iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** X **Month of publication:** October 2023

DOI: https://doi.org/10.22214/ijraset.2023.56226

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue X Oct 2023- Available at www.ijraset.com

Economic Study of Effect of Different Organic Fertilizers on Yield of Off-Season Organic Tomato Production in a Semi-Controlled Environment in Kathmandu

Prashant Raj Giri[1], Poonam Bhatt[2], Georgina Asare[3]
[1]*Masters in Agribusiness, Westcliff University, Nepal*
[2]*Department of Soil Science, Faculty of Agronomy, Agricultural University - Plovdiv Bulgaria*
[3]*Department of Soil Science, Faculty of Agriculture and Economics, University of Agriculture in Krakow, Poland*

Abstract: A field experiment was conducted to analyzes the economic importance and the effects of different organic fertilizers on the yield of organic tomato farming during off season in a semi-controlled environment in Kathmandu, Nepal. Six different treatments were examined, including Jholmal (Liquid Manure) (T1), Farm Yard Manure (FYM) (T2), Vermicompost (T3), a combination of ½ dose of jholmol + ½ vermicompost (T4), ½ dose of jholmol + ½ FYM (T5) and control (T6). Each treatment was replicated 4 times in a plot of 12*0.5 m, with each plot carrying 20 tomato plants. The variety chosen was Srijana, and the distance for the plantation was maintained at 60 cm along the row. The results showed that combining ½ dose of Jholmal and ½ dose of vermicompost (T5)yielded the highest tomato productivity. The benefit-cost ratio was also the highest for T5 along with the highest productivity. The productivity of treatments T1, T2, and T3 were found to have no significant difference statistically, but the B: C ratio showed a clear difference. The study highlighted the potential benefits of transitioning to organic farming practices for improved crop yields and economic returns.
Keywords: Organic fertilizers, economic return

I. INTRODUCTION

Tomato *(Solanum lycopersicum)* is one of the most consumed vegetables worldwide, with an annual consumption reported at 90 billion USD in 2019 (FAO, 2019). Tomato is one of Nepal's most produced and most consumed commercial crops, with an annual production of 422703 MT cultivated over 22911 Ha of land (MoALD, 2023). Tomato is among the prerequisites for Nepalese meals, whose daily demand is reported to be around 50-70 MT daily alone in Kathmandu Valley (Dhungana, 2023). In contrast, the yearly price fluctuation is reported from Nrs.8 to Nrs 114.6 (*KFVMDC, 2023*).

According to the survey by Bhatta et al. (2010), the willingness to pay for organic products was found to be 78% for the price of the products, which is 20-30% higher than the inorganic products, and also found that people seek certification of the products as there are many fraud cases reported. Organic tomato farming is profitable in many developing countries (Abebe et al., 2022). In contrast, the benefit-cost ratio (B: C) was higher in Kathmandu organic farms than in conventional farms (Shrestha et al., 2014). The shifting from chemical farming to organic can be challenging, considering the mindset and farming practice that has been practiced for so long. Organic fertilizers provide plant nutrients, suppress disease pests, and promote microbial activity, cation exchange capacity, organic matter, and soil carbon content (Yanar et al., 2011). There are various organic fertilizers developed over the years, and they are unique in the way of materials used and the nutrient contents. Still, the principle of organic compost remains the same, i.e., conversion of organic matter to a more refractory, i.e., stable form, minimum content of phytotoxic compounds and allelopathic chemicals, and absence of plant and animal pathogens (Senesi, 1989). In the research, we will see much about the effect of compost, vermicompost, and Jholemeal (a locally made liquid organic fertilizer) in isolation and combined in different compositions on the productivity of tomatoes. We will also analyze the economic values associated.

Culturing the Srijana Variety is highly popular in Nepal, considering its size, consistency, productivity, and adaptability for off-season production (Magar et al., 2016). The seasonal cultivation of tomatoes in Kathmandu Valley is done during the rainy season, whereas the off-season cultivation is done during the months of March/ April (Chapagain et al., 2011). The harvesting period starts in June/July and ends in November/December, considering the care taken, disease pest infestation, and temperature variation.

The Semi-controlled environment or tunnel farming is one of the most popular off-season farming methods in Kathmandu Valley (Pal, 2022). Plastic tunnel farming is a simple and low-cost approach to controlling the microclimate. Growing and producing vegetable crops during the off-season in plastic houses is becoming highly profitable in Nepal (Lamichhane, 2017). Unlike the advanced tunnel technology used in developed nations, Nepalese farmers have accepted it in a simplified version (FAO,2020). The tunnel construction is often made of bamboo or galvanized iron (GI) pipe framework wrapped with clear silpaulin/ tarpaulin or other local plastics ranging in weight from 45 to 90 GSM (KC et al., 2021). The tunnels are built to have a roof covered with plastic for protecting the crops during monsoon rains and the desirable temperature and humidity during the growing seasons; the sideways in the tunnels are left open, unlike a full covering in high-tech tunnels and greenhouses.
Despite the growing demands and the choice of farmers to adopt organic practices, the economic feasibility has been less explored, so this research focuses on the economic feasibility and productivity of the Srijana variety of tomatoes under the semicontrolled structure in Kathmandu, Nepal.

II. METHODOLOGY

The research was conducted in Aarogya Integrated Farm, located at the northwestern corner of Kathmandu Valley. The study used a randomized complete block design (RCBD) experimental design, with six treatments and four replications. The Srijana tomato variety, one of the most popular commercial varieties, was used in the study. In the 12*0.5 m plots, a seedling aged 40 days was transplanted among the 24 plots in the experiment. Planting of seedlings was done at the spacing of 60 cm between the plants, and they were planted in a single-row raised bed with a 40 cm walking gap between the beds. The cultivation was done during the month of April, which is considered to be off-season tomato cultivation in Nepal. The six different treatments used in the experimental design is presented in Table 1.

Table 1: Description of the treatments used in the experiement

S.N.	Treatment Number	Treatment detail
1.	T1	*A full dose of Jholmal - 1.2 ltr/ m2*
2.	T2	Farm Yard Manure (FYM) - 2.5 kg/plant
3.	T3	Vermicompost - 0.5 kg/plant
4.	T4	½ dose Jholmal+½ dose FYM
5.	T5	½ dose Jholmal + ½ dose vermicompost
6.	T6	Control

A. Farm Yard Manure (FYM)

Farmyard manure is mostly made by decomposing the cow dung, urine, waste straw, feed, forage stubbles, and other dairy byproducts. The best results were absorbed in tomatoes when 2.5 kg / m^2 was applied (MOHAMMED et al., 2014); the FYM contains 0.5–1.5% N, 0.2–0.4% P_2O_5, and 0.5–1.0% K2O (Kumar et al., 2021).

B. Vermicompost

0.5 kg of vermicompost is found to perform best for the production of tomatoes (Mukta et al., 2015). We used the vermicompost from Praramva Biotech, which contains 1.5 -2.5 %, P: 0.75 -1.5 %, K: 1.5 – 2.5 % as per the company (Praramva Biotech, 2023).

C. Jholmal

Jholmal is a homemade bio-fertilizer made by combining farmyard manure (FYM), animal urine, water, and herbal plants in a predetermined ratio, with 1.7% organic carbon (OC), 1.3 mg/g nitrogen (N), 0.1 mg/g phosphorus (P), 0.2 mg/mL potassium, and a pH of around 8.1 (Subedi et al., 2019). The plants used are usually fast decomposing with insect-repellent properties. The Jholmal is to be used in 1.2 liters per m2 (Bhusal et al., 2022), and the effective frequency of use was observed to be 21 days (Acharya et al., 2020). The Jholmal was prepared on the farm using locally available plants (*Artemisia vulgaris, Melia azedarach, Allium sativum, Urtica dioica, Zanthoxylum piperitum, Trifolium, Portulaca oleracea*), cattle urine, and effective microorganisms (EM) bought from the market.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue X Oct 2023- Available at www.ijraset.com

D. Economic Analysis

BCR analysis was calculated using the following formula:

Benefit-Cost Ratio = Present value of benefit/Present value of cost.

E. Statistical Analysis

Data were statistically analyzed using MS Excel and GenStat. Duncan's multiple range test (DMRT) at a 5% significance level was used to compare the mean values. The cost of a plastic tunnel house has been divided over 5 years as the expected life of the structure, the land lease, labor costs, and fixed costs are divided among all the treatments.

III. RESULT AND DISCUSSION

A. Effect of Different Treatments on Productivity

The six treatments were found to significantly affect the growth and productivity of the Tomato plants under the semi-controlled environment. The highest productivity with 6.085 kg/plant was found to be with the ½ dose Jholmal + ½ dose vermicompost, i.e., T5. In contrast, the lowest, with 2.065 kg/plant productivity, was found with no treatment, i.e., control (T6). The productivity through the treatment T1, T2, and T3 were found to have no significant difference, whereas the T5 and T6 were significantly different from all the treatments. Applying Jholmal, combined with compost or vermicompost, positively affected productivity.

Table 1: Effect of Treatments on Tomato`s Productivity

Treatment	Yield
1	4.795b
2	4.725b
3	4.745b
4	5.612c
5	6.085d
6	2.065a
Statistical analysis	
Grand mean	4.671
Sem	0.1235
CV (%)	5.3
LSD	0.3723
F value	<.001
P value	9.89

B. Benefit Cost Ratio

The most profitable treatment was T5, i.e., with the ½ dose Jholmal + ½ dose vermicompost with the B: C ratio of 2.71. The average selling price over the harvest period was NPR 45.5. The control had a B: C almost close to 1, while the treatment with ½ dose Jholmal + ½ dose FYM
was profitable with a B: C ratio 2.58.

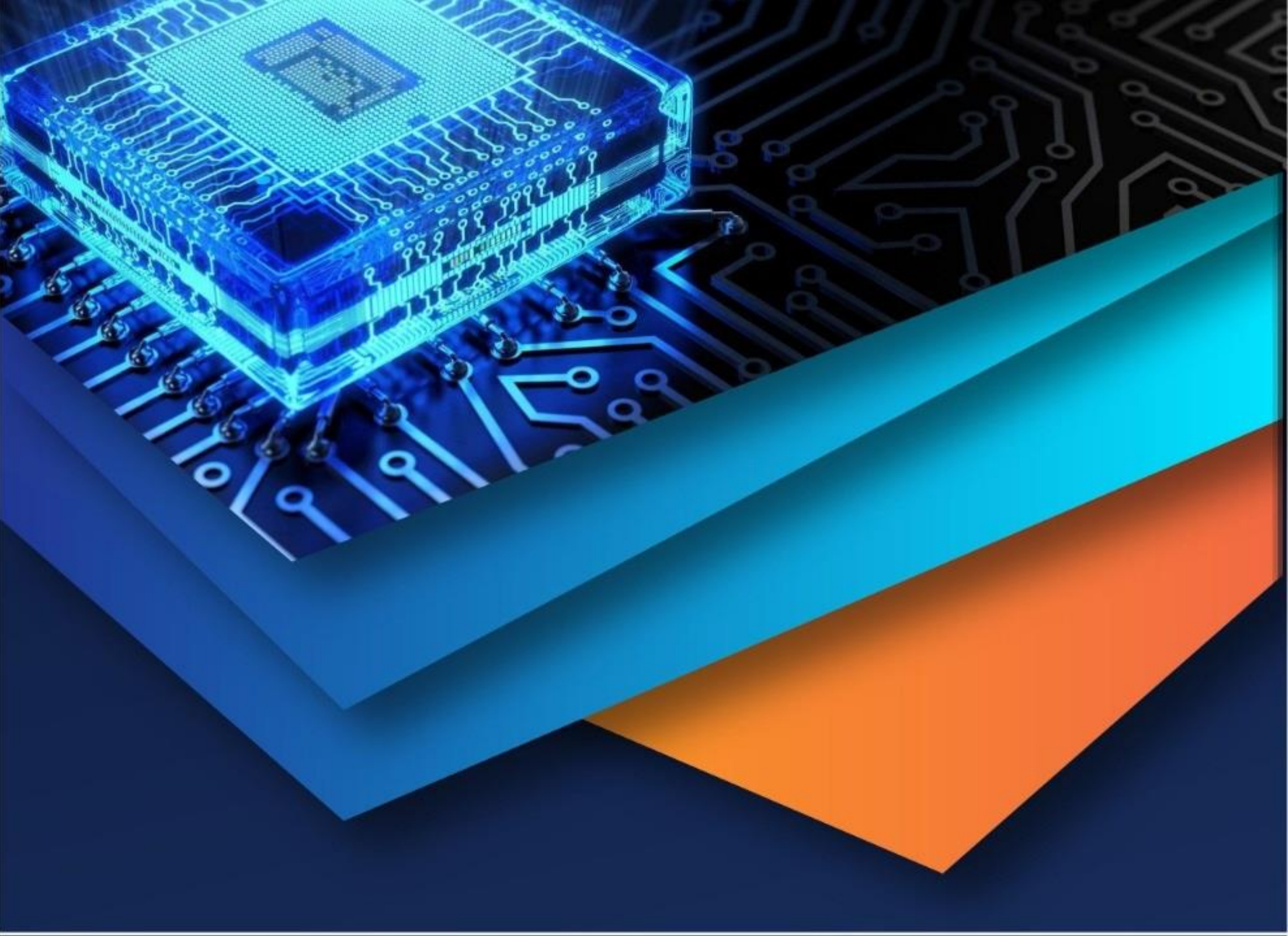
Replication	Return	Cost	B: C
T1	17453.8	8570.71	2.043
T2	17199	7275.71	2.36
T3	17271.8	7805.71	2.21
T4	20429.5	7915.71	2.58
T5	22149.4	8175.71	2.71
T6	7516.6	6925.71	1.09

IV. CONCLUSION

The study's findings reveal that the organic fertilizer treatment used has a considerable impact on tomato plant productivity in a semi-controlled environment with the best yield achieved from the combination of ½ dose Jholmal + ½ dose vermicompost (T5). Despite the productivity among the first three treatments (T1, T2 & T3) not having a significant difference, the B: C ratio notably differs among them. Despite the high production cost through the use of treatment 5, the B: C ratio is the highest among all the treatments, which suggests that the combination of ½ dose Jholmal + ½ dose vermicompost (T5) could be the most effective organic fertilizer for the most profitable return for the farming aiming to opt organic tomato production under the semi-controlled environment in Kathmandu valley.

REFERENCES

[1] Food and Agriculture Organization (FAO) (2019) http://fao.org/faostat/en
[2] Ministry of Agriculture and Livestock Development (MoALD). (2023). Statistical Information on Nepalese Agriculture (2021/22). Nepal: Planning and Development Cooperation Coordination Division Statistics and Analysis Section.
[3] Dhungana, N. (2023, June 18). Homepage. Retrieved from Online Khabar: https://www.onlinekhabar.com/2023/06/1324020
[4] Kalimati Fruit and Vegetable Market Development Committee (KFVMDC). (2023, July 12). Price trends of agricultural produce. Retrieved from Kalimati Fruit and Vegetable Market Development Committee: https://kalimatimarket.gov.np/price-history
[5] Bhatta, G. D., Doppler, W., & KC, K. B. (2010). Urban demands for organic tomatoes in the Kathmandu Valley, Nepal. Middle East Journal of Scientific Research, 5(4), 199-209.
[6] Abebe, G. K., Traboulsi, A., & Aoun, M. (2022). Performance of organic farming in developing countries: a case of organic tomato value chain in Lebanon. Renewable Agriculture and Food Systems, 37(3), 217-226. https://doi.org/10.1017/S1742170521000478
[7] Shrestha, K., Shrestha, G., & Pandey, P. R. (2014). Economic analysis of commercial organic and conventional vegetable farming in Kathmandu valley. Journal of Agriculture and Environment, 15, 58-71.
[8] Magar, D. B., Gauchan, D., Timsina, K. P., & Ghimire, Y. N. (2016). Srijana Hybrid Tomato: A Potential Technology for Enterprise Development in Nepal. Khumaltar, Lalitpur, Nepal: Socioeconomics & Agricultural Research Policy Division, Nepal Agricultural Research Council (NARC).
[9] Chapagain, T. R., Khatri, B. B., & Mandal, J. L. (2011). Performance of tomato varieties during rainy season under plastic house conditions. Nepal Journal of Science and Technology, 12, 17-22.
[10] Pal, S. K. (2022). An Economic Analysis of Tunnel Tomato Farming in Chandragiri Municipality, Kathmandu (Doctoral dissertation, Faculty of English).https://elibrary.tucl.edu.np/handle/123456789/15747
[11] Lamichhane, J., Ghimire, Y. N., Timsina, K., Magar, D. T., Sharma, T., Timilsina, C., ... & Adhikari, S. P. (2017, September). Profitability assessment of tomato cultivation under plastic house in western hills of Nepal. In Proceedings of the 9th National Horticulture Workshop, Burlington, VE, USA (pp. 8-9).
[12] Food and Agriculture Organization (FAO) (accessed on 30 May 2020).Tunnel Farming for Off-Season Vegetable Cultivation in Nepal. Available online: http://www.fao.org/3/CA3560EN/ca3560en.pdf
[13] Kc, D., Jamarkattel, D., Maraseni, T., Nandwani, D., & Karki, P. (2021). The Effects of tunnel technology on crop productivity and livelihood of smallholder farmers in Nepal. Sustainability, 13(14), 7935. https://doi.org/10.3390/su13147935
[14] Yanar, D., Gebologlu, N., Yanar, Y., Aydin, M., & Cakmak, P. (2011). Effect of different organic fertilizers on yield and fruit quality of indeterminate tomato (Lycopersicon esculentum). Scientific Research and Essays, 6(17), 3623-3628.
[15] Senesi, N. (1989). Composted materials as organic fertilizers. Science of the Total Environment, 81, 521-542.
[16] Subedi, R., Bhatta, L. D., Udas, E., Agrawal, N. K., Joshi, K. D., & Panday, D. (2019). Climate-smart practices for improvement of crop yields in mid-hills of Nepal. Cogent Food & Agriculture, 5(1), 1631026.https://doi.org/10.1080/23311932.2019.1631026
[17] Bhusal, K., Udas, E., & Bhatta, L. D. (2022). Ecosystem-based adaptation for increased agricultural productivity by smallholder farmers in Nepal. Plos one, 17(6), e0269586. https://doi.org/10.1371/journal.pone.0269586
[18] Acharya, A. K., Joshi, K. D., Dhungel, S., & Acharya, G. (2020). Smart Agriculture and Safe Vegetable Production: Key Learnings of CEAPRED.
[19] MOHAMMED, H. M., Prasad, V. M., & Saravanan, S. (2014). Effect of FYM, NPK and micronutrients on yield of tomato (Lycopersicon esculentum Mill.) cv. heem sohna under protected cultivation. International Journal of Agricultural Science and Research (IJASR), 4(1), 17-26.
[20] Kumar, S., Dhar, S., Barthakur, S., Rajawat, M. V. S., Kochewad, S. A., Kumar, S., ... & Meena, L. R. (2021). Farmyard manure as k-fertilizer modulates soil biological activities and yield of wheat using the integrated fertilization approach. Frontiers in Environmental Science, 9, 503. https://doi.org/10.3389/fenvs.2021.764489
[21] Mukta, S., Rahman, M. M., & Mortuza, M. G. (2015). Yield and nutrient content of tomato as influenced by the application of vermicompost and chemical fertilizers. Journal of Environmental Science and Natural Resources, 8(2), 115-122.
[22] Praramva biotech (2023, September 30). Retrieved from Praramva Biotech: https://praramvabiotech.com/bhu-doc/



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429