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Response of different levels of NPK and Neem cake on soil health, growth and yield attributes of Field pea (*Pisum sativum* L.) Cv. T-19

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Abstract
A field experiment was conducted at Research farm, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, SHUATS, Allahabad (U.P.) during the *Rabi* season of 2017-18 with the objective to response of different levels of NPK and Neem cake on soil health, growth and yield attributes of Field pea (*Pisum sativum* L.) Cv. T-19. The experiment was laid out in a Randomized Block Design with nine treatment combinations, consisting of three N P K levels (0, 50 and 100%) and neem cake (0, 50 and 100%). It was observed that for postharvest, soil properties in treatment T_8 (*i.e.* @N 40kg + P@ 50kg + K@ 40kg and neem cake @2.5 q ha^{-1}) were improved significantly due to organic and inorganic use of inputs. Organic carbon (0.55%), Available nitrogen (301.37 kg ha^{-1}), Phosphorus (27.03 kg ha^{-1}), Potassium (194.17 kg ha^{-1}) and respectively were found significantly higher as compared to other treatment combination.

Keywords: field pea, NPK levels, neem cake, soil parameters etc.

Introduction
Peas (*Pisum sativum* L.) are grain legume and member of the leguminosae family grown throughout the world. It is a native of central or Southeast Asia. It grows well in cool weather in the presence of ample moisture. Peas are recognized as one of the earliest agricultural crops domesticated by human beings. It is most important cultivated legume next to soybean, groundnut and beans (Hules, 1994) [4].

Nutrition value of green peas per 100g contain Energy 339KJ, Dietary Fiber 5.1g, Protein 5.42, Carbohydrates 14.45g, Sugars 5.67g, Fat 0.4g, Vitamin C 40mg, Folic acid 50.7μg, Iron 1.47mg, Potassium 217mg, Magnesium 33mg and phosphorus 108mg. (FAO stat, 2012) [20].

India has a major world's crop area under pulses and one fourth of the total production. Pulse crops offer and stable source of protein in vegetarian diet of masses. Besides their well-recognized role in restoring fertility and its physical conditions, pulse crops provide succulent and nutritious to our cattle, therefore, have been described as "Unique jewels of Indian crop husbandry". Pulses add 0.8 to 1.5 tonnes of organic matter to the soil in the form of their roots left after harvesting of the crops, on an average, one hectare crop adds 15 to 30 kg nitrogen in readily available form (Singh, 2001). The population of our country is at an alarming rate, which would be expected to reach 1280 million in 2020 and at this rate of population increase, India will need at least 30 million tonnes of pulses by 2020 (Kumar *et al.* 2004) [6].

Legumes have been recognized as an important component of any cropping system and as a low input approach towards improvement of soil fertility. It appears to have originated many thousands of years ago in central Asia and the Middle East. They were originally dried and stored for long periods, providing nutrition during the non-growing seasons. Peas are now grown throughout the world and are consumed in both fresh and dried conditions. It is widely cultivated in temperate regions for its fresh green seed. Peas are an excellent human food (Kakar *et al.* 2002) [9], either eaten as a vegetable or used in preparation of soup. The peas are full of nutrition because its grain is rich in protein, complex carbohydrates, vitamins, minerals, dietary fibers and antioxidant compounds (Bhatt *et al.* 2013)

The center of production of peas has moved from the traditional Middle East local to Canada, which is now the largest single producer. Pea production in Western Canada has been increasing since 1997. France, China and India are also large producers next to Canada. Peas ranks 4th in the world on a production basis (441.53 thousand tonnes) among grain legumes after soybean, groundnut and French beans and is grown on an area of 528.71 thousand hectares in the world (FAO stat, 2009) [19].

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India is the largest producer of pulses and accounts for about 25 per cent of the global share. In India, pulse crops are grown over an area of 26.28 M ha with an annual production of 18.09 Mt and productivity of 689 kg ha^{-1}. In Gujarat, it is cultivated in 2.09 lakh hectares with an annual production of 1.14 lakh metric tonnes leading to average productivity of 546 kg ha^{-1} (Anonymous, 2011).

T-19 Varity of pea is medium tall and double podded Varity has been developed by Department of Agriculture, U.P. The first blossom appears at 12-14th node after 60 days. Pods are yellowish green, slightly curved, 8.5 cm long with 6-7 wrinkled seeds with 45 % shelling percentage (Anonymous, 2016) [1]

Materials and Methods
The experiment was conducted in the research farm of Department of Soil Science and Agricultural Chemistry, SHUATS, Allahabad. The experimental site is located in the sub–tropical region with 25^0 28'46.14" N latitude, 81^0 54'49.95" E longitude and 98m altitudes above the mean sea level. The experiment was laid out in a Randomized Block Design with nine treatment combinations of organic and inorganic source of fertilizers T_0 - L_0N_0 (control), T_1 - L_0N_1 ($N_0P_0K_0$ and Neem cake 1.25 t ha^{-1}), T_2 - L_0N_2 ($N_0P_0K_0$ and

Neem cake 2.5t ha^{-1}), T_3 - L_1N_0 ($N_{20}P_{25}K_{20}$ and Neem cake 0 t ha^{-1}), T_4 - L_1N_1 ($N_{20}P_{25}K_{20}$ and Neem cake 1.25t ha^{-1}), T_5 - L_1N_2 ($N_{20}P_{25}K_{20}$ and Neem cake 2.5 t ha^{-1}), T_6 - L_2N_0 ($N_{40}P_{50}K_{40}$ and Neem cake 0 t ha^{-1}), T_7 - L_2N_1 ($N_{40}P_{50}K_{40}$ and Neem cake 1.25t ha^{-1}), T_8 - L_2N_2 ($N_{40}P_{50}K_{40}$ and Neem cake 2.5 t ha^{-1}),consisting of three N P K levels (0, 50 and 100%) and Neem cake (0, 50 and 100%). The Allahabad will be situated in South east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 ^{0}C - 48 ^{0}C and seldom falls as low as 4 ^{0}C - 5 ^{0}C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually. The recommended dose of fertilizers such as Nitrogen (40 kg ha^{-1}), Phosphorus (50 kg ha^{-1}), Potassium (40 kg ha^{-1}) and Neem cake (2.5 q ha^{-1}) respectively were applied into the field. Half dose of nitrogen and full dose of phosphorus and potassium were applied before sowing of Field pea. The data was calculated. All the agronomic practices were carried out uniformly to raise the crop. After crop harvesting the soil samples were collected from the soil 0-15 cm depth, air dried kept in an oven at 105 ^{0}C for 48 hrs. For drying, pass through 2 mm sieve, soils were analyzed by using the following standard procedures.

Table 1: Results of physic-chemical properties of pre-soil samples. (Before sowing of crop)

Particulars	Results	Methods
Sand (%)	58	Bouyoucos hydrometer (Bouyoucos 1927) [2]
Silt (%)	27	
Clay (%)	15	
Texture of soil	Sandy loam	
Particle density (g cm^{-3})	2.42	Graduated measuring cylinder (Muthuaval et al. 1992)
Bulk density (g cm^{-3})	1.37	Core method (Muthuaval et al. 1992)
Soil pH	7.5	Digital pH meter (Jackson 1958) [5]
EC (dS m^{-1})	0.29	Digital conductivity meter (Wilcox 1950) [18]
Organic carbon (%)	0.39	Rapid titration method (Walkley and Black 1947)
Available Nitrogen (kg ha^{-1})	228.4	Available Nitrogen (Subbaih and Asija 1956) [13]
Available Phosphorus (kg ha^{-1})	20	Colorimetric method (Olsen et al. 1954) [12]
Available Potassium (kg ha^{-1})	148.3	Flame photometric method (Toth and prince 1949) [16]

Table 2: Effect of different levels of N, P, K and Neem cake on physio-chemical properties of soil in Field pea (*Pisum sativum*) Cv. T-19

| Treatments	Soil bulk density (g cm^{-1})	Soil particle density (g cm^{-1})	Percent pore space (%)	Soil pH	EC (dS^{-1})	Available Nitrogen (kg ha^{-1})	Available Phosphorus (kg ha^{-1})	Available Potassium (kg ha^{-1})	Organic carbon (%)
T_0(I_0F_0)	1.27	2.54	44.70	7.80	0.12	247.73	20.50	114.97	0.56
T_1 (I_0F_1)	1.26	2.57	45.37	7.70	0.13	252.43	21.13	123.53	0.57
T_2 (I_0F_2)	1.23	2.60	46.07	7.70	0.13	261.13	21.80	131.83	0.60
T_3 (I_1F_0)	1.22	2.63	46.53	7.67	0.14	266.10	22.23	145.17	0.61
T_4 (I_1F_1)	1.20	2.65	47.40	7.37	0.15	272.67	22.63	157.23	0.63
T_5 (I_1F_2)	1.15	2.67	48.13	7.37	0.15	278.33	23.33	167.13	0.65
T_6 (I_2F_0)	1.08	2.68	48.90	7.43	0.16	287.63	24.50	174.17	0.67
T_7 (I_2F_1)	1.06	2.71	50.07	7.20	0.16	295.83	25.70	183.10	0.69
T_8 (I_2F_2)	1.04	2.72	50.70	7.20	0.17	301.37	27.03	194.17	0.70
Mean	0.016	0.003	0.198	0.001	0.166	0.674	0.14	1.333	0.005
C.D at 5%	0.016	0.003	0.198	0.001	0.166	0.674	0.14	1.333	0.005
F test	NS	S	NS	S	NS	S	S	S	NS
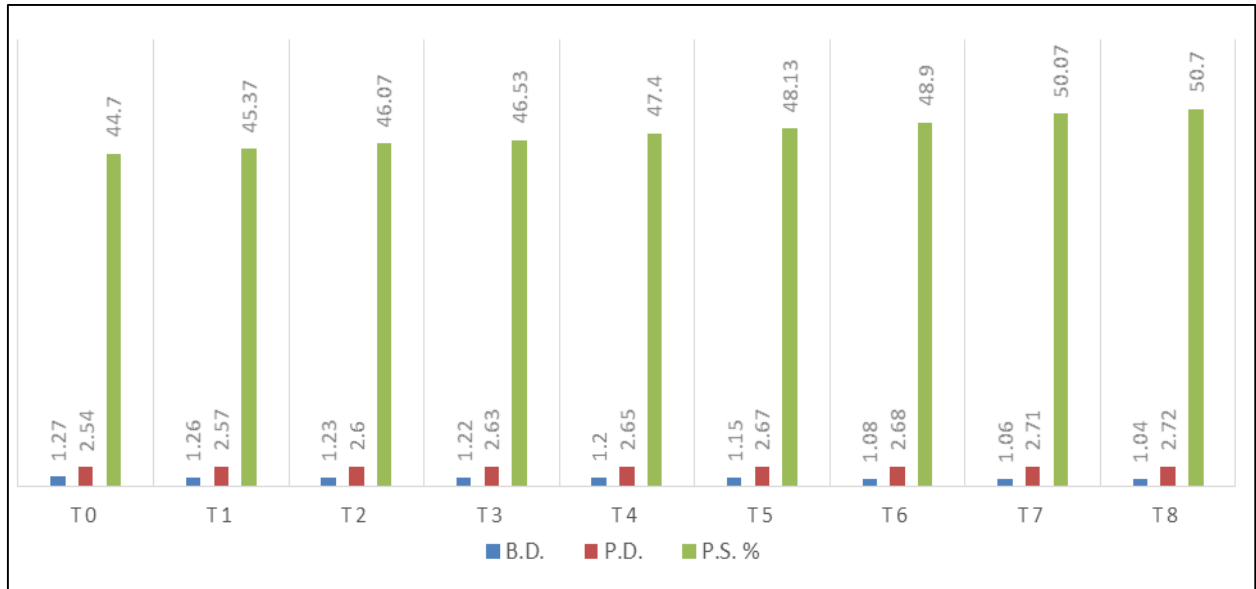
Fig 1: Effect of different levels of N, P, K, and Neem cake on their interaction between Bulk density, Particle density, Pore space % of Field pea (*Pisum sativum* L.) Cv. T-19
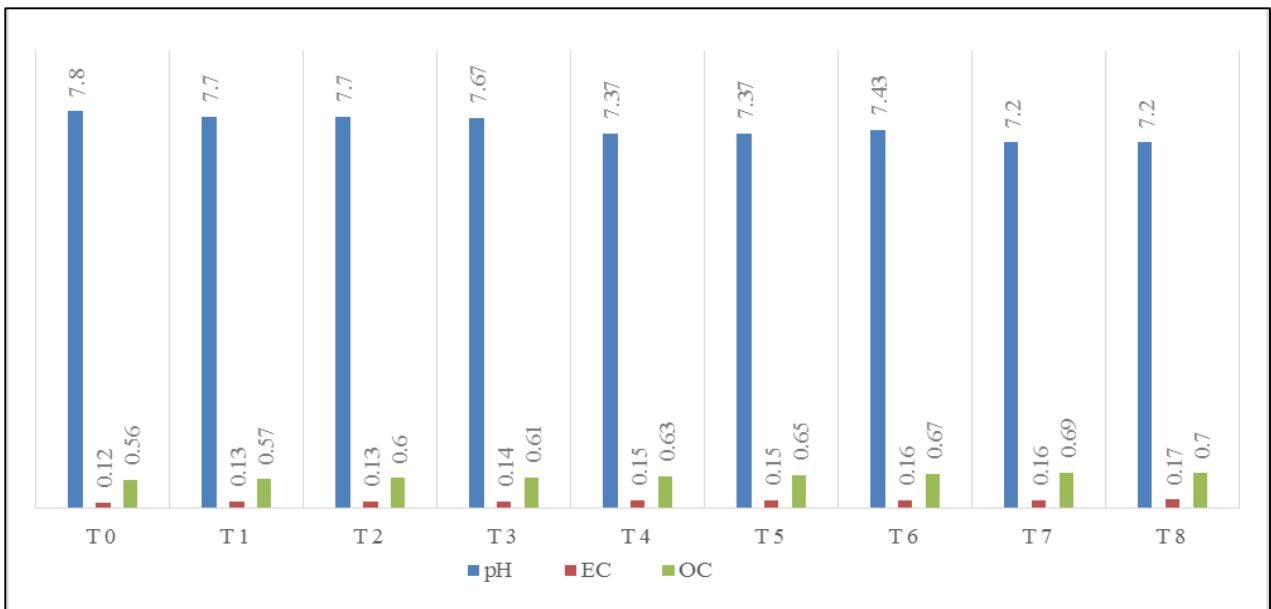

Fig 2: Effect of different levels of N, P, K, and Neem cake on their interaction between Soil pH, EC, Organic carbon % of Field pea (*Pisum sativum* L.) Cv. T-19
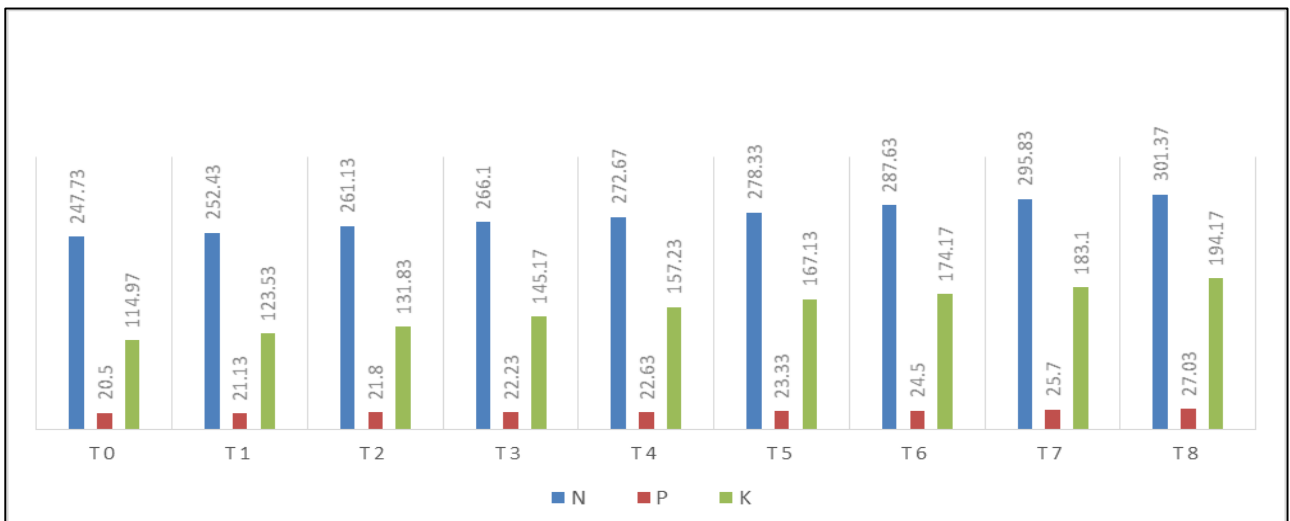

Fig 3: Effect of different levels of N, P, K, and Neem cake on their interaction between Nitrogen, Phosphorus, Potassium of Field pea (*Pisum sativum* L.) Cv. T-19

Results and Discussion

The results given in Table 2 indicate some of the important parameter on physical properties on Field pea (*Pisum sativum*) Cv. T-19 crop. Neem cake and inorganic fertilizers in conjunction on Bulk density (1.04), percentage Pore space (50.70), EC (0.17), Organic carbon percent (0.70), was found non-significant and particle density, Soil pH (7.20), Available nitrogen (301.37 kg ha^{-1}), Available phosphorus (27.03 kg ha^{-1}), Available potassium (194.17 kg ha^{-1}) was found significant. And their values were recorded respectively in the treatment T_8 that was significantly higher as compared to other treatment combination. Soil pH was recorded 7.20 in the treatment T_8 that were significantly lower as compared to other treatment combination. The slight decreased in soil pH and increased in soil EC (dSm^{-1}), Organic carbon (%), Available Nitrogen (kg ha^{-1}), Available Phosphorus (kg ha^{-1}), Available Potassium (kg ha^{-1}), may be due to increase in levels of organic and inorganic fertilizer and plant growth, which is turn increased the plant residues into soil. It may be concluded from trial that the various level of NPK and Neem cake used from different sources in the experiment, the treatment T_8 - L_2N_2 ($N_{40}P_{50}K_{40}$ and Neem cake 2.5 t ha^{-1}) was found to be the best, for improvement in physical and chemical properties of soil.

Acknowledgements

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