Table-2 Mean performance of growth and yield attributes in field pea

S.no	Treatment	Field Emergence (%)	Plant height 30(days)	Plant height 60(days)	Days to 50% Flowering	No. of pods per plant	No. of Seeds per pod	Seed yield per plant	Seed yield per plot	Biological yield	Harvest index
1	T0	86.34	21.80	66.46	45.67	10.1	35.66	7.4	12.07	524.5	59.57
2	T1	88.17	26.73	67.73	44.93	12.3	37.63	9.4	16.98	703.2	62.35
3	T2	87.46	27.17	68.06	43.23	13.0	37.70	7.8	15.39	633.5	63.19
4	T3	89.25	25.60	67.80	43.86	11.0	38.83	12.1	14.20	619.7	63.60
5	T4	88.44	27.73	68.10	44.06	13.0	37.10	8.8	13.40	593.3	62.41
6	T5	87.5	28.33	68.13	43.76	12.1	38.33	9.2	14.07	621.0	62.60
7	T6	87.82	27.13	68.36	42.96	12.3	37.63	8.4	15.13	634.4	62.15
8	T7	87.77	27.00	68.73	44.00	12.2	38.13	9.2	15.14	635.8	62.87
9	**T8**	**92.75**	**30.43**	**72.83**	**40.76**	**16.2**	**42.23**	**12.7**	**21.84**	**870.4**	**65.46**
10	T9	88.07	27.76	68.23	44.23	13.3	38.30	8.1	16.22	655.6	62.73
11	T10	87.95	26.33	68.13	43.60	12.0	37.36	8.0	14.54	608.7	62.85
12	T11	88.00	28.66	68.20	43.70	13.4	38.70	9.4	16.39	653.1	63.15
13	T12	90.48	24.80	69.03	42.20	13.1	40.73	9.9	17.59	778.9	64.80
	Grand Mean	**88.46**	**26.88**	**68.44**	**43.61**	**12.62**	**38.35**	**9.26**	**15.61**	**656.3**	**62.90**
	CD@ 5%	1.09	2.42	1.12	0.99	1.82	1.13	1.28	3.38	113.2	2.15
	SE(m)	0.37	0.83	0.38	0.33	0.62	0.38	0.44	1.15	39.01	0.73
	SE(d)	0.52	1.17	0.54	0.48	0.88	0.54	0.62	1.63	55.2	1.24
	CV	0.73	5.32	0.96	1.34	8.54	1.75	8.12	12.78	10.29	2.03

Discussion

In pre-sowing seed treatment plant growth regulators plays important role in enhancing seed quality characters. The Growth Hormones GA_3, NAA, IAA used in different concentration to improve seed germination, plant growth and yield in plants and modify plant growth, increasing branching and shoot gowth.by GA_3 application in plants helps in germination percentage, increases physical and metabolic activities within the seeds promoting embryo growth. Higher concentration of GA_3 application leads to rapid seed germination. IAA helps to improve water content in plants, protein synthesis of seed in low concentration promotes cell elongation and helps to improve at flowering and yielding stage. By treating seeds with NAA, seeds will mature early compared to untreated seeds. Development of embryo will be grown quickly. Hence, early improvement shown in plant height, early in flowering, pod forming, good quality in yield. Plant growth regulators showed better results in comparison to chemicals and organic treatments. Plant growth regulators are good for environment as they are eco friendly to use.

CONCLUSION

It is concluded from the present study of seed treatment that various parameters among such as plant height, days to 50% flowering ,seed yield, biological and harvest index respond significantly when seeds were subjected to various pre-sowing treatments. Application of T_8-NAA@100ppm for 12 hrs gave positive results on field conditions among all treatments recorded followed by T_{12} IAA @100ppm for 12hrs. whereas control (T_0) seeds showed lowest readings among all parameters.

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