



Influence of vermicompost on the growth and yield of cucumber under different growing conditions

Sawaira Ishaq* and Faiza Amman

Department of Horticulture, Faculty of Crop Production Science, The University Agriculture, Peshawar-Pakistan

*Corresponding author's E-mail address: sawairamhammadishaq@gmail.com

Received: 22nd Oct 2025 | Revised: 30th Jan 2026 | Accepted: 6th Feb 2026

Abstract—A research titled "Influence of vermicompost on the growth and yield of cucumber under different growing conditions" was carried out at the Horticulture Ornamental Nursery, The University of Agriculture Peshawar during summer, 2024. The experiment was laid out using RCBD (Randomized Complete Block Design) with a split plot arrangement having two factors. The first factor included growing conditions (Open field and Shade house with 50% shade), while the second factor comprised levels of vermicompost (0, 1.5, 2.5, and 3.5 tons ha⁻¹). Results showed that both the factors significantly influenced the growth and yield attributes of cucumber. Cucumber plants grown under shade house conditions exhibited superior performance across most attributes compared to those grown under open field conditions. The highest vine length (81.07 cm), number of branches plant⁻¹ (11.68), number of leaves plant⁻¹ (31.00), days to 50 % flowering (41.08), number of fruits plant⁻¹ (14.03), single fruit weight (237.55 g), fruit diameter (5.40 cm), fruit length (17.15 cm), fruit volume (170.83 cm³) and yield (20.56 tons ha⁻¹) were recorded for those plants which were raised under the growing conditions of shade house. However, plants which were grown under open field conditions showed the lowest vine length (79.93 cm), number of branches plant⁻¹ (8.75), number of leaves plant⁻¹ (25.64), days to 50 % flowering (36.46), number of fruits plant⁻¹ (12.63), single fruit weight (233.04 g), fruit diameter (5.07 cm), fruit length (16.28 cm), fruit volume (169.20 cm³) and yield (19.10 tons ha⁻¹). Similarly, application of vermicompost significantly improved the performance of plants across all parameters. Maximum vine length (84.65cm), number of branches plant⁻¹ (14.93), number of leaves plant⁻¹ (40.97), days to 50 % flowering (36.85), number of fruits plant⁻¹ (18.88), single fruit weight (248.7g), fruit diameter (6.65 cm), fruit length (18.68 cm), fruit volume (175.82 cm³) and yield (23.22 tons ha⁻¹), while minimum days to flowering (36.17) were recorded at 3.5 tons ha⁻¹ of vermicompost. The lowest vine length (76.02), number of branches plant⁻¹ (6.12), number of leaves plant⁻¹ (19.60), days to 50 % flowering (40.75), number of fruits plant⁻¹ (8.58), single fruit weight (221.27g), fruit diameter (4.13cm), fruit length (14.97cm), fruit volume (164.25 cm³) and yield (15.05 tons ha⁻¹) were recorded in control plots where no vermicompost was applied. In conclusion, growing conditions of shade house showed positive effects on the growth and yield of cucumber compared to open field conditions during summer. Moreover, vermicompost at the rate of 3.5 tons ha⁻¹ exhibited good effects on the growth and yield of cucumber. Hence, shade house conditions and vermicompost at the rate of 3.5 tons ha⁻¹ are recommended for the better growth and production of cucumber during summer in Peshawar region.

Keywords—cucumber, temperature, humidity, shade house, open field, horticulture, organic fertilizers, vermicompost

INTRODUCTION

A Cucurbitaceae family member, Cucumber (*Cucumis sativus* L.) is one of the most widely cultivated vegetable in the world. It is originated from the Indian subcontinent and is grown for its edible fruit. It is a summer-season crop which is cultivated as an annual crop and is important for its refreshing flavor, high water content and many health benefits. As it is a major agricultural crop, it is extensively grown in Europe, Asia and North America where it contributes to both food processing industries and fresh consumption. Because of high water content (95%) cucumber serves as a low-calorie and hydrating food. It is mostly consumed fresh in salads or preserved as pickles to enhance flavor and extend their shelf life (Gurel *et al.*, 2020).

Cucumbers cultivated under shade house conditions perform better than those cultivated in open fields with better fruit quality, high yields and extended harvesting periods (Patil *et al.*, 2019). There are many other advantages of cultivation under shade house, such as efficient utilization of irrigation water, reduced incidence of insect-pest infestation and diseases and protection against abiotic stresses such as strong winds and rainfall. As of these benefits shade houses are valuable during the peak summer season in which open-field cucumber cultivation faces extreme abiotic and biotic stresses. Protected structures are getting popular among farmers as an effective method to ensure sustainable cucumber production in regions with harsh summer climates (Reddy and Rao, 2021). The protected cultivation system has many advantages like high productivity, better utilization of water and land resources

The modification of growing environments through protected structures is crucial for maintaining crop productivity. As well, sustainable soil fertility management is equally important for improving the crop production and quality. Use of excessive synthetic chemical fertilizers has developed several environmental problems like nutrient imbalance, soil degradation and reduced soil organic matter. Therefore, organic amendments such as vermicomposting are gaining popularity as eco-friendly alternatives that not only supply essential plant nutrients but also improve soil structure and enhance biological activity. In comparison to synthetic fertilizers they are cheap and effective and serves as a good nutrient source for plants. By using organic materials helps in minimizing production costs than of expensive chemical fertilizers. Some species of earthworms can breakdown a multitude of organic waste materials, from sewage sludge to animal wastes, crop residues and industrial byproduct. Alternates like animal waste, compost, crop rotations, green manure, vermicompost, biofertilizers and pesticides are all used in organic farming systems that play an important role in the promotion of sustainable agriculture (Dominguez *et al.*, 2020). Vermicompost is a stable organic product derived from the decomposition of organic wastes with the help of both earthworms and microorganisms. It is rich in plant macronutrients like nitrogen, phosphorus, potassium and other micronutrients. It is also rich in plant growth regulators, humic substances and beneficial microbes which improve nutrient availability and promote plant growth (Arancon and Edwards, 2011).

Several studies have reported that by incorporating vermicompost results in increased water-holding capacity, soil aeration and microbial diversity, thereby producing a favorable rhizosphere environment for crop growth (Garg and Gupta, 2019). In addition to these benefits, vermicompost has significantly enhanced seed germination, vegetative growth, flowering and fruiting in many horticultural crops including cucumber. Vermicomposting is one of the sustainable approach that reduce dependency on synthetic fertilizers, enhancing crop production and also contribute to environmentally safe agricultural practices (Singh *et al.*, 2021). Several agricultural based countries have been able to achieve its goal of self-sufficiency in food production with the help of advancement in high-yielding varieties, high-quality pesticides and chemical fertilizers. Anyhow, the excess use of these chemical fertilizers has brought disastrous consequences towards human health and the environment. Meanwhile, the application of vermicompost for vegetable cultivation has represented a solution to the waste disposal problem and also replenish the soil with much-required organic matter (Alam *et al.*, 2019).

Cucumber has high economic importance and is widely cultivated but its production is often constrained by unfavorable summer conditions and declining soil fertility due to continuous use of synthetic fertilizers. Shade house technology provides an effective way to mitigate environmental stress, while vermicompost serves as an organic nutrient source to maintain soil health and crop yield. However, limited research has been conducted to

evaluate the influence of different growing conditions (open field vs. shade house) and vermicompost application on the growth and yield of cucumber. Therefore, this study was undertaken to investigate the influence of vermicompost on cucumber growth and yield under different growing conditions, with the aim of developing sustainable strategies for enhancing cucumber production. The study was aimed to achieve the following objectives:

- To identify the best growing condition for the growth and yield of cucumber.
- To findout the appropriate level of vermicompost for the optimum growth and production of cucumber.
- To study the interaction between vermicompost and growing conditions for growth and yield attributes of cucumber.

MATERIALS AND METHODS

An experiment entitled, "Influence of vermicompost on the growth and yield of cucumber under different growing conditions" was conducted at Ornamental Nursery, Horticulture Department, The University of Agriculture, Peshawar, during summer, 2024.

Studied Parameters. Data were recorded on the following parameters.

Days to flowering

Data recorded by counting days from sowing seeds till 50% plants produce flowers for each treatment in each replication and the mean value were worked out and recorded.

Fruit volume (cm³)

The volume of five fruits from each treatment in each replication was measured by using water displacement method. Then the average were calculated.

Yield (tons ha⁻¹)

For measuring yield, fruits were harvested first from each treatment in each replication, weighted individually and then the total weight was converted to yield per hectare by using the following formula;

$$\text{Yield ha}^{-1} (\text{tons}) = \frac{\text{Yield plot}^{-1} (\text{kg}) \times 10,000 \text{ m}^2}{\text{Area of plot (m}^2) \times 1000}$$

Statistical analysis

The data were subjected to analysis of variance (ANOVA) method to determine the difference between different treatments. While, least significant difference (LSD) test were used to find out mean difference at five percent or one percent level of significance (Steel and Torrie, 1997). Statistical software STATISTIX version 8.1 was applied for calculating ANOVA and LSD.

RESULTS AND DISCUSSIONS

Days to 50% flowering

Mean data regarding days to 50% flowering are presented in Table 4.4, with the results of the analysis of variance (ANOVA) shown in Table 4.4a. Replicated data are presented in Appendix IV. The ANOVA reveals that both growing conditions and different levels of vermicompost significantly affected the days to flowering in cucumber. However, the interaction between these two factors was not significant.

The average data pertaining to growing conditions showed that plants in the shade house took maximum days to flowering (41.08 days). However, plants in the open field took the lowest days to flower (36.46 days). Regarding the effect of vermicompost, the number of days to flowering varied depending on the concentration applied. The shortest time to flowering (36.85 days) was observed in plants treated with 3.5 tons ha⁻¹. Plants treated with 2.5 tons ha⁻¹ had a slightly longer flowering period (37.98 days). On the other hand, the control plots, which did not receive any vermicompost, exhibited the longest days to flowering (40.75).

Cucumber plants grown in shade houses flowered earlier than those grown in open fields. The controlled environment, with stable temperatures and lower sunlight intensity, helped promote faster flowering (Maiti *et al.*, 2019). Shade house provided a more favorable light condition, reducing stress caused by high solar radiation, which led to quicker flowering compared to open-field conditions (Rashid *et al.*, 2018). Additionally, the reduced pest infestation in the shade house environment allowed the plants to grow properly, flower earlier and produce better yields than those grown in open fields (Reddy *et al.*, 2015).

Table 4.4 Influence of vermicompost on days to 50% flowering of cucumber under different growing conditions.

Vermicompost (tons ha ⁻¹)	Growing Condition		Mean
	Open Field	Shade House	
Control	34.93	46.57	40.75A
1.5	36.00	43.00	39.50A
2.5	36.70	39.27	37.98B
3.5	38.20	35.50	36.85C
Mean	36.46B	41.08A	

LSD value for vermicompost at $P \leq 0.01 = 1.13$

LSD value for growing condition at $P \leq 0.01 = 1.47$

Mean values with different letters indicate a statistically significant difference at the 1% level of significance.

Table 4.4a Analysis of variance for days to 50% flowering of cucumber as influenced by vermicompost under different growing condition.

Source of variation	DF	SS	MS	F-Value	P-value
Replications	2	4.0	1.99		
Growing conditions (G)	1	13.2	13.20	214.08	0.000
Error I	2	0.1	0.06		
Vermicompost (V)	3	236.6	78.86	118.68	0.000
G x V	3	1.7	0.58	0.87	0.482
Error II	12	8.0	0.66		
Total	23	263.60			

CV for vermicompost = 8.55 %

CV for growing condition = 4.44%,

Yield (tons ha⁻¹)

The data on yield are presented in Table 4.10, with the analysis of variance (ANOVA) results shown in Table 4.10a. Replicated data regarding fresh fruit yield of

cucumber are presented in Appendix-X. The ANOVA indicates that both growing conditions and different levels of vermicompost had a significant effect on cucumber yield (tons per hectare). However, the interaction between these two factors was not significant.

The average data regarding growing conditions showed that plants under shade house conditions produced higher yield (20.56 tons ha⁻¹) than those in the open field (19.10 tons ha⁻¹). Data pertaining to vermicompost application showed that the yield varied depending on the concentration of vermicompost used. The highest yield (23.22 tons ha⁻¹) was observed in plots treated with 3.5 tons ha⁻¹ of vermicompost. In comparison, the control treatment, where plants did not receive any vermicompost, produced the lowest yield (15.05 tons ha⁻¹) among the tested levels.

Shade house conditions allowed plants to yield better than open field conditions which might be due to the fact that shade house created a controlled environment that protected plants from harsh weather conditions, such as

extreme heat, strong winds and, heavy rain while still allowing enough sunlight and air circulation. The study highlighted that the shade provided by the shade house helped maintain ideal photosynthesis levels, leading to better fruit production (Ravindran *et al.*, 2020).

Vermicompost also promoted growth leading to better yield which might be because of a balanced mix of macronutrients and micronutrients in the vermicompost, along with beneficial microorganisms that improved soil fertility. Using vermicompost had a positive impact on crop yield by improving soil structure, water retention, nutrient availability, and overall plant health (Bashir *et al.*, 2017). Cucumber plants grown on soil with vermicompost developed stronger roots and produced higher yields due to improved soil conditions and better nutrient retention. Vermicompost also contributed to higher yields by promoting a more diverse soil microbial community and reducing disease, which improved plant’s health (Jayanthi, 2018).

Table 4.10 Influence of vermicompost on yield (tons ha⁻¹) of cucumber under different growing conditions.

Vermicompost	Growing Condition		
	Open Field	Shade House	Mean
Control	15.05	16.19	15.62D
1.5	18.65	21.29	19.97C
2.5	20.59	21.55	21.07B
3.5	22.12	23.22	22.67A
Mean	19.10B	20.56A	

LSD value for vermicompost at P ≤ 0.01 = 1.29

LSD value for growing condition at P ≤ 0.01 = 0.07

Mean values with different letters denote statistically significant differences at the 1% level of significance.

Table 4.10a Analysis of variance for yield (tons ha⁻¹) of cucumber as influenced by vermicompost under different growing condition.

SOV	DF	SS	MS	F-ratio	P-value
Rep	2	1.9	0.96		
Growing Condition (G)	1	12.8	12.76	7656.25	0.000
Error 1	2	0.0	0.00		
Vermicompost (V)	3	164.1	54.69	51.77	0.000
G x V	3	2.8	0.93	0.88	0.479
Error2	12	12.7	1.06		
Total	23	194.22625			

CV for Growing conditions = 0.2%

CV for Vermicompost = 5.2%

CONCLUSIONS

Based on the findings, the following conclusions are drawn:

- The shade house resulted in improved growth and yield of cucumber compared to open field conditions. The highest vine length, number of branches plant⁻¹, number of leaves plant⁻¹, days to 50 % flowering, number of fruits plant⁻¹, single fruit weight, fruit diameter, fruit length, fruit volume and yield were recorded for cucumber plants grown under the growing conditions of shade house.
- Application of vermicompost significantly improved the performance of plants across all parameters. Maximum vine length, number of branches plant⁻¹, number of leaves plant⁻¹, days to 50 % flowering, number of fruits plant⁻¹, single fruit weight, fruit diameter, fruit length, fruit volume and yield tons ha⁻¹.
- The interaction of growing conditions and vermicompost application was found non- significant for all the studied parameters of cucumber.

RECOMMENDATION

Based on the conclusions, the following recommendations were made:

- In case of growing condition, shade house is recommended for the better growth and yield of cucumber during summer season.
- Soil application of vermicompost at the rate of 3.5 tons ha⁻¹ is recommended for the healthy growth and better production of cucumber.
- Further research is required to explore the influence of growing conditions and vermicompost beyond 3.5 tons ha⁻¹ for cucumber and other summer vegetables.

REFERENCES

- Abad, Q. and S. Shafiqi. 2022. Vermicompost: Significance and benefits for agriculture. *J. Res. Appl. Sci. Biotechnol.* 3(2): 100-110.
- Ansari, R. and R. Khan. 2021. Impact of greenhouse environments on cucumber growth and vine length. *Int. J. Greenhouse Manag.* 22(5): 27-34.
- Bajpai, S., et al. 2016. Comparative study of cucumber yield in shade house and open field conditions. *Horti. Res. J.* 15(3): 113-120.
- Bashir, S., et al. 2017. Influence of vermicompost on cucumber yield and soil health. *J. Org. Agric.* 10(2): 184-190.
- Cakmak, I. 2000. Tansley Review No. 111. Possible roles of zinc in protecting plant cells from damage by reactive oxygen species. *New Phytol.* 1(88): 185-205.
- Garg, V., N.A. 2013. Effect of vermicompost on cucumber growth and leaf production. *Soil Fertil. Sci.* 42(1): 37-43.
- Garg, V.K. and R. Gupta. 2019. Vermicomposting: A review of improved soil physical, chemical, and biological properties. *J. Appl. Agric. Res.* 11(1): 33-45.
- <https://ojs.bakrie.ac.id/index.php/APJSAFE/about>
- Gupta, N., S.K. Jain, B.S. Tomar, A. Anand, J. Singh and A.K. Singh. 2021a. Influence of fruit load per vine on seed quality in cucumber (*Cucumis sativus* L.) grown under open field and protected environments. *Indian J. Hortic.* 78: 93-100.
- Hirata, S.L. and R. Tilato. 2002. Comparative cost of Teepee-trellised vs non-trellised cucumber production. *Econ. Inf. Rep.* EL95(1): 40-46.
- Hossain, M., M. Rahman and M.R. Islam. 2016. Effect of shade levels on cucumber growth and yield in a shade house. *Bangladesh J. Agric. Res.* 41(3): 475-484.
- Ismail, M. and A. Ali. 2018. Comparative analysis of cucumber growth in open fields and under controlled environments. *Agric. Sci. Res. J.* 9(6): 45-53.
- Jensen, M.H. 2022. Controlled environment agriculture in deserts, tropics and temperate regions – A world review. *Acta Hortic.* 578: 19-25.
- Kadans, J.M. 1979. *Encyclopedia of Medical Foods*. Thorns Publ. Ltd., Willing Borough, North.
- Kumar, A., et al. 2017. Influence of vermicompost on cucumber growth and fruit yield. *J. Agric. Sci. Technol.* 19(4): 329-337.
- Mahesh, C.S., D. Singh Kachwaya and K. Kalsi. 2018. Soilless cucumber cultivation under protective structures in relation to irrigation coupled fertigation management, economic viability and potential benefits – A review. *Int. J. Curr. Microbiol. Appl. Sci.* 7(3): 2451-2468.
- Nath, G., and K. Singh. 2009. Utilization of vermiwash potential on certain summer vegetable crops. *J. Cent. Eur. Agric.* 10(4): 417-426.
- Rashid, A., et al. 2018. Flowering and growth of cucumber under different growing environments: A comparative study of open field vs. shade house conditions. *Hort. Technol.* 9(2): 102-107.
- Singh, D., et al. 2017. Effects of organic fertilizers on flowering and fruiting of cucumber under controlled conditions. *Int. J. Plant Sci.* 33(2): 110-118.
- Singh, J., M.K. Singh, M. Kumar, V. Kumar, K.P. Singh and A.Q. Omid. 2018. Effect of integrated nutrient management on growth, flowering and yield attributes of cucumber (*Cucumis sativus* L.). *Int. J. Chem. Stud.* 6(4): 567-572.
- Singh, M.C., J.P. Singh and K.G. Singh. 2019b. Optimal operating microclimatic conditions for drip fertigated cucumbers in soilless media under a naturally ventilated greenhouse. *Indian J. Ecol.* 44: 821-826.
- Singh, R., et al. 2021. Effects of shade house conditions on pest control and cucumber fruit growth. *Crop Prot. J.* 42(5): 245-251.
- Singh, R., P. Sharma, S. Kumar and A. Verma. 2008. Vermicompost substitution influences growth, physiological disorders, fruit yield and quality of strawberry (*Fragaria* × *ananassa* Duch.). *Bioresour. Technol.* 99(17): 8507-8511..