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**Ashwani Kumar Verma**
M.Sc. Student, Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**RR Kushwaha**
Professor Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Supriya**
Associate Professor Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**KK Mourya**
Assistent Professor Department of Agricultural Statistics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Kaushlendra Srivastava**
M.Sc. Student, Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Devika Suresh**
M.Sc. Student, Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Kuldeep Maurya**
M.Sc. Student, Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Sudhanshu Ranjan Yadav**
M.Sc. Student, Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Corresponding Author:**
**RR Kushwaha**
Professor Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

# An economic analysis of Mentha cultivation in Barabanki District of Uttar Pradesh

**Ashwani Kumar Verma, RR Kushwaha, Supriya, KK Mourya, Kaushlendra Srivastava, Devika Suresh, Kuldeep Maurya and Sudhanshu Ranjan Yadav**

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**Abstract**
In this study, *Mentha arvensis* (commonly known as Japanese mint or pudina) was examined for its economic viability and production challenges in Barabanki district, Uttar Pradesh, India's leading Mentha-producing region. Conducted during 2023–24, the research aimed to estimate the costs and returns of Mentha cultivation and to identify constraints faced by farmers. Two blocks, Harakh and Siddhaur, were purposively selected, and primary data was collected from 100 respondents using a structured survey. Cost calculations were based on CACP cost concepts (A1, A2, B1, B2, C1, C2, and C3). The average cost of cultivation per hectare was ₹45,808.69, with medium farms incurring the highest cost at ₹54,619.63. Average gross income stood at ₹1,35,453.52 per hectare, resulting in a benefit-cost ratio of 1:1.97, indicating profitability. Marginal farms showed higher input-output efficiency. Constraints were analyzed using Garrett's ranking technique, with highest infestation of insect & pest (score 55.37) and unavailability of quality seed(score 55.3) ranked as the top issues. The study concludes that Mentha cultivation is economically beneficial and holds strong potential for income generation, provided key constraints are addressed through targeted interventions.

**Keywords:** Costs and returns economic viability, efficiency and Garrett's ranking technique

## Introduction
Mentha is an herbaceous perennial crop known for its peppermint aroma. Scientifically referred to as *Mentha arvensis*, it is commonly known as Japanese mint or pudina, originating from Japan. It belongs to the mint family (Lemnaceae) and has around 30 different species are primarily found in temperate and tropical/subtropical regions. It is widely cultivated for its essential oil, which has significant applications in pharmaceuticals, cosmetics, and food industries. Mentha species, including *Mentha arvensis* (Japanese mint), Mentha piperita (peppermint), and Mentha spicata (spearmint), are known for their high menthol content, which imparts medicinal and therapeutic properties (Verma *et al.,* 2019; Kumar *et al.,* 2021) [6, 1].
In 2022, world production of peppermint was 51,081 tonnes, led by Morocco with 84% of the total (51081.00) followed by Argentina with 14%. While some countries cultivate mint on a large scale, others produce minimal amounts In the United States, Oregon and Washington produce most of the country's peppermint, the leaves of which are processed for the essential oil to produce flavourings mainly for chewing gum and toothpaste (*Oregon State University, Corvallis,* 2022) [2].
Uttar Pradesh dominates Mentha production due to its favourable agro-climatic conditions and well-established processing industries. The state's Mentha farming is concentrated in districts such as Barabanki, Sitapur, Bahraich, and Lucknow, which collectively contribute to over 50% of the state's output (ICAR Report, 2023) [3].
Barabanki district plays a crucial role in Uttar Pradesh's Mentha economy. In 2023, the district had an estimated Mentha cultivation area of 45,000 hectares, producing around 7,500 metric tonnes with an average yield of 166 kg/ha (Department of Agriculture, UP, 2023) [5]. The average farm holding size in Barabanki is approximately 1.2 hectares, and Mentha is predominantly grown in small and marginal farms as a commercial cash crop. The net sown area

of the district is around 4.2 lakh hectares, with Mentha contributing significantly to farmers' incomes (District Agricultural Office, Barabanki, 2023) [4].

**Objectives:**

1. to work out the costs and return of cultivation of Mentha production;
2. to identify the constraints faced by the farmers in production of Mentha crop.

## Materials and Methods

### Selection of Area

The Study has been carried out in the Barabanki district of Uttar Pradesh in the year 2023-24, because of its highest area and production under Mentha crop.

The blocks namely "Harakh", and "Siddhaur" having maximum area and production in Mentha were selected purposively for this study. Two blocks Harakh and Siddhaur and from these blocks 100 respondents (50 from each block) was selected.

### Collection of Data

The primary data was collected through a survey method using personal interviews with a schedule. Secondary data was collected from various sources including Zila Vikas Bhawan, Zila Sankhyaki Patrika, the Department of Agriculture at block and district headquarters, journal reports, books, and the internet. A list of all the villages in the selected block was prepared and arranged in ascending order according to area.

### Selection of Respondent

A separate list of all respondent growing Mentha of each selected village was prepared. All Mentha grower of selected village was stratified into three categories. i.e.

marginal - (less than 1 ha),

small - (1-2 ha) and,

medium - (2-4 ha & above)

**Table 1:** Village wise number of the selected farmers under different size group of farms.

| S. No. | Village | Marginal (<1hac) | | Small (1-2 hac) | | Medium (2-4hac) | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | P. | S | P. | S. | P. | S. | P. | S. |
| **Harakh** | | | | | | | | | |
| 1 | Barauli Malik | 125 | 4 | 98 | 3 | 32 | 1 | 255 | 8 |
| 2 | Mahrupur | 149 | 5 | 86 | 3 | 28 | 1 | 263 | 9 |
| 3 | Bhanmau | 132 | 5 | 110 | 4 | 21 | 1 | 263 | 10 |
| 4 | Badipur | 173 | 6 | 106 | 4 | 35 | 1 | 314 | 11 |
| 5 | Naktua | 169 | 6 | 134 | 5 | 22 | 1 | 325 | 12 |
| Sub Total | | 748 | 26 | 534 | 19 | 138 | 5 | 1420 | 50 |
| **Siddhaur** | | | | | | | | | |
| 1 | Niyamatpur | 176 | 6 | 109 | 4 | 26 | 1 | 311 | 11 |
| 2 | Ashdamau | 138 | 5 | 84 | 3 | 20 | 1 | 242 | 9 |
| 3 | Sarsa | 188 | 6 | 124 | 4 | 43 | 2 | 355 | 12 |
| 4 | Uchita | 166 | 5 | 93 | 3 | 39 | 1 | 298 | 9 |
| 5 | Tilasia | 153 | 5 | 101 | 3 | 42 | 1 | 296 | 9 |
| Sub Total | | 821 | 27 | 511 | 17 | 170 | 6 | 1502 | 50 |
| Grand Total | | 1569 | 53 | 1045 | 36 | 308 | 11 | 2922 | 100 |

### Analytical tools

CACP cost concepts were utilized to calculate the cultivation expenses of Mentha under both systems, including the cost components. (Pljevljakušić, D. and Brkić, S.2020) [7]

1. Wage of hired labour
2. Charge for bullock labour
3. Hired labour charge of implement and machinery
4. Cost incurred on manures & fertilizers
5. Cost of slips & suckers
6. Plant protection chemicals
7. Irrigation charge
8. Distillation charge
9. Depreciation
10. Repair charges on farm assets
11. Interest on working capital
12. Rental value of Land
13. Value of Family labour

### Cost of cultivation and returns from Mentha were estimated using CACP

To work out the cost of production on different farms of different sizes, various cost concepts such as A1, A2, B1, B2, C1, C2, and C3 were computed. The details of these concepts are given below: (Kumar, S. *et al.*, 2011) [8]

Cost A1 = 1 to 12 items

Cost A2 =cost A1+Rent paid for leased in land

Cost B1 = Cost A1 + interest on the value of owned capital assets (excluding land)

Cost B2 = Cost B1 + Rental value of owned land (net of land revenue) and rent paid for leased in land

Cost C1 = Cost B1 + Imputed value of family labour

Cost C2 = Cost B2 + Imputed value of family labour

Cost C3 = Cost C2 +10% of cost on account of managerial functions performed by farmers

Interest on working capital was calculated at 4 percent

Interest on Fixed capital was calculated at 8 percent

Rental value of land- It was calculated based on prevailing rates of leased out-of owned land on the sample farms in the study area.

### Measures of farm profit

Gross Income = Yield in quintal × Price per quintal

Net Income = Gross Income – Cost C3

Farm Business Income = Gross Income - Cost A1

Family labour income = Gross Income - Cost B2

Farm investment income = Net Income + Rental value of owned land + Interest on fixed capital

Cost of production (Rs/Liter) = Cost C3/Yield

### Constraints

Constraints faced by farmers have been analysed through survey based on demographic profile of the farmer like age group and

educational level of farmer Garret ranking technique has been used to analysed the constraints faced by farmers. (Gangwar *et al.*, 2019; Chaturvedi *et al.*, 2022) [9, 110]

Percent position = 100 (Rij- 0.5)/Nj

Where,
Rij =Rank given for ith factor by jth individual
Nj = Number of factors ranked by jth individual

## Results and Discussion

### Economics of Mentha

Table 2 provides a breakdown of the per-hectare input costs involved in mentha cultivation. On average, the overall cost of cultivating mentha per hectare was calculated to be ₹45,808.69. Among the different farm sizes, medium farms reported the highest cultivation cost at ₹54,619.63, largely due to greater investment in total working capital. Small farms followed this at ₹48,152.25 and marginal farms at ₹42,388.15.

For marginal farms, the highest portion of the total cost was attributed to human labour, which accounted for 23.58% of the expenses. This was followed by costs for manure and fertilizer (16.55%), rental value of owned land (14.15%), irrigation (10.36%), seed (7.80%), and machinery charges (6.41%). Other notable costs included distillation charges at 5.85%, plant protection at 3.64%, interest on working capital at 2.18%, and interest on fixed capital at 1.96%.

The study further indicates that for small farms, the highest share of cost was spent on human labour, accounting for 21.08% of the total expenses. This was followed by spending on manure and fertilizers (16.54%), the rental value of owned land (12.46%), irrigation (10.62%), seed (9.13%), and machinery charges (6.88%). Additional costs included plant protection (5.57%), distillation charges (5.22%), interest on working capital (2.83%), and interest on fixed capital (1.83%).

On medium-sized farms, human labour also made up the largest share of costs at 23.31%, followed by manure and fertilizers (17.22%), rental value of owned land (10.99%), irrigation (10.24%), and seed (8.84%). Machinery charges accounted for 6.63%, plant protection for 5.69%, and distillation charges for 4.61%. Interest on working capital and fixed capital made up 2.94% and 1.68% of the total costs, respectively.

The overall average cost distribution shows that the highest expenditure in mentha cultivation was on human labour, which accounted for 22.59% of the total cost. This was followed by costs for manure and fertilizers at 16.63%, the rental value of owned land at 10.99%, irrigation at 10.44%, and seed at 8.44%. Machinery charges made up 6.62%, distillation charges 5.45%, plant protection 4.64%, interest on working capital 2.53%, and interest on fixed capital 1.08% of the total cost.From this data, it can be concluded that there is a direct relationship between per per-hectare cost of cultivation and the size of landholding in the study area; larger holdings generally correspond with higher per-hectare costs.

**Table 2:** Cost of cultivation of Mentha crop on different size groups of sample farms (Rs.)

| Sl. No. | Particulars | Size Group of Farms | | | Overall Average |
|---|---|---|---|---|---|
| | | Marginal | Small | Medium | |
| 1 | Human Labour | 9324.6 (23.58) | 9542.61 (21.08) | 12059.17 (23.31) | 9703.89 (22.59) |
| | a. Family Labour | 7652.21 (19.35) | 1426.44 (3.15) | 1051.93 (2.03) | 4684.90 (10.91) |
| | b. Hired Labour | 1672.39 (4.23) | 8116.17 (17.93) | 11007.24 (21.28) | 5018.98 (11.69) |
| 2 | Machinery Charges/ Tractor Charges | 2718.57 (6.41) | 3315.11 (6.88) | 3619.12 (6.63) | 3032.38 (6.62) |
| 3 | Seed Cost | 3304.91 (7.80) | 4397.08 (9.13) | 4829.74 (8.84) | 3865.82 (8.44) |
| 4 | Manures and Fertilizers | 7014.08 (16.55) | 7964.73 (16.54) | 9407.81 (17.22) | 7619.62 (16.63) |
| 5 | Irrigation | 4392.64 (10.36) | 5111.40 (10.62) | 5591.76 (10.24) | 4783.30 (10.44) |
| 6 | Plant Protection | 1544.09 (3.64) | 2684.19 (5.57) | 3107.85 (5.69) | 2126.54 (4.64) |
| 7 | Distillation Charges | 2481.72 (5.85) | 2513.25 (5.22) | 2520.50 (4.61) | 2497.34 (5.45) |
| 8 | Total working capital | 23128.40 (54.56) | 34101.93 (70.82) | 40084.02 (73.39) | 28943.99 (63.18) |
| 9 | Interest on working capital @ 4% | 925.14 (2.18) | 1364.08 (2.83) | 1603.36 (2.94) | 1157.76 (2.53) |
| 10 | Rental value of owned land | 6000.00 (14.15) | 6000.00 (12.46) | 6000.00 (10.99) | 6000.00 (13.10) |
| 11 | Interest on fixed capital | 828.94 (1.96) | 882.32 (1.83) | 914.90 (1.68) | 857.61 (1.87) |
| 12 | Sub-Total | 38534.68 (90.91) | 43774.77 (90.91) | 49654.21 (90.91) | 41644.26 (90.91) |
| 13 | Marginal Cost @ 10% of sub-total | 3853.47 (9.09) | 4377.48 (9.09) | 4965.42 (9.09) | 4164.43 (9.09) |
| Grand Total | | 42388.15 (100.00) | 48152.25 (100.00) | 54619.63 (100.00) | 45808.69 (100.00) |

**Measures of costs and income of Mentha Costs of cultivation**

The per hectare costs and returns from mentha cultivation across various farm categories have been calculated and are shown in Table 3. The results indicate that, on average, the costs were as follows: Cost A1/A2 amounted to ₹30,101.75, Cost B1 to ₹30,959.36, Cost B2 to ₹36,959.36, Cost C1 to ₹35,644.26, Cost C2 to ₹41,644.26, and Cost C3 to ₹45,808.69.

The table 3 shows that the overall average cost of cultivation per hectare, based on Cost C3, was ₹45,808.69. Among the different farm sizes, medium farms recorded the highest cost at ₹54,619.63 per hectare, followed by small farms at ₹48,152.25, and marginal farms at ₹42,388.15 per hectare.

Regarding income measures, the table shows that the highest gross income per hectare was recorded on medium farms at ₹147,735.92. This was followed by small farms at ₹137,471.10 and marginal farms at ₹131,533.92. The overall average gross income across all farm categories stood at ₹135,453.52 per hectare.

Net income was found to be highest on medium farms at ₹93,116.29, followed by small farms at ₹89,318.85 and marginal farms at ₹89,145.77. On average, the family labour income amounted to ₹98,494.16, farm business income to ₹1,05,351.78, and farm investment income to ₹1,00,666.87 per hectare.

Family labour income was the highest on marginal farms, followed by medium and then small farms. In contrast, farm investment income peaked on medium farms, followed by small and marginal farms. Farm business income was also highest on marginal farms, with medium farms next, and small farms recording the lowest. The study observed that as farm size increases, various income measures also tend to rise.

The table 3 clearly shows that the cost of production per quintal, based on Cost C3, was highest on medium farms at ₹374.52, followed by small farms at ₹353.77 and marginal farms at ₹324.84. The overall average cost of production across all farms was ₹340.72 per quintal.

The average input-output analysis was conducted based on various cost concepts Cost A1/A2, B1, B2, C1, C2, and C3, resulting in ratios of 1:4.68, 1:4.54, 1:3.76, 1:3.83, 1:3.27, and 1:2.97, respectively. Among these, the input-output ratio based on Cost C3 was highest for marginal farms at 1:3.10, followed by small farms at 1:2.85, and medium farms at 1:2.70.

For Cost C2, marginal farms again had the highest ratio at 1:3.41, followed by small farms at 1:3.14, and medium farms at 1:2.98. When considering Cost C1, the input-output ratio was 1:4.04 for marginal farms, 1:3.64 for small farms, and 1:3.38 for medium farms.

In the case of Cost B1, marginal farms achieved the highest input-output ratio at 1:5.29, followed by small farms at 1:3.78, and medium farms at 1:3.47. For Cost B2, the ratios were 1:4.26 for marginal farms, 1:3.25 for small farms, and 1:3.04 for medium farms. Lastly, based on Cost A1/A2, the input-output ratio was highest for marginal farms at 1:5.47, with small farms at 1:3.88 and medium farms at 1:3.54.

The benefit-cost ratio was found to be highest on marginal farms at 1:2.10, followed by small farms at 1:1.85, and medium farms at 1:1.70. The overall average benefit-cost ratio across all farm categories was 1:1.97. This indicates that mentha cultivation is profitable for farmers and holds strong potential for contributing to the doubling of their income in the study area.

**Table 3:** The per-hectare costs and income from the production of Mentha on different costs concept (Rs.)

| Sl. No. | Particulars | Size group of farms | | | Overall Average |
|---|---|---|---|---|---|
| | | Marginal | Small | Medium | |
| 1 | CostA1/A2 | 24053.54 | 35466.01 | 41687.38 | 30101.75 |
| 2 | CostB1 | 24882.47 | 36348.33 | 42602.28 | 30959.36 |
| 3 | CostB2 | 30882.47 | 42348.33 | 48602.28 | 36959.36 |
| 4 | CostC1 | 32534.68 | 37774.77 | 43654.21 | 35644.26 |
| 5 | CostC2 | 38534.68 | 43774.77 | 49654.21 | 41644.26 |
| 6 | CostC3 | 42388.15 | 48152.25 | 54619.63 | 45808.69 |
| 7 | Yield (qtl/ha.) | 130.49 | 136.11 | 145.84 | 134.20 |
| 8 | Gross Income | 131533.92 | 137471.10 | 147735.92 | 135453.52 |
| 9 | Net Income | 89145.77 | 89318.85 | 93116.29 | 89644.84 |
| 10 | Family Labour Income | 100651.45 | 95122.77 | 99133.64 | 98494.16 |
| 12 | Farm Business Income | 107480.38 | 102005.09 | 106048.54 | 105351.78 |
| 12 | Farm Investment Income | 99828.17 | 100578.65 | 104996.61 | 100666.87 |
| 13 | Cost of production (Rs./Qtl.) | 324.84 | 353.77 | 374.52 | 340.72 |
| **14** | **Input-Output Ratio** | | | | |
| a. | Basedon CostA1 | 1:5.47 | 1:3.88 | 1:3.54 | 1:4.68 |
| b. | BasedonCostB1 | 1:5.29 | 1:3.78 | 1:3.47 | 1:4.54 |
| c. | BasedonCostB2 | 1:4.26 | 1:3.25 | 1:3.04 | 1:3.76 |
| d. | BasedonCostC1 | 1:4.04 | 1:3.64 | 1:3.38 | 1:3.83 |
| e. | BasedonCostC2 | 1:3.41 | 1:3.14 | 1:2.98 | 1:3.27 |
| f. | BasedonCostC3 | 1:3.10 | 1:2.85 | 1:2.70 | 1:2.97 |
| 15 | Benefit-costratio | 1:2.10 | 1:1.85 | 1:1.70 | 1:1.97 |

**Identify the Constraints Faced by the Farmers**

Garrett's ranking technique was used to identify and prioritize the various constraints faced by mentha farmers in the study area. According to Table 4, the most significant issue reported was the highest infestation of insect and pest in mentha, which received the highest Garrett score of 55.37, earning it the top rank. The second major challenge was the unavailability of quality seed of mentha, with an overall Garrett score of 55.3. Other key constraints highlighted by growers included the untimely rains (score of 52.64, ranked III), followed by high input costs (score of 51.96, ranked IV), and the lack of irrigation facility (score of 51.94, ranked V).In addition to these, several other problems were identified as less severe but still notable. These included labour scarcity during peak agricultural periods (Garrett score 50.53, rank VI), Lack of Improved and Quality Distillation Unit (score 50.08, rank VII), lack of training on cultivation methods (score 46.13, rank VIII), inadequate credit supply (score 46.06, rank IX),and lack of government subsidies, which received the lowest score of 44.03 and was ranked X.

**Table 4:** Major Constraints Faced by the Farmers in the Production of Menthe Crop.

| Problems | Garret Position | Garret Value | Average Score | Rank |
|---|---|---|---|---|
| Untimely Rains | 5 | 82 | 52.64 | III |
| Highest Infestation of Insect & Pest | 15 | 70 | 55.37 | I |
| Labour Scarcity during Peak time | 25 | 63 | 50.53 | VI |
| Lack of Irrigation Facility | 35 | 58 | 51.94 | V |
| High Input Cost | 45 | 52 | 51.96 | IV |
| Unavailability of Quality Seed | 55 | 48 | 53.3 | II |
| Lack of Improved and Quality Distillation Unit | 65 | 42 | 50.08 | VII |
| Lack of Training on Cultivation Methods | 75 | 37 | 46.13 | VIII |
| Inadequate credit supply | 85 | 30 | 46.06 | IX |
| Lack of Government Subsidies | 95 | 18 | 44.03 | X |

## Conclusion

The study on Mentha cultivation highlights its economic viability and profitability across different farm sizes, despite varying cost structures. The average cost of cultivation per hectare was ₹45,808.69, with medium farms recording the highest cost at ₹54,619.63, followed by small farms at ₹48,152.25 and marginal farms at ₹42,388.15. Human labour constituted the largest share of input costs, averaging 22.59% across all farms, followed by manure and fertilizers (16.63%), and rental value of owned land (10.99%). Gross income per hectare was highest for medium farms at ₹1,47,735.92, compared to ₹1,37,471.10 for small farms and ₹1,31,533.92 for marginal farms, resulting in an overall average of ₹1,35,453.52. However, in terms of input-output efficiency, marginal farms performed better, with the highest Cost A1/A2 ratio of 1:5.47 and Cost C3 ratio of 1:3.10, compared to 1:3.54 and 1:2.70 respectively on medium farms. The overall benefit-cost ratio stood at 1:1.96, reaffirming the profitability of Mentha cultivation. Garrett's ranking technique revealed highest infestation of insect &pest (score 55.37), unavailability of quality seed (score 55.3), and untimely rains(score 52.64) as the top three constraints. These findings suggest that while Mentha cultivation is economically beneficial and holds promise for enhancing farm incomes, targeted interventions are necessary to stabilize yields, reduce input costs, and improve access to resources for sustained growth.

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