



## Research Article

# INFLUENCES OF ORGANIC NUTRIENTS IN COMBINATION WITH BIO-FERTILIZERS ON YIELD AND QUALITY OF GARDEN PEA (*Pisum sativum* L.) CV. BONNEVILLE

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**Abstract:** An 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 weight of pod (6.10 g, 6.29 g and 6.19 g), highest yield of pods per plot (1.98 kg, 2.22 kg and 2.10 kg) and yield of pods per hectare (101.35 q, 113.70 q and 107.52 q) was recorded with treatment F<sub>5</sub> (Recommended dose of N as neem cake) and treatment T<sub>1</sub> [Seed treatment with PSB (200ml/ha)] was found significantly highest number of pods harvested per plant (6.34, 6.16 and 6.25), weight of pod (6.22 g, 6.26 g and 6.24 g), yield of pods per plot (1.93 kg, 2.19 kg and 2.06 kg) and yield of pods per hectare (98.73 q, 112.28 q and 105.50 q) during the year 2013, 2014 and in pooled analysis, respectively. The significantly highest number of pods harvested per plant (5.89) was observed with treatment F<sub>5</sub> (Recommended dose of N as neem cake) in pooled. The significantly maximum nitrogen content (4.20 % and 4.15 %) and protein content (26.28 % and 25.96 %) was recorded with treatment F<sub>5</sub> (Recommended dose of N as neem cake) and treatment T<sub>1</sub> [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.

**Keywords:** Bonneville, Garden pea, Growth, Yield

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## 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 [11]. 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 [19]. 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 [1, 18, 25]. 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 within 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 [9].

Table-1 Influences of organic nutrients and bio-fertilizers on yield and yield attributes of garden pea

Treatments	Total number of pickings			No. of pods harvested plant <sup>-1</sup>			Weight of pod (g)			Yield of green pod plot <sup>-1</sup> (kg)			Yield of green pod hectare <sup>-1</sup> (q)		
	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>	3.17	3.72	3.44	5.52	5.14	5.33	5.62	5.90	5.76	1.82	1.93	1.87	93.38	98.82	96.10
F <sub>2</sub>	3.28	3.72	3.50	5.56	5.05	5.31	5.91	5.99	5.95	1.86	2.10	1.98	95.30	107.76	101.53
F <sub>3</sub>	3.11	3.83	3.47	5.32	5.03	5.17	6.02	5.99	6.00	1.65	1.97	1.81	84.67	101.14	92.91
F <sub>4</sub>	3.28	3.78	3.56	5.58	5.16	5.37	5.84	6.05	5.95	1.76	2.11	1.94	90.11	108.28	99.20
F <sub>5</sub>	3.44	3.83	3.61	5.96	5.82	5.89	6.10	6.29	6.19	1.98	2.22	2.10	101.35	113.70	107.52
S. Em.±	0.11	0.19	0.11	0.17	0.27	0.16	0.09	0.09	0.06	0.06	0.05	0.04	3.11	1.95	2.06
C.D. at 5%	NS	NS	NS	NS	NS	0.44	0.26	0.24	0.18	0.20	0.10	0.10	8.80	5.38	5.80
<b>Bio-fertilizers</b>															
T <sub>1</sub>	3.40	4.13	3.77	6.34	6.16	6.25	6.22	6.26	6.24	1.93	2.19	2.06	98.73	112.28	105.50
T <sub>2</sub>	3.27	3.80	3.53	5.99	5.94	5.96	5.83	6.14	5.99	1.81	1.98	1.90	92.91	101.61	97.26
T <sub>3</sub>	3.20	3.73	3.47	5.30	4.70	5.00	5.90	6.20	6.05	1.83	2.03	1.93	93.80	104.27	99.03
T <sub>4</sub>	3.27	3.67	3.47	6.06	4.03	5.05	5.69	5.64	5.66	1.88	1.94	1.91	96.49	99.47	97.98
T <sub>5</sub>	3.13	3.53	3.47	4.02	5.69	4.86	5.98	6.03	6.00	1.85	2.11	1.98	95.06	108.35	101.70
T <sub>6</sub>	3.27	3.80	3.54	5.83	4.93	5.38	5.76	6.00	5.88	1.58	2.14	1.86	80.78	109.65	95.21
S. Em.±	0.12	0.21	0.12	0.18	0.29	0.17	0.10	0.09	0.07	0.06	0.06	0.04	3.41	2.96	2.26
C.D. at 5%	NS	NS	NS	0.51	0.83	0.48	0.29	0.27	0.19	0.20	0.20	0.10	9.60	8.40	6.30
CV %	13.88	21.33	18.57	12.53	21.66	17.42	6.64	6.04	6.34	14.20	10.82	12.43	14.20	10.82	12.43

Table-2 Influences of organic nutrients 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

## Results and Discussion

### Yield and Yield Attributes

Organic manures: A perusal of data from Table 1 revealed that the numerically maximum numbers of pickings were recorded with treatment F<sub>5</sub> (3.44 and 3.83) during the both year (2013 and 2014) and treatment F<sub>5</sub> (3.61) in pooled analysis. Significantly maximum number of pods harvested per plant was found under treatment F<sub>5</sub> (5.89) in pooled. Significantly highest weight of pod was recorded with treatment F<sub>5</sub> (6.10 g and 6.29 g) during both the years of experimentation (2013 and 2014) and treatment F<sub>5</sub> (6.19 g) in pooled. Significantly maximum yield of green pods per plot was recorded with treatment F<sub>5</sub> (1.98 kg and 2.22 kg) during both the years of experimentation (2013 and 2014) and treatment F<sub>5</sub> (2.10

kg) in pooled. Significantly maximum yield of green pods per hectare recorded with treatment F<sub>5</sub> (101.35 q and 113.70 q) during both the years of experimentation (2013 and 2014) and treatment F<sub>5</sub> (107.52 q) in pooled. Bio-fertilizers: A perusal of data from Table 1 revealed that the maximum numbers of pickings were observed with treatment T<sub>1</sub> (3.40 and 4.13) during the both year (2013 and 2014) and treatment T<sub>1</sub> (3.77) in pooled. Significantly maximum number of pods harvested per plant was observed with treatment T<sub>1</sub> (6.34 and 6.16) during the both year (2013 and 2014) and treatment T<sub>1</sub> (6.25) in pooled. Significantly highest weight of pod was observed with treatment T<sub>1</sub> (6.22 g and 6.26 g) during both the years of experimentation (2013 and 2014) and treatment T<sub>1</sub> (6.24 g) in pooled.

Significantly maximum yield of green pods per plot was recorded with treatment T1 (1.93 kg and 2.19 kg) during both the years of experimentation (2013 and 2014) and treatment T1 (2.06 kg) in pooled. Significantly maximum yield of green pods per hectare was observed with treatment T1 (98.73 q and 112.28 q) during both the years of experimentation (2013 and 2014) and treatment T1 (105.50 q) in pooled. The effect of organic manures viz., FYM, vermicompost, poultry manure, neem cake and bio-fertilizers in balanced proportion played a vital role in decomposition and easy release of different plant nutrients throughout the plant life. Initially, the bio-fertilizers provided rapidly better nutrition with all essential nutrients and their uptake by the plant which leads to better plant growth. In latter stage, the required plant nutrient provided through decomposed organic manures for the good development of the plant which in turn resulted into higher yield of the crop. It is fact that PSB produce organic acids like gluconic, guccinic, lactic, oxalic, citric and  $\alpha$ -ketogluconic acid which convert the insoluble phosphate to soluble one and synthesis growth promoting substances which augment plant growth. The overall development of plant in terms of root and shoot which might have absorbed more nutrient and enhanced photosynthesis and production of assimilates, which in turn increased the yield of pea. The results obtained in present investigation are in line with the findings of in garden pea [1, 4-6, 8, 12, 13, 20-26, 28].

### Physico-Chemical Parameters

#### Organic manures

A perusal of data from Table 2 revealed that the maximum length of pod was found in treatment F4 (8.44 cm) during the year 2013; F5 (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 F4 and F5 during the year 2013; 10.15 mm in treatment F2 and F5 during the year 2014 and treatment F4 (10.25 mm) in pooled. The highest total sugar content of pod was found with treatment F5 (4.22 %) during the year 2013; treatment F1 (4.38 %) during the year 2014 and treatment F5 (4.29 %) in pooled. Significantly maximum nitrogen content in seed was noted with treatment F5 (4.20 %, and 4.15 %) during the year (2013 and 2014) of experimentation. Significantly maximum protein content in seed was noted with treatment F5 (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 T1 (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 T2 and T5 during the year 2013; treatment T1 (10.20 mm) during the year 2014 and treatment T2 (10.26 mm) in pooled. The highest total sugar content of pod was found with treatment T1 (4.20 %) during the year 2013; treatment T5 (4.38 %) during the year 2014 and 4.27 % with treatment T4 & T5 in pooled. Significantly maximum nitrogen content in seed was noted with treatment T1 (4.29 %, and 4.13 %) during the both years (2013 and 2014) of experimentation. Significantly maximum protein content in seed was noted with treatment T1 (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 has been reported earlier by [22]. 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 those of [2], [8] and [10].

### Summary and Conclusion

Significantly maximum number of pods harvested per plant were recorded with treatment F5 (Recommended dose of N as neem cake) in pooled and treatment T1 [Seed treatment with PSB (200ml/ha)] during the both years (2013 and 2014) and in pooled. The treatment combination F5T1 [Recommended dose of N as neem cake + Seed treatment with PSB (200 ml/ha)] was observed maximum number of pods harvested per plant during the year 2013 and in pooled.

Significantly maximum weight of pod, yield of green pods per plot, yield of green pod per hectare were found with treatment F5 (Recommended dose of N as neem cake), treatment T1 [Seed treatment with PSB (200ml/ha)] and in treatment combination F5T1 [Recommended dose of N as neem cake + Seed treatment with PSB (200 ml/ha)] during the both years (2013 and 2014) and in pooled. Significantly maximum nitrogen content and protein content in seed on dry matter basis were recorded with treatment F5 (Recommended dose of N as neem cake), treatment T1 [Seed treatment with PSB (200ml/ha)] and in treatment combination F5T1 [Recommended dose of N as neem cake + Seed treatment with PSB (200 ml/ha)] during the both years (2013 and 2014).

**Application of research:** The experimental evidences warrant the following specific conclusion which may be adopted for profitable organic production of garden pea under North Gujarat condition. It may be concluded that the application of nitrogen through neem cake in combination with bio-fertilizer like PSB are achieved better growth, reasonably comparable yield with good quality of pods under North Gujarat condition.

**Research Category:** Vegetable Science

#### Abbreviations:

CD: Critical Difference, CV: Coefficient of variation

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