International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(6): 906-908

Received: 23-09-2017
Accepted: 25-10-2017

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Effect of integrated nutrient management on growth and yield attributes of table pea (*Pisum sativum* L.) cv. AP-3

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Abstract
An experiment was carried out to assess the, "Effect of integrated nutrient management on growth and yield of table pea (*Pisum sativum* L.) cv. AP-3", during rabi season 2016-17 at Department of Vegetable Science, Kalyanpur, C.S.A.U.A & T, Kanpur. Results indicate that the six treatments *viz.*, T_1 (Full dose of NPK through chemical fertilizer @ 40:60:40 kg/ha), T_2 (FYM @ 10 t/ha + ½ dose of NPK through chemical fertilizer), T_3 (Vermicompost @ 2.5 t/ha + ½ dose of NPK through chemical fertilizer), T_4 (Pressmud @ 5 t/ha + ½ dose of NPK through chemical fertilizer), T_5 (Sewage sludge @ 10 t/ha + ½ dose of NPK through chemical fertilizer) and T_6 (Poultry manure @ 2.5 t/ha + ½ dose of NPK through chemical fertilizer) were tested in RBD with three replications and cultivar Azad Pea-3 was used. The field observations (Days to 50% flowering, Pod length (cm), Pod width (mm), Number of pod/plant, Number of seed in a pod and Pod yield kg/plot & q/ha) were recorded. Among different treatments result indicate that highest Pod length (cm), Pod thickness (mm), Number of pod/plant, Pod weight plant^{-1} (g), Pod yield plot^{-1} (kg) and Pod yield (q ha^{-1}) were observed in the T_3 (Vermicompost @ 2.5 t/ha + ½ dose of NPK through chemical fertilizer). However maximum No. of grains pod^{-1} (avg. 10 pods) were recorded in the T_5 (Sewage sludge @ 10 t/ha + ½ dose of NPK through chemical fertilizer) and highest Pod weight [avg. of 10 pods (g)] were recorded in the, T_4 (Pressmud @ 5 t/ha + ½ dose of NPK through chemical fertilizer).

Keywords: table pea, FYM, vermicompost, sewage sludge, pressmud, NPK

Introduction
Pea is the most important vegetable grain legume which belongs to family Papilionaceae (Watt and Merrill, 1963 and Hassan, 1997) [20, 3]. India accounts 33% of world area and 22% of world production of pulses. In India, pea is grown in an area of 498000 ha with a production of 4811000 mt (www.agricoop.nic.in 2015-16).

It is not only a main source of protein but also it provides carbohydrate, fat, micronutrients and vitamins which are useful for human health. Pea contains nutritional value per 100gram (3.5 oz) energy 339 kJ (81kcal), carbohydrates 14.45 g, sugars 5.67g, Dietary fiber 5.1 gram fat 0.4g, protein 5.42 g, vitamin A equiv. 38 µg, beta carotene 449 µg, lutein, zeaxanthin 2.477 µg, thiamine (B_1) 0.266 mg, riboflavin (B_2) 0.132 mg, niacin (B_3) 2.09 mg, vitamin (B_6) 0.169 mg, folate (B_9) 65 µg, vitamin C 40 mg, vitamin E 0.13 mg, vitamin K 24.8 µg, calcium 25 mg, iron 1.47 mg, magnesium 33 mg, manganese 0.41mg, phosphorus 108 mg, potassium 244 mg, sodium 5 mg and zinc 1.24 mg. Green peas contain a high percentage of essential amino acids.

Vegetable pea is one of the important cool season vegetable crop grown all over the world. It is widely grown as a cool season vegetable crop. The seed may be planted as soon as the soil temperature reaches 10 °C (50°F), with the plant growing best at a temperature of 13-18°C(55-64°F). Being a leguminous crop, it enriches the soil by fixing atmospheric nitrogen in the soil and also provides an effective cover to the land and thus restricts soil erosion. Vegetable plays a major role in Indian Agriculture by not only providing nutritional food and economic security but more importantly, producing a higher return (Kumari *et al*., 2017) [7, 8]. The area in short vegetables has higher productivity, shorter maturity cycle, high volume and provide greater income leading to improves livelihoods. Now a days the production has been stagnant at 12 to 15 million tons over last two decades or increasing the production a comprehensive approach of integrated nutrients management which would be eco-friendly is required.

Chemical fertilizers are needed to get good crop yields but their abuse and overuse can be harmful for the environment and their cost cannot make economic and profitable agricultural products (Bobade *et al*., 1992; Kumari *et al*., 2015) [9, 2]. The increased use of chemicals under intensive cultivation has not only contaminated the ground and surface water but has also distributed the harmony existing among the soil, plant and microbial population (Bahadur *et al*., 2006; Kumari *et al*., 2016) [1, 10]. A judicious use of organic manures may be effective not only sustaining crop productivity and in soil health, but also in supplementing chemical fertilizers of crop (Jaipal *et al*., 2011) [5]. Organic manures such as Farm yard manure and vermicompost is the excreta of earthworms, which is rich in humus and nutrients and provide a lot of advantage in association of microorganisms (Azotobacter, Azospirillum, PSB etc.) (Singh *at el*., 2017). Many workers have been reported the integrated nutrient management work on agriculture crops Pandey *et al*., (2017) [8] on Dahlia, Kumari *et al*., (2015; 2016; 2017) [7-10] on Paddy, Legumes and cole crops, Yadav *et al*., (2010) [21], Umar *et al*., (2009) [18], Singh *et al*., (2008) [15], Rana and Chandel (2003) [14], Zargar *et al*., (2008) [23], Umar *et al*., (2010) [19] and Jain *et al.* (2013) on strawberry.

Materials and Methods

The experiment was carried out at department of vegetable science kalyanpur, C. S. Azad University of Agriculture and Technology, Kanpur during the year 2016-2017 during the *rabi* season. The experiment site is situated in gangatic alluvial belt of Central Uttar Pradesh and located between 25°26ˈto 26°28ˈnorth latitude and 79°31ˈto 80°34ˈ East longitude at elevation of 127.00 meters above mean sea level. The mean analysis of soil was sandy loam in texture, pH (6.25), available organic carbon (0.50%), nitrogen (0.52%) phosphorous (0.080%), potash (0.054%), boron (0.20 ppm) and EC (0.25 m mhos/cm). 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. On the other hand two weeding on 20 and 40 days after sowing was done at this time plant to plant distance was maintained by manually thinning and four pickings recorded in harvesting. The Field experiment was laid out in randomized block design, having three replications and six treatments *viz*., T_1 (Full dose of NPK through chemical fertilizer @ 40:60:40 kg/ha), T_2 (FYM @ 10 t/ha + ½ dose of NPK through chemical fertilizer), T_3 (Vermicompost @ 2.5 t/ha + ½ dose of NPK through chemical fertilizer), T_4 (Pressmud @ 5 t/ha + ½ dose of NPK through chemical fertilizer), T_5 (Sewage sludge @ 10 t/ha + ½ dose of NPK through chemical fertilizer) and T_6 (Poultry manure @ 2.5 t/ha + ½ dose of NPK through chemical fertilizer). The fertilizer doses of N:P:K (40:60:40 kg/ha) were distributed according to layout in different plots. The half dose of nitrogen and full dose of phosphorous and potash as per recommendation urea, diammonium phosphate and murat of potash respectively, was applied in the soil before sowing and rest of the half dose of nitrogen was applied as a top dressing. In experiment field, FYM, poultry manure, sewage sludge, pressmud, vermicompost were also applied as per recommendation. Observation was recorded *viz*., pod length (cm), pod thickness (mm), no. of pods plant^{-1}, no. of grains pod^{-1} (avg. 10 pods), pod weight [avg. of 10 pods (g)], pod weight plant^{-1} (g), pod yield plot^{-1} (kg) and pod yield (q ha^{-1}).

Results and Discussion

The present investigation shows that the effect of different combination of nutrients on different growth and yield attributes has been given in table 1. With respect to the pod length, pod thickness, no. of pods plant^{-1}, pod weight plant^{-1}, pod yield plot^{-1} and pod yield (8.69 cm,13.65 mm, 8.00, 27.10 g, 7.28 kg and 80.84 q ha^{-1}, respectively) was observed in the treatment T_3 (Vermicompost @ 2.5 t/ha + ½ dose of NPK through chemical fertilizer) which was 11.13, 6.23, 13.48, 13.48, 15.01 and 14.96% higher compared to the lowest treatment T_1 (Full dose of NPK through chemical fertilizer @ 40:60:40 kg/ha). However highest no. of grains pod^{-1} and pod weight (5.74 and 3.24 g, respectively) was recorded in the treatment T_5 (Sewage sludge @ 10 t/ha + ½ dose of NPK through chemical fertilizer) and T_4 (Pressmud @ 5 t/ha + ½ dose of NPK through chemical fertilizer) which 12.33 and 0.93% higher compared to the lowest treatment value. The increase in growth such as plant height may be due to the application of vermicompost which facilitates quick and greater availability of plant nutrients and thus provides a better environment for root growth and proliferation. Vermicompost also creates a more adsorptive surface for uptake of nutrients. These results are accordance with the finding of Patil *et al.* (2007) [13]. The present study also revealed that the impact of vermicompost in combination with ½ dose of NPK is favourable due the probable reason behind this fact that for overall growth enzymes, hormones, as well as macronutrients, are imperative Yadav *et al.* (1992) [22], Johnston *et al.* (2001) [6], Sundara *et at*.(2004) [17].

On the other hand regarding to the pod length, pod thickness, no. of pods plant^{-1}, pod weight, pod weight plant^{-1}, pod yield plot^{-1} and pod yield (8.60 cm, 13.41 mm, 7.59, 3.23 g, 25.82 g, 6.91 kg and 76.75 q ha^{-1}, respectively) second highest treatment was observe in the T_5 (Sewage sludge @ 10 t/ha + ½ dose of NPK through chemical fertilizer). The reason for increased pod yield in pea was attributed to the increased solublization, affect and availability of nutrients by adding of, organic manures and inorganic fertilizer, which is increased the physiological activity leading to building up of sufficient food resources for developing sink and better pertaining to words the developing fruits, similar results were also reported by Musinguzi *et al.* (2010) [11]. Therefore, these treatments may be recommended to exploit the better eco-friendly economic pod yield of Azad Pea-3 variety. It will ensure the sustainability in production and soil health.

Table 1: Effect of integrated nutrient management on growth and yield attributes of table pea

Treatment combinations	Pod length (cm)	Pod thickness (mm)	No. of pods plant^{-1}	No. of grains pod^{-1} (avg. 10 pods)	Pod weight [avg. of 10 pods (g)]	Pod weight plant^{-1} (g)	Pod yield plot^{-1} (kg)	Pod yield (q ha^{-1})
T_1:Full recommended dose of NPK through chemical fertilizer	7.82	12.85	7.05	5.25	3.21	23.88	6.33	70.32
T_2:FYM@ 10t/ha + half NPK through chemical fertilizer	8.44	13.11	7.09	5.33	3.22	23.90	6.42	71.30
T_3:Vermicompost @ 2.5 t/ha + half	8.69	13.65	8.00	5.73	3.22	27.10	7.28	80.84

NPK through chemical fertilizer								
T_4:Pressmud @ 5t/ha + half NPK through chemical fertilizer	8.46	13.15	7.20	5.11	3.24	24.64	6.55	72.83
T_5:Sewage sludge @ 10t/ha + half NPK through chemical fertilizer	8.60	13.41	7.59	5.74	3.23	25.82	6.91	76.75
T_6:Poultry manure @ 2.5 t/ha + half NPK through chemical fertilizer	8.55	13.35	7.34	5.55	3.21	25.09	6.67	74.14
CD (P = 0.05)	_	_	_	_	_	_	_	_
SEM	0.38	0.45	0.28	0.21	0.11	0.90	0.24	2.76
CV (%)	7.86	5.98	6.80	6.94	6.35	6.28	6.43	6.43

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