The Pharma Innovation Journal 2023; 12(8): 625-627

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(8): 625-627

www.thepharmajournal.com
Received: 02-05-2023
Accepted: 04-06-2023

Nawraj Chaudhary
M.Sc. Ag, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Pradeep Rajput
Assistance Professor, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh

Pradeep Kr. Kanaujiya
Assistance Professor, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Anand Chaurasiya
M.Sc. Ag, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Nirdosh Goyal
M.Sc. Ag, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Corresponding Author:
Nawraj Chaudhary
M.Sc. Ag, Department of Agronomy, ITM University, Gwalior, Madhya Pradesh, India

Effects of integrated nutrient management on yield and economics of potato

Nawraj Chaudhary, Pradeep Rajput, Pradeep Kr. Kanaujiya, Anand Chaurasiya and Nirdosh Goyal

Abstract
In India, potato is a crucial crop in terms of monetary gain and food security. However, inadequate fertilizer management practices and low soil fertility constrained the crop's productivity. A field experiment was conducted during summer Rabi season-2022 at the Crop Research Center of ITM University, Gwalior (M.P.) INDIA to study the Effects of Integrated Nutrient Management on Yield and Economics of Potato. The treatments comprised with 8 Nutrient management practices viz; T0:control, T_1:100% RDF, T_2:100% RDF + 2.5 t ha^{-1} FYM, T_3:75% RDF + 2.5 t ha^{-1} FYM, T_4: 50% FYM + 5 t ha^{-1} FYM, T_5:75% RDF + 2.5 t ha^{-1} Vermicompost, T_6: 50% RDF + 5 t ha^{-1} vermicompost, T_7:100% RDF + 1 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM, T_8:75% RDF + 2 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM, T_9:25%RDF + 3 t ha^{-1} Vermicompost + 5 t ha^{-1} FYM. Productivity and profitability of potato were significantly impacted by the simultaneous use of both inorganic and organic manures. Application of 100% RDF + 1 t ha-1 Vermicompost + 2.5 t ha-1 FYM considerably improved tuber and haulm yield (Kg ha-1) as well as net return and B: C ratio.

Keywords: Potato, Recommended dose of fertilizers (RDF), organic manure yield and Economics

Introduction

Potato is the most important staple food crop as well as vegetable crop grown from a root or tuber, globally. More than a billion people worldwide consume it as daily diet, and it is cultivated in more than 125 different nations. According to the data presented (Statista), Potato production in the country was estimated to reach around 59.74 million metric tonnes in FY2023. Potato production increased by more than three million metric tonnes as compared to the previous financial year. The country now has 2.05 million acres under potato cultivation and needs about 6.15 million tons of high-quality seed. Because of its high production potential and extensive nutritional content, it is an essential staple food for both developed and developing countries. Potato needs high soil nutrition because they have shallow root systems and are relatively poorly developed (Perrenoud, 1993) [5]. Potato is relatively low maintenance in comparison to grains and legumes. Produce a substantially greater amount of dry matter within a less amount of time. (Singh & Trehan, 1998) [7]. Because of the high rate at which dry weight is formed, most soils cannot provide the necessary nutrients, which results in a significant loss of nutrients in terms of the length of time and area involved. As a result, using nutrients derived from outside sources as fertilizer is becoming increasingly crucial. High yields can only be maintained by applying the optimum NPK dose in the appropriate proportion. The primary nutrients that influence potato production's growth, development, and yield are phosphorus, nitrogen, and potassium, respectively. As a component of protoplasm, nitrogen is beneficial to chlorophyll production because it encourages its synthesis. Phosphorus directly influences shoot improvement, root advancement and potato production. In contrast, potassium constitutes the main component of cells, and a deficit in it is detrimental to the quality of the tuber. Phosphorus can be found in soil and water. The advantage of using both organic manures, *viz.*, farm yard manure, compost, vermicompost, biofertilizers and micronutrients with chemical fertilizer are well beneficial to the soil. A balanced application of both organics and inorganics using biofertilizers seems to be the most effective choice to address the nutrient needs of most vegetable crops. Integrated nutrient management practices for vegetable crops are critical to achieving yield quality and returns. Vermicompost and Farm yard manure (FYM) gradually and steadily release nutrients and stimulate soil microbial biomass.

Additionally, FYM can support cropping systems by enhancing the physical characteristics of the soil and improving nutrient recycling. FYM also affects the soil's physicochemical and biological factors, enhancing its aeration, drainage, water retention, structure, porosity, and fertility and preventing soil degradation.

Materials and Methods

In the *Rabi* season of 2022, the investigation was carried out at CRC, part of the Department of Agriculture at ITM University in Gwalior, Madhya Pradesh (INDIA). Gwalior falls under the sub-tropical region of Madhya Pradesh, with a hot summer and moderately cool winter at the latitude of 26 degrees 8' 51" north latitude and 75 degrees 25' east latitude and a height that is 206 meters above the level of the mean sea. The texture of the soil that was employed in the experimental field was sand and loam. The temperature ranged anywhere from 5.5 °C to 33.1 °C while the crop was actively growing. Likewise, the minimum and highest relative humidity ranged from 48% to 98.5%. At the same time, the crop season's overall rainfall totaled 728.4 mm. The research work was done successfully with Randomized block design (RBD) in three replications and ten treatments. The potato variety Pukhraj-385 was sown on November 21, 2022. The experiment comprised ten treatments *viz.*, T_0:control, T_1:100% RDF, T_2:100% RDF + 2.5 t ha^{-1} FYM, T_3:75% RDF + 2.5 t ha^{-1} FYM, T_4: 50% FYM + 5 t ha^{-1} FYM, T_5:75% RDF + 2.5 t ha^{-1} Vermicompost, T_6:50% RDF + 5 t ha^{-1} vermicompost, T_7:100% RDF + 1 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM, T_8:75% RDF + 2 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM, T_9:25%RDF + 3 t ha^{-1} Vermicompost + 5 t ha^{-1} FYM. While preparing the land, a well-decomposed FYM was applied at 5 t ha^{-1}. The 160:100:80 kg ha-1 NPK dose was used according to the package recommendation and practiced. A full amount of phosphorus, potassium, and half an amount of nitrogen were given at planting time. The remaining 50% nitrogen was added 45 days after planting in a 10 cm diameter band around each plot at 3 to 4 cm depth. 10 days after planting, vermicompost (1 kg plot^{-1}) was applied to the plants. The net profit was determined by deducting the treatment cultivation expense from the total profit. To determine the benefit-cost ratio, divide the total profit by the total input costs. The harvest of the crop was completed on March 4, 2022. A randomized block design with analysis of variance (ANOVA) was applied for analyzing data on crops. (Gomez and Gomez, 1984) [1].

Results and Discussion

The mean values for the number of tubers per plant, Tuber mass per plant, Volume of tuber (cm^3), and Tuber productivity (t per ha) after statistical analysis of potato were recorded at harvest. The maximum quantity of tuber per plant (7.93) was accomplished by 100% RDF + 1.0 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM application, that had been much better than the other treatments where it was at par at T_2 and T_8. However, under control treatment (T_0), the least amount of tuber per plant was found. The maximum tuber mass per plant (381.02 g) was produced by applying 100% RDF + 1.0 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM, which was much better than other treatments and at par with T_2, T_5 and T_8. However, under control treatment (T_0), a minimal number of tubers mass per plant was found. This could be attributable to the usage of both organic as well as inorganic chemical fertilizers, as an organic fertilizer promoted aeration in the soil, facilized root advancement and boosted microbes and biological production in the rhizosphere. Both came to a similar conclusion Solanke *et al.* (2009) [8] and Jaipaul *et al.* (2011) [2]. A maximum volume of tuber (73.33 cm^3) was produced after applying 100% RDF + 1 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM which was much higher than other treatments where it was at par at T_1, T_2 and T_8. However, the control treatment (T_0) produces the tuber minimum dry volume**.** The implementation of 100% RDF + 1 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM (30.27 t ha^{-1}) was much higher than that from other treatments, where it was at par at T_2 and T_8. However, the control treatment produced minimum tuber productivity (20.17 tha^{-1}). This could be ascribed to the use of organic manure and fertilizer, which altered the physical characteristics of the soil to enhance the efficiency of nutrient use and led to a larger total uptake of nutrients due to better root accessibility which increased nutrient and moisture absorption. Khurana *et al.* (2005) [3] discovered a similar outcome. Narayan *et al.* (2013) [4] also support these outcomes. The combination of 100% RDF + 1 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM had the highest B:C ratio among all the treatments. This is because the overall cost of cultivation is proportionally lower when compared to the gross return in terms of the B: C ratio. Whereas the control treatment produced a minimum B: C ratio.

Table 1: Effect of integrated nutrient management (INM) on Yields.

Details of treatment	No. of tuber per plant	Tuber weight per Plant (g)	Volume of tuber (cm^3)	Tuber yield (t ha^{-1})
T_0 – Control	4.28	157.74	62.50	20.17
T_1 - 100% RDF	5.11	181.29	72.97	23.56
T_2 - 100% RDF + 2.5 t ha^{-1} FYM	7.68	372.10	73.16	29.20
T_3 - 75% RDF + 2.5 t ha^{-1} FYM	6.08	270.65	69.33	27.14
T_4 - 50% RDF + 5 t ha^{-1} FYM	5.30	198.25	68.77	23.03
T_5 - 75% RDF + 2.5 t ha^{-1} Vermicompost	6.95	371.80	71.11	28.11
T_6 - 50% RDF + 5 t ha^{-1} vermicompost	6.38	277.60	70.54	27.92
T_7 -100% RDF + 1 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM	7.93	381.02	73.33	30.27
T_8 - 75% RDF + 2 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM	7.23	371.70	71.78	28.71
T_9 - 25%RDF + 3 t ha^{-1} Vermicompost + 5 t ha^{-1} FYM	5.99	261.31	69.47	25.62
SEm±	0.24	4.18	0.72	0.61
CD (P=0.05)	0.73	12.57	2.19	1.85

Table 2: Effect of integrated nutrient management (INM) on Economics.

Details of treatment	Total cost of cultivation (₹ ha^{-1})	Gross returns (₹ ha^{-1})	Net returns (₹ ha^{-1})	B:C
T_0 – Control	105500	242040	136540	1.29
T_1 - 100% RDF	120000	282720	162720	1.36
T_2 - 100% RDF + 2.5 t ha-1 FYM	123750	350400	226650	1.83
T_3 - 75% RDF + 2.5 t ha^{-1} FYM	120125	325680	205555	1.71
T_4 - 50% RDF + 5 t ha^{-1} FYM	120250	276360	156110	1.30
T_5 - 75% RDF + 2.5 t ha^{-1} Vermicompost	123875	337320	213445	1.72
T_6 - 50% RDF + 5 t ha^{-1} vermicompost	127750	335040	207290	1.62
T_7 - 100% RDF + 1 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM	126750	363240	236490	1.87
T_8 - 75% RDF + 2 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM	124730	344520	219790	1.76
T_9 - 25%RDF + 3 t ha^{-1} Vermicompost + 5 t ha^{-1} FYM	125625	307440	181815	1.45

Conclusion

From the present research results, it may be assumed that integrated nutrient management improved potato productivity under sandy loam soil and provide additional advantages to soil sustainability in tems of soil fertility. Application of 100% RDF + 1 t ha^{-1} Vermicompost + 2.5 t ha^{-1} FYM can be recommended to enhance growth, tuber yield and profitability. Based on the result obtained from the results of the investigation, it was determined that the simultaneous use of inorganic chemical fertilizers and organic manures considerably enhanced plant vegetative development, more sustainably increased potato productivity and contributed to sustainable agriculture.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

1. Gomez KA, Gomez AA. Statistical for Agriculture Research. John. Wiley and Sons. New York; c1984. p. 704.
2. Jaipaul, Sharma S, Sharma AK. Effect of Organic Fertilizers on Growth, Yield and Quality of Potato under Rainfed Conditions of Central Himalayan Region of Uttarakhand. Potato J. 2011;38(2):176-181.
3. Khurana SC, Bhutani RD. Effect of FYM, Biofertilizer and Inorganic Fertilizer on Potato. Potato Journal. 2005.32:3-4.
4. Narayan S, Kanth RH, Narayan R, Khan FA, Singh P, Rehman SU. Effect of Integrated Nutrient Management Practices on Yield of Potato. Journal of Potao. 2013;40(1):84-86.
5. Perrenoud S. Fertilizing for high-yield potato. IPI Bulletin 8. 2nd Edition. International Potash Institute, Basel, Switzerland; c1993.
6. Sarkar A, Sarkar S, Zaman A. Growth and Yield of Potato as Influenced by a Combination of Organic Manures and Inorganic Fertilizers. Potato J. 2011;38(1):78-80.
7. Singh JP, Trehan SP. Balanced Fertilization to Increase the Yield of Potato. In: Proceedings of the IPI-PRII-PAU Workshop on Balanced Fertilization in Punjab Agriculture, held at Punjab Agricultural University, Ludhiana, India, 1998;15-16:129-139.
8. Solanke AV, Shete BT, Dhage VJ. Growth and Yield of Potato as Influenced by Integrated Nutrient Management. Ann. Pl. Physiol. 2009; 23(2):189-191.