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## Response of organic manures on growth yield, nutrients Uptake of potato and its impact on soil health

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### Abstract

The experiment entitled response of organic manures on growth, yield, nutrients uptake of Potato and its impact on soil health was conducted at vegetable form of the Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya (U.P.). The experiment was laid out in randomized block design with three replication having seven treatment combination. The soil of the experimental field was silt loam having pH 8.2, EC 0.24(dSm<sup>-1</sup>), organic carbon 0.3%, available N 138.9kg/ha, available P 13.5kg/ha and available K 268kg/ha Growth and yield of potato increased with conjunction use of organic and inorganic nitrogen in comparison to alone organic N. The mineralization of organic matter decrease of soil pH and increases organic carbon and fertility status of soil. There was found most beneficial and feasible for cultivation of organic potato.

**Keywords:** Organic manures, potato, mineralization

### Introduction

Potato (*Solanum tuberosum* L.) belongs to the order Solanales in the Solanaceae family of flowering plants. The trend of organic farming is getting momentum because people prefer to consume vegetable free from chemical residues. On the other hand, the ecological concerns regarding residual toxicity due to indiscriminate and excessive use of chemicals by means of fertilizers and pesticides and their harmful effects on soil health as well as on biodiversity indicates an urgent need for a shift to available organic resources as manure along with fertilizers. The organic manures not only supply the nutrients but also improve the physical environment for better plant and tuber growth. The manures are low analysis nutrients carries yet play a significant role in the fertilizer economy. The yields obtained with combined use of organic manures and fertilizers are higher than fertilizer alone. As such, the knowledge of organic manures and fertilizer equivalent to organic manures is essential for making a sound fertilizers programme. The manures alone are poor sources of nitrogen for obtaining optimum potato yield but improve organic carbon status of soil. Presently, FYM is a major source of organic matter and nutrients, besides poultry manure and vermin compost. These organic sources generally contain low level of nutrients and are required in higher amounts to fulfill the needs of crop, therefore, it is essential to supply the nutrients in integrated manner. By this way the dependence on fertilizer can be reduced in the days to come and in the mean time the soil will also develop its quality and fertility status by the continuous use of organic sources. Integrated use of organic and inorganic is a must to supply balance nutrition to potato. Organic agriculture is a holistic production management system, which promotes and enhances agro-ecosystem health, including bio-diversity, biological cycles and soil-biological activity. Bio-fertilizer (PSB) play important role in subside the nutrients available in the soil, Singh and Kushwaha (2006) [3].

### Materials and Methods

The field experiment was carried out at MES, Vegetable Research Farm of Department of vegetable Science, Narendra Deva University Agricultural and Technology Kumarganj, Ayodhya during autumn-winter season 2018-19. Experiment was conducted in randomized block design with three replications having seven treatment combinations. T<sub>1</sub> Control, T<sub>2</sub> - FYM 30t/ha + biofertilizer (PSB), T<sub>3</sub> Poultry manure 5t/ha + biofertilizer (PSB), T<sub>4</sub> Vermicompost 7.5t/ha + biofertilizer (PSB), T<sub>5</sub> FYM 10t/ha + Poultry manure 1.7 t/ha + vermicompost 2.5t/ha + biofertilizer (PSB), T<sub>6</sub> Recommended dose of nitrogen (150kg/ha) in which 67% N through inorganic and 33% N through FYM + biofertilizer (PSB), T<sub>7</sub> Farmers practices (through organic).

As per the treatments organic manures i.e. FYM, vermicompost and poultry manure were applied during final land preparation and inorganic nitrogen (Urea) half dose

applied as basal and remaining half of N was applied as top dressing at the time of earthing-up (30DAP). The potato (K. Ashoka) crop was raised by following the GAP of the region.

**Table 1:** Response of organic manures on growth, and yield of potato (K. Ashoka)

Growth wise tuber yield t/ha						
Treatment	Plant height(cm)	0-25g	25-50g	50-75g	>75g	Total Yield
T <sub>1</sub>	34.50	0.93	3.95	4.38	3.95	13.22
T <sub>2</sub>	35.00	1.43	8.35	10.55	7.47	27.80
T <sub>3</sub>	35.40	1.50	8.87	11.26	7.99	29.62
T <sub>4</sub>	35.00	1.45	8.70	11.05	7.81	29.01
T <sub>5</sub>	37.50	1.54	9.18	10.98	8.87	30.58
T <sub>6</sub>	41.50	1.93	11.52	14.58	10.37	38.41
T <sub>7</sub>	34.45	1.52	9.07	9.53	3.56	26.28
SE(a)	1.14	0.07	0.40	0.51	0.35	1.32
CD	3.40	0.15	0.88	1.12	0.77	2.90

**Table 2:** Response of organic manures on nutrients content and uptake in Potato Crop.

Treatments	Nutrients composition (%)			Nutrients uptake by tuber (kg/ha)		
	N	P	K	N	P	K
T <sub>1</sub>	0.43	0.08	0.45	43.30	8.43	45.36
T <sub>2</sub>	0.45	0.09	0.46	96.08	18.08	97.46
T <sub>3</sub>	0.46	0.09	0.47	103.94	19.49	106.15
T <sub>4</sub>	0.45	0.09	0.47	101.07	18.87	104.01
T <sub>5</sub>	0.46	0.09	0.47	107.26	20.35	111.12
T <sub>6</sub>	0.48	0.09	0.49	140.58	26.15	145.57
T <sub>7</sub>	0.44	0.08	0.47	89.53	17.02	94.14
SE(a)	0.01	0.00	0.01	5.08	0.86	4.76
CD	0.01	NIL	0.01	11.19	1.90	10.49

**Table 3:** Soil health of experimental field after harvesting of Potato crop.

Soil health						
Treatments	pH	EC(dSm <sup>-1</sup> )	OC%	Av. N (Kg/ha)	Av. P (Kg/ha)	Av. P (Kg/ha)
T <sub>1</sub>	8.2	0.24	0.30	140.0	13.7	268
T <sub>2</sub>	8.1	0.22	0.33	149.0	15.0	272
T <sub>3</sub>	8.1	0.22	0.33	149.2	15.0	274
T <sub>4</sub>	8.1	0.22	0.36	149.5	15.0	274
T <sub>5</sub>	8.0	0.21	0.36	150.2	15.2	275
T <sub>6</sub>	8.0	0.21	0.32	156.5	15.0	272
T <sub>7</sub>	8.1	0.22	0.33	149.7	15.0	272
Initial status of soil	8.2	0.24	0.30	138.9	13.5	268

## Result and Discussion

Response of organic manures on growth and yield of potato have been given in table-1. The data revealed that growth and yield of Potato increased with the addition of organic manures in all the treatments except control. Treatment T<sub>6</sub> was found better in which integration of inorganic (67% through urea) and organic (33% through FYM) + bio-fertilizer (PSB) showed maximum plant height (41.50cm), grade wise tuber yield i.e. 0-25g (1.93t/ha) 25-50g (11.52t/ha), 50-75g (14.58t/ha), 775g (10.37t/ha) and total yield (38.41t/ha), over rest of the treatments. It may be due to integration of organic and inorganic nutrients. Which also helped in cell elongation of stem due to development of cell and rapid cell division and cell elongation in meristematic region of plant. The maximum achieving of growth and yield of tubers in T<sub>6</sub> treatment might be due to integrated nutrient management though urea nitrogen (67%N) and organic manure FYM (33%N) + bio-fertilizer (PSB) application. Similar results was reported by Yadav *et al.* (2014)<sup>[5]</sup>.

Effect of organic manures on nutrients content and uptake in Potato have been presented in table-2 results revealed that maximum N content (0.48%) P (0.09%) K (0.49%) and uptake of N (140.58kg/ha), P were recorded (26.15kg/ha) and K (145.57kg/ha) were found under T<sub>6</sub> treatment followed by T<sub>5</sub>,

T<sub>4</sub>, T<sub>3</sub>, T<sub>2</sub>, T<sub>1</sub>, and T<sub>7</sub> treatments. The maximum content and uptake of nutrients under T<sub>6</sub> treatment (67% N through organic +33% inorganic + biofertilizer) might be due to integrated nutrients management, which enhance nutrients availability and nutrients uptake as well as better growth and activity of roots. Similar findings were also observed by Singh *et al.* (2008), Ventatasalan *et al.* (2012)<sup>[4]</sup> and Yadav *et al.* (2014)<sup>[5]</sup>.

The fertility status of experimental soil was slightly improved after harvesting of potato might be due to addition of organic manures. Among different treatments maximum soil fertility improvement was recorded in T<sub>5</sub> (FYM 10t +Poultry manure 1.7t + Vermi compost 2.5t/ha + PSB) treatments as compared to other treatments except control. Soil health of post harvest soil was slightly improved in all plots except control plot, which might due to there released of organic acid from organic manure Islam *et al.* (2013)<sup>[1]</sup>. Integrated nitrogen management which favored the conversion of organically bound N to inorganic form, Yadav *et al.* (2014)<sup>[5]</sup>, solubilization of native P in the soil through released of various organic acid and CO<sub>2</sub> during decomposition of organic manures Tripathi *et al.* (2009), K status in post harvest soil increased due to application of different organic

manures and PSB helped in the solubilization of phosphorus in the soil Roy and Singh (2014) <sup>[2]</sup>.

### Conclusion

On the basis of results it may be concluded that application of integrated nitrogen management (67%N through Urea + 33%N through FYM+PSB) was found better to increased growth and yield of potato tuber. Addition of organic manures (FYM, Poultry manure and vermicompost) into potato field was also found very effective response on growth, and of potato. The mineralization of organic manures decrease the soil pH and slightly improved the soil health of potato field.

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