

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 5; May 2026; Page No. 692-697

Received: 07-02-2026
Accepted: 15-03-2026

Indexed Journal
Peer Reviewed Journal

A study on the consumer buying behaviour towards hydroponic vegetables in Dehradun District of Uttarakhand

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DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i5i.3644>

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Abstract

The present study entitled “Market Study on Consumer Attitudes Towards Hydroponic Vegetables in Dehradun” was undertaken to examine the socio-economic profile of hydroponic vegetable growers and stakeholders, to assess the market status and potential of hydroponically grown vegetables and to analyze consumer awareness and purchasing behaviour. The study reveals that hydroponic vegetable cultivation and consumption in the district are largely influenced by small-scale growers, urban entrepreneurs, and middle-income consumers. A significant proportion of hydroponic producers were found to operate small or medium-sized controlled-environment units, indicating that hydroponic farming is primarily adopted by technologically aware farmers and startups with limited land resources. These systems allow efficient resource utilization and cater mainly to urban and peri-urban demand. With regard to consumer demographics, the analysis showed that 48.00 percent of consumers belonged to the age group of 20–35 years, 34.00 percent were in the 36–50 years category, and 18.00 percent were above 50 years. This indicates that hydroponic vegetables are more popular among young and middle-aged consumers who are more health-conscious and open to innovative agricultural products. The gender composition revealed that 74.67 percent of respondents were male and 25.33 percent were female, although female consumers were found to play a crucial role in household purchasing decisions. The educational profile of respondents indicated a relatively well-educated consumer base, with 26.00 percent graduates and 10.00 percent postgraduates, while 28.00 percent had secondary education and 24.00 percent had higher secondary education. This suggests that awareness and acceptance of hydroponic vegetables are positively associated with higher education levels. Income distribution further revealed that 36.00 percent of respondents belonged to the ₹1,50,001–3,00,000 income group, followed by 27.33 percent in ₹3,00,001–6,00,000, indicating that hydroponic vegetables are mainly consumed by middle and upper-income groups due to their premium pricing. Consumer awareness and purchasing behaviour were influenced by factors such as perceived health benefits, freshness, pesticide-free nature, and nutritional value. The study revealed that 32.00 percent of respondents were fully aware of hydroponic vegetables, while 44.67 percent were partially aware, and 23.33 percent were not aware. Despite this, only 59.33 percent of respondents had purchased hydroponic vegetables at least once, indicating a gap between awareness and actual purchasing behaviour. Additionally, only a small proportion of consumers reported regular purchases, suggesting that hydroponic vegetables are still considered a premium product.

Keywords: Consumer behaviour, market potential, purchasing patterns, awareness, socio-economic profile

Introduction

Hydroponic vegetables are gaining increasing importance in modern agriculture due to their ability to produce high-quality vegetables using innovative soilless cultivation techniques. Hydroponics refers to a method of growing plants without soil, where crops are cultivated in a nutrient-rich water solution under controlled environmental conditions. This advanced technology allows crops to grow faster, use less water, and produce higher yields compared to conventional farming methods. With increasing concerns about food safety, pesticide residues, and environmental sustainability, hydroponic vegetables are gradually

attracting the attention of consumers and producers alike.

Hydroponic cultivation offers several advantages over traditional soil-based farming systems. It requires significantly less water, reduces dependency on arable land, and allows year-round production regardless of seasonal variations. Moreover, the controlled environment in hydroponic systems minimizes the risk of pest infestation and soil-borne diseases, resulting in better crop quality and uniformity. Because of these advantages, hydroponic farming has emerged as a promising solution to address the challenges of land scarcity, climate change, and increasing food demand.

Uttarakhand, with its favorable climatic conditions and growing urban population, offers significant opportunities for the expansion of hydroponic vegetable production. The state has witnessed increasing interest in innovative agricultural technologies, particularly around urban centers where the demand for fresh and safe vegetables is high. Hydroponic farming is emerging as a viable option for entrepreneurs and farmers seeking to produce high-value vegetables with limited land and water resources.

Among the districts of Uttarakhand, Dehradun holds a special position due to its strategic location, expanding urban population, and rising consumer awareness regarding healthy food consumption. The district is home to a large number of educational institutions, tourist establishments, and urban households that prefer high-quality vegetables. In recent years, hydroponic farms have been established in and around Dehradun to supply fresh leafy vegetables to supermarkets, restaurants, hotels, and health-conscious consumers.

Despite the growing popularity of hydroponic vegetables, their adoption and market penetration remain limited in many parts of India. One of the major factors influencing the success of hydroponic farming is consumer acceptance and purchasing behaviour. Consumers often perceive hydroponic vegetables as premium products due to their higher price compared to conventionally grown vegetables. Lack of awareness about hydroponic technology, limited availability in local markets, and uncertainty regarding quality and authenticity also influence consumer purchasing decisions.

Therefore, a systematic study on consumer buying behaviour toward hydroponic vegetables in Dehradun district of Uttarakhand is essential to understand the socio-economic profile of stakeholders involved in hydroponic farming, assess the current status and market potential of hydroponically grown vegetables, identify existing marketing channels, analyze consumer awareness and purchasing behaviour, and examine the constraints faced by consumers in purchasing hydroponic produce. Such an analysis will help in identifying key factors influencing consumer acceptance and provide valuable insights for policymakers, entrepreneurs, and marketers to promote hydroponic agriculture and expand the market for safe and sustainable vegetable production.

Major Countries Adopting Hydroponic Farming

Rank	Country	Major Hydroponic Crops
1	Netherlands	Lettuce, tomato, cucumber, herbs
2	United States	Lettuce, spinach, kale, basil
3	Japan	Leafy greens and herbs
4	Canada	Lettuce, cucumber, tomato
5	Australia	Lettuce, herbs, exotic vegetables

The adoption of hydroponic technology varies widely across countries depending on technological advancement, investment capacity, and consumer demand. The Netherlands is considered a global leader in hydroponic and greenhouse agriculture, using highly advanced technologies for efficient vegetable production. Similarly, the United States, Canada, and Japan have developed large-scale hydroponic farms that supply fresh vegetables to supermarkets, restaurants, and institutional buyers.

Objectives of the study

1. To study the socio-economic profile of hydroponic vegetable growers and stakeholders in Dehradun district.
2. To identify the present status and market potential of hydroponically grown vegetables in the district.

Research Methodology

Sampling Design

The present study is confined to Dehradun district, which is one of the leading urban markets for hydroponic produce in Uttarakhand. A multistage stratified random sampling technique was adopted to ensure proper representation of hydroponic growers, consumers, and market stakeholders. The sampling procedure was carried out in the following stages:

1. **First Stage:** Selection of District (Purposive Sampling)
2. **Second Stage:** Selection of Localities/Markets (Purposive Sampling)
3. **Third Stage:** Selection of Respondents (Random Sampling)
4. **Fourth Stage:** Selection of Hydroponic Growers/Startups (Random Sampling)
5. **Fifth Stage:** Selection of Retailers and Market Functionaries (Purposive Sampling)

Dehradun district comprises several localities, retail markets, and organized grocery outlets. For the present study, five prominent localities / markets were selected purposively based on their proximity to hydroponic vegetable growers, availability of hydroponic produce, and consumer accessibility:

- **Rajpur Road Area:** High density of supermarkets and organic stores
- **Clock Tower Market:** Central retail market with diverse consumer segments
- **Dalanwala:** Mix of direct farm-to-consumer outlets
- **Vasant Vihar / ISBT Area:** Growing presence of health-conscious consumers
- **Patel Nagar / Majra:** Known for household purchases of premium vegetables

A total of 120 consumers were selected randomly from the above localities for the study. Respondents were chosen to include diverse age groups, education levels, income classes, and household sizes to ensure that the sample represented the buying behaviour of different consumer segments. Additionally, 30 hydroponic growers/ startups and 15 retailers and market intermediaries were also selected for detailed investigation.

Nature and Sources of Data

The study utilized both primary and secondary data to ensure a comprehensive analysis. Primary data were collected using a pre-tested structured interview schedule. Respondents included consumers, hydroponic growers, and market stakeholders. The collected information covered:

- Socio-economic profile of consumers and growers
- Awareness of hydroponic vegetables and health benefits
- Purchase frequency, quantity, and expenditure on hydroponic produce

- Preferred purchase channels and buying preferences

Secondary data were collected from sources such as

- Directorate of Horticulture, Uttarakhand
- District Statistical Office, Dehradun
- Published reports and research papers on hydroponics and urban agriculture
- Market reports and publications from Agricultural Produce Market Committees (APMCs)
- Government websites and industry associations

These data were used to analyze market trends, consumer preferences, and hydroponic production in Dehradun district.

Analysis of Data

Descriptive statistics

For analysing the data percentage was calculated and this was shown with the help of tables and charts. Tabular and chart presentation was adopted to analyse the socio-economic status of the entrepreneurs and to get opinion regarding the problems faced. Simple statistical tools like averages and percentages will be used to compare, contrast, and interpret the results properly.

Analytical Tools

The following statistical tools and techniques will be used in analysis of data and interpretation of result.

$$\text{Arithmetic Mean} = \text{AM} = \frac{1}{n} \sum_{i=1}^n a_i$$

Where, AM = Arithmetic Mean

n = Number of values

a_i = Data set values

Chi-Square Test

The Chi-Square Test as a goodness of fit has been used to analyse the magnitude of difference in opinion of respondents between observed outcome and the expected outcome under the assumption that it is equally distributed on a 5-point scale.

$$\text{Formula used: } \chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where, χ^2 = chi square

O_i = Observed value

E_i = Expected value

Market Potential/ Demand Estimation

Market Potential (MP) = Total Area under Hydroponics (ha) x Average Yield per ha (kg) x Average Price per kg (Rs.)

Total Area under Hydroponics = Sum of all cultivated area in Dehradun district.

Average Yield per ha = Mean production per hectare from the survey.

Average Price per kg = Average selling price in the

market.

Buyer/Channel Concentration Index

$$\text{Buyer Concentration (\%)} = \frac{\text{Number of vegetables sold to Major Buyers}}{\text{Total Vegetables sold}} \times 100$$

Distribution Channel Efficiency (using Marketing Margin)

$$\text{Marketing Margin (\%)} = \frac{\text{Selling Price by Retailer}}{\text{Selling Price by Retailer} - \text{Purchase price from Grower}} \times 100$$

Channel Preference Score (survey-based ranking)

$$\text{Channel Preference Index} = \frac{\sum (\text{Frequency of preference} \times \text{Rank})}{\text{Total Responses}}$$

$$\text{Awareness Level (\%)} = \frac{\text{Number of respondents aware of hydroponic vegetables}}{\text{Total respondents surveyed}} \times 100$$

Purchasing Behaviour Index (PBI)

$$\text{PBI} = \frac{\sum (\text{Frequency of Purchase} \times \text{Weight assigned to frequency})}{\text{Total Respondents}}$$

Consumer Preference Score

$$\text{Preference Score} = \frac{\text{Number of consumers preferring hydroponics}}{\text{Total Respondents}} \times 100$$

Results and Discussion

Keeping in view the objectives of the study, the data collected from respondents were analyzed using suitable statistical tools. The results obtained from the analysis are presented and discussed as under:

Table 1: Distribution of Respondents According to Age

S. No.	Category	Frequency	Percentage (%)
1	Young (20–35 years)	72	48.00
2	Middle (36–50 years)	51	34.00
3	Old (>50 years)	27	18.00
Total		150	100.00

The data reveals that 48% of respondents belong to the young age group (20–35 years), making it the dominant category. This indicates that hydroponic farming is gaining popularity among youth, particularly those who are educated and interested in innovative and sustainable agricultural practices. The involvement of younger individuals suggests a shift from traditional farming to modern, technology-driven agriculture.

The middle-aged group (36–50 years), comprising 34%, also shows considerable participation. This group generally possesses better financial stability, experience, and risk-bearing capacity, enabling them to invest in hydroponic systems.

The older age group (>50 years), accounting for 18%, is relatively less involved. This may be due to resistance to adopting new technologies, lack of technical knowledge, or

preference for conventional farming methods.

Overall, the age distribution highlights that hydroponics is a youth-driven and innovation-oriented sector, with strong future growth potential.

Table 2: Education Status

S. No.	Category	Frequency	Percentage (%)
1	Primary	18	12.00
2	Secondary	42	28.00
3	Higher Secondary	36	24.00
4	Graduate	39	26.00
5	Post Graduate	15	10.00
Total		150	100.00

The educational profile shows that a significant proportion of respondents are well-educated. About 36% of respondents are graduates and postgraduates, while another 52% have secondary and higher secondary education. This indicates that hydroponic farming requires a certain level of technical knowledge and awareness. Educated individuals are more likely to:

- Understand nutrient management and controlled environment systems
- Access digital platforms and market information
- Adopt advanced farming technologies

The relatively low percentage of respondents with only primary education (12%) suggests that hydroponics is less accessible to less-educated farmers, possibly due to its technical complexity and capital requirements.

A large proportion of respondents are educated, with graduates and above constituting 36%. This indicates that hydroponic farming is knowledge-intensive and attracts educated individuals.

Table 3: Gender Distribution

Category	Frequency	Percentage (%)
Male	112	74.67
Female	38	25.33
Total	150	100.00

The gender distribution shows that 74.67% of respondents are male, while 25.33% are female. This indicates male dominance in hydroponic farming and related marketing activities. However, the presence of over one-fourth female respondents is noteworthy. Women are increasingly participating in:

- Urban farming startups
- Packaging and retailing
- Online marketing of hydroponic produce

This trend reflects changing socio-economic dynamics and the growing role of women in agribusiness. However, barriers such as lack of access to capital, training, and decision-making power still limit female participation. Hence, there is a need to encourage women entrepreneurship in hydroponics through training and financial support.

Table 4: Income Distribution

Income Group (₹/Year)	Frequency	Percentage (%)
<1,50,000	32	21.33
1,50,001–3,00,000	54	36.00
3,00,001–6,00,000	41	27.33
>6,00,000	23	15.34
Total	150	100.00

The income distribution shows that 36% of respondents fall in the middle-income group (₹1.5–3 lakh), followed by 27.33% in ₹3–6 lakh category. This indicates that hydroponics is primarily adopted by middle-income individuals who have moderate financial capacity to invest. The low-income group (21.33%) has limited participation, possibly due to high initial investment requirements. On the other hand, 15.34% of high-income respondents indicates that hydroponics is also seen as a profitable business opportunity by affluent individuals.

This distribution suggests that hydroponics is:

- A capital-intensive enterprise
- More accessible to financially stable individuals
- Emerging as a commercial agribusiness model

Table 5: Consumer Awareness

Category	Frequency	Percentage (%)
Fully Aware	48	32.00
Partially Aware	67	44.67
Not Aware	35	23.33
Total	150	100.00

The study shows that only 32% of consumers are fully aware of hydroponic vegetables, while 44.67% are partially aware and 23.33% are unaware.

This indicates that although hydroponics is gaining recognition, there is still a significant knowledge gap among consumers. Many consumers are not fully aware of:

- The benefits of pesticide-free produce
- Nutritional advantages
- Production methods

Partial awareness suggests that consumers may have heard about hydroponics but lack complete understanding, which affects their purchasing decisions.

This highlights the need for:

- Awareness campaigns
- Product labeling and branding
- Educational marketing strategies

Thus, increasing awareness can significantly boost demand and market expansion.

Table 6: Willingness to Pay Premium Price

Category	Frequency	Percentage (%)
Yes	89	59.33
No	61	40.67
Total	150	100.00

The data indicates that 59.33% of consumers are willing to pay a premium price, while 40.67% are not willing. This reflects a growing trend toward health-conscious consumption, where consumers value:

- Food safety
- Chemical-free production
- High quality

However, a significant portion (40.67%) is still price-sensitive. This group may prefer conventional vegetables due to lower prices.

This suggests that:

- Hydroponic produce has a strong niche market
- Price remains a key barrier for mass adoption
- Market segmentation is essential (premium vs. general consumers)

Summary and Conclusion

The major findings derived from the analysis are presented in detail below, incorporating quantitative results obtained during the investigation.

The analysis of the socio-economic characteristics of respondents revealed that the majority of consumers belonged to the young and middle-age groups, with 48.00 percent in the age group of 20–35 years and 34.00 percent in the age group of 36–50 years, indicating that hydroponic vegetables are gaining popularity among economically active and health-conscious consumers. In terms of education, a significant proportion of respondents were well educated, with 26.00 percent graduates and 10.00 percent postgraduates, while 28.00 percent had secondary education and 24.00 percent had higher secondary education. Gender distribution showed that 74.67 percent respondents were male and 25.33 percent were female, indicating male dominance but with increasing female participation. Income analysis indicated that 36.00 percent of respondents belonged to the income group of ₹1,50,001–3,00,000, followed by 27.33 percent in ₹3,00,001–6,00,000, suggesting that hydroponic vegetable consumption is more prominent among middle-income groups. These findings indicate that education and income level play a crucial role in influencing awareness and adoption of hydroponic vegetables.

The study also examined the present status and market potential of hydroponic vegetables in Dehradun district. The findings revealed that hydroponic vegetables are still at an emerging stage but show promising growth potential. The awareness level among consumers indicated that 32.00 percent of respondents were fully aware, 44.67 percent were partially aware, and 23.33 percent were not aware of hydroponic vegetables. Despite moderate awareness, a significant 59.33 percent of respondents expressed willingness to pay a premium price for hydroponic produce, reflecting a positive attitude toward safe and pesticide-free vegetables. The availability of hydroponic vegetables was mainly limited to supermarkets, organic stores, and direct farm outlets, indicating restricted market penetration but increasing demand due to rising health consciousness.

The study also analyzed consumer awareness and purchasing behaviour toward hydroponic vegetables. The results indicated that while a considerable proportion of consumers were aware of hydroponic vegetables, regular

purchasing was still limited. Consumers who preferred hydroponic vegetables cited reasons such as freshness, better quality, pesticide-free nature, and higher nutritional value. However, many consumers purchased hydroponic vegetables only occasionally, indicating that these products are still considered premium and not part of regular consumption patterns. The willingness to pay premium prices by 59.33 percent of respondents reflects strong future market potential if affordability and availability improve.

Suggestions for Policy Implications

Based on the findings of the present study, the following policy suggestions are proposed to promote the consumption and marketing of hydroponic vegetables and to strengthen the hydroponic farming sector in the study area.

government agencies, agricultural universities, and private organizations should conduct awareness campaigns, seminars, and workshops to educate consumers about the advantages of hydroponic vegetables, such as being pesticide-free, hygienic, and nutritionally rich. Mass media, social media platforms, and promotional campaigns can also be used to increase public awareness.

Efforts should be made to expand the retail distribution network by increasing the number of outlets selling hydroponic produce. Supermarkets, organic food stores, and local vegetable markets should be encouraged to stock hydroponic vegetables so that consumers can easily access them.

Government support in the form of subsidies, financial assistance, and technological support for hydroponic farming can help reduce production costs. Lower production costs will ultimately reduce market prices and make hydroponic vegetables more affordable for a wider range of consumers.

References

1. Saediman H, Sianturi DA, Abdullah S, Mboe IS. Consumer perceptions of hydroponic vegetables: Health, environmental, and product aspects. *International Journal of Research in Engineering, Science and Management*. 2024;7(7):174-178.
2. Amalia R, Saediman H, Dedu LOA. Analysis of factors influencing consumer purchase decisions for hydroponic vegetables. *International Journal of Management and Business Intelligence*. 2025;3(3):217-232.
3. Kurniastuti T, Sari YN. The influence of consumer behavior on the purchase decision of hydroponic vegetables in Puccan Hydroponic, Blitar City. *JOSAR (Journal of Students Academic Research)*. 2023;8(1):126-135.
4. Jiang W, Lu R, Zhang Z. Exploring green consumption trends and consumer behavior toward hydroponic vegetables in post-pandemic China. *SHS Web of Conferences*. 2025;215:01011.
5. Verma DK, Srivastav PP. Consumer perception of hydroponic vegetable quality attributes. *Food Research International*. 2020;130:108924.
6. Rocchetti G, *et al.* Nutritional and sensory evaluation of hydroponic vegetables. *Food Chemistry*. 2025;463(Pt 4):141516.
7. Saediman H, *et al.* Consumer perceptions of

- hydroponic vegetables: Health, environmental, and product aspects. *International Journal of Research in Engineering, Science and Management*. 2024;7(7):2581-5792.
8. Gole K, Nalange T, Gaikwad P. Consumers perception towards hydroponically grown residue-free vegetables. *Our Heritage*. 2020;68(30):8215-8229.
 9. Lantarsih R, *et al.* Marketing strategy analysis of hydroponic vegetables of Kebun Sehati. *Agric*. 2023;35(1):13-26.
 10. Amalia R, *et al.* Analysis of factors influencing consumer purchase decisions for hydroponic vegetables. *International Journal of Management and Business Intelligence*. 2025;3(3):217-232.
 11. Yusnidar Y, Agusta MA. Hydroponic vegetable marketing strategy in Pekanbaru: An empirical research. *International Journal of Environmental Sustainability and Social Science*. 2024;5(6):2051-2059.