



EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND SEED YIELD OF FIELD PEA (*Pisum sativum* L)

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ABSTRACT

Biofertilizers are cost-effective and renewable source of plant nutrients to supplement the parts of chemical fertilizers. The present research study entitled “Effect of Integrated Nutrient Management on growth and seed yield of field pea (*Pisum sativum* var. arvensis)” was conducted in *Rabi* season 2015-2016 at the Field Experimentation Centre of Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad in RBD (Randomized Block Design) with three replication and 11 treatments. The results showed that the effect of integrated nutrient management was significant on growth and yield parameters of field pea. In field observation where highest mean performance of No. of branches/plant (19.00), No. of seed/pod (8.13), No. of pods/plant (16.40), Pod length (8.83cm), pod weight/plant (39.47g), plant height (78.31cm), Biological yield (54.07g), Harvest index (49.30), Seed yield/plant (30.47g) etc. were observed by T₅ as compared to control with mean value of (9.60, 4.60, 8.93, 5.13cm, 29.53g, 68.53cm, 38.87g, 55.92, 18.80g respectively). Thus, It showed that the treatment T₅ (100% RDF + *Rhizobium* @20 g/kg seed) was identified as a desirable treatment with respect of growth & seed yield of field pea.

KEYWORDS: Field pea, Integrated Nutrient Management, Seed Yield.

INTRODUCTION

Field pea (*Pisum sativum* L.) is a highly nutritive *Rabi* season legume containing high percentage of digestible protein, along with carbohydrates, vitamin A, C, calcium and phosphorus. Use of inorganic fertilizer alone is injurious to soil health and soil productivity. Use of organic and bio-fertilizers enhances crop production and sustain soil health (Akbari *et al.*, 2011). India accounts for 33% of the world area 22% of the world production of pulses. The major pulse crop grown in India are chickpea, pigeon pea, lentil, moong bean, urd bean and field pea. About 90% of the global pigeon pea, 65% of chick pea 37% of lentil area falls in India, corresponding to 93%, 68% and 32% of the global production, respectively (FAOSTAT, 2013).

Biofertilizers are known to play an important role in increasing availability of nitrogen and phosphorus besides improving biological fixation of atmospheric nitrogen and enhance phosphorus availability to crop. Introduction of efficient strains of *Rhizobium* in soils with low nitrogen may help augment nitrogen fixation and there by boost production of crops. Phosphorus is known to play an important role in growth and development of the crop and have direct relation with root proliferations, straw strength, grain formation, crop maturation (Bhat *et al.* (2013). Phosphorus and potassium application had significant effect on vine length while their interaction indicated non-significant differences among the treatment means. The result indicates that the vine length significantly increased with the increasing rate of phosphorus and potassium up to 69kg P₂O₅ and 100 kg K₂O ha⁻¹ respectively (Akhtar *et al.* (2003). Integrated nutrient management (INM) plays a

vital role to maintain soil fertility, to bring stability, sustainability in agricultural production and also avoid over dependence on chemical fertilizers. Efficient use of integrated plant nutrient supply system is a pre-requisite for achieving continuous advances in biological productivity of vegetable crops in ecologically sustainable manner (Sreenivas *et al.*, 2000). Keeping in this view the present research study was conduct to assess the Effect of Integrated Nutrient Management on growth and seed yield of field pea.

MATERIALS AND METHODS

The research experiment was conducted during *Rabi* 2015-2016 at Field Experimentation Centre of the Department of Genetics and Plant Breeding, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology & Science, Deemed-to-be-University, Allahabad. The Pea variety PSM-3 was selected for this research trial and seed source is Indian Institute of Pulse Research (IIPR) Kanpur (U.P.) India. The gross area of field is about 154 m² and net area 132 m² respectively. Seeds were sown in line sowing method with 30 cm row to row spacing and 10 cm plant to plant spacing respectively. The soil of the experimental field was sandy loam and having p^H 7.5 The Application of fertilizer was given at the time of sowing and recommended dose of fertilizer @30:60:40 NPK 20 kg/ha was applied in the form of urea, single super phosphate and murate of potash respectively as basal dose at the time of sowing and recommended dose of biofertilizers treatments as *Rhizobium* (20 gm/kg seed), *Pseudomonas* (20gm/ kg seed), Carbendazim (3gm/kg seed) where T₀- control, T₁- 100% RDF, T₂-

Rhizobium, T₃- Psuedomonas, T₄- Carbendazim, T₅-100% RDF + Rhizobium, T₆-100% RDF + Psuedomonas, T₇-100% RDF + Carbendazim, T₈-Rhizobium + Psuedomonas, T₉- Rhizobium + Carbendazim, T₁₀-Psuedomonas + Carbendazim. The experiment was carried out in Randomized block design with 11 treatments included Bio fertilizers and Chemical fertilizers (Psuedomonas, Carbendazim, Rhizobium). The following observations were recorded such as growth parameters Plant height(cm), Days to 50% flowering, No. of branches/plant, and Yield and yield characters, Number of pods per plant, seed yield per plant (kg), No. of seed/ pod, days to maturity, Nodules /plant, pod weight/plant(gm), pod length(cm), Biological yield (gm), Harvest index etc.

RESULTS & DISCUSSION

The results showed significant difference was observed for all of the treatments at 5% level of significance. The effect of integrated nutrient management on growth and seed yield characters were also found significantly.

Plant Height (cm) & No. of branches/plant

In field observation where mean performance of plant height at maturity stage ranged from 68.53 cm to 77.91 cm

with mean value of 73.42. Maximum plant height (78.31 cm) was recorded by T₅ as compared to control with mean value of (68.53cm). The mean performance for number of branches per plant at maturity stage ranged from 9.6 to 19 with mean value of 14.3. Maximum number of branches (19.00) was recorded by T₅ as compared control with mean value of (9.60). Bapi das *et al.*, (2011) evaluate the effect of 16 treatments *i.e.* various sources of nutrient on growth parameter, yield attributes, nutrient uptake, and soil nutrient status of cowpea (*Vigna unguiculata* L.) variety 'pusa komol'. As regards the growth parameters the plant height, number of leaves and branches per plant were significantly increased to a greater extent by the treatment 75 per cent RDF + Vermicompost + *Rhizobium* + PSB as compared to RDF alone at the field of Horticulture farm, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra). Patel *et al.* (1998) conducted at Indore in Madhya Pradesh, showed that application of *rhizobium* culture and phosphate solubilizing bacteria in combination with 50% of N&P significantly increased plant height, pods/plant, grains/pod and ultimately pod yield over control and chemical fertilizers alone.

TABLE 1: Mean performance of ten field characters of field pea

Treatments	days 50% flowering	no of branches per plant	no of seed/pod	no of pod / plant	pod length (cm)	pod weight / plant gm)	plant height (cm)	days to maturity	Biological yield (gm)	harvest index	seed yield / plant (gm)	Nodule per plant
T0	36.67	09.60	4.60	08.93	5.13	29.53	68.53	93.67	38.87	55.92	18.80	21.40
T1	37.00	13.93	5.47	11.07	6.11	32.13	71.75	92.33	45.47	50.68	23.00	23.13
T2	36.33	15.20	6.40	12.87	7.14	34.60	73.18	91.67	51.60	53.17	27.07	25.00
T3	38.33	13.20	5.56	12.60	6.33	32.13	74.01	92.67	47.73	52.03	24.47	20.87
T4	38.33	14.60	5.87	11.87	6.62	32.13	72.05	93.33	49.00	51.54	24.80	24.93
T5	35.33	19.00	8.13	16.40	8.83	39.47	78.31	90.67	54.07	49.30	30.47	27.80
T6	36.67	15.80	6.33	15.87	7.25	35.07	75.33	94.33	49.80	53.77	26.60	23.67
T7	36.00	16.40	6.40	15.07	7.67	33.13	73.90	94.00	52.40	51.68	26.53	25.47
T8	37.33	17.27	7.67	15.40	8.15	35.33	75.45	93.67	52.73	53.73	28.00	28.73
T9	37.67	18.13	7.07	15.13	7.61	35.80	77.91	92.33	51.87	53.99	27.80	24.07
T10	38.00	15.60	6.80	13.47	6.82	33.87	72.55	95.33	52.60	51.02	26.20	22.13
Grand	37.06	15.34	6.39	13.52	7.06	33.93	73.91	93.09	49.65	52.44	25.79	24.29
Sem	0.87	0.20	0.25	0.33	0.21	0.37	2.18	0.73	0.93	0.84	0.28	1.50
CD 1%	3.52	0.79	1.00	1.34	0.85	1.47	8.77	2.94	3.72	3.37	1.15	6.05
CD 5%	2.58	0.58	0.73	0.99	0.62	1.08	6.43	2.16	2.73	2.47	0.84	4.44
CV	4.08	2.03	6.72	4.28	5.19	1.87	5.11	1.36	3.23	2.77	1.91	10.72

No. of pods/plant & Pod Length (cm)

The mean performance of number of pod per plant ranged from 8.93 to 15.87 with mean value of 12.4. Maximum number of pods per plant (15.87) was recorded by T₅ as compared to control with mean value of (8.93). The mean performance of pod length (cm) ranged from 5.13 to 8.83 with mean value of 6.98. Maximum number of pod length (8.83) was recorded by T₅ as compared to control with mean value of (5.13). Bapi das *et al.* (2011) evaluate the effect of 16 treatments *i.e.* various sources of nutrient on growth parameter, yield attributes, nutrient uptake, and soil nutrient status of cowpea (*Vigna unguiculata* L.) variety 'pusa komol'. In respect of yield per hectare and over all yield contributing factors, such as number of pods, diameter and length of pods, the treatment of 75% RDF + Vermicompost + *Rhizobium* + PSB was found significant over control and RDF alone. It indicates a saving of 25 %

chemical fertilizer. Nitrogen status in soil after harvest was found significant in treatment RDF + *Rhizobium* + PSB and phosphorus status in soil after harvest was found significant in treatment 75% RDF + vermicompost + *Rhizobium* + PSB. Maximum nitrogen and phosphorus uptake by plant was found significant in treatment 75% RDF + Vermicompost + *Rhizobium* + PSB. Thus there was increase in soil fertility level by using biofertilizer, FYM, vermicompost along with chemical fertilizer as compared to chemical fertilizers alone at the field of Horticulture farm, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra). Upadhyay *et al.* (1999) reported that significant increase in the plant height, number of branches, number of nodules, pods per plant and seed per pod and seed yield when green gram seeds inoculated with *Rhizobium* compared to no inoculation.

Pod weight/plant & Days to Maturity

The mean performance of pod weight per plant (g) ranged from 29.53 to 39.47 with mean value of 34.5g. Maximum weight (39.47g) was recorded by T₅ as compared to control with mean value of (29.53g). The mean performance of Days to maturity ranged from 90.67 to 95.33 with mean value of 93. Maximum day to maturity (95.33) was recorded by T₁₀ as compared to T₅ with mean value of (90.67). R. A. Singh (2011) reported that the Integration of 25 kg N + 50 kg P₂O₅ with residue of 100 q FYM ha⁻¹ significantly increased the pods weight plant⁻¹, grains pod⁻¹, grain weight plant⁻¹ and 100-grain weight, which culminated into significant increase in grain yield. Mishra *et al.* (2010) A field experiment was conducted during two consecutive Rabi seasons of 2007 and 2008 to study the effect of bio-fertilizers in conjunction with inorganic fertilizers on growth and yield of dwarf field pea (cv. Jai) at Oil Seed Research Farm, Kalyanpur in C.S.A. University of Agriculture and Technology, Kanpur. The experiment was laid out in split plot design with three replications in sandy loam soil. The experiment comprised 32 treatment combinations of four levels of fertility (Control, 50, 75 and 100% RDF) and eight bio-fertilizer treatments (Control, *Rhizobium*, PSB, PGPR, *Rhizobium* + PSB, *Rhizobium* + PGPR, PSB + PGPR and *Rhizobium* + PSB + PGPR). Results indicated that the combined application of 100% RDF and seed inoculation with *Rhizobium* + PSB + PGPR improved all the growth; yield attributes and yields of field pea. Fresh and dry weight plant⁻¹, nodules number and dry weight plant⁻¹ were found significantly maximum. Thus, it can be recommended that to obtain the maximum grain yield and net profit from dwarf field pea, seed should be inoculated with *Rhizobium* + PSB + PGPR and crop should be fertilized with 100% recommended dose of fertilizer.

Number of Seeds/pod & No. of Nodules/plant

The mean performance of Number of seeds per pod ranged from 4.6 to 8.13 with mean value of 6.36. The maximum number of seeds per pod (8.13) was recorded by T₅ as compared to control (4.60). The mean performance of Number of Nodules per plant ranged from 21.4 to 28.73 with mean value of 25.06. Maximum number of nodule per plant (28.73) was recorded by T₈ as compared to T₃ with mean value of (20.87). Mishra *et al.* (2010) also reported to the effect of biofertilizers in conjunction with inorganic fertilizers on growth and yield of dwarf field pea (cv. Jai) and found that number of pods plant⁻¹, number of seeds pods⁻¹ at maturity attributed significantly increasing with the application of 100% DRF and seed inoculation of *Rhizobium* + PSB + PGPR. Gupta and Namdeo (1999), Prasad *et al.* (2002) and Sarg and Hassan *et al.* (2003), observed a significant increase in number of nodule/plant in pea crop, when organic amendments and bio-fertilizers are both applied in together combination and also reported by Ramadan (1997) indicated that seed inoculation with *Rhizobium*, revealed significant effect on all studied morphological characters; i.e. stem length (cm), number of branches, number of leaves and number of nodules/plant compared to un-treated one (control).

Seed yield/plant, Biological yield & Harvest Index

The mean performance of Seed yield per plant ranged from 18.8g to 30.47g with mean value of 24.63. Maximum seed yield per plant (30.47 g) was recorded by T₅ as

compared to control with mean value of (18.80 g). Data for biological yield per plant ranged from 38.87g to 54.07g with mean value of 46.47g. Maximum biological yield per plant (54.07g) was recorded by T₅ as compared to control with mean value of (38.87g). The data for harvest index per plant ranged from 49.3 to 55.92 with mean value of 52.61. Minimum harvest index per plant (49.3) was recorded by T₅ as compared to control with mean value of (55.92). J.S. Meena (2015) reported that the application of 100 percent RDF+VC @2 t/ha significantly increased the plant height, number of branches per plant, chlorophyll content, total root and effective root nodules, fresh weight and dry weight of nodules, number of pods per plant, number of seeds per pod, seed, biological yield and remained at par with the application of 75 per cent RDF+VC @ 2 t/ha over control. Rather *et al.* (2010) also find out the effect of biofertilizers (*Rhizobium*, *Azotobacter* and phosphate solubilizing bacteria (PSB)) application on growth, yield and economics of field pea (*Pisum sativum* L.). The co-inoculation of all the three bio-fertilizers i.e. *Rhizobium*, *Azotobacter* and PSB produced significantly higher growth characters as compared to absolute control and when inoculated them individually. The treatment T₈ comprising *Rhizobium* + *Azotobacter* + PSB gave highest growth in terms of plant height (45.26 cm), number of branches/ plant (4.20), number of leaves/ plant.

CONCLUSION

The above findings of results of the study clearly indicated the combination of chemical fertilizers and biofertilizers were significant on increase the growth and yield parameters of field pea. No. of branches/plant (19.00), No. of seed/pod (8.13), No. of pods/plant (16.40), Pod length (8.83cm), pod weight/plant (39.47g), plant height (78.31cm), Biological yield (54.07g), Harvest index (49.30), Seed yield/plant (30.47g) etc. were observed by T₅ (100% RDF + *Rhizobium* @400 g/ha). Thus, It showed that the treatment T₅ (100% RDF + *Rhizobium* @400 g/ha) was identified as a desirable treatment with respect of growth & seed yield of field pea.

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