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## Effects of organic nutrients in combination with bio-fertilizers on growth and physico-chemical parameters of garden pea (*Pisum sativum* L.) CV. *bonneville*

**HN Joshi, LR Varma, SG More, HS Bhaduria and BH Prajapati**

### Abstract

The experiment was conducted to examine the thirty treatments with five levels of organic nutrients *viz.*, control (Recommended dose of N as urea), farmyard manure, vermicompost, poultry manure and neem cake along with six levels of bio-fertilizers *viz.*, seed treatment with PSB (200 ml/ha), seed treatment with KMB (200 ml/ha), seed treatment with *Azospirillum* (200 ml/ha), soil treatment with PSB (500 ml/acre), soil treatment with KMB (500 ml/acre) and soil treatment with *Azospirillum* (500 ml/acre) were tested in a Randomized Block Design (with factorial concept) with three replications during the *rabi* season of the year 2013 and 2014. The results revealed that, the significantly maximum nitrogen content (4.20% and 4.15%) and protein content (26.28% and 25.96%) was recorded with treatment F5 (Recommended dose of N as neem cake) and treatment T1 [Seed treatment with PSB (200ml/ha)] was found significantly maximum nitrogen content (4.29% and 4.13%) and protein content (26.86% and 25.88%) during the year 2013 and 2014. The days taken for germination, germination (%), vine length of 45 & 90 DAS (cm), days taken for initiation of I<sup>st</sup> flower, length of pod (cm), thickness of pod (mm) and sugar (%) found non-significant in all treatments.

**Keywords:** Bonneville, garden pea, growth, physico-chemical, quality

### Introduction

The growing of vegetable is the most intensive and remunerative business. Garden pea (*Pisum sativum* L. var. hortense) is a second important food legume of the world. The green and dry foliage are used as cattle fodder and green pods of vegetable pea are highly nutritive so, preferred for culinary purpose. The high percentage of digestible protein (7.2 g), carbohydrates (15.8 g), vitamin A (139 I.U.), vitamin C (9 mg), magnesium (34 mg) and phosphorus (139 mg) per 100 g of edible portion (Gopalkrishnan, 2007) [6]. The food legumes restorer of soil fertility has long been recognized due to their unique ability of symbiotic nitrogen fixation. This also makes them the most important and useful component of a cropping system in the present context of energy crisis (Rana *et al.* 1998) [12]. To eradicate the low yield of pea, success of Indian agriculture depends heavily on use of fertilizers. To sustain soil health and benign environment there is a need for standardization the conjunctive use of organic sources and bio-fertilizers in order to increase the productivity and alternately improving the soil health (Sharma and Chauhan, 2011; Bahadur *et al.* 2006; Rajput and Kushwah, 2005) [13, 1, 11]. The concept of organic nutrients with bio-fertilizers are gaining considerable momentum today but negligible study has been conducted so, the present investigation was planned on garden pea.

### Materials and Methods

The investigation was conducted at Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Sardarkrushinagar. Five levels of organic nutrients including recommended dose of N as chemical fertilizer and six levels of bio-fertilizers were applied individually and with in combination. So, the total numbers of treatment combinations were thirty were tested during the *rabi* season of the year 2013 and 2014. The experiment was laid out in a Randomized Block Design (with factorial concept) with thirty treatments were employed and replicated thrice.

The details of treatments, their combinations and notations are furnished here in order to have their clear understanding.

✓ **Factors:****A) Organic Fertilizers (Five levels):**

- Control (Recommended dose of N as Urea)
- Recommended dose of N as Farm Yard Manure
- Recommended dose of N as Vermicompost
- Recommended dose of N as Poultry Manure
- Recommended dose of N as Neem cake

**Notation**

F<sub>1</sub>  
F<sub>2</sub>  
F<sub>3</sub>  
F<sub>4</sub>  
F<sub>5</sub>

**B) Bio-fertilizers (Six levels):**

- Seed treatment with PSB (200 ml/ha)
- Seed treatment with KMB (200 ml/ha)
- Seed treatment with *Azospirillum* (200 ml/ha)
- Soil treatment with PSB (500 ml/acre)
- Soil treatment with KMB (500 ml/acre)
- Soil treatment with *Azospirillum* (500 ml/acre)

T<sub>1</sub>  
T<sub>2</sub>  
T<sub>3</sub>  
T<sub>4</sub>  
T<sub>5</sub>  
T<sub>6</sub>

To raise the crop recommended package of practices were followed. The treatments were evaluated on the basis of growth, flowering and yield performance from ten randomly selected tagged plants at different stages. The mean data were subjected to statistical analysis following analysis of variance technique (Gomez and Gomez, 1984) [5].

**Results and Discussion****Growth Parameters**

**Organic manures:** A perusal of data from Table 1 revealed that minimum days taken for germination were observed with treatment F<sub>5</sub> (7.47) during the year 2013, treatment F<sub>1</sub> (6.72) during the year 2014 and treatment F<sub>1</sub> (7.12) in pooled data. The maximum germination percent was observed with treatment F<sub>4</sub> (94.81% and 94.10%) during the year 2013 and pooled analysis; treatment F<sub>3</sub> (93.59%) during the year 2014. Numerically maximum vine length at 45 days after sowing was recorded with treatment F<sub>5</sub> (48.57 cm and 46.85 cm) during the both years (2013 and 2014) and treatment F<sub>5</sub> (47.71 cm) in pooled. The highest vine length at 90 days after sowing was observed with treatment F<sub>5</sub> (117.60 cm, 117.73 cm and 117.67 cm) during the both year (2013 and 2014) and in pooled. Minimum days taken for flowering were observed with treatment F<sub>4</sub> (51.47 days) during the year of 2013, treatment F<sub>4</sub> (51.08 days) in pooled and treatment F<sub>1</sub> (50.63 days) during the year 2014.

**Bio-fertilizers:** A perusal of data from Table 1 revealed that the numerically minimum days for germination was observed under treatment T<sub>1</sub> (7.37) and treatment T<sub>2</sub> (7.37) during the year 2013, treatment T<sub>3</sub> (6.69) during the year 2014 and treatment T<sub>1</sub> (7.12) in pooled. Maximum germination percent was obtained with treatment T<sub>1</sub> (95.48%, 93.75% and 94.62%) during the year 2013, 2014 and in pooled. The maximum vine length (cm) at 45 days after sowing recorded with treatment T<sub>1</sub> (49.59 cm) during the year 2013, treatment T<sub>1</sub> (48.20 cm) in pooled and treatment T<sub>2</sub> (47.21 cm) during the year 2014. Maximum vine length at 90 days after sowing was obtained with treatment T<sub>2</sub> (119.11 cm, 117.91 cm and 118.51 cm) during the year 2013, 2014 and in pooled. Initiation of flower in minimum days was observed with

treatment T<sub>1</sub> (51.46 days, 50.26 days and 50.86 days) during the year 2013, 2014 and in pooled.

These results might be due to the slow release of nutrients from organic manures and when supplemented with bio-fertilizers it helped to microorganisms in the faster decomposition of organic manures, thereby increasing the availability of nutrients and ultimately resulting in higher plant growth rate. These findings are agreement with the findings of El-Beheidi *et al.* (1985) [3], Zaghoul *et al.* (1988) [16], Bahadur *et al.* (2006) [11], Negi *et al.* (2006) [8], Taura and Fatima (2008) [14] in cowpea, El-Desuki *et al.* (2010) [4], Mishra *et al.* (2010) [7], Chattoo *et al.* (2010) [2], Pan and Das (2011) [9] in cowpea, Patra and Sinha (2012) [10] in green gram, Sharma *et al.* (2011) [13] in garden pea and Tetali *et al.* (2016) [15] in blackgram.

**Physico-Chemical Parameters**

**Organic manures:** A perusal of data from Table 2 revealed that the maximum length of pod was found in treatment F<sub>4</sub> (8.44 cm) during the year 2013; F<sub>5</sub> (8.44 cm and 8.42 cm) during the year of 2014 and in pooled.

Numerically maximum thickness of pod (10.34 mm) was observed in treatment F<sub>4</sub> and F<sub>5</sub> during the year 2013; 10.15 mm in treatment F<sub>2</sub> and F<sub>5</sub> during the year 2014 and treatment F<sub>4</sub> (10.25 mm) in pooled. The highest total sugar content of pod was found with treatment F<sub>5</sub> (4.22%) during the year 2013; treatment F<sub>1</sub> (4.38%) during the year 2014 and treatment F<sub>5</sub> (4.29%) in pooled. Significantly maximum nitrogen content in seed was noted with treatment F<sub>5</sub> (4.20%, and 4.15%) during the year (2013 and 2014) of experimentation. Significantly maximum protein content in seed was noted with treatment F<sub>5</sub> (26.28%, and 25.96%) during the year (2013 and 2014) of experimentation.

**Bio-fertilizers:** A perusal of data from Table 2 revealed that the maximum length of pod was recorded with treatment T<sub>1</sub> (8.56 cm, 8.46 cm and 8.51 cm) during the year 2013, 2014 and in pooled. The numerically maximum thickness of pod (10.36 mm) was observed in treatment T<sub>2</sub> and T<sub>5</sub> during the year 2013; treatment T<sub>1</sub> (10.20 mm) during the year 2014 and treatment T<sub>2</sub> (10.26 mm) in pooled. The highest total sugar content of pod was found with treatment T<sub>1</sub> (4.20%) during the year 2013; treatment T<sub>5</sub> (4.38%) during the year 2014 and 4.27% with treatment T<sub>4</sub> & T<sub>5</sub> in pooled. Significantly maximum nitrogen content in seed was noted with treatment T<sub>1</sub> (4.29%, and 4.13%) during the both years (2013 and 2014) of experimentation. Significantly maximum protein content in seed was noted with treatment T<sub>1</sub> (26.86% and 25.88%) during the both years (2013 and 2014) of experimentation. The effect of organics and bio-fertilizer doses on protein content in seed. They attributed this firstly to the increase in the N content of beans and N being an integral part of enzymes and amino acids, plays a major role in synthesis of proteins and secondly due to the increase in the availability of P with the application of bio-fertilizer, which help in energy storage and transfer in form of ADP and ATP, which are essential for protein biosynthesis. These results are in conformity with El-Desuki *et al.* (2010) [4].

**Table 1:** Influences of organic nutrients and bio-fertilizers on growth parameters of garden pea

Treatments	Days taken for germination			Germination (%)			Vine length at 45 DAS (cm)			Vine length at 90 DAS (cm)			Days taken for initiation of 1 <sup>st</sup> flower		
	Year 2013	Year 2014	Pooled	Year 2013	Year 2014	Pooled	Year 2013	Year 2014	Pooled	Year 2013	Year 2014	Pooled	Year 2013	Year 2014	Pooled
<b>Organic manures</b>															
F <sub>1</sub>	7.52	6.72	7.12	94.12	90.45	92.29	46.58	46.12	46.35	116.99	114.27	115.63	51.57	50.63	51.10
F <sub>2</sub>	7.52	6.74	7.13	94.39	92.62	93.50	47.92	46.33	47.12	115.97	116.33	116.15	51.49	51.11	51.30
F <sub>3</sub>	7.59	6.74	7.17	93.76	93.59	93.67	47.66	46.48	47.07	116.59	115.84	116.21	51.56	51.04	51.30
F <sub>4</sub>	7.52	7.32	7.42	94.81	93.39	94.10	47.37	46.23	46.80	115.84	116.55	116.20	51.47	50.69	51.08
F <sub>5</sub>	7.47	7.26	7.36	94.60	93.12	93.86	48.57	46.85	47.71	117.60	117.73	117.67	51.68	51.26	51.47
S. Em.±	0.11	0.21	0.12	0.65	1.14	0.66	0.88	0.36	0.47	1.20	1.84	1.10	0.47	0.24	0.26
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
<b>Bio-fertilizers</b>															
T <sub>1</sub>	7.37	6.87	7.12	95.48	93.75	94.62	49.59	46.82	48.20	115.58	115.56	115.57	51.46	50.26	50.86
T <sub>2</sub>	7.37	7.20	7.28	94.39	92.07	93.23	48.47	47.21	47.84	119.11	117.91	118.51	51.68	51.42	51.55
T <sub>3</sub>	7.63	6.69	7.16	94.74	91.83	93.28	45.39	46.07	45.73	116.04	115.60	115.82	51.49	51.07	51.28
T <sub>4</sub>	7.57	7.02	7.30	94.69	93.08	93.89	47.83	45.98	46.91	117.51	116.28	116.89	51.55	50.93	51.31
T <sub>5</sub>	7.57	6.89	7.23	93.56	92.67	93.11	47.69	46.69	47.19	116.90	117.01	116.96	51.55	51.02	51.28
T <sub>6</sub>	7.64	7.06	7.35	93.16	92.41	92.79	46.75	45.66	46.21	114.45	114.51	114.48	51.59	50.98	51.29
S. Em.±	0.13	0.23	0.13	0.72	1.25	0.72	0.96	0.39	0.72	1.32	2.02	1.20	0.52	0.26	0.29
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	6.45	12.71	9.85	2.93	5.23	4.22	7.80	3.25	6.03	4.38	6.72	5.67	3.87	1.97	3.08

**Table 2:** Effects of organic manures and bio-fertilizers on physico-chemical parameters of garden pea

Treatments	Length of pod (cm)			Thickness of pod (mm)			Total sugar (%)			Nitrogen content (%) in seed			Protein content (%) in seed		
	Year 2013	Year 2014	Pooled	Year 2013	Year 2014	Pooled	Year 2013	Year 2014	Pooled	Year 2013	Year 2014	Pooled	Year 2013	Year 2014	Pooled
<b>Organic manures</b>															
F <sub>1</sub>	8.31	8.39	8.35	10.23	10.00	10.12	4.16	4.38	4.27	4.07	4.07	4.07	25.45	25.46	25.46
F <sub>2</sub>	8.34	8.26	8.30	10.27	10.15	10.22	4.18	4.28	4.23	4.10	4.07	4.08	25.67	25.45	25.56
F <sub>3</sub>	8.40	8.22	8.31	10.31	10.02	10.17	4.15	4.36	4.26	4.15	3.93	4.04	25.97	24.58	25.28
F <sub>4</sub>	8.44	8.34	8.39	10.34	10.12	10.23	4.14	4.34	4.24	4.08	4.09	4.09	25.56	25.58	25.57
F <sub>5</sub>	8.40	8.44	8.42	10.34	10.15	10.25	4.22	4.36	4.29	4.20	4.15	4.18	26.28	25.96	26.12
S. Em.±	0.12	0.14	0.10	0.19	0.22	0.15	0.03	0.03	0.02	0.01	0.02	0.06	0.05	0.12	0.40
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.02	0.05	NS	0.13	0.34	NS
<b>Bio-fertilizers</b>															
T <sub>1</sub>	8.56	8.46	8.51	10.17	10.20	10.19	4.20	4.32	4.26	4.29	4.13	4.21	26.86	25.88	26.37
T <sub>2</sub>	8.32	8.22	8.27	10.36	10.15	10.26	4.17	4.31	4.24	4.08	4.00	4.04	25.54	25.04	25.29
T <sub>3</sub>	8.39	8.28	8.33	10.30	10.12	10.21	4.18	4.34	4.26	4.06	4.00	4.03	25.43	25.04	25.19
T <sub>4</sub>	8.29	8.34	8.32	10.29	10.13	10.21	4.17	4.36	4.27	4.00	4.01	4.00	25.03	25.09	25.05
T <sub>5</sub>	8.36	8.36	8.36	10.36	9.96	10.16	4.16	4.38	4.27	4.07	4.08	4.07	25.47	25.52	25.49
T <sub>6</sub>	8.35	8.32	8.34	10.30	9.98	10.14	4.16	4.36	4.26	4.22	4.02	4.12	26.39	25.17	25.78
S. Em.±	0.13	0.16	0.10	0.21	0.24	0.16	0.03	0.03	0.02	0.01	0.02	0.07	0.05	0.13	0.50
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.02	0.06	NS	0.14	0.37	NS
CV%	5.97	7.19	6.61	7.84	9.25	8.56	2.80	2.51	2.65	0.75	1.98	1.49	0.75	1.98	1.49

## Summary and Conclusion

Significantly maximum nitrogen content and protein content in seed on dry matter basis were recorded with treatment F<sub>5</sub> (Recommended dose of N as neem cake), treatment T<sub>1</sub> [Seed treatment with PSB (200ml/ha)] and in treatment combination F<sub>5</sub>T<sub>1</sub> [Recommended dose of N as neem cake + Seed treatment with PSB (200 ml/ha)] during the both years (2013 and 2014). The experimental evidences warrant the following specific conclusion which may be adopted for profitable organic production of garden pea under North Gujarat conditions. It may be concluded that the application of nitrogen through neem cake in combination with PSB achieved better growth with good quality of pods under North Gujarat condition, as this treatment combination proved to be the best among all the treatments.

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