



# Assessing the Economic Viability of Watermelon Cultivation in Haryana and Karnataka, India: A Comparative Analysis

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

**Aims:** To analyze the costs, returns and profitability of watermelon production in the study area.

**Place and Duration of Study:** The study was carried out in Haryana and Karnataka state during the year 2021-22.

**Methodology:** For the study, 120 farmers (60 farmers from each state) were selected from Haryana and Karnataka which are selected purposively. From Haryana state, Sonipat and Jhajjar

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districts and from Karnataka, Koppal and Chitradurga districts were selected purposively based on highest area under watermelon production. From each district two blocks were selected randomly. Further from each selected block two villages (15 farmers each) were selected.

**Results:** Farmers of Karnataka investing more on seeds and plant protection chemicals (PPC) compared to farmers of Haryana. The cost of cultivation is higher in the Karnataka state (₹1,70,034.37/ha) compared to Haryana state (₹1,49,450.59/ha) farmers. The variation in cost of cultivation is due to Karnataka farmers were spending more on seeds, neem cake and PPC. The gross and net returns obtained per hectare was more in Karnataka state compared to Haryana state, because Karnataka has the suitable agro-climatic conditions for growing watermelon.

**Conclusion:** The cost and return analysis revealed that watermelon production in the study area was profitable with returns per rupee of investment (B: C ratio) of 1:51 in Haryana and 1:75 in Karnataka.

*Keywords: Returns; costs; profitability; production; investment.*

## 1. INTRODUCTION

The *Citrullus lanatus* (watermelon) is one of the most important fruit crops grown in tropical regions and eaten around the world. In many regions of India, the word "watermelon" is also known as "tarbuj," "tarmuj," "kalingad," and "kalindi." Kumar and Kulkarni [1]. Due to the fruit's size and shape, as well as its delicious, pulpy flesh, the word "melon" was given to it. Greek and Latin roots both contribute to the scientific name of the watermelon. It is well known to have few calories while being very nourishing and satiating.

The fruit is consumed more widely than any other cucurbit in the world. China, Turkey, India, and Brazil are the world's largest producers of watermelon, Anonymous 2019. Watermelon was grown on 110 thousand acres of land in India in 2021–2022, with a production of 3225 thousand tonnes. In terms of watermelon production, Uttar Pradesh is in the lead and followed by Andhra Pradesh. Watermelon production in the state of Haryana was 197 thousand tonnes, with 6.23 thousand ha area under cultivation, Anonymous 2021-22. Sonipat district was the highest producer, with 2.55 thousand ha under cultivation, followed by Jhajjar (0.95 thousand ha) and Karnal (0.4 thousand ha.). Watermelon production in the state of Karnataka was 298.39 thousand tonnes, with 7.13 thousand ha under cultivation. The top producer is Koppal district, with 1.10 thousand ha of watermelon planted there, followed by Chitradurga (0.63 thousand ha).

West Africa is where the watermelon was first cultivated. It is a fruit that is very beneficial to the health system and is extremely medicinal. Watermelon has 46 per cent calories, yet offers

20 per cent vitamin C and 17 per cent vitamin A. It has significantly more lycopene than tomatoes to combat free radicals. It soothes tight muscles and is healthy for body hydration. The minerals included in watermelon seeds prevent cancer and lower levels of harmful cholesterol in the body. Water melon's economic viability is influenced by its multiple uses. It has 95 per cent water and rest comprises of fiber, proteins, fat and minerals Ahmad et al. [2].

Many people around the world like fresh watermelon as a fruit. *Citrullus lanatus* seeds are increasingly employed in the cosmetic and pharmaceutical industries in addition to being used for their oil [3-5]. Seeds are utilised to promote baby feeding because of their high protein and fat content. Watermelon is well recognized for having little calories and for containing vitamins C and A that aid with dry skin, dermatitis, and psoriasis as well as night blindness.

Comparative studies conducted in two separate areas can be very beneficial in providing alternate solutions that farmers, marketers, and policymakers may choose to implement. As a result, both consumers and producers will gain.

## 2. METHODOLOGY

For the study, Haryana and Karnataka states are selected purposively. In Haryana state, Sonipat and Jhajjar districts are purposively selected as are having highest area under watermelon production. From the Sonipat district, two blocks i.e., Rai and Murthal and one village from each block namely, Khedwa and Asadpur were selected randomly. From Jhajjar district, Jhajjar and Machhrauli blocks and villages namely,

Kheri hoshdarpur and Neola were selected. Further, 15 farmers were chosen from each selected village. Thus, a sample of 60 farmers were interviewed from Haryana.

Similarly, in Karnataka state, Koppal and Chitradurga districts are selected. From the Koppal district, two blocks i.e., Koppal and Yalaburga and two villages namely, Hanumanahatti and Vadparvi were selected randomly. From Chitradurga district, two blocks i.e., Chitradurga and Challakere blocks and villages namely, G R halli and Neralagunte were selected randomly to study watermelon cultivation. Further, fifteen farmers were chosen from each selected village. Thus, total 60 farmers were interviewed.

The study was conducted using primary data collected directly from the farmers. The data was related to the agricultural year 2021-22 and was obtained through personal interviews using a carefully crafted and pre-tested questionnaire designed specifically for this study. Tabular analysis was followed to analyze the collected data.

## 2.1 Descriptive Statistics

The data collected were presented in tabular form to facilitate easy comparison. This tabular presentation technique was employed for estimating cost and returns with the aid of averages, ratios, percentages, etc.

## 2.2 Cost Concepts

To calculate cost of cultivation, the costs concepts as devised by CACP namely, Cost A1, Cost A2, Cost B1, Cost B2, Cost C1, Cost C2, Cost C2 (Modified) and Cost C3 were calculated [6].

where,

- ❖ Cost A1: Value of seed, value of field preparation cost, value of manure and fertilizers, value of irrigation charges, value of plant protection chemicals, depreciation on implements/ machineries, value of hired labour and machine labour cost, land revenue, cesses and other taxes and interest on working capital are considered.
- ❖ Cost A2: Cost A1+ Rent paid for leased in land
- ❖ Cost B1: Cost A1+ Interest value of owned fixed 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
- ❖ Modified Cost (C2M): Cost C2+ marketing costs and transportation costs.
- ❖ Cost C3: Cost C2+ Management and risk charges

## 2.3 Farm Income Measures

Different income measures were derived using the cost concepts. The following formulae are used; [6]

- ❖ Farm business income = Gross income - Cost A1 or A2
- ❖ Family labour income = Gross income - Cost B
- ❖ Net income = Gross income - Cost C
- ❖ Farm investment income = Farm business income - Imputed value of family labour
- ❖ Cost of production = Total cost divided by total output
- ❖ Benefit-cost ratio = Gross return divided by total cost
- ❖ Returns over variable cost = Gross return - Total variable cost
- ❖ Accounting profit = Gross return - Explicit costs or paid out costs
- ❖ Economic profit = Gross return - (Explicit cost + Implicit cost).

## 3. RESULTS AND DISCUSSION

### 3.1 Cost of Cultivation of Watermelon in the Study Area

The various expenses incurred in the cultivation of watermelon in Sonipat and Jhajjar districts from Haryana are represented in Table.1. In Sonipat, the variable cost was around ₹89738.72 ha<sup>-1</sup> and fixed cost was ₹61120.05 ha<sup>-1</sup>. Whereas, in Jhajjar the corresponding figures were ₹91732.10 ha<sup>-1</sup> and ₹56310.32 ha<sup>-1</sup>. Thus, the total cost of watermelon cultivation in overall both the districts was ₹149450.59 ha<sup>-1</sup> and the total variable cost was ₹90735.41 ha<sup>-1</sup> which accounted for 60.71 per cent of the total cost in overall. In the variable cost, cost incurred on the seeds was high accounted for 16.32 per cent of the total cost followed by picking cost (7.28%). Similarly, in the fixed cost in both the districts, rental value of owned land was found to

be 24.79 per cent of total cost followed by management charges (6.07%) and risk factor (6.07%).

Whereas, the total cost from both the districts of Karnataka was around ₹170034.37 ha<sup>-1</sup> and variable cost was ₹103108.42 ha<sup>-1</sup> which accounted for 60.64 per cent of the total cost in overall (Table 2). In Koppal, the cost incurred by the farmers on the variable inputs costs around ₹104949.89 ha<sup>-1</sup> and fixed inputs around ₹69743.66 ha<sup>-1</sup>. However, in Chitradurga the variable cost goes around ₹101266.95 ha<sup>-1</sup> and fixed cost was ₹64108.24 ha<sup>-1</sup>. In variable cost of overall selected districts from Karnataka, cost incurred on the seeds was more as similar to Haryana which accounts for 17.68 per cent of the total cost followed by plant protection cost (8.35%). Whereas, in fixed costs of overall selected area, the rental value of owned land was more, accounted for 24.70 per cent of total cost followed by management charges (6.06%) and risk factor (6.06%).

Table 3 and Fig. 1 provide a comparison of various factors related to watermelon cultivation in selected districts of Haryana and Karnataka. In Sonipat the variable cost was around ₹89738.72, while Jhajjar has a higher cost of ₹91732.10, and overall, from both the districts of Haryana was ₹90735.41. In Sonipat, yield was 271.54 qtl, Jhajjar produces 284.05 qtl, and

in overall the region achieves a production of 277.79 qtl. The gross return was ₹223111.26 in Sonipat, ₹228178.60 in Jhajjar and ₹225644.93 in both the districts as a whole.

In Koppal the variable cost was around ₹104949.89, in Chitradurga it was ₹101266.95, and the overall variable cost in both the districts from Karnataka was ₹103108.42. In Koppal the yield was 373.38 qtls, Chitradurga produced 356.83 qtls, and the average from both the districts of Karnataka was 365.11 qtls. The gross return obtained by the farmers of Koppal was ₹303445.54, Chitradurga farmers earned ₹291442.30, and the overall gross return in both the districts from Karnataka was ₹297,443.92. Koppal farmers achieved a net income of ₹128751.99, Chitradurga farmers earned ₹126067.10, and the overall net income in both the districts from Karnataka was ₹127409.55. The B:C Ratio considering all costs was 1:48 in Sonipat, 1:54 in Jhajjar and 1:51 in overall from both districts of Haryana, corresponding figures for Koppal, Chitradurga and overall for Karnataka were 1.74, 1.76 and 1.75. Similar results were reported by Hile et al. [7] for summer capsicum in Maharashtra, Kumar and Kulkarni [1] for watermelon in Haveri (Karnataka) and Ananthapur Districts (Andhra Pradesh) and Chahal [8] for carrot production in Hisar (Haryana) [9,10].

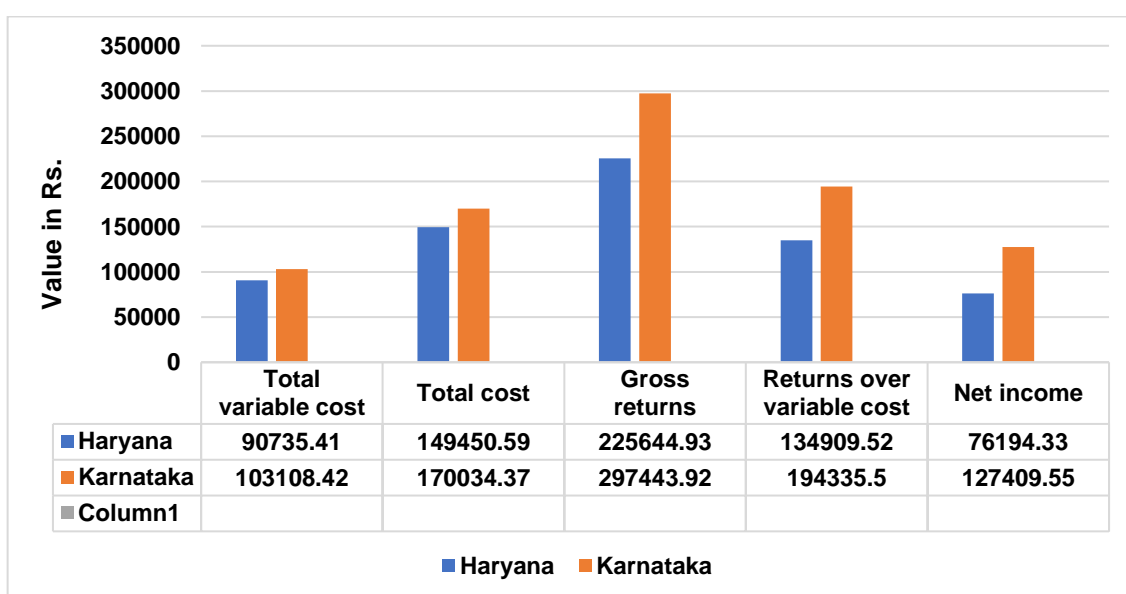


Fig. 1. Cost and returns from watermelon cultivation from Haryana and Karnataka

**Table 1. Cost of cultivation of watermelon in Haryana (₹/ha)**

S.N.	Particulars	Sonipat			Jhajjar			Overall		
		Qty.	Value (₹)	%*	Qty.	Value (₹)	%*	Qty.	Value (₹)	%*
1	Preparatory tillage	4.90	10085.83	(6.69)	4.93	9810.02	(6.63)	4.92	9947.93	(6.66)
2	Pre-sowing irrigation		1105.33	(0.73)		1074.45	(0.73)		1089.89	(0.73)
3	Dibbling		6067.97	(4.02)		6405.53	(4.33)		6236.75	(4.17)
4	Mulching		7367.19	(4.88)		7624.07	(5.15)		7495.63	(5.02)
5	Seed cost (kg)	1.26	23926.07	(15.86)	1.27	24856.43	(16.79)	1.26	24391.25	(16.32)
6	Manure - FYM (qtl)	56.81	1976.00	(1.31)	53.52	1630.20	(1.10)	55.16	1803.10	(1.21)
	Fertilizers (kg)									
	a. Nitrogen	76.64	789.58	(0.52)	80.85	804.40	(0.54)	78.74	796.99	(0.53)
	b. Phosphorous	56.81	3046.50	(2.02)	56.56	3039.58	(2.05)	56.69	3043.04	(2.04)
	c. Potash	74.10	4174.30	(2.77)	72.45	4174.30	(2.82)	73.28	4174.30	(2.79)
	d. Zinc sulphate	10.29	874.79	(0.58)	12.35	1049.75	(0.71)	11.32	962.27	(0.64)
	e. Sulphur	5.43	513.76	(0.34)	4.20	363.91	(0.25)	4.82	438.84	(0.29)
7	Total fertilizer investment (a to e)		9398.93	(6.23)		9431.94	(6.37)		9415.43	(6.30)
8	Fertilizer application		1246.53	(0.83)		1153.49	(0.78)		1200.01	(0.80)
9	Irrigation		3756.87	(2.49)		3709.03	(2.51)		3732.95	(2.50)
10	Weeding									
	a. Chemical		387.54	(0.26)		489.14	(0.33)		438.34	(0.29)
	b. Manual		-	-		-	-		-	-
11	Plant Protection		8883.77	(5.89)		10382.23	(7.01)		9633.00	(6.45)
12	Picking		10925.63	(7.24)		10835.07	(7.32)		10880.35	(7.28)
13	Miscellaneous		1517.40	(1.01)		1364.26	(0.92)		1440.83	(0.96)
	Total (1 to 13)		86597.86	(57.40)		88521.48	(59.79)		87559.67	(58.58)
14	Interest on working capital @ 3.5% pa		3140.86	(2.08)		3210.62	(2.17)		3175.74	(2.12)
A	Variable Cost (1 to 14)		89738.72	(59.49)		91732.10	(61.96)		90735.41	(60.71)
15	Rental value of owned land		39520.00	(26.20)		34580.00	(23.36)		37050.00	(24.79)
16	Management charges		8973.87	(5.95)		9173.21	(6.20)		9073.54	(6.07)
17	Risk factor		8973.87	(5.95)		9173.21	(6.20)		9073.54	(6.07)
18	Transportation, loading and unloading charges		3652.31	(2.42)		3383.90	(2.29)		3518.10	(2.35)
B	Fixed cost (15 to 18)		61120.05	(40.51)		56310.32	(38.04)		58715.19	(39.29)
	Total cost (A+B)		150858.77	(100.00)		148042.41	(100.00)		149450.59	(100.00)

Note: Interest on working capital and interest on fixed capital are calculated for one cropping season. The figure in the parenthesis indicates per cent to total cost

**Table 2. Cost of cultivation of watermelon in Karnataka (₹/ha)**

S.N.	Particulars	Koppal			Chitradurga			Overall		
		Qty.	Value (₹)	%*	Qty.	Value (₹)	%*	Qty.	Value (₹)	%*
1	Preparatory tillage	5.63	12300.60	(7.04)	5.30	12144.17	(7.34)	5.47	12222.38	(7.19)
2	Pre-sowing irrigation		881.79	(0.50)		883.44	(0.53)		882.61	(0.52)
3	Sowing		3680.30	(2.11)		3262.05	(1.97)		3471.17	(2.04)
4	Mulching		8822.43	(5.05)		11304.37	(6.84)		10063.40	(5.92)
5	Seed cost (kg)	1.78	31670.75	(18.13)	1.65	28456.46	(17.21)	1.71	30063.61	(17.68)
6	Manure - FYM (qtl)	59.69	2824.03	(1.62)	57.63	2700.53	(1.63)	58.66	2762.28	(1.62)
	Fertilizers (kg)									
	a. Nitrogen	73.36	946.01	(0.54)	73.36	946.01	(0.57)	73.36	946.01	(0.56)
	b. Phosphorous	57.16	3359.20	(1.92)	58.87	3342.73	(2.02)	58.01	3350.97	(1.97)
	c. Potash	74.10	4577.73	(2.62)	74.10	4557.15	(2.76)	74.10	4567.44	(2.69)
	d. Zinc sulphate	6.59	592.80	(0.34)	6.59	572.22	(0.35)	6.59	582.51	(0.34)
	e. Neem cake	69.98	1123.85	(0.64)	64.63	1057.98	(0.64)	67.31	1090.92	(0.64)
7	Total fertilizer investment(a to e)		10599.59	(6.07)		10476.09	(6.33)		10537.84	(6.20)
8	Fertilizer application		829.59	(0.47)		728.07	(0.44)		778.83	(0.46)
9	Irrigation		6060.97	(3.47)		5683.06	(3.44)		5872.01	(3.45)
10	Weeding									
	a. Chemical		512.53	(0.29)		819.22	(0.50)		665.87	(0.39)
	b. Manual		-	-		-	-		-	-
11	Plant protection		14741.70	(8.44)		13639.34	(8.25)		14190.52	(8.35)
12	Picking		7337.55	(4.20)		6743.10	(4.08)		7040.32	(4.14)
13	Miscellaneous		1235.00	(0.71)		1235.00	(0.75)		1235.00	(0.73)
	Total (1 to 13)		101276.64	(57.97)		97722.61	(59.09)		99499.63	(58.51)
14	Interest on working capital @ 3.5% pa		3673.25	(2.10)		3544.34	(2.14)		3608.79	(2.12)
A	Variable Cost (1 to 14)		104949.89	(60.08)		101266.95	(61.23)		103108.42	(60.64)
15	Rental value of owned land		44460.00	(25.45)		39520.00	(23.90)		41990.00	(24.70)
16	Management charges		10494.99	(6.01)		10126.70	(6.12)		10310.84	(6.06)
17	Risk factor		10494.99	(6.01)		10126.70	(6.12)		10310.84	(6.06)
18	Transportation, loading and unloading charges		4293.68	(2.46)		4334.85	(2.62)		4314.27	(2.54)
B	Fixed cost (15 to 18)		69743.66	(39.92)		64108.24	(38.77)		66925.95	(39.36)
	Total cost (A+B)		174693.55	(100.00)		165375.19	(100.00)		170034.37	(100.00)

Note: Interest on working capital and interest on fixed capital are calculated for one cropping season. The figure in the parenthesis indicates per cent to total cost

**Table 3. Returns from watermelon cultivation in Haryana and Karnataka (₹/ha)**

S. N.	Particulars	Haryana			Karnataka		
		Sonipat	Jhajjar	Overall	Koppal	Chitradurga	Overall
1	Variable cost	89738.72	91732.10	90735.41	104949.89	101266.95	103108.42
2	Total cost	150858.77	148042.41	149450.59	174693.55	165375.19	170034.37
3	Production (qtl)	271.54	284.05	277.79	373.38	356.83	365.11
4	Gross Return	223111.26	228178.60	225644.93	303445.54	291442.30	297443.92
5	Returns over variable cost	133372.54	136446.51	134909.52	198495.65	190175.34	194335.50
6	Net income	72252.48	80136.19	76194.33	128751.99	126067.10	127409.55
7	B:C Ratio (VC)	2:49	2:49	2:49	2.90	2.88	2.89
8	B:C Ratio	1:48	1:54	1:51	1.74	1.76	1.75

#### 4. CONCLUSION

From the findings of the study, it was observed that, the cost and returns of watermelon cultivation in overall chosen districts from Haryana showed that, average yield was 277.79 q ha<sup>-1</sup>. The returns over variable cost were ₹134909.52 ha<sup>-1</sup>. Farmers obtaining a net return of ₹76194.33 ha<sup>-1</sup> with a benefit-cost ratio of 1:51.

Similarly, cost and returns of watermelon cultivation in both the districts from Karnataka showed that, the gross income obtained from watermelon cultivation was found ₹297443.92 ha<sup>-1</sup>, total cost incurred was found ₹170034.37 ha<sup>-1</sup> as respondent farmers were investing more cost on variable inputs like seeds and plant protection chemicals. Overall average yield was 365.11 Q ha<sup>-1</sup>. The returns over variable cost were found ₹194335.50 ha<sup>-1</sup> and a net return of ₹127409.55 ha<sup>-1</sup> with a benefit-cost ratio of 1:75. So, it is concluded from the study that cultivation of watermelon is highly beneficial in both the states.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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