



Influence of Different Levels Organic and Inorganic Fertilizer Growth and Yield of Potato (*Solanum tuberosum* L.)

Raju Linda ^a, Arun Alfred David ^a and Tarence Thomas ^{a*}

^a Department of Soil science and Agricultural Chemistry, NAI, SHUATS, Prayagraj, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/ijpss/2025/v37i15290>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/130443>

Original Research Article

Received: 24/11/2024

Accepted: 27/01/2025

Published: 01/02/2025

ABSTRACT

The global food demand of growing human population and need for eco-friendly strategy for sustainable soil-plant-microbes-environmental system currently a crucial challenge. In conventional farming for increasing the crop yield farmers are using huge amount of chemical fertilizer in the fields. Due to either over or imbalance use of chemical fertilizers in cultivation of crops, degraded the soil fertility and health of soil. Such farming is blamed for land degradation and environment pollution and adversely affecting the human health, plants and animals. Soil degradation contributes to low agricultural productivity. Organic amendments (OAs) have the potentials to reverse soil degradation processes by improving the soil's physical and chemical properties and consequently improve crop growth and yield performance. An experiment was carried out during the winter season of 2021- 2022 to know the Effect of different levels of Vermicompost, Neam cake and fertilizer on soil health and yield of Potato (*Solanum tuberosum* L.) ". The experiment was laid out in Randomised Block Design (RBD) with three replicates for each treatment. The fertilizer applied for

*Corresponding author: E-mail: leo8thomas94@gmail.com;

the crop was NPK and @ 120kg, ha⁻¹, 80kg ha⁻¹, 100 kg ha⁻¹, Vermicompost 6 and Neem cake 1.2 t ha⁻¹, respectively, showed significant influence on the soil health of Potato. Based on the above research work, it is concluded that application of Vermicompost, Neam cake and fertilizer, treatment T9 [NPK 100% + VC @100% + Neem Cake @ 100% ha⁻¹] was found more beneficial and significantly improved soil, and tuber yield of Potato grown under Allahabad Agro-climatic conditions.

Keywords: Nitrogen; phosphorus; potassium; organic amendments; soil properties; soil health; yield and potato.

1. INTRODUCTION

“Potato (*Solanum tuberosum*, L.) is considered as one of the most important vegetable food crops all over the world, As a world crop, it ranks the first most important tuber crop, and next to wheat and rice” (Alam et al. 2007). “Potato tubers are an important source of digestible carbohydrates, dietary fiber, vitamin C, and some necessary minerals” (Sarhan et al. 2004). “So, it can use as a staple food, vegetable, source of starch, flour, alcohol, acetone and glucose. Nitrogen (N), Phosphorus (P) and potassium (K) are considered as the most three important elements prerequisite for plant nutrition in large amounts. They play essential roles in overall metabolism of plant enzymes activity, promoting photosynthesis, cell division and development of meristematic tissue, nitrogen and water consumption respiration. Since, nitrogen (N) is an essential element for building up protoplasm, proteins and amino acids, which induce cell division and initiate meristematic activity” (Patel, et al., 2022 & Tiwari et al., 2021). “Also, phosphorus is a part of molecular structure of nucleic acid (DNA and RNP), the energy transfer compounds and phosphor-proteins. Moreover, potassium element is very important in overall metabolism of plant enzymes activity. It is important to serve a vital role in photosynthesis by direct increasing in growth and leaf area and hence CO₂ assimilation” (Gardener et al. 1985). The effects of the three mineral fertilizers nitrogen (N), phosphorus (P) and potassium (K) individually or in combination with either one or more of each potato cultivar plants were reported by several investigations such as: Danilchenko et al. (2005) and Alam et al. (2007) using NPK. Since, they found that using such fertilizers reflected significant effects on the vegetative, yield and chemical compositions characters of potato plants.

It is well known that organic manure improved the structure of the soil and this consequently encourage the plant to have a good growth.

Moreover, the slow released nutrients contained in organic manure permit the plants to beneficial of it. Organic manures maintain and increase the long-term fertility of soil (Islam, et al.,2021). They avoid all forms of pollution. Organic manures maintain the genetic diversity of potato and also allow adequate returns and satisfaction to potato growers from their work including a safe working environment. Organic manures act not only as a source of nutrients and organic matter, but also increase microb (Kumar et al., 2016, Pandit et al., 2018, Panwar et al., 2014). ial diversity and activity in soil, which influence soil structure and nutrients rotation, in addition to improvement in other physical, chemical and biological properties of the soil. All these reasons resulted in improve plant growth. Studies were also made by several researchers on the effects of organic and inorganic fertilizers on vegetative growth, yield, and ~~data~~ chemical compositions of potato, such as; Danilchenko et al. (2005) and Singh and Kushwah (2012).

Vermicompost has been found to effectively enhance the root formation, elongation of stem and production of biomass in potato crop. Using of vermicompost is now a global movement for the second green revolution that emphasizes on composting. Ghosh et al., (1999) observed that “integration of vermicompost with inorganic fertilizers tends to increase the yield of potato crop”. “Vermicompost has higher level of nitrogen (1.6%), phosphorous (0.7%) and potassium (0.8%), calcium (0.2%). The use of vermicompost as long been considered as effective means of improving the structure and fertility of soil” (Nyoro., 2023). “Neem cake organic manure is the by-product obtained in the process of cold pressing of neem fruits and kernels, and the solvent extraction process for neem oil cake. Neem cake organic manure is used directly and/or in blends with urea or with other organic manure like seaweed or farmyard manure to an extent of 15-20% by weight, for higher yields in various corps” (Yourtchi, et al., 2013). “Neem Cake Organic Manure has more

nitrogen, phosphorous, potassium, calcium and magnesium than the farmyard manures” (Habibi and Thomas 2016). It is rich in sulphur compounds as well as bitter limonoids content of neem cake N-1.5%, P 1.0%, K 1.4%, Ca 0.96% and Na 0.4 %. Therefore, the main objective of this study was to investigate the effects of organic manure and inorganic NPK in soil health and yield of potato plants.

2. MATERIALS AND METHODS

Two field experiments were carried out during the two consecutive winter seasons of 2020-21 and 2021-22 Research Farm of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad University of Agriculture, Technology and Sciences (U.P.) located at 25° 57' N latitude 81° 57' E longitude and 98m above mean sea level. Agro climatically, Allahabad district represents the subtropical belt of the South East of Uttar Pradesh, and is endowed with extremely hot summer and fairly cold winter. The maximum temperature of the location ranges between 46 °C - 48 °C and seldom falls below 4 °C - 5 °C. The relative humidity ranges between 20-94%. The average rainfall of this area is around 1100mm annually. The treatment combination was laid out as T1-(Control)-NPK 0% Recommended Dose of Fertilizer (RDF) + vermicompost @ 0t ha⁻¹ + Neem cake @ 0t ha⁻¹, T2- NPK 0% RDF + Vermicompost @ 3t ha⁻¹ + Neem cake @ 0.6t ha⁻¹, T3-NPK 0% RDF + vermicompost @ 6t ha⁻¹ + Neem cake @ 1.2t ha⁻¹, T4-NPK 50% RDF + Vermicompost @ 0t ha⁻¹ + Neem cake @ 0t ha⁻¹, T5-NPK 50% + Vermicompost @ 3t ha⁻¹ + Neem cake @ 0.6 t ha⁻¹, T6. NPK 50% RDF + Vermicompost @ 6t ha⁻¹ + Neem cake @ 1.2t ha⁻¹, T7-NPK 100% RDF + Vermicompost @ 0t ha⁻¹ + Neem cake @ 0t ha⁻¹, T8-NPK 100% RDF + Vermicompost @ 3t ha⁻¹ + Neem cake @ 0.6t ha⁻¹, T9-NPK 100% RDF + Vermicompost @ 6t ha⁻¹ + Neem cake @ 1.2t ha⁻¹, respectively .

3. RESULTS AND DISCUSSION

3.1 Plant Height (cm)

The data pertaining in Table 1 reveals that the effect of different level of vermicompost, Neem cake and fertilizers on plant height at 30, 60 and 90 DAS were significantly differ among the treatment in both the years. At 30 DAS, the

maximum plant height was observed in T9 (26.28cm and 27.75 cm) followed by T8 (25.67 and 27.20) while minimum plant height was recorded in T1 (17.45 and 17.82) in the both years. At 60 DAS, maximum plant height was observed in T9 (37.23 cm and 41.16 cm) followed by T8 (34.63 and 39.23) T7 (33.19 and 36.63) while minimum plant height was recorded in T1 (22.73 and 24.83) in the both years. At 90 DAS, maximum plant height was observed in T9 (43.97 and 48.63 cm) followed by T8 (43.21 and 46.21), while minimum plant height was recorded in T1 (28.47) in the both years. Pooled data of two years, plant height were significantly increased over the control in three DAS (30,60 and 90 DAS) and maximum plant height was observed in T9 (27.02,39.20 and 46.30 cm) followed by T8 (26.44,36.93 and 44.71) while minimum plant height was recorded in T1 (17.64, 23.78 and 28.47) respectively. Appropriate fertilization was reported to increase the average fresh tuber, plant height, leaf number and tuber; weight per plant responded positively application and Leaf area increased (Kandil et al., 2011). Similar finding were also observed by Habibi and Thomas (2016), Goswami, et al., 2019, Taha et al., (2019) and Dey et al., (2015).

3.2 Number of Leaves Plant⁻¹

The data pertaining in Table 2 reveals that the effect of different level of vermicompost, Neem cake and fertilizers on Leaves plant⁻¹ at 30,60 and 90 DAS were significantly differ among the treatment in both the years. At 30 DAS the maximum plant height was observed in T9 (15.20 cm and 17.10 cm) followed by T8 (14.67 and 16.57) while minimum Leaves plant⁻¹ was recorded in T1 (9.33 and 10.50) in the both years. At 60 DAS maximum Leaves plant⁻¹ was observed in T9 (23.53 cm and 28.03 cm) followed by T8 (22.53 and 27.03) T7 (21.47 and 25.97) while minimum Leaves plant⁻¹ was recorded in T1 (15.27 and 19.77) in the both years. At 90 DAS, maximum Leaves plant⁻¹ was observed in T9 (37.86 and 42.36 cm) followed by T8 (33.65 and 38.15), while minimum Leaves plant⁻¹ was recorded in T1 (19.91 and 24.74) in the both years. Pooled data of two years, leaves plant⁻¹ were significantly increased over the control in three DAS (30,60 and 90 DAS) and maximum leaves plant⁻¹ was observed in T9 (16.15,25.78 and 40.11 cm) followed by T8 (15.62,24.78 and 35.90 cm) while minimum Leaves plant⁻¹ was recorded in T1 (9.92,17.52 and 22.33) respectively in the both years. Appropriate fertilization was reported to increase

the average fresh tuber, plant height, leaf number and tuber; weight per plant responded positively application and Leaf area increased (Kandil et al., 2011). Similar finding were also observed by Habibi and Thomas (2016), Gulam and David (2019), Lanunpiuia et al., (2019), Taha.et al., 2019) and Dey et al., (2015).

3.3 Number of Tubers Plant⁻¹

Number of Tubers Plant⁻¹ presented in Table 3 reveals that effect of different level of vermicompost, neem cake and fertilizers when subjected to statistical analysis indicated that there was a significantly difference among the treatments during the both year. Comparatively maximum Number of Tubers Plant⁻¹was observed in treatment T₉ (8.81 and 9.14)

followed by T₈ (8.23 and 8.37) while minimum Number of Tubers Plant⁻¹was recorded in T₁ (6.57and 6.91) in the both years. Pooled data of two years shows that Number of Tubers Plant⁻¹ significantly increased over the control and maximum Number of Tubers Plant⁻¹was observed in T₉(8.98) followed by T₈ (8.43) while minimum Number of Tubers Plant⁻¹ was recorded in T₁ (6.74) respectively in the both years. Appropriate fertilization was reported to increase the average fresh tuber, plant height, leaf number and tuber; weight per plant responded positively application and Leaf area increased (Kandil et al., 2011, Barman, et al.,2018).). Similar finding was also observed by Habibi and Thomas (2016), Gulam and David (2019), Lanunpiuia et al., (2019), Dev, et al., 2020, Brijesh et al., 2017 Taha.et al (2019) and Dey et al., (2015).

Table 1. Influence of vermicompost, neem cake and inorganic fertilizers on plant height (cm) of potato

Treatments	(2020-21)			(2021-22)			Pooled		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T ₁	17.45	22.73	28.47	17.82	24.83	28.47	17.64	23.78	28.47
T ₂	17.78	24.83	30.03	18.89	25.45	30.03	18.34	25.14	30.03
T ₃	19.18	25.45	32.64	19.03	27.56	32.64	19.11	26.51	32.64
T ₄	20.6	27.56	34.97	20.93	29.13	34.97	20.77	28.35	34.97
T ₅	22.89	31.13	37.22	25.36	34.13	40.22	24.13	32.63	38.72
T ₆	24.31	32.13	39.33	26.12	35.19	42.33	25.22	33.66	40.83
T ₇	24.92	33.19	40.79	26.52	36.63	43.79	25.72	34.91	42.29
T ₈	25.67	34.63	43.21	27.2	39.23	46.21	26.44	36.93	44.71
T ₉	26.28	37.23	43.97	27.75	41.16	48.63	27.02	39.20	46.30
F – test	S	S	S	S	S	S	S	S	S
CD @ 5%	0.65	1.59	2.22	1.15	1.74	2.25	0.90	1.67	2.24
S. Ed. (±)	0.3	0.75	1.04	0.53	0.82	1.06	0.42	0.79	1.05

Table 2. Influence of vermicompost neem cake and inorganic fertilizers on number leaves plant⁻¹ of potato

Treatments	(2020-21)			(2021-22)			Pooled		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T ₁	9.33	15.27	19.91	10.50	19.77	24.74	9.92	17.52	22.33
T ₂	9.67	15.6	22.55	11.13	20.10	27.05	10.40	17.85	24.80
T ₃	10.67	16.07	22.79	13.43	21.13	27.29	12.05	18.60	25.04
T ₄	13.13	18.87	26.21	15.53	23.37	30.71	14.33	21.12	28.46
T ₅	14.6	20.2	27.29	16.9	24.7	31.79	15.75	22.45	29.54
T ₆	14.2	19.53	30.43	17.43	24.77	34.93	15.82	22.15	32.68
T ₇	14.40	21.47	31.08	16.3	25.97	35.58	15.35	23.72	33.33
T ₈	14.67	22.53	33.65	16.57	27.03	38.15	15.62	24.78	35.90
T ₉	15.20	23.53	37.86	17.1	28.03	42.36	16.15	25.78	40.11
F - test	S	S	S	S	S	S	S	S	S
CD @ 5%	1.02	1.72	3.34	1.13	1.75	3.35	1.08	1.74	3.35
S.Ed. (±)	0.48	0.81	1.57	0.53	0.82	1.56	0.51	0.82	1.57

Table 3. Influence of vermicompost neem cake and inorganic fertilizers on number of tubers plant⁻¹ of potato

Treatments	(2020-21)	(2021-22)	Pooled
T ₁	6.57	6.91	6.74
T ₂	6.81	7.14	6.98
T ₃	7.06	7.33	7.20
T ₄	7.22	7.49	7.36
T ₅	7.31	7.7	7.51
T ₆	7.89	8.09	7.99
T ₇	8.03	8.37	8.20
T ₈	8.23	8.63	8.43
T ₉	8.81	9.14	8.98
F – test	S	S	S
CD @ 5%	0.82	0.46	0.64
S. Ed. (±)	0.38	0.22	0.30

Table 4. Influence of vermicompost neem cake and inorganic fertilizers on tuber yield (t ha⁻¹) of potato

Treatments	(2020-21)	(2021-22)	Pooled
T ₁	7.88	8.07	7.98
T ₂	12.68	12.73	12.71
T ₃	21.09	22.31	21.70
T ₄	12.68	13.02	12.85
T ₅	19.17	20.4	19.79
T ₆	26.37	27.73	27.05
T ₇	15.82	17.56	16.69
T ₈	21.62	23.88	22.75
T ₉	32.13	34.24	33.19
F – test	S	S	S
CD @ 5%	4.53	5.55	5.04
S.Ed. (±)	2.07	2.64	2.36

3.4 Tuber Yield (t ha⁻¹)

Tuber Yield (t ha⁻¹) of Potato presented in Table 4 reveals that effect of different level of vermicompost, neem cake and fertilizers when subjected to statistical analysis indicated that there was a significantly difference among the treatments during the both years. Comparatively maximum Tuber Yield (t ha⁻¹) was observed in treatment T₉ (32.13 and 34.24) followed by T₈ (21.62 and 23.88) while minimum Tuber Yield (t ha⁻¹) was recorded in T₁ (7.88 and 8.07) in the both year. Pooled data of two years shows that Tuber Yield (t ha⁻¹) significantly increased over the control and maximum Tuber Yield (t ha⁻¹) was observed in T₉(33.19) followed by T₈ (22.75) while minimum Tuber Yield (t ha⁻¹) was recorded in T₁ (7.98) respectively in the both years. Appropriate fertilization was reported to increase the average fresh tuber, plant height, leaf number and tuber; weight per plant responded positively application and Leaf area increased

(Kandil et al., 2011). Similar finding were also observed by Habibi and Thomas, (2016), Gulam and David (2019), Lanunpiuia et al., (2019), Taha.et al., (2019) and Dey et al., (2015).

3.5 Haulm Yield (t ha⁻¹)

Haulm Yield (t ha⁻¹) of Potato presented in Table 5 reveals that effect of different level of vermicompost, neem cake and fertilizers when subjected to statistical analysis indicated that there was a significantly difference among the treatments during the both years. Comparatively maximum Haulm Yield (t ha⁻¹) was observed in treatment T₉ (3.23 and 3.3) followed by T₈ (2.99 and 3.05) while minimum Number of Tubers Plant⁻¹was recorded in T₁ (1.56and 1.63) in the both year. Pooled data of two were on haulm yield (t ha⁻¹) showed significant in both the years and maximum haulm yield (t ha⁻¹) was observed in T₉(3.27) followed by T₈ (3.02) while minimum Haulm Yield (t ha⁻¹) was recorded in T₁ (1.60)

Table 5. Influence of vermicompost neem cake and inorganic fertilizers on haulm yield (t ha⁻¹) of potato

Treatments	(2020-21)	(2021-22)	Pooled
T ₁	1.56	1.63	1.60
T ₂	1.75	1.82	1.79
T ₃	2.03	2.1	2.07
T ₄	2.33	2.4	2.37
T ₅	2.56	2.63	2.60
T ₆	2.44	2.5	2.47
T ₇	2.61	2.67	2.64
T ₈	2.99	3.05	3.02
T ₉	3.23	3.3	3.27
F – test	S	S	S
CD @ 5%	0.35	0.31	0.33
S.Ed. (±)	0.12	0.14	0.13

respectively in the both years. Appropriate fertilization was reported to increase the average fresh tuber, plant height, leaf number and tuber; weight per plant responded positively application and Leaf area increased (Kandil et al., 2011). Similar finding were also observed by Habibi and Thomas, (2016), Ansari, 2008, Gulam and David, (2019), Lanunpiuia et al., (2019), Taha. et al .,(2019) and Dey et al., (2015).

4. CONCLUSION

The findings of present study concluded that among nine treatment combination the best results were obtained with treatment T₉ [RDF @ 100 % + Vermicompost @ 6 t ha⁻¹+ Neem cake @ 1.2 t ha⁻¹] followed by treatment T₈[RDF @ 100 % + Vermicompost @ 3 t h⁻¹+ Neem cake @ 0.6 t ha⁻¹]. It proved that T₉ gave significantly higher result in respect to plant height, number of branches, potato tuber and haulm yield than other treatments. Hence it is being recommended to farmers for higher benefits and maintaining soil health.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Alam, M. N., Jahan, M. S., Ali, M. K., Ashraf, M. A., & Islam, M. K. (2007). Effect of vermicompost and chemical fertilizers on growth, yield and yield components of potato in barind soils of Bangladesh. *Journal of Applied Sciences Research*, 3(12), 1879–1888.
- Ansari, A. A. (2008). Effect of vermicompost on the productivity of potato (*Solanum tuberosum*), spinach (*Spinacia oleracea*) and turnip (*Brassica campestris*). *World Journal of Agricultural Sciences*, 4(3), 333–336.
- Barman, K. S., Kumar, A., Kasera, S., & Ram, B. (2018). Integrated nutrient management in potato (*Solanum tuberosum*) cv. Kufri Ashoka. *Journal of Pharmacognosy and Phytochemistry*, SP1, 1936–1938.
- Brijesh, K. S., Kumar, A., Kasera, S., & Ram, B. (2017). Integrated nutrient management in potato (*Solanum tuberosum*) cv. Kufri Ashoka. *Journal of Pharmacognosy and Phytochemistry*, SP1, 1936–1938.
- Dev, A., Kumar, S., Kumar, D., Patel, V. K., Kumar, A., Sahu, R. K., & Singh, P. (2020). The effect of integrated nutrient management (INM) and Zn fertilization on

- yield of potato. *International Journal of Current Microbiology and Applied Sciences*, 9(4).
- Dey, A., Dasgupta, S., Bhattarcharya, S., Chaitanya, A. K., Pati, S., & Pal, B. (2015). Soil physical fertility and performance of potato crop as affected by integration of organic and inorganic fertilizers in new alluvial soil of West Bengal.
- Danilchenko, S. N., Pokrovskiy, V. A., Bogatyrov, V. M., Sukhodub, L. F., & Sulkio-Cleff, B. (2005). Carbonate location in bone tissue mineral by X-ray diffraction and temperature-programmed desorption mass spectrometry. *Crystal Research and Technology: Journal of Experimental and Industrial Crystallography*, 40(7), 692-697.
- Ghosh, M., Chottopadhyaya, G. N., Baral, K., & Munsii, P. S. (1999). Possibility of using vermicompost in agriculture for reconciling sustainability with productivity. *Proceeding of the Seminar on Agro-Technology and Environment*, 64–68.
- Goswami, P., Vishwakarma, S. K., & Upadhyay, V. B. (2019). Organic farming package for rice-potato cropping system. *Journal of Pharmacognosy and Phytochemistry*, 8(1), 962–967.
- Gardener, J. A., Briggs, G. A. D., & Castell, M. R. (2009). Scanning tunneling microscopy studies of c 60 monolayers on au (111). *Physical Review B—Condensed Matter and Materials Physics*, 80(23), 235434.
- Habibi, & Thomas. (2016). Effect of FYM and chemical fertilizers on yield and economics of potato-based sequences in Lahual valley of Himachal Pradesh. *Potato Journal*, 31(3–4), 191–193.
- Habibi, F. H., & Thomas, T. (2016). Effect of different level of fertilizers and neem cake on attributes and yield of potato (*Solanum tuberosum* L.). *International Journal of Multidisciplinary Research and Development*, 3(4), 196–199.
- Islam, M. R., Hoque, T. S., Islam, S., Ahmed, M., & Hoque, M. (2021). Performance of different organic manures with chemical fertilizers in increasing growth, yield and nutritional quality of potato (*Solanum tuberosum* L.). *Bangladesh Journal of Botany*, 50(3), 651–657.
- Kumar, R., & Singh, N. D. (2016). Effect of inorganic and organic sources of nutrients on nutrient uptake, yield and economics of processing potato (*Solanum tuberosum* L.). *International Journal of Advanced Research*, 4(4), 498–503.
- Nyoro, A. G. (2023). *Evaluation of Vermicompost-inorganic Fertilizer Combination on Growth, Yield and Quality of Strawberry* (Doctoral dissertation, University of Nairobi).
- Pandit, B. P., Kumar, A., Dotaniya, M. L., Jat, N. K., & Lal, B. (2018). Effect of organic sources of nutrients on tuber bulking rate, grades and specific gravity of potato tubers. *The National Academy of Sciences*, 86(1), 47–53.
- Panwar, & Wani. (2014). Effect of inorganic and organic sources of nutrients on nutrient uptake, yield and economics of processing potato (*Solanum tuberosum* L.). *International Journal of Advanced Research*, 4(4), 498–503.
- Patel, A., Gurjar, P. K. S., & Patel, P. (2022). Study on the effect of organic manures and bio-fertilizers on growth, yield and quality of potato (*Solanum tuberosum* L.). *The Pharma Innovation Journal*, 11(2), 507–511.
- Sarhan, T. Z. (2011). Effect of humic acid and seaweed extracts on growth and yield of potato plant (*Solanum tuberosum* L) DESIREE CV. *Mesopotamia Journal of Agriculture*, 39(2), 19-0.
- Singh, S. P., & Kushwah, V. S. (2012). Effect of planting method on production potential of potato+ pea intercropping system. *Potato Journal*, 39(1), 95-97.
- Taha, M. T., Bhatia, A. K., & Deswal, S. (2017). Tuber growth and quality of potato var. Kufri Bahar as affected by FYM, vermicompost and neem cake under Western Haryana conditions, India. *International Journal of Current Microbiology and Applied Sciences*, 6(12), 4118–4125.
- Tiwari, A., Kumar, R., Prakash, V., Pandey, S. R., Pathak, D., & Kumar, N. (2021). Effect of organic manures on potato yield, nutrient uptake and soil fertility. *The Pharma Innovation Journal*, 10(5), 1561–1563.

Yourtchi, M. S., Hadi, M. H. S., & Darzi, M. T. (2013). Effect of nitrogen fertilizer and vermicompost on vegetative growth, yield

and NPK uptake by tuber of potato (*Agria cv.*). *International Journal of Agricultural and Crop Sciences*, 5(18), 2033–2040.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2025): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:

<https://www.sdiarticle5.com/review-history/130443>