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RESEARCH PAPER

Correlated response of integrated nutrient management for seed yield and yield contributing traits of pea (*Pisum sativum* L.)

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Abstract : An experiment was conducted in RBD with three replications to find out the effect of integrated nutrient management in popular variety of pea, Azad Pea-3. The result revealed that application of vermicompost @ 2.5 tonnes ha^{-1} + ½ dose of NPK kg ha^{-1} resulted significantly maximum field emergence (24.18 sqm^{-1} area), days to 50 per cent flowering (30.66), green pod test weight (4024.77 g), plant height (98.04cm), test weight of seed (220.25 g), volume of 100 seed (21.30 cubic mm) and seed yield (22.52 qha^{-1}). An association study among the major yield characters exhibited significant strong, positive correlation between seed yield and field emergence, plant height, length of pod, number of grains pod^{-1}, number of pods $plant^{-1}$, green pod test weight, test weight of seed and volume of 100 seed.

Key Words : Seed yield, Yield contributing traits, Selection parameters, Inter relationships

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INTRODUCTION

Pulses are not only a low cost and rich source of protein but they can also a low cost substitute for majority of Indian consumers during high prices of vegetables. In India pea covers an area about 3.7 million hectares producing in the 3517 million tonnes with 9.50 metric tonnes ha^{-1} productivity. After India, China stands on second position in area and production in pea. The major pea producing states are Uttar Pradesh, Jharkhand, Himachal Pradesh, J & K, Punjab, West Bengal, Madhya Pradesh, and Haryana. In India, Uttar Pradesh covers 43.60 per cent area of the total area. In Uttar Pradesh pea is grown over an area of 159200 hectares with production of about 1532400 metric tonnes and productivity 9.60 metric tonnes ha^{-1} (IHD, 2011).

The increased use of chemical fertilizers under intensive cultivation has not only contaminated the ground and surface water but has also disturbed the harmony existing among the soil, plant and microbial population (Bahadur *et al*., 2006). There has been a growing public concern about adverse impacts of excess use of chemical fertilizers on the environment and on the safety and quality of food. Organic manures can be used to promote the healthy population of beneficial organisms in the soil. Bio fertilizers, on the other hand are cost-effective and renewable source of plant nutrients to supplement the parts of chemical fertilizers. A judicious use of organic manures and bio fertilizers may be effective not only in sustaining crop productivity and in soil health, but also in supplementing chemical fertilizers of the crops. Vermicompost is a very potential organic input for sustainable agriculture

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which contain beneficial microorganism, NPK, micronutrients, enzymes and hormones. There are several reports, which show that the combined and/or sole application of organic manures and bio fertilizers increased yield and influence quality attributes in most of the crops (Bahadur *et al*., 2003; 2006; Chatterjee *et al.* (2006) and Sharma *et al.* (2012). So integrated nutrient management should be eco-friendly and comparatively inexpensive and has the potential to reach marginal farmers as low cost input in different cropping system. Therefore, the present investigation was aimed to increase the growth, seed yield and yield attributes in pea with use of organics, bio fertilizer and their different compositions with recommended inorganic fertilizers.

MATERIAL AND METHODS

The field experiment on a popular pea variety, Azad Pea-3 was conducted during *Rabi* 2010-11 at Vegetable Research Farm, C.S. Azad University of Agriculture and Technology, Kanpur, U.P. (India). The soil of experimental field was sandy loam, with pH 7.0, electric conductivity 0.25 dSm^{-1}, organic carbon 0.50 per cent, total N 0.52 per cent, available P_2O_5 0.80 per cent and available K_2O 0.054 per cent. The field experiment consisted of nine treatments including control *viz.*, T_1 (Control-full dose of NPK @ 40:60:40 kg ha^{-1}), T_2 (FYM @ 20 tonnes ha^{-1}), T_3 (FYM @ 10 tonnes ha^{-1} + ½ dose NPK kg ha^{-1}), T_4 (Neem cake @ 5 q ha^{-1}), T_5 (Neem cake @ 2.5 q ha^{-1} + ½ dose of NPK kg ha^{-1}), T_6 (Poultry manure @ 5 tonnes ha^{-1}), T_7 (Poultry manure @ 2.5 tonnes ha^{-1} + ½ dose of NPK kg ha^{-1}), T_8 (Vermicompost @ 5 tonnes ha^{-1}) and T_9 (Vermicompost @ 2.5 tonnes ha^{-1} + ½ dose of NPK kg ha^{-1}), was laid out in RBD with three replications. The seed was treated with thiram @ 2.5 g kg^{-1} of seed. The crop was sown on 28 October 2010 using 100 kg seed ha^{-1} in rows at spacing of 30 cm × 10 cm by adopting best agricultural packages and harvested manually on 5 March 2011. Two weeding practices on 20 and 40 DAS was done. The highest rainfall of 41.90 mm was recorded in the month of November and least 0.0 in January, 2010-2011. For better root growth and aeration in the soil, hoeing and thinning was done after first weeding. In order to pre-sowing irrigation, two more irrigation was applied at 37 days after sowing and second irrigation was applied at pod filling stage. Two rouging were carried out before flowering and before maturity. The field observations were recorded on five randomly selected plants per plot. Statistical analyses were computed using MASTA-C computer programme following Searle (1961). The mean of the following characters were subjected to analysis, for field emergence (sqm^{-1} area), days to 50% flowering, plant height at 90 DAS (cm), length of pod (cm), number of grains pod^{-1}, number of pods $plant^{-1}$, green pod test weight (g), test weight of seed (g), volume of seed (cubic mm) and seed yield q ha^{-1}.

RESULTS AND DISCUSSION

The variances due to the treatments under study were significant in the case of the characters *viz.*, days to 50 per cent flowering, plant height at 90 DAS, test weight of green pods, test weight of seed and seed yield (Table 1). There were strong and significant correlation between all the yield contributing characters and seed yield. Field emergence sqm^{-1} area (0.876), plant height (0.987), length of pod (0.953), number of grains pod^{-1} (0.974), number of pods $plant^{-1}$ (0.973), test weight of green pods (0.977), test weight of seed (0.958) and volume of 100 seed (0.889) showed highly positive and significant association with seed yield. It revealed that seed yield can be increased through simultaneous selection of these traits (Table 2). The major yield enhancing traits length of pod, number of grains pod^{-1} and number of pods $plant^{-1}$ were significantly and positively associated with seed yield. Volume of 100 seed revealed that seed yield was positively and significantly related due to the vigorous size of seed. Test weight was positively and significantly associated with plant height at 90 DAS and test weight of green pods, indicated that both the characters can be enhanced simultaneously. Such findings were supported by Chaudhary and Sharma (2003); Singh and Singh (2005) and Singh and Dhillon (2004).

INM treatments showed significant response on yield and yield attributing characters. Among the various INM

Table 1 : ANOVA for yield and yield contributing traits for ten characters

Characters	Replication S.S. (2)	Treatment S.S. (8)	Error S.S. (16)
Days to 50% flowering	3.19	177.85**	10.81
Plant height at 90 DAS (cm)	3.90	1127.58**	10.83
Test weight of green pods (g)	18.67	5469.90**	70.15
Test weight of seed (g)	0.24	2495.80**	8.24
Length of pod (cm)	12.99	151.89	612.22
Number of grains pod^{-1}	13.01	140.54	570.10
Number of pods $plant^{-1}$	13.05	147.15	568.44
Field emergence sqm^{-1} area	2.63	43.20	22.10
Volume of 100 seed (cubic mm)	1.64	21.55	9.25
Seed yield (q ha^{-1})	19.21	29.96**	9.04

* and ** indicate significance of values at P=0.05 and P=0.01, respectively

treatments, yield and all the yield parameters such as field emergence (24.18 sqm^{-1} area), days to 50 per cent flowering (30.66), green pod test weight (4024.77 g), plant height (98.04cm), test weight of seed (220.25 g), volume of 100 seed (21.30 cubic mm) and seed yield (22.52 qha^{-1}) were significantly improved with the application of vermicompost @ 2.5 tonnes ha^{-1} + ½ dose of NPK kg ha^{-1} as compared to control-full dose of NPK @ 40:60:40 kg ha^{-1} and poultry manure @ 2.5 tonnes ha^{-1} + ½ NPK kg ha^{-1} followed by poultry manure @ 5 tonnes ha^{-1}and vermicompost @ 5 tonnes ha^{-1} (Table 3). The increase in yield attributed parameters might be due to integration of organic manure with inorganic fertilizer increased the availability of nutrients and these nutrients being important constituents of nucleotides, protein, chlorophyll and enzyme involved in various metabolic pathways which have direct impact on vegetative and reproductive phases of plant. These findings were supported by Kumaran *et al.* (1998) who reported that the better response was observed when organic manures

Table 2: Correlation between different yield contributing characters on seed yield

Parameters	Days to 50% flowering	Plant height at 90 DAS (cm)	Length of pod (cm)	No. of grains pod^{-1}	No. of pods plant^{-1}	Test weight of green pods (g)	Test weight of seed (g)	Volume of 100 seed (cubic mm)	Seed yield (q ha^{-1})
Field emergence sqm^{-1} area	-0.949**	0.937**	0.964**	0.955**	0.960**	0.953**	0.953**	0.964**	0.876**
Days to 50% flowering	1.000	-0.995**	-0.982**	-0.998**	-0.995**	-0.991**	-0.987**	-0.958**	-0.979**
Plant height at 90 DAS (cm)		1.000	0.981**	0.995**	0.994**	0.994**	0.979**	0.936**	0.987**
Length of pod (cm)			1.000	0.984**	0.992**	0.986**	0.981**	0.956**	0.953**
No. of grains pod^{-1}				1.000	0.996**	0.994**	0.992**	0.964**	0.974**
No. of pods plant^{-1}					1.000	0.996**	0.987**	0.958**	0.973**
Test weight of green pods (g)						1.000	0.989**	0.948**	0.977**
Test weight of seed (g)							1.000	0.972**	0.958**
Volume of 100 seed (cubic mm)								1.000	0.889**

* and ** indicate significance of values at P=0.05 and P=0.01, respectively

Table 3: Effect of INM on growth, seed yield and yield contributing traits of pea

Treatments	Field emergence sqm^{-1} area	Days to 50% flowering	Plant height at 90 DAS (cm)	Length of pod (cm)	No. of grains pod^{-1}	No. of pods plant^{-1}	Test weight of green pods (g)	Test weight of seed (g)	Volume of 100 seed (cubic mm)	Seed yield (q ha^{-1})
Control (full dose of NPK @ 40:60:40 kg ha^{-1})	24.10	32.00	95.04	7.71	7.38	7.72	4017.99	215.27	21.16	21.95
FYM @ 20 tonnes ha^{-1}	21.79	37.33	81.95	7.33	6.77	7.11	3991.32	198.49	19.36	20.60
FYM @ 10 tonnes ha^{-1} + ½ NPK kg ha^{-1}	22.58	36.00	83.34	7.41	6.89	7.24	3995.54	203.31	20.37	20.70
Neem cake @ 5 q ha^{-1}	20.67	38.33	78.12	7.08	6.59	6.88	3979.26	190.81	18.84	20.31
Neem cake @ 2.5 q/ ha^{-1} + ½ NPK kg ha^{-1}	21.26	38.00	80.20	7.20	6.64	7.03	3987.16	192.18	18.86	20.52
Poultry manure @ 5 tonnes ha^{-1}	23.88	34.00	89.32	7.61	7.11	7.49	4006.76	207.64	20.42	21.27
Poultry manure @ 2.5 tonnes ha^{-1} + ½ NPK kg ha^{-1}	24.05	33.00	91.39	7.65	7.26	7.63	4013.35	213.54	20.96	21.56
Vermicompost @ 5 tonnes ha^{-1}	23.15	35.00	86.93	7.53	7.02	7.40	3999.78	203.30	20.38	20.98
Vermicompost @ 2.5 tonnes ha^{-1} + ½ NPK kg ha^{-1}	24.18	30.66	98.04	7.90	7.50	7.90	4024.77	220.25	21.30	22.52
SE(d) ±	0.959	0.67	0.87	0.32	0.31	0.31	1.70	0.59	0.59	0.70
CD (P=0.05)	2.03	1.42	1.42	0.69	0.66	0.66	3.62	1.24	1.23	1.50

+ inorganic fertilizers applied in tomato. Similarly Chopra *et al*. (2008) reported that combined use of organic and inorganic fertilizer might have enhanced the nutrient uptake as well as yield in pea. Probably, vermicompost alone could not provide all the necessary nutrient elements in adequate quantities at critical stages for proper growth and yield of peas.

Thus, eco-friendly and economically vermicompost @ 2.5 tonnes ha^{-1} + ½ dose of NPK kg ha^{-1} may be recommended to exploit highest seed yield of pea variety, Azad Pea-3.

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