Global Journal of Science and Technology (GJST)

A Review study on Compression and Yielding of Microgreen under Home Condition

Pragya Dubey and Avshesh Kumar

Department of Botany, T.D.P.G. College, Jaunpur Affliated to VBSP University, Jaunpur (U.P.) 222002.

ABSTRACT

Microgreens are nutrient-rich seedlings that are commonly cultivated at home. This review looks at how seed production is affected by compression brought on by mechanical pressure and seed density. While severe pressure stunts growth and encourages illness, moderate compression enhances germination. Productivity is also affected by elements including temperature, water, and light. Higher yield and higher-quality microgreen production are guaranteed when these parameters are properly managed.

KEYWORDS

Microgreens, Compression stress, Seed density, Yield optimization, Home cultivation, Germination, Plant growth, Growing conditions, Biomass production, Sustainable agriculture

ARTICLE HISTORY

Received: 27 January 2026
Accepted: 03 February 2026
Published: 05 March 2026

CITATION

Dubey. P. & Kumar. A., (2026). A Review study on Compression and Yielding of Microgreen under Home Condition, Journal of Science and Technology (GJST), 2(1), 145-152. https://doi.org/10.65523/gjst.2026.v2.i1.18

1. Introduction

Microgreens are young, delicate vegetable and herb seedlings that are harvested soon after germination, usually when the first genuine leaves appear or at the cotyledon stage. Due to their potent aromas, vivid hues, and outstanding nutritional value, these little greens have become increasingly popular throughout the world in recent years. Microgreens are an essential aspect of functional foods and health-conscious diets because, according to studies, they frequently have higher concentrations of vitamins, minerals, and bioactive substances than their mature plant counterparts (Xiao et al., 2012). They are especially well suited for home-based production systems and urban agriculture due to their short growth cycle, low space requirements, and ease of cultivation.

The growing popularity of home gardening, particularly in urban and semi-urban regions, has increased demand for microgreens even more. As worries about pesticide residues, food safety, and environmental sustainability mount, people are looking to home production as a dependable supply of wholesome, fresh vegetables. According to Kyriacou et al. (2016), microgreens can be cultivated indoors on windowsills, balconies, or small trays using basic supplies, making them accessible to a wide range of people regardless of space constraints. Because of this, microgreens are now a crucial component of sustainable food systems and a potential way to enhance household nutrition.

The successful production and yield of microgreens in home conditions are influenced by a number of parameters, despite their ease of cultivation. The biomass or number of edible shoots generated per unit area or per tray is referred to as yield in this context. A major goal for both home planters and professional plants is to maximize productivity while preserving quality. Among the many variables influencing yield, seed density and compression are important but frequently disregarded. High seeding density, tray stacking during germination, or the use of physical pressure to improve seed-to-medium contact are the main causes of compression in microgreens.

Growers frequently use compression in the early phases of germination. To provide even contact between the seeds and the growing media, it is frequently applied by covering the seeds with another tray or using a light weight. This technique promotes consistent sprouting, increases germination rates, and improves water absorption. On the other hand, overcompression may be harmful to plant development. Overcrowding and high pressure can limit the amount of oxygen available, decrease air circulation, and provide a humid microenvironment that promotes the growth of fungi and the development of disease (Di Gioia et al., 2017). Therefore, maximizing microgreen production requires an understanding of the balance between advantageous and detrimental compression levels.

One of the most important variables affecting microgreen yield is seed density, which is strongly correlated with compression. Although a higher seed density might boost the overall biomass production per unit area, it may also cause seedlings to compete with one another for water, light, and nutrients. Reduced leaf expansion, weak, extended stems, and heightened susceptibility to infections are all consequences of overcrowding. Conversely, a very low seed density could result in less productivity overall and underutilization of available space. Finding the ideal seed density is therefore essential to striking a balance between plant health and yield (Murphy & Pill, 2010).

The growth and yield of microgreens are also greatly influenced by environmental factors such light, temperature, humidity, and watering techniques. The growth of chlorophyll, photosynthesis, and general plant morphology are all significantly impacted by light. Natural sunlight is frequently employed in homes, however depending on the location and time of year, its duration and intensity might change. While too much light can contribute to stress and dehydration, too little light can result in poor growth and decreased nutritional quality. Similarly, to promote healthy growth, temperature and humidity must be kept within ideal levels. High humidity levels might raise the risk of mold and fungal diseases, which can drastically lower yield and jeopardize food safety, particularly when combined with compression (Treadwell et al., 2010).

In microgreen growing, watering techniques are just as crucial. For seeds to germinate and for seedlings to grow, the right amount of moisture is necessary. On the other hand, underwatering can cause poor germination and stunted growth, while overwatering can result in waterlogging, decreased oxygen availability, and increased microbial growth. The selection of a growing media, such as soil, cocopeat, or hydroponic substrates, also affects the availability of nutrients, water retention, and aeration, all of which have an impact on total production.

The restricted control over environmental variables is another significant feature of microgreen cultivation at home. Home growers frequently depend on ambient conditions, which can vary greatly, in contrast to controlled commercial systems. It is difficult to standardize growing techniques and attain reliable yields because of this diversity.In order to maximize output, it is necessary to comprehend how various elements interact at home and how they can be efficiently managed. While a number of studies have examined microgreen production in controlled settings, home-scale gardening has received comparatively less attention. Particularly, little is known about how compression affects growth and how it interacts with other elements. The majority of current research focuses on hydroponic systems, light levels, and nutrient content; practical factors like seed density, tray management, and mechanical stress are given less consideration. This knowledge gap emphasizes how crucial it is to carry out thorough assessments in order to compile the available data and offer helpful recommendations for home growers.

In plant science, the idea of mechanical stress—including compression—is not new. Thigmomorphogenesis is the process by which plants alter their physiology and morphology in response to external stimuli. While extreme mechanical stress can stunt growth and lower productivity, moderate mechanical stress can occasionally increase a plant's strength and resistance. Compression can be regarded as a type of mechanical stress in microgreens that affects root growth, seedling development, and total biomass accumulation. Creating successful cultivation tactics requires an understanding of these reactions.

When producing microgreens, quality factors including flavor, texture, color, and nutritional value are crucial in addition to yield. These characteristics can be impacted by compression and high-density planting, which change the metabolism and growth patterns of plants. For example, lower chlorophyll content and paler leaves can result from limited light penetration in densely packed trays, but texture and shelf life can be impacted by excessive wetness. Therefore, improving yield and guaranteeing high-quality produce need optimal compression and associated parameters.

The goal of this review is to examine how seed density and compression affect microgreen yield in domestic settings. Additionally, it looks at how agriculture and environmental conditions affect production and growth. This study aims to provide a thorough understanding of the opportunities and problems related to home-based microgreen production by combining findings from multiple studies. Additionally, it seeks to determine the optimum methods for attaining the highest possible yield and quality while reducing the dangers of excessive compression and inadequate environmental control.

In summary, microgreens offer several nutritional and environmental advantages, making them a viable and sustainable choice for home food production. However, controlling a number of variables, including as compression, seed density, and environmental parameters, is necessary to provide the best possible yield and quality. The development of effective and dependable cultivating methods for home growers will be aided by a deeper comprehension of these elements and how they interact. Therefore, academics, students, and practitioners interested in sustainable agriculture and microgreen production will find this review to be a useful resource.

Methodology

1. Research Methods

The review research methodology used in this work entails gathering, evaluating, and synthesizing secondary data from previously published scientific literature. This method works well for comprehending how compression affects microgreens' yield in a home setting without the need for lab or field testing.

2. Data Gathering

2.1.Data Origins

Pertinent data was gathered from:

- Peer-reviewed publications in horticulture, agriculture, and plant science
- Internet resources like ScienceDirect, ResearchGate, and Google Scholar
- Microgreen cultivation-related books and extension materials
-

2.2.Terms Employed

We searched for pertinent literature using the following keywords:

- Yield of microgreens
- Microgreens' density of seeds
- Plant compression stress
- Microgreens grown at home

Plant growth and indoor farming

2.3 Selection Standards

- Research released in the previous ten to fifteen years
- Articles about plant density and microgreen production
- Research on home-based or small-scale farming
- Relevant and reliable scientific references

3. Analysis of Data

- The gathered literature was thoroughly examined and divided into themes:

Effects of compression

- The density of seeds
- Environmental aspects
- A comparative analysis was done to determine:
- Comparable results
- Inconsistencies

Research deficiencies • Rather than using statistics, the data was analyzed qualitatively.

4. Conceptual Framework

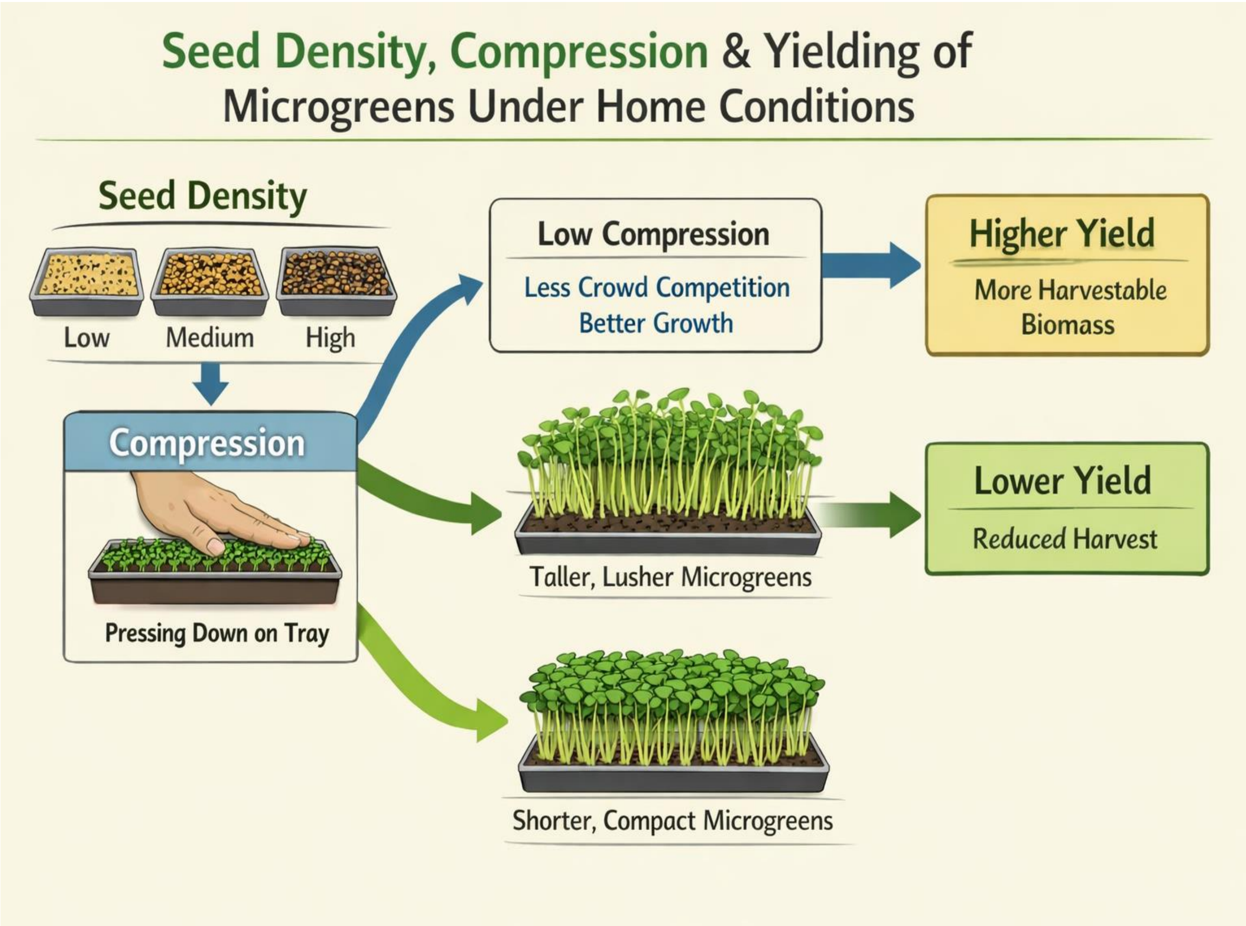
The study is based on the relationship between compression and yield of microgreensunder home conditions.

Key Variables:

- **Independent Variables**:
- Seed density
- Compression (tray stacking/pressure)
- Environmental factors (light, water, temperature, humidity)

Dependent Variable:

- Yield (biomass production, growth quality)



5. Conceptual Model

1. Seed Density and Yield (Fresh Biomass):

Up to an ideal threshold (approximately 12 seeds/cm² for small seeds like broccoli, 2 seeds/cm² for bigger seeds like peas), yield rises as seed density rises. Beyond this, quality declines (smaller plants, more mold) and yield plateaus or declines as a result of competition.

2. Compression (Weighting):

During the three-day blackout period, applying weight forces seeds into the substrate, improving root-to-water contact and resulting in stronger, thicker stems from the microgreens.

3. Ideal "Home" Situation:

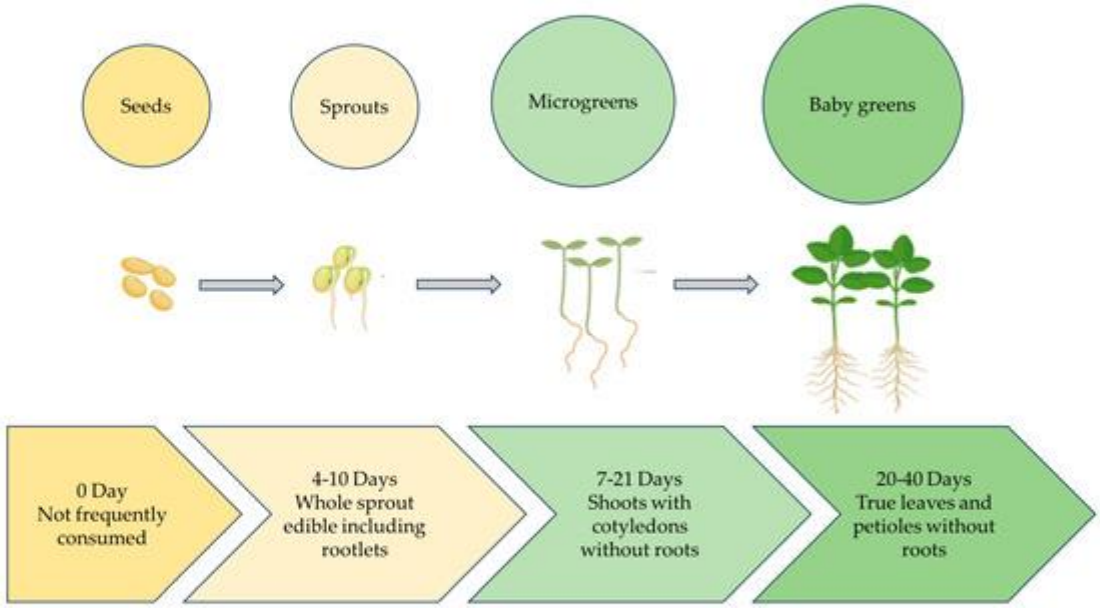
Aim for a "carpet" of seeds that touch but do not overlap.

3.1 Compression: To improve "compression" and increase stem density during the three-day blackout period, apply a 1-2 lb weight (such as a brick or another tray).

3.2 High-Density Hazards: In a residential environment with high humidity and poor air circulation, over-seeding can result in "damping off" (fungal infection) and cause stems to stretch (become lanky) as they fight for light.

3.3 Species Specificity: To prevent congestion, smaller seeds (radish, kale) require a higher density, whereas larger seeds (sunflower, peas) require a lower density.

6. Diagram: Home Microgreen Setup



7. Significance of Methodology

- Helps summarize existing knowledge
- Provides guidance for home growers
- Identifies research gaps for future studies

Conclusion

Microgreens are especially well suited for home cultivation because they are a very nutritious, quick-growing, and compact crop. The importance of compression and seed density in affecting microgreens' development, yield, and general quality under domestic settings is highlighted in this paper. Compression, which is mostly caused by high seed density and tray stacking during germination, has two functions in the creation of microgreens. Excessive compression can hinder plant growth by limiting ventilation, raising humidity, and encouraging fungal infections, whereas moderate compression is advantageous for guaranteeing even germination and effective use of available space.

The results of numerous research show that keeping an ideal balance between seed density and environmental factors is crucial for yield. High seed density causes overcrowding, which reduces biomass and produces (weak) seedlings due to competition for nutrients, light, and water. On the other hand, extremely low density leads to a reduced total yield and an inefficient use of available space. To maximize yield, it is therefore essential to determine and maintain an ideal seed density. Microgreen growth is also influenced by environmental elements like light, temperature, humidity, and watering techniques. Effective management of these issues becomes much more crucial in home settings, where environmental control is limited. Healthy photosynthesis and coloration are ensured by adequate light, while disease and microbial contamination are avoided with careful ventilation and watering.

Additionally, the choice of growing media promotes healthy plant development by improving aeration and moisture retention.

Overall, this analysis highlights that a balanced strategy is necessary for successful microgreen growth at home. When paired with appropriate environmental control, moderate compression during the early stages of germination can greatly increase yield and quality. On the other hand, improper cultivation methods and excessive pressure might result in lower output and a higher risk of illness. In summary, microgreens provide a workable and sustainable way to enhance household nutrition and advance urban agriculture. Home growers can maximize their production methods to create bigger yields and higher-quality produce by comprehending the connection between compression, seed density, and environmental conditions.To standardize procedures and create more dependable and effective microgreen production techniques, more study is required, especially experimental experiments conducted at home.

References

1. Bewley, J. D., et al. (2013). Seed physiology. https://link.springer.com
2. Bradford, K. J. (2002). Seed germination. *Plant Cell*. https://academic.oup.com
3. Bulgari, R., Baldi, A., Ferrante, A., &Lenzi, A. (2017). Yield and quality of microgreens. *Agriculture*, 7(5). https://www.mdpi.com
4. Choe, U., Yu, L. L., & Wang, T. T. (2018). Science behind microgreens. *Journal of Agricultural Science*. https://www.ccsenet.org
5. Cowden, R. J., Markussen, B., Ghaley, B. B., &Henriksen, C. B. (2024). Effects of light, seed density, and fertilization on microgreens. *Plants*, 13(1), 124. https://www.mdpi.com
6. Di Gioia, F., Mininni, C., Santamaria, P., &Serio, F. (2017). Microgreens production and sustainability. *Agronomy*, 7(4). https://www.mdpi.com
7. Dubey, S., et al. (2026). Microgreens production under controlled environments. *PubMed Central (PMC)*. https://pmc.ncbi.nlm.nih.gov
8. Dubey, S., et al. (2026). Seed density effects on yield and microbial load in microgreens. *PubMed Database*. https://pubmed.ncbi.nlm.nih.gov
9. Dubey, S., Harbourne, N., Reilly, A., Hurley, D., & Elliott-Kingston, C. (2026). Microgreens: Optimising seed density and light effects on yield. *Plants*, 15(4), 635. https://www.mdpi.com/2223-7747/15/4/635
10. El-Nakhel, C., &Rouphael, Y. (2021). Plant nutrition in microgreens. *Agronomy*, 11(4). https://www.mdpi.com
11. European Food Safety Authority (2011). Food safety of sprouts. https://www.efsa.europa.eu
12. Food and Agriculture Organization (2013). Urban agriculture for sustainable cities. https://www.fao.org

13. Food and Agriculture Organization (2019). The future of food and agriculture. https://www.fao.org
14. Gordanić, S., Dragumilo, A., Mrđan, S., et al. (2025). Impact of sowing density on productivity of basil microgreens. *AgroReS Journal*. https://agro.blupress.unibl.org
15. Hopkins, W. G., &Hüner, N. (2009). *Introduction to Plant Physiology*.https://www.wiley.com
16. Jones-Baumgardt, C., et al. (2019). Seed density effects. *HortScience*. https://journals.ashs.org
17. Kou, L., Luo, Y., et al. (2014). Nutritional changes in microgreens. *Food Chemistry*. https://www.sciencedirect.com
18. Kozai, T., Niu, G., &Takagaki, M. (2015). *Plant Factory: Indoor Farming*. https://www.sciencedirect.com
19. Kyriacou, M. C., El-Nakhel, C., Pannico, A., et al. (2016). Microgreens as a component of space life support systems. *Frontiers in Plant Science*, 7 : https://www.frontiersin.org
20. Kyriacou, M. C., Rouphael, Y., &Santamaria, P. (2020). Advances in microgreens production systems. *Agronomy*. https://www.mdpi.com
21. Kyriacou, M. C., Rouphael, Y., et al. (2019). Micro-scale vegetable production. *Trends in Food Science & Technology*. https://www.sciencedirect.com
22. Mir, S. A., Shah, M. A., & Mir, M. M. (2017). Microgreens: Production and shelf life. *Critical Reviews in Food Science and Nutrition*, 57(12). https://www.tandfonline.com
23. Murphy, C. J., & Pill, W. G. (2010). Cultural practices to speed the growth of microgreens. *HortScience*, 45(2). https://journals.ashs.org
24. Ntsoane, M. L., Manhivi, V. E., Shoko, T., et al. (2023). Phytonutrient content and yield of Brassica microgreens at different densities. *Horticulturae*. https://www.mdpi.com
25. Pinto, E., Almeida, A. A., Aguiar, A. A., & Ferreira, I. M. (2015). Mineral profile of microgreens. *Food Chemistry*, 173. Retrieved from: https://www.sciencedirect.com
26. Reddy, K. S., et al. (2023). Microgreens of tropical edible species: Growth and yield analysis. *Future Foods*. https://www.sciencedirect.com
27. Renna, M., &Paradiso, V. M. (2020). Microgreens as emerging functional foods. *Foods Journal*. https://www.mdpi.com
28. Renna, M., &Paradiso, V. M. (2020). Microgreens research. *Foods*, 9(6). https://www.mdpi.com
29. Rouphael, Y., Kyriacou, M. C., &Colla, G. (2018). Controlled environment agriculture. *Horticulture Research*. https://www.nature.com
30. Samuolienė, G., et al. (2013). LED lighting effects on microgreens. *ActaHorticulturae*. https://www.actahort.org
31. Singh, J., et al. (2021). Indoor farming sustainability. *Sustainability*. https://www.mdpi.com
32. Singh, P., et al. (2024). Microgreens: Cultivation practices and bioactive potential. *Food Bioscience*. https://www.sciencedirect.com
33. Taiz, L., Zeiger, E., et al. (2015). *Plant Physiology and Development*. https://global.oup.com
34. United States Department of Agriculture (2018). Microgreens nutrition data.https://www.usda.gov
35. University of Florida IFAS Extension (2010). Microgreens: A new specialty crop. https://edis.ifas.ufl.edu
36. Walters, K. J., &Currey, C. J. (2015). Hydroponic production of microgreens. *HortTechnology*. https://journals.ashs.org
37. Weber, C. F. (2017). Broccoli microgreens nutrition. *Journal of Food Composition and Analysis*, 61.https://www.sciencedirect.com
38. World Health Organization (2020). Healthy diet guidelines. https://www.who.int

39. Xiao, Z., Lester, G. E., Luo, Y., & Wang, Q. (2012). Assessment of vitamin and carotenoid concentrations of microgreens. *Journal of Agricultural and Food Chemistry*, 60(31), 7644–7651. https://pubs.acs.org
40. Zhang, H., et al. (2020). Hydroponic production systems. *Agricultural Water Management*. https://www.sciencedirect.com
41. Samuolienė, G., et al. (2017). Light intensity effects on microgreens growth. *Plant Physiology*. https://academic.oup.com
42. Jones-Baumgardt, C., &Zheng, Y. (2019). Influence of seeding density on microgreen yield. *HortScience*. https://journals.ashs.org