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## Effect of organic manures on potato yield, nutrients uptake and soil fertility

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#### Abstract

A field experiment entitled “Effect of organic manures on Potato yield, nutrients uptake and soil fertility” was conducted at Main Experiment Station Vegetable Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during rabi season of 2018-19. The soil of the experimental field was silt loam texture, having pH 8.1, EC ( $\text{dSm}^{-1}$ ) 0.23, organic carbon ( $\text{gkg}^{-1}$ ) 3.1, available N 140kg/h, P 15.2kg/h, K 240kg/h, bacterial population 25.5 cfu/g soil and fulgal population 14.7 cfu/g soil. Field trial was laid out in RBD with three replication, having 7 number of treatments viz. T<sub>1</sub>-Control, T<sub>2</sub> FYM 30 t/ha + PSB, T<sub>3</sub>-Poultry manures 5t/ha + PSB, T<sub>4</sub>-Vermicompost 7.5 t/ha + PSB, T<sub>5</sub>-FYM 10 t/ha + Poultry manures 1.7 t/ha + Vermicompost + 2.5 t/ha + PSB, T<sub>6</sub>-Recommended dose of nitrogen (150 kg) in which 67% N through inorganic and 33% N through FYM + PSB, T<sub>7</sub>- Farmer practices – FYM 15t/ha + Vermicompost 1t/ha + PSB. Growth and yield of potato and nutrients uptake were found significantly superior in T<sub>6</sub> treatment (where organic and inorganic N applied in the ratio of 1:2) over control. Maximum potato tubers yield (38.41 t/ha), nutrients uptake N (184.4 kg/ha), P (34.6 kg/ha) and K (185.2 kg/ha) were recorded in T<sub>6</sub> while B:C ratio (2.47) was observed under T<sub>3</sub> treatment (where poultry manure 5t/ha + PSB applied). Better soil health recorded with T<sub>5</sub> treatment (where FYM 10 t/ha + Poultry manure 1.7 t/ha + Vermicompost 2.5 t/ha + PSB applied).

**Keywords:** Organic manures, potato, nutrients content and uptake and soil fertility

#### Introduction

Continuous Use of chemical fertilizers had increased the crop yield, but caused many environmental problem including soil, air and water pollution and finally human health hazards and making the crop productivity unsustainable (Eid *et al.*, 2006) [3]. And further use of chemical fertilizer in imbalanced and indiscriminate manner has developed many problems like decline of soil organic matter, increase in salinity and sodicity, deterioration in the quality of crop produce, increase in hazardous pests, diseases and soil pollution problems. For nutritional importance of potato, cultivation of potato under organic condition is the positive step for quality food production. In this cultivation, each organic source of nutrient (i.e. farm yard manure, vermicompost, Poultry manure and bio-fertilizers etc.) individually and specifically in integration of nitrogen is the important aspect in nutritional management of the crop for achieving higher productivity, good quality of food and soil health. Organic manures (FYM, vermicompost, poultry manure and bio-fertilizer) is the source of primary, secondary and micronutrient to the plant growth and constant source of energy for heterotrophic microorganism, which help in increasing availability of nutrient, quality and quantity of crop produce (Roy and Singh, 2014) [4]. As on single source of capable of supplying the required amount of plant nutrients, integrated use of all source of plant nutrient is a must to supply balanced nutrition to the crop (Banerjee *et al.*, 2016) [2]. Over the year, there has been stagnation or decline in yield of potato in this agro-climate zone. Decline soil fertility, specially soil organic matter, is one of the important factor responsible for this. The effect of organic manure incorporation in such field has been formed inevitable. Hence, the present investigation has been planned to conducted the experiment entitled “Effect of organic manures on potato yield, nutrient uptake and soil fertility”.

#### Materials and Method

The experiment was conducted at MES Vegetable form Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during rabi season of 2018-19. The soil of the experimental field was silt loam in texture with medium soil fertility.

The field experiment was laid out in Randomized Block Design with three replication having seven treatment i.e T<sub>1</sub>-Control, T<sub>2</sub> FYM 30 t/ha + PSB, T<sub>3</sub>-Poultry manures 5t/ha + PSB, T<sub>4</sub>-Vermicompost 7.5 t/ha + PSB, T<sub>5</sub>-FYM 10 t/ha + Poultry manures 1.7 t/ha + Vermicompost + 2.5 t/ha + PSB, T<sub>6</sub>-Recommended dose of nitrogen (150 kg) in which 67% N through inorganic and 33% N through FYM + PSB, T<sub>7</sub>-Farmer practices – FYM 15t/ha + Vermicompost 1t/ha + PSB. As per organic manures (fYM, Poultry manures and Vermicompost) were applied during final field preparation and inorganic nitrogen (urea) half dose applied as basal and remaining half of N was applied as top drashing at the time of earthing up. The potato variety (Kufari Anand) crop was raised follow the good agricultural practices of the region. Soil fertility parameter were analysed by adopting standard

laboratory methods.

### Result and Discussion

It is clear from the table 1 that potato tubers emergence, plant height and tuber yield increased with the addition of organic manure in all the treatment except control. The treatment T<sub>6</sub> (Recommended dose of nitrogen (150 kg) in which 67% N through inorganic and 33% N through FYM + PSB applied) was found better on higher tuber emergence (94.27%) plant height at 30 DAS (41.50 cm) and tuber yield (38.41 t/ha) over rest of the treatments. This might be due to better integrated nitrogen management and availability of nutrient which resulted better growth and development of plant. Ahmed *et al.* (2019)<sup>[1]</sup>.

**Table 1:** Effect of Organic manures on Potato tubers emergence, plant height and yield of potato

Treatments	Tuber Emergence (%)	Plant Height (cm) 30 DAS	Tuber Yield (t/ha)
T <sub>1</sub>	92.19	34.50	10.25
T <sub>2</sub>	91.15	35.00	27.80
T <sub>3</sub>	93.75	35.40	29.62
T <sub>4</sub>	92.71	35.00	29.01
T <sub>5</sub>	93.75	37.50	30.58
T <sub>6</sub>	94.27	41.50	38.41
T <sub>7</sub>	91.67	34.45	26.28
S.Em±	0.87	1.57	1.32
CD	1.91	4.86	2.90

**Table 2:** Effect of organic manures on nutrients content and uptake in potato

Treatments	Nutrients content in potato (%)			Nutrients uptake by potato (kg/ha)		
	N	P	K	N	P	K
T <sub>1</sub>	0.43	0.08	0.45	56.8	10.6	59.5
T <sub>2</sub>	0.45	0.09	0.46	125.1	25.0	127.0
T <sub>3</sub>	0.46	0.09	0.47	136.3	26.7	137.5
T <sub>4</sub>	0.45	0.09	0.47	130.5	26.0	131.8
T <sub>5</sub>	0.46	0.09	0.47	140.7	27.5	142.0
T <sub>6</sub>	0.48	0.10	0.49	184.4	34.6	185.2
T <sub>7</sub>	0.44	0.08	0.47	115.6	21.0	117.2
S.Em±	0.01	0.00	0.01	5.08	0.86	4.76
CD	0.02	NS	0.02	11.19	1.90	10.49

Effect of organic manures on nutrient content and uptake have been from in table 2. It is clear from the table that maximum N (0.48%), P (0.10%) and K (0.49%) content and uptake N (184.4 kg/ha), P (34.6 kg/ha) and K (185.2 kg/ha) were observed under T<sub>6</sub> treatment (Recommended dose of nitrogen (150 kg) in which 67% N through inorganic and 33% N

through FYM + PSB applied) over rest of the treatment. This might be due to better utilization and supply of nutrient to potato crop. The increase N,P and K availability of nutrient means more translocation of nutrients from soil to plant. Verma *et al.* (2011)<sup>[6]</sup>.

**Table 3:** Effect of organic manures on soil fertility status before sowing of potato

Treatments	pH	EC (dSm <sup>-1</sup> )	OC (g/kg)	N (Kg/ha)	P (Kg/ha)	K (kg/ha)	Bacteria Cfu/gsoil	Fungi Cfu/gsoil
T <sub>1</sub>	8.13	0.23	3.1	129.0	13.0	225	26.0	13.5
T <sub>2</sub>	8.00	0.21	3.5	147.0	14.5	240	40.0	17.5
T <sub>3</sub>	8.00	0.22	3.3	140.0	14.0	239	35.0	15.0
T <sub>4</sub>	8.00	0.21	3.3	143.0	14.5	239	37.0	17.0
T <sub>5</sub>	7.75	0.20	3.5	147.5	14.7	240	45.0	17.7
T <sub>6</sub>	8.10	0.22	3.2	148.0	14.0	237	41.5	16.0
T <sub>7</sub>	8.10	0.22	3.3	147.0	14.0	235	42.5	16.5

Initial and after harvesting the potato crop fertility status of soil have been presented in table 3 and 4 revealed that addition of organic manures slightly improve the fertility status of soil pH, EC, OC, N, P, K and microbial population (Bacteria and Fungi) composed with initial soil in all the treatment except control. Maximum improvement in soil fertility of the experimental field was found under T<sub>5</sub>

treatment (Where FYM 10 t/ha + Poultry manures 1.7 t/ha + Vermicompost + 2.5 t/ha + PSB applied) soil and by T<sub>2</sub> (Where FYM 30 t/ha + PSB applied). This was mainly due to addition of organic matter through organic manures. While nutrient availability was recorded under T<sub>6</sub> treatment (where 67% N through inorganic and 33% N through FYM + PSB applied).

**Table 4:** Effect of organic manures on soil fertility after harvesting of potato

Treatments	pH	EC (dSm <sup>-1</sup> )	OC (g/kg)	N	P	K	Bacteria	Fungi
T <sub>1</sub>	8.13	0.23	3.1	129.0	13.0	225	26.0	13.5
T <sub>2</sub>	8.00	0.21	3.5	147.0	14.5	240	40.0	17.5
T <sub>3</sub>	8.00	0.22	3.3	140.0	14.0	239	35.0	15.0
T <sub>4</sub>	8.00	0.21	3.3	143.0	14.5	239	37.0	17.0
T <sub>5</sub>	7.75	0.20	3.5	147.5	14.7	240	45.0	17.7
T <sub>6</sub>	8.1	0.22	3.2	148.0	14.0	237	41.5	16.0
T <sub>7</sub>	8.1	0.22	3.3	147.0	14.0	235	42.5	16.5
S.Em±	0.036	0.12	0.062	2.15	0.16	2.16	1.07	0.70
CD	0.113	0.36	0.193	6.65	0.50	6.69	3.10	2.00

This was mainly due to addition of inorganic N through urea that release available form of nitrogen to soil.

On the basis of results, it may be concluded that integrated nutrient (N) management (33% nitrogen through FYM and 67% through urea + PSB) was found better treatment on growth, yield. However on soil health application of FYM @ 10t/ha + poultry manure 1.7t/ha + Vermicompost 2.5t/ha + PSB were observed significantly better response over rest of the treatments.

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