

Economic Analysis, Marketing and Storage of Onion Cultivation in District Bhiwani, Haryana

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ABSTRACT

The current research was carried out in the Bhiwani district of the state of Haryana due to the greater area of onions being grown there. The current research concluded that the cost of production per quintal in the studied region was Rs. 599.37. The major cost incurred on items included rental value of land (Rs. 18765.00), fertilizers (Rs. 3898.21), plant protection (Rs. 1582.54) and seed cost (Rs. 9212.31). The average yield of onion was 134.87 q/acre. The average variable cost was Rs. 48450.39. The gross returns per acre were Rs. 182074.50 and net returns were recorded Rs. 101911.28. While channel-I was observed to have the greatest disposal of onion produce, channel-III was determined to be the most effective of the different marketing channels. It was shown that onion producers might increase their profits up to six months of storage before they began to lose money.

Key words: Economics, onion, marketing and storage

INTRODUCTION

The onion (*Allium cepa* L.) is one of the most important commercially grown and eaten vegetables. It has been grown and eaten almost everywhere in the world since at least 4000 BC. It started in the area that includes North-West India, Afghanistan, Kazakhstan, Uzbekistan, Western Tianshan, and Western Asia. The area around the Mediterranean Sea is where it spread to other parts of the world. Dehydrated onions come in the form of powder and flakes that can be used as spices. Onions can also be used to make oil and pectin, which are full of phosphorus, calcium, carbs, proteins and vitamins (B and C). Onions can be used to treat many diseases and conditions. The most common ones are dropsy, heart disease, liver cirrhosis, diabetes, tuberculosis and heart attacks (Kumar *et al.*, 2016). India is the biggest producer in the world. It makes up 25.57% of the total global output (Food and Agriculture Organization, 2020), with a production of 26.74 million tonnes (2020) and an average productivity of 18.65 t/ha. Between 1991-92 and 2017-18, the area under onion cultivation almost tripled, while output grew

by roughly four times (Horticultural Statistics at a Glance, 2018; Kumar *et al.*, 2017). Maharashtra (8854.09 thousand MT), Madhya Pradesh (3701.01 thousand MT) Karnataka (2986.59 thousand MT), Bihar (1240.59 thousand MT), and Andhra Pradesh are the top five states in terms of onion output (915.73 thousand MT). About 90% of India's production of onions comes from the top 10 states. The production per hectare varied throughout the states, with Gujarat leading with 24.25 t/ha and Odisha coming in last with 10.77 t/ha. Mewat, Yamunanagar, Ambala and Bhiwani are the main onion producing regions, but district Fatehabad, with productivity of 39.89 t/ha, is at the top, followed by Karnal and Sonapat, with productivity of 36.34 and 32.63 t/ha, respectively (hortiharyana.gov. com). Haryana is in ninth place with an average productivity of 20.45 t/ha and production of 6.40 lakh tonnes (Kumar *et al.*, 2020). Onion has the benefit of being less perishable and enters the marketing channels for interstate and international commerce to a significant degree since it can endure harsh handling and long-distance transportation. Even under bad weather conditions, it may be preserved for a

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substantial amount of time after harvest and afterwards sold on the market when prices are advantageous for the growers. It may be sold on the market for a longer period of time than other veggies. Thus, there are vast opportunities to preserve onion pricing by providing onion farmers with improved marketing and storage facilities, as well as high-yielding cultivars and contemporary farming methods.

METHODOLOGY

For computing the costs and returns of the onion crop; cost of farm inputs, variable as well as total cost and net returns of onion growers were calculated.

Some of the production inputs were derived from family resources, while others were acquired from the market. Farm inputs such as human labour (both family and hired), tractor power, seed, manures, fertilize (Rs.), insecticides and pesticides, irrigation fees, and other agronomic operation fees were priced based on real expenditures spent at current market rates.

The input-output relationship was determined by fitting the Cobb-Douglas production function: Gross returns per farm as a dependent variable and eight inputs including land, preparatory tillage, seed, FYM, fertilizers. human labour and machine power, plant protection chemicals, and irrigation expenditures as independent variables. The overall shape of the function was as described below:

$$Y \text{ (gross returns of onion in rupees)} = a x_1^{b1} x_2^{b2} x_3^{b3} x_4^{b4} x_5^{b5} x_6^{b6} x_7^{b7} x_8^{b8}$$

Where,

- a=Constant
- x₁=Area under crop in hectare
- x₂=Value of preparatory tillage in rupees
- x₃=Value of seed in rupees
- x₄=Value of manures in rupees
- x₅=Value of fertilizers in rupees
- x₆=Value of human labour and machine power in rupees
- x₇=Value of plant protection chemicals in rupees
- x₈=Value of irrigation in rupees
- bi=The regression coefficient of the ith independent variable (i = 1 to 8)

Total variable costs comprised the cost of all

agricultural inputs such as human and bullock labour, tractor power, seed, manures and fertilize (Rs.), insecticides and pesticides, irrigation charges, repair and maintenance of farm tools, and interest on working capital at 9% per year throughout the onion crop's growth season.

Total fixed costs included the current rental value of owned and leased-in land, as well as depreciation on agricultural tools, equipment, and buildings at 10% per year of the present worth of the building and machinery.

Market charges paid by the farmers included farmers' expenses for transporting their goods from the field to the market, such as transportation, unloading, and cleaning fees, etc.

The production was valued based on the selling price of the onion crop.

$$GR = TP \times P$$

Where,

- GR=Gross returns
- TP=Total produce
- P=Price at which produce was sold.

Returns over variable cost were calculated by subtracting the total variable cost from the gross returns as:

$$\text{Return over variable cost} = \text{Gross returns} - \text{Total variable cost}$$

The data gathered from various market functionaries were evaluated to predict marketing expenses, margins, efficiency and pricing spreads in various marketing channels.

Information regarding the marketing channels of onion was collected from the producers and marketing agencies involved in marketing of onion through different marketing channels. The marketing cost incurred on different marketing functions was calculated from the data collected through different marketing functionaries and finally computed in form of total and percentage form.

$$C = C_F + C_{M1} + C_{M2} + C_{M3} \dots \dots \dots C_{MN}$$

Where,

- C=Total marketing cost
- C_F=Cost paid by the farmer at the time

of produce leaves the farm, till he sells.

C_{Mi} = Cost incurred by the i^{th} middlemen in the process of buying and selling.
 $i=1, 2, 3, \dots, N$

Marketing margin was the difference between the middleman's total payments (cost+ purchase price) and receipt (selling price). Marketing efficiency was worked out by employing the formula given by Acharya's approach:

$$ME = \frac{NP_F}{MC + MM + ML}$$

Where,

NP_F = Net price received by the farmers
 MC = Total marketing cost
 MM = Total marketing margin
 ML = Total loss incurred during marketing

Price spread analysis was carried out as follows:

$$\text{Price spread} = \frac{\text{Price paid to retailer}}{\text{Consumer's price} - \text{Producer selling price}}$$

Producer's share in consumer's rupee was the farmer's price stated as a percentage of the consumer's price.

$$\text{Producer's share in} = \frac{\text{Producer's price}}{\text{Consumer's price}} \times 100$$

Costs incurred for the purchase of materials required for the construction of local storage structure included in total fixed cost while labour and maintenance charges included in the variable cost. The overall profit was computed by deducting the whole cost of storage from the extra revenue obtained after storage.

$$\text{Profit earned} = Q_2 \times P_2 - (Q_1 \times P_1 + TC)$$

Where,

Q_2 = Quantity left after storage i.e. quantity after storage losses
 P_2 = Price at which produce sold after the storage

Q_1 = Quantity stored

P_1 = Price just after harvesting of onion

RESULTS AND DISCUSSION

Cost of production was found Rs. 594.62 in the district Bhiwani (Haryana). The cost incurred on major items included rental value of land, irrigation, fertilizer use, plant protection, seed cost, hoeing/weeding and harvesting were 23.40, 4.86, 4.86, 1.97, 11.49, 4.88 and 11.18% of total cost, respectively (Table 1). The average yield of onion was 134.87 q/acre as also by Kumar *et al.* (2016, 2017).

Table 1. Average cost of production of onion in Bhiwani (value in Rs./acre)

Inputs	Bhiwani
Preparatory tillage	1024.85 (1.28)
Nursery raising	11841.90 (14.77)
(a) Seed	9212.31 (11.49)
(b) Seed treatment	656.09 (0.81)
(c) FYM	1483.80 (1.85)
(d) Irrigation	489.70 (0.61)
Transplanting	3556.79 (4.43)
Ridging	1472.48 (1.83)
FYM	4451.41 (5.55)
Transplanting irrigation	489.70 (0.61)
Fertilizer nutrients	
(a) Nitrogen	786.84 (0.98)
(b) Phosphatic	1928.34 (2.40)
(c) Potassic	847.52 (1.06)
(d) Zinc Sulphate	335.51 (0.42)
Total fertilizer investment	3898.21 (4.86)
Fertilizers application	354.21 (0.44)
Irrigation	3897.67 (4.86)
Weeding	
(a) Manual	3917.33 (4.88)
(b) Chemical	-
Plant protection	1582.54 (1.97)
Harvesting/digging	8969.25 (11.18)
Miscellaneous	994.80 (1.24)
Total working capital	46450.14 (57.9)
Interest on working capital @ 9% per annum	2090.25 (2.60)
Variable cost	48450.39 (60.43)
Transportation	3257.75 (4.06)
Management charges @ 10% per annum	4845.04 (6.04)
Risk factor @ 10% per annum	4845.04 (6.04)
Rental value of land	18765.00 (23.40)
Total cost	80163.22 (100)
Production (q)	
(a) Main	134.87
(b) By product	-
Gross returns	182074.5
Returns over variable cost	133624.11
Net returns	101911.28
Cost of production (Rs./q)	599.37
B : C Ratio	2.27

Figures in parentheses indicate the percentage to total cost.

The average variable cost was Rs. 48450 (60.43%) and total cost was Rs. 80163.22/acre as also reported by Kumar *et al.* (2016). The gross returns/acre were Rs. 182074.50 and net returns were Rs. 101911.28. Returns per rupee of investment were 2.27 96 as also reported by Amarnath and Velmurugan (2015) and Kumar *et al.* (2016, 2020).

Cobb-Douglas production function was employed to study the relationship between the onion production and the inputs used in the onion production. The adjusted coefficient of multiple determinations was 0.99 in district Bhiwani which revealed that the production function model was a good fit and 99% of the variation in onion yield was influenced by the explanatory variables included in the model (Table 2). In log linear production function, the coefficient represented the production elasticity of the resources used. The coefficients of land, preparatory tillage, seed, fertilizer, labour and machine power and irrigation were positive and significant at one per cent level with the co-values of 0.008, 0.006, 0.266, 0.0752, 0.639 and 0.014, respectively. This indicated that an increase in the usage of land, preparatory tillage, seed, fertilizer, labour and machine power and irrigation number by one per cent from the existing mean level. While the coefficient for manures and plant protection chemicals was negative. The results indicated that planting material/seed and labour had a positive and significant influence in onion cultivation since these were the major operations in onion cultivation.

Table 2. Regression coefficients of different inputs used for onion cultivation

Particulars	Bhiwani
Constant	0.7396
Land	0.008* (1.1274)
Preparatory tillage	0.006* (0.1982)
Seed	0.266* (0.7009)
Manures	-0.021NS (0.0030)
Fertilizers	0.0752** (0.1299)
Labour and machine power	0.639** (0.5367)
Plant protection chemicals	0.014* (0.1292)
Irrigation	0.180** (0.5806)
Coefficient of determination (R ²)	0.99
F-value	14.097
Return to scale	0.9873

Figures in parentheses are the standard error of regression coefficient.

*Significant at 1% level of significance.

**Significant at 5% level of significance, NS-Non-significant.

Following three major marketing channels were studied in the study area in marketing of onion.

Channel - I (Producer → Wholesaler-cum-Commission agent → Retailer → Consumer)

In this channel, two intermediaries, namely, wholesaler-cum-commission agent and retailer were involved between producers and ultimate consumers. The results revealed that producers received a net price of Rs. 1269.94/q accounting for 68.64% of consumer's price in market (Table 3). The costs incurred by the producers in the marketing of the produce were Rs. 117.86/q. The major cost items incurred by producers were packaging charges, transportation, loading and unloading charges which accounted for Rs. 25.55, Rs. 23.00 and Rs. 4.00/q, respectively. Post-harvest losses were accounted to Rs. 57.51. Purchase prices of wholesalers were Rs. 1387.80/q. Wholesaler sold the produce to the retailer and costs incurred by wholesalers were Rs. 57.01/q. The items of cost were loading, unloading and transportation charges, storage charges, market fee, spoilage and other charges.

Wholesaler sold the produce to retailer at the price of Rs. 1566.72/q. The net margins of wholesalers were Rs. 121.91/q and accounted for the 5.54% of consumer's price in the market. The retailers incurred marketing costs of Rs. 123.87/q in the market. Sale prices of retailer or purchase prices of consumer were Rs. 1850/q. The retailers received net margin of Rs. 169.41/q sharing about 8.61% of the consumer's price in the market. Total price spread through channel-I was found to Rs. 580.06/q.

Channel - II (Producer → Retailer → Consumer)

The producer brought his produce in the market and sold to retailer directly without any commission agent. Thus, only one intermediary i.e. the retailers were involved between the producer and consumer. The producer's shares as percentage of consumer's price were 78.27% (Table 4). The marketing costs incurred by the producer were Rs. 79.44/q and the sale prices of producer/purchase prices at retailer for the produce were Rs. 1245.80/q. Therefore, net price received by the producers was Rs. 1166.36/q in three different zones. Marketing costs incurred by the retailer were Rs. 54.80/q, sale price of retailer or

Table 3. Price spread of onion in marketing channel- I (value in Rs./q)

S.No.	Particulars	Bhiwani
1.	Net price received by the producer	1269.94 (68.84)
2.	Expenses incurred by the producer	
	(a) Transportation	23.00 (1.24)
	(b) Loading and unloading charges	4.00 (0.21)
	(c) Cleaning and dressing charges	3.50 (0.19)
	(d) Grading charges	4.30 (0.23)
	(e) Packaging/cost of gunny bags	25.55 (1.38)
	(f) Post-harvest losses	57.51 (3.10)
	Sub-total	117.86 (6.37)
3.	Sale price of producer/purchase price at wholesaler	1387.80 (75.01)
4.	Expenses incurred by the wholesaler	
	(a) Filling	8.00 (0.42)
	(b) Weighing and sewing	10.60 (0.57)
	(c) Market fees @ 2%	31.33 (1.69)
	(d) Storage charges	2.90 (0.15)
	(e) Miscellaneous	0.50 (0.03)
	(f) Storage losses	3.68 (0.20)
	Sub-total	57.01 (3.08)
5.	Net margin of wholesaler	121.91 (6.54)
6.	Sale price of wholesaler/purchase price of retailer	1566.72 (84.68)
7.	Expenses incurred by the retailer	
	(a) Commission	92.50 (5.00)
	(b) Loading and unloading charges	4.00 (0.21)
	(c) Transportation	19.00 (1.03)
	(d) Storage charges	4.50 (0.24)
	(e) Spoilage and losses	3.87 (0.21)
	Sub-total	123.87 (6.69)
8.	Net margin of retailer	159.41 (8.61)
9.	Sale price of retailer/Consumer's purchase price	1850 (100)

Figures in parentheses indicate the percentage to the sale price of retailer.

Table 4. Price spread of onion in marketing channel-II (value in Rs./q)

S. No.	Particulars	Bhiwani
1.	Producer selling price	1166.36 (78.28)
2.	Expenses incurred by the producer	
	(a) Transportation	22.00 (1.47)
	(b) Loading charges and unloading	4.00 (0.27)
	(c) Cleaning charges and dressing	3.50 (0.23)
	(d) Grading	4.00 (0.27)
	(e) Packaging/cost of gunny bags	25.55 (1.71)
	(f) Post-harvest losses	20.39 (1.37)
	Sub-total	79.44 (5.33)
3.	Sale price of producer/Purchase price of retailer	1245.80 (83.61)
4.	Expenses incurred by the retailer	
	(a) Loading and unloading charges	2.00 (0.14)
	(b) Market fees @ 2 percent	29.80 (2.00)
	(c) Transportation	18 (1.21)
	(d) Storage charges	1.13 (0.07)
	(e) Spoilage and losses	3.87 (0.26)
	Sub-total	54.80 (3.67)
5.	Net margin of retailer	189.41 (12.71)
6.	Sale price of retailer/Consumer purchase price	1490 (100)

Figures in parentheses indicate the percentage to the sale price of retailer.

purchase prices of consumer were Rs. 1490/q. The net margins received by retailers were Rs. 189.41/q and accounted for 12.71% of the sale price of the retailer/purchase price of consumer in different zones.

Channel - III (Producer → Consumer)

It was the shortest channel in onion

marketing. In this channel, no intermediaries between producer and consumer were involved i.e. direct marketing. The result revealed that producer received a net price of Rs. 1350/q (Table 5), accounting for 95.00% of consumer price in different zones, respectively. The major cost items incurred by producer were packaging charge, transportation, loading and

Table 5. Price spread of onion in marketing channel-III (value in Rs./q)

S. No.	Particulars	Bhiwani
1.	Producer selling price	1350.00 (94.98)
2.	Expenses incurred by the producer	
	(a) Transportation	23.00 (1.62)
	(b) Loading charges	2.00 (0.14)
	(c) Cleaning and dressing charges	3.50 (0.25)
	(d) Grading	4.30 (0.30)
	(e) Packaging/cost of gunny bags	18.12 (1.27)
	(f) Post-harvest losses	20.39 (1.43)
	Sub-total	71.31 (5.02)
3.	Sale price of producer/purchase price of consumer	1421.31 (100)

Figures in parentheses indicate the percentage to the sale price of retailer.

unloading charges accounting for Rs. 4.00/q, respectively. It was observed that producer's share in consumer's rupee was found highest in direct sale as followed by wholesaler-cum-commission agent and retailer. The highest net price received by the producers in channel III (producer to consumer).

Marketing efficiency calculated by Acharya's method (Modified measure of marketing efficiency) under different marketing channels was 2.18, 3.60 and 19.01 in channel-I, channel-II and channel- III, respectively (Table 6). From this efficiency index, it was clear that channel-III was found most efficient among all marketing channels. This was because of the fact that in channel III, intermediaries were not involved and hence this channel was most efficient than all other channels (Nimbrayan, 2022).

Table 6. Marketing efficiency of different marketing channels in Bhiwani (value in Rs./q)

S. No.	Particulars	Bhiwani		
		I	II	III
Marketing channels				
1.	Consumer's purchase price	1850	1490	1421
2.	Marketing cost (MC)			
	(a) MC incurred by farmer	117.86	79.44	71.31
	(b) MC incurred by wholesaler	57.01	-	-
	(c) MC incurred by retailer	123.87	54.80	-
	Total marketing cost	298.74	134.24	71.31
3.	Net margin of intermediaries (MM)			
	(a) MM received by wholesaler	121.91	-	-
	(b) MM received by retailer	159.41	189.41	-
	Total margin	281.32	189.41	-
4.	Net price received by farmers	1269.94	1166.36	1350
5.	Total price spread	580.06	323.64	71
6.	Producer share in consumer's rupee	68.64	78.27	95.00
Index of marketing efficiency				
A	Acharya's method (4/2+3)	2.18	3.60	19.01
B	Conventional method (5/2)	1.94	2.41	1.00
C	Shepherd's method (1/2)	6.19	11.09	19.92

Table 7. Marketing behaviour of onion growers in Bhiwani

Marketing channels	Volume of transaction (% of total marketed surplus)
Channel-I	15.00
Channel-II	24.00
Channel-III	61.00

Moreover, marketing efficiency increased with the decrease in number of market intermediaries between producer and consumer. The marketing efficiency according to conventional method under different marketing channels i.e. channel-I, channel-II and channel - III was 1.94, 2.41 and 1.00 in zone-III, respectively. According to this efficiency index, it was evident that channel-II was the most efficient among all marketing channels. The marketing efficiency according to Shepherd's method under different marketing channels i.e. channel-I, channel-II and channel-III was 6.19, 11.09 and 19.92 in zone-III, respectively. From this efficiency index, channel-III was the most efficient among all the marketing channels (Nimbrayan *et al.*, 2021).

The volume of transaction through different marketing channels is presented in Table 7. It is evident from the table that channel-III was most effective as farmers transacted 61.00% of their marketed surplus, while channel-I had lowest transaction (Nimbrayan, 2022).

Onion produced in *kharif* season is not suitable for storage, while onion produced in summer

season can be stored up to 5-6 months in ordinary condition and it can be brought in the market during rainy season i.e. from June to October. Sufficiently ventilated structures with adequate air circulation are needed for storage under ordinary conditions. The purpose of storage was to protect onion bulbs from direct sunlight, dampness and rain.

Only few farmers adopted local scientific storage method at their own farms (Table 8). These local onion storage structures were of size 1000 ft³ with a storage capacity of 20 q and their costs were analyzed in different zones of Haryana. The structure was made up of bamboo and thatched sheds with cement flooring. It was constructed inside the farmer's house which made it free from watch and ward. Cost of construction of storage structure was found Rs. 17349.50. Variable costs/charges for storage of onion were found Rs. 2009.89. Maintenance cost during storage period of six months also followed same trend. Maintenance costs per annum were calculated at 10% of total cost occurred.

Table 8. Cost of local storage structure in Bhiwani (value in Rs./structure)

Particulars	Bhiwani
Bamboo sticks/iron rod/ any other material	7182.67 (30.40)
Wiring	6931.72 (29.34)
Cover (Polythene sheets plastics/straw)	786.90 (3.33)
Any other material used	745.98 (3.15)
Labour charges	1702.23 (7.20)
Total fixed cost	17349.50 (73.43)
Depreciation	1734.95 (7.34)
Variable cost	2009.89 (8.50)
Cost of gunny bags	190 (0.80)
Packaging cost	300 (1.26)
Transportation cost	110 (0.44)
Protection chemicals	1429.89 (6.04)
Maintenance cost	2530.65 (10.73)
Up to 2 months	956.98 (4.05)
2-4 months	896.58 (3.79)
4-6 months	677.09 (2.86)
More than 6 months	-
Overall total cost	23624.99

Figures in parentheses are the percentage of total cost. Storage structure of 20 q with a life span of 6-8 years.

CONCLUSION

The present study revealed that the cost of production/q in the studied region was Rs. 599.37. The major cost incurred on items included rental value of land (Rs. 18765.00), fertilizers (Rs. 3898.21), plant protection (Rs.

1582.54) and seed cost (Rs. 9212.31). The average yield of onion was 134.87 q/acre. The average variable cost was Rs. 48450.39. The gross returns/acre were Rs. 182074.50 and net returns were recorded Rs. 101911.28. Channel-III was shown to be the most effective of all marketing channels, whereas channel-I had the greatest disposal of onion output. Profit obtained by onion producers was observed to increase up to six months of storage. However, farmers had to experience loss beyond six months of storage.

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