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Shivam
Department of Business Management, CCS HAU, Hisar, Haryana, India

Usha
Department of Agricultural Economics, CCS HAU, Hisar, Haryana, India

PK Nimbrayan
Department of Agricultural Economics, CCSHAU College of Agriculture, Bawal, Haryana, India

Darvinder Kumar
Department of Statistics, PGDAV College, University of Delhi, Delhi, India

Corresponding Author:
PK Nimbrayan
Department of Agricultural Economics, CCSHAU College of Agriculture, Bawal, Haryana, India

Price analysis of onion cultivation in Mewat District of Haryana

Shivam, Usha, PK Nimbrayan and Darvinder Kumar

Abstract
The current research was carried out in the Mewat 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 ₹651.22. The major cost incurred on items included rental value of land (₹19245.00), fertilizers (₹4188.81), plant protection (₹1368.26) and seed cost (₹8886.12), respectively. The average yield of onion was 118.23 quintals per acre. The average variable cost was ₹45343.00. The gross return per acre was ₹151334.40 and net return was recorded ₹74340.94 per acre. 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 for up to six months of storage before they began to lose money. After 2 months, 4 months, and 6 months in storage, the farmer earned ₹125.89, ₹176.52, and ₹210.539 per quintal, respectively.

Keywords: 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 (Augusti, 1990) [4]. India is the biggest producer in the world. It makes up 25.57 percent 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 tonnes per hectare. Between 1991–1992 and 2017–2018, the area under onion cultivation almost tripled, while output grew by roughly four times (Horticultural Statistics at a Glance, 2018). 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 tonnes/ha and Odisha coming in last with 10.77 tonnes/ha. Mewat, Yamunanagar and Ambala are the main onion producing regions, but district Fatehabad, with productivity of 39.89 tonnes per ha, is at the top, followed by Karnal and Sonipat, with productivity of 36.34 and 32.63 tonnes per ha, respectively (hortiharyana.gov.com). Haryana is in ninth place with an average productivity of 20.45 tonnes/ha and production of 6.40 lakh tonnes (Usha *et al.*, 2022) [19]. 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 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

Economic analysis of onion production

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 in Mewat.

Valuation of farm inputs

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, fertilizers, insecticides and pesticides, irrigation fees, and other agronomic operation fees were priced based on real expenditures spent at current market rates.

Regression analysis

The input-output relationship was determined by fitting the Cobb-Douglas production function. Gross return 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:

$Y = ax_1^{b1}\, x2^{b2}\, x_3^{b3}\, x_4^{b4}\, x_5^{b5}\, x_6^{b6}\, x_7^{b7}\, x_8^{b8}$
Y = Gross returns of onion in rupees

Where,
A = Constant
X_1 = Area under crop in hectare
X_2 =Value of preparatory tillage in rupees
X_3 = Value of seed in rupees
X_4 = Value of manures in rupees
X_5 = Value of fertilizers in rupees
X_6 = Value of human labour and machine power in rupees
X_7 = Value of plant protection chemicals in rupees
X_8 = Value of irrigation in rupees
Bi = The regression coefficient of the i^{th} independent variable (i = 1 to 8)

Total variable cost

Total variable costs comprised the cost of all agricultural inputs such as human and bullock labour, tractor power, seed, manures and fertilizers, 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 cost

Fixed costs include 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

Farmers' expenses for transporting their goods from the field to the market, such as transportation, unloading, and cleaning fees, were calculated.

Valuation of output

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

$GR = TP \times P$

Where,
GR = Gross Return
TP = Total Produce
P = Price at which produces was sold.

Returns over variable cost

Returns over variable cost were calculated by subtracting the total variable cost from the gross return.
Return over variable cost = Gross return – Total variable cost

Evaluation of marketing system

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

Marketing pattern of onion

Information regarding the marketing channels of onion were collected from the producers and marketing agencies involved in marketing of onion through different marketing channels.

Marketing cost

The marketing cost incurred on different marketing function was calculated from the data collected through different marketing functionaries and finally computed in form of total and percentage form.

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

Where,
C = Total marketing cost
C_F =Cost paid by the farmer at the time produce leave 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, N

Marketing margins

This is the difference between the middleman's total payments (Cost + purchase price) and receipt (Selling price).

Marketing efficiency

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

Price spread analysis was carried out as follows:

$$\text{Price spread} = \frac{\text{Prie paid to Retailer}}{\text{Consumer‟s Price} - \text{Producer Selling Price}}$$

Producer's share in consumer's rupee

It is the farmer's price stated as a percentage of the consumer's price.

$$\text{Producer's Share in Consumer's Rupee} = \frac{\text{Producer's Price}}{\text{Consumer's Price}} \times 100$$

Economic efficiency of storage

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.

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

To work out costs and returns of onion cultivation

The cost and returns of onion in Mewat district of Haryana have been presented in table 1. Cost of production was found in Mewat was ₹651.22. In zone-II, the rental value of land, seed cost, fertilizer use, plant protection, irrigation, hoeing/weeding and harvesting were major items which accounted for 24.99, 11.54, 5.44, 1.77, 4.23, 4.86 and 10.33 percent of the total cost, respectively. The average yield of onion was 118.23 quintals per acre in the district (Gangwar and Chhikara, 1973; Ahmed *et al.,* 2014) [8, 2]. The rental value of land was contributed highest to the total cost which accounted for ₹19245.00 (24.99 percent) followed by ₹11075.17 (14.38 percent) expenses incurred on nursery raising in the district. The seed cost was found ₹8886.12 (11.54 percent) in the Mewat district. The average variable cost was ₹45343.00 (58.89 percent) in the district. The gross return per acre was recorded ₹151334.40. Return per rupee of investment was 1.96 (Pajankar *et al.,* 2000; Verma *et al.,* 2004; Shrichand and Jain 2008; Amarnath and Velmurugan, 2015) [14, 20, 16, 3].

Table 1: Average cost of production of onion in Mewat (Value in ₹ acre^{-1})

Inputs	Mewat
Preparatory tillage	1146.74 (1.48)
Nursery raising	11075.17 (14.38)
a. Seed	8886.12 (11.54)
b. Seed treatment	622.44 (0.84)
c. FYM	1268.18 (1.64)
d. Irrigation	398.43 (0.52)
Transplanting	3504.54 (4.55)
Ridging	1365.14 (1.77)
FYM	3924.54 (5.10)
Transplanting irrigation	398.43 (0.52)
Fertilizer nutrients	
a. Nitrogen	825.26 (1.07)
b. Phosphatic	2134.21 (2.77)
c. Potassic	856.17 (1.11)
d. Zinc Sulphate	373.17 (0.48)
Total fertilizer investment	4188.81 (5.44)
Fertilizers application	327.86 (0.42)
Irrigation	3255.92 (4.23)
Weeding	
a. Manual	3742.06 (4.86)
b. Chemical	-
Plant protection	1368.26 (1.77)
Harvesting/digging	7958.14 (10.33)
Miscellaneous	1034.83 (1.34)
Total working capital	43390.44 (56.3)
Interest on working capital @9 percent per annum	1952.56 (2.54)
Variable cost	45343.00 (58.89)
Transportation	3357.76 (4.36)
Management charges @ 10 percent per annum	4523.85 (5.87)
Risk factor @ 10 percent per annum	4523.85 (5.87)
Rental value of land	19245.00 (24.99)
Total cost	76993.46 (100)
Production (qtl)	
a. Main	118.23
b. By product	-
Gross return	151334.4
Return over variable cost	105991.4
Net return	74340.94
Cost of production (₹ per qtl)	651.22
B:C Ratio	1.96

Figures in parenthesis indicate the percentage to total cost.

Input-output relationship of onion cultivation

Cobb-Douglas production function was employed to study the relationship between the onion production and the inputs used in the onion production. The estimated Cobb-Douglas production functions of onion farms are furnished in Table 2. The adjusted coefficient of multiple determinations was 0.99 which reveals that the production function model was a good fit and 99 percent of the variation in onion yield was influenced by the explanatory variables included in the model. In log linear production function, the coefficient represents the production elasticity of the resources used. The coefficients of land, preparatory tillage, seed, fertilizers, labour and machine power and irrigation were positive and significant at one percent level with the co-values of 0.0100, 0.009, 0.336, 0.114, 0.486 and 0.146 in the district, respectively. This indicated that an increase in the usage of land, preparatory tillage, seed, fertilizers, labour and machine power and irrigation number by one percent from the existing mean level. While the coefficient for manures and plant protection chemicals are negative. The results indicated that planting material/seed and labour had a positive and significant influence in onion cultivation since these were the major operation in onion cultivation.

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

Particulars	Mewat
Constant	0.8376
Land	0.0100*(0.3238)
Preparatory tillage	0.009* (0.1414)
Seed	0.336* (0.4000)
Manures	-0.018NS (0.0110)
Fertilizers	0.114** (0.3565)
Labour and machine power	0.486** (0.6634)
Plant protection chemicals	-0.017NS (0.6983)
Irrigation	0.146** (0.0824)
Coefficient of determination (R^2)	0.99
F-value	19.809
Return to Scale	0.9562

Figures in parenthesis are the standard error of regression coefficient.
*Significance at 1 percent level of significance
** Significance at 5 percent level of significance, NS-Non-significant.

Price spread of onion through different marketing channels and their efficiency

Marketing channels

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

Producer → Wholesaler-cum-commission agent → Retailer → Consumer
Producer → Retailer → Consumer
Producer → Consumer

Price spread of onion through different marketing channels

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 (Naik *et al.,* 1995) [12]. The marketing margins, price spread and cost in this channel were given in table 3. The results revealed that producers received a net price of ₹1251.27 per quintal accounting for 68.37 percent of consumer's price in market. The costs incurred by the producers in the marketing of the produce were ₹110.68 per quintal. The major cost items incurred by producers were packaging charges, transportation, loading and unloading charges which accounted ₹25.55, ₹ 23.00 and ₹4.00 per quintal, respectively. Post-harvest was accounted to ₹50.33, respectively. Purchase prices of wholesalers were ₹1361.95 per quintal. Wholesaler sold the produce to the retailer and costs incurred by wholesalers were ₹55.51 per quintal. The items of cost were loading, unloading and transportation charges, storage charges, market fee, spoilage and other charges.

Table 3: Price spread of onion in marketing channel- I (Value in ₹ qtl^{-1})

Sr. No.	Particulars	Mewat
1.	Net Price received by the producer	1251.27 (68.37)
2.	**Expenses incurred by the producer**	
	a. Transportation	23.00 (1.37)
	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 (1.39)
	f. Post-harvest losses	50.33 (2.75)
	Sub-total	110.68 (6.05)
3.	Sale price of producer/ Purchase price at wholesaler	1361.95 (74.42)
4.	**Expenses incurred by the wholesaler**	
	a. Filling	7.00 (0.38)
	b. Weighing and sewing	10.60 (0.57)
	c. Market fees @ 2 percent	30.49 (1.66)
	d. Storage charges	2.90 (0.16)
	e. Miscellaneous	0.50 (0.03)
	f. Storage losses	3.72 (0.20)
	Sub-total	55.51 (3.03)
5.	Net margin of wholesaler	122.42 (6.68)
6.	Sale price of wholesaler / Purchase price of retailer	1539.88 (84.15)
7.	**Expenses incurred by the retailer**	
	a. Commission	91.50 (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	3.62 (0.19)
	Sub-total	122.62 (6.70)
8.	Net margin of retailer	168.00 (9.18)
9.	Sale price of retailer/ Consumer's purchase price	1830 (100)

Figures in parenthesis indicate the percentage to the sale price of retailer

Wholesaler sold the produce to retailer at the price of ₹1539.98 per quintal. The net margins of wholesalers were ₹122.42 per quintal and accounted for the 6.68 percent of consumer's price in the market. The retailers incurred marketing costs of ₹122.62 per quintal in the market. Sale prices of retailer or purchase prices of consumer were ₹1830 per quintal. The retailers received net margin of ₹168.00 per quintal sharing about 9.18 percent of the consumer's price in the market. Total price spread through channel-I was found to ₹578.73 per quintal.

Channel- II: Producer → Retailer → Consumer

Marketing margins, price spread and cost in the channel-II are depicted in table 4. The producer brings their produce in the market and sold to retailer directly without any Commission agent. Thus, only one intermediary i.e., the retailers are involved between the producer and consumer. The producer's

shares as percentage of consumer's price were 77.12 percent. The marketing costs incurred by the producer were ₹83.43 per quintal and the sale prices of producer/purchase prices at retailer for the produce were ₹1174.78 per quintal (Bhonde *et al.*, 1991). Therefore, net price receive by the producers were ₹1091.36 per quintal. Marketing costs incurred by the retailer were ₹52.16 per quintal, sale price of retailer or purchase prices of consumer were ₹1415 per quintal, respectively. The net margins received by retailers were ₹188.06 per quintal and accounted for 13.29 percent of the sale price of the retailer/purchase price of consumer in different zones.

Table 4: Price spread of onion in marketing channel-II (Value in ₹ qtl^{-1})

Sr. No.	Particulars	Mewat
1.	Producer selling price	1091.35 (77.15)
2.	**Expenses incurred by the producer**	
	Transportation	22.00 (1.55)
	Loading charges and unloading	4.00 (0.28)
	Cleaning charges and dressing	3.50 (0.25)
	Grading	4.00 (0.28)
	Packaging/cost of gunny bags	25.55 (1.80)
	Post-harvest losses	24.43 (1.72)
	Sub-total	83.43 (5.89)
	Sale price of producer/Purchase price of retailer	1174.78 (83.02)
4.	**Expenses incurred by the retailer**	
	Loading and unloading charges	2.00 (0.14)
	Market fees @ 2 percent	28.30 (2.00)
	Transportation	17 (1.20)
	Storage charges	1.24 (0.08)
	Spoilage and losses	3.62 (0.20)
	Sub-total	52.16 (3.68)
	Net margin of retailer	188.06 (13.29)
	Sale price of retailer/Consumer purchase price	1415 (100)

Figures in parenthesis indicate the percentage to the sale price of retailer

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 presented in the table 5 reveals that producer received a net price of ₹1280 per quintal, accounting for 94.39 percent of consumer price in different zones, respectively. The major cost items incurred by producer were packaging charge, transportation, loading and unloading charges accounting for ₹18.55, ₹23.00 and ₹4.00 per quintal, respectively. It was observed that producer's share in consumer's rupee was found highest in direct sale in followed by wholesaler-cum-commission agent and retailer. The highest net price received by the producers in channel III (producer to consumer). Whereas in the channel I and II, net prices of producer were found 68.08 percent and 78.03 percent of consumer's rupee in the market respectively. The producer's share in consumer's rupee was increased with decrease in the number of intermediaries between producer and consumer.

T**able 5:** Price spread of onion in marketing channel-III (Value in ₹ qtl^{-1})

Sr. No.	Particulars	Mewat
	Producer selling price	1280.00 (94.41)
	Expenses incurred by the producer	
	Transportation	23.00 (1.69)
	Loading charges	2.00 (0.14)
	Cleaning and dressing charges	3.50 (0.26)
	Grading	4.30 (0.31)
	Packaging/cost of gunny bags	18.55 (1.36)
	Post-harvest losses	24.43 (1.80)
	Sub-total	75.78 (5.59)
	Sale price of producer / purchase price of consumer	1355.78 (100)

Figures in parenthesis indicate the percentage to the sale price of retailer

Marketing efficiency of different marketing channels

The table 6 shows that the marketing efficiency of onion in different marketing channels Haryana. Marketing efficiency calculated by Acharya's method (Modified measure of marketing efficiency) under different marketing channels were 2.16, 3.37 and 16.84 in channel-I, channel-II and channel- III, respectively. 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 (Barakade *et al.*, 2011) [5].

Moreover, marketing efficiency increased with the decreased 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 were 2.00, 2.38 and 1.00, 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 were 6.33, 10.43 and 17.89, respectively. From this efficiency index, channel III was the most efficient among all the marketing channels (Kunwar *et al.*, 1972) [11].

Table 6: Marketing efficiency of different marketing channels in Mewat (Value in ₹ qtl^{-1})

Sr. No.	Particulars	Mewat		
	Marketing channels	**I**	**II**	**III**
1.	Consumer's purchase price	1830	1415	1356
2.	**Marketing cost (MC)**			
a.	MC incurred by farmer	110.68	83.43	75.78
b.	MC incurred by wholesaler	55.51	-	-
c.	MC incurred by retailer	122.62	52.16	-
	Total marketing cost	288.81	135.59	75.78
3.	**Net margin of intermediaries (MM)**			
a.	MM received by wholesaler	122.42	-	-
b.	MM received by retailer	168.0	188.06	-
	Total margin	290.42	188.06	-
4	Net price received by farmers	1251.27	1091.35	1280
5.	Total price spread	578.73	323.65	76
6.	Producer shares in consumer's Rupee	68.37	77.12	94.39
	Index of marketing efficiency			
A	Acharya's method (4/2+3)	2.16	3.37	16.84
B	Conventional method (5/2)	2.00	2.38	1.00
C	Shepherd's method (1/2)	6.33	10.43	17.89

Marketing behavior of onion growers

The volume of transaction through different marketing channels was presented in table 7. It is evident from the table that channel-I was most effective in which farmers transacted 52.00 percent of their marketed surplus. Pattern of disposal revealed that farmers sold major portion of produce through channel-I where wholesaler plays an important role in study area (Nandal and Karwasra, 1979; Sarfraz *et al.*, 2008) [13, 15].

Table 7: Marketing behavior of onion growers in Mewat

Marketing channels	Volume of transaction (Percent of total marketed surplus)
Channel-I	52.00
Channel-II	37.00
Channel-III	11.00

Average producer's surplus of onion in different zones

Average onion bulbs produced by selected onion growers were 116.23 qtl per acre. Total marketable surplus was recorded 84.45 qtl per acre and unmarketable bulbs at field level were recorded 28.39 qtl per acre at the time of harvesting due to various losses at field levels like doubles, bolters, rotted bulbs, drying, bulbs injuries, de- topping, packing, transportations and marketing. Out of the total marketable produce 1.83 quintals of onion bulbs retained by the sample onion growers for home consumption and seed purpose and remaining quantity was sold in the market (Table 8).

Table 8: Producer's surplus use pattern of onion in Mewat (value in qtl acre^{-1})

Sr. No.	Particulars	Mewat
1.	Average area allotted for onion crop (Percent of total cropped area)	38.28
2.	Average yield of onion (qtl per acre)	116.23
3.	Used for home consumption	1.83 (1.55)
4.	Used to gift relatives/ friends	1.56 (1.34)
5.	Post-harvest losses at farmers level	28.39 (24.43)
6.	Total use and losses	31.78 (27.32)
7.	Total marketable surplus	84.45 (72.68)

Figures in parenthesis indicate the percentage to total yield.

Profit earned by onion growers at different periods of storage through different marketing channels

Profit earned by the onion growers after different periods of storage was calculated and explained in table 9. It is clear from the table that price obtained by farmers by marketing of onion just after harvesting was highest (₹1280/qtl) through channel-III and lowest (₹1091/qtl) in channel-II (Shroff *et al.*, 2012) [17]. Total marketed surplus just after harvesting were found 92.75 percent, respectively.

Marketing of onion after 2 months of storage

Storage losses within two months were calculated to 5.42 kg/qtl and marketed surplus was 87.33 percent of total stored quantity. Storage costs incurred during 2 months were calculated ₹65.37. Marketing of onion through channel-I after 2 months of storage was uneconomical but through channel-II and III, farmers earned a minimum profit of ₹57.99 per qtl and maximum profit of ₹ 125 per qtl, respectively.

Marketing of onion after 4 months of storage

Storage losses within four months were estimated to 9.98 kg/qtl and marketed surplus reported was 82.77 percent of total stored quantity, respectively. Storage costs incurred during 4 months were ₹114.51. Marketing of onion through channel-I after 4 months of storage was uneconomical and farmers earned a minimum profit of ₹52.19 per qtl through channel-II to maximum profit ₹ 176.52 per qtl received (Ahmad *et al.*, 2008) [1].

Marketing of onion after 6 months of storage

Storage losses within six months were calculated to 14.16 kg/qtl which decreases marketed surplus to 78.59 percent of total stored quantity. Storage costs incurred during 6 months were ₹149.93. More than 6 months of storage of onion was found uneconomical in all channels and farmers lose an amount of ₹ 225.26/qtl to a maximum of ₹ 399.69/qtl in, due to decline in onion market prices observed due to new market arrivals of new season crop. Therefore, profit earned by farmers through storage of onion was found increasing upto 6 months of storage but after 6 months, farmers incurred losses due to low prices and high storage cost.

Table 9: Profit earned by onion growers at different period of storage (Value in kg qtl^{-1} and ₹ qtl^{-1})

Sr. No.	Particulars	Mewat
Just after harvesting		
	Losses at farm level	7.25
	Total marketed surplus	92.75
	Quantity sold	92.75
Marketing of onion through different marketing channels:		
C- I	Selling price of onion	1251
	Farmer's share in consumer's rupee	68.37
C-II	Selling price of onion	1091
	Farmer's share in consumer's rupee	77.12
C-III	Selling price of onion	1280
	Farmer's share in consumer's rupee	94.39
	Total quantity Stored	92.75
After 2 months of Storage		
	Storage losses within two months	5.42
	Quantity sold	87.33
	Storage cost incurred	65.37
Marketing of onion through different marketing channels		
C- I	Selling price of onion	1450
	Farmer's share in consumer's rupee	71.47
	Storage efficiency / Profit	-37.98
C-II	Selling price of onion	1470
	Farmer's share in consumer's rupee	81.94
	Storage efficiency	125.89
C-III	Selling price of onion	1600
	Farmer's share in consumer's rupee	95.46
	Storage efficiency	57.99
0-4 Months of storage		
	Storage losses during 0-4 months	9.98
	Quantity sold	82.77
	Storage cost incurred	114.51
Marketing of onion		
C- I	Selling price of onion	1700
	Farmer's share in consumer's rupee	74.60
	Storage efficiency	-1.39
C-II	Selling price of onion	1790
	farmer's share in consumer's rupee	84.67
	Storage efficiency	176.52
C-III	Selling price of onion	1860
	Farmer's share in consumer's rupee	96.07
	Storage efficiency	52.19
	0-6 Months of storage	
	Storage losses during 0-6 months	14.16
	Quantity sold	78.59
	Storage cost	149.93
Marketing of onion		
C- I	Selling price of onion	2080
	farmer's share in consumer's rupee	78.23
	Storage efficiency	29.91
C-II	Selling price of onion	2130
	farmer's share in consumer's rupee	86.81
	Storage efficiency	210.53
C-III	Selling price of onion	2220
	Farmer's share in consumer's rupee	96.69
	Storage efficiency	93.21
After 6 months of storage		
	Storage losses after 6 months	17.18
	Quantity sold	75.57
	Storage cost	176.12
Marketing of onion		
C- I	Selling price of onion	1550
	Farmer's share in consumer's rupee	72.81
	Storage efficiency	-341.38
C-II	Selling price of onion	1590
	Farmer's share in consumer's rupee	83.60
	Storage efficiency	-225.26
C-III	Selling price of onion	1650
	Farmer's share in consumer's rupee	95.43
	Storage efficiency	-399.69

Cost of local onion storage structure

Onion produced in kharif season is not suitable for storage while onion produced in summer season can be stored upto 5-6 months in ordinary condition and it can be brought in the market during rainy season i.e., from June to Oct. Sufficiently ventilated structures with adequate air circulation are needed for storage under ordinary conditions (Singh and Singh, 1973; Kassali and Idowu, 2008) [18, 9]. The purpose of storage is to protect onion bulbs from direct sunlight, dampness and rain. These local onion storage structures were of size 1000 ft^3 with a storage capacity of 20 quintals and their costs were analyzed in different zones of Haryana as given in table 10. The structure was made up of Bamboo and thatched shed with cement flooring. It was constructed inside the farmer's house which makes it free from watch and ward. Cost of construction of storage structure was found ₹17130.87. Variable cost/ charges for storage of onion were found ₹ 2097.59. Maintenance cost during storage period of 6 months also follows same trend. Maintenance costs per annum were calculated at 10 percent of total cost occurred.

Table 10: Cost of local storage structure in Mewat (Value in ₹ $structure^{-1}$)

Particulars	Mewat
Bamboo sticks/Iron rod/ any other material	7054.49 (29.46)
Wiring	6719.89 (26.06)
Cover (Polythene sheets plastics/ Straw)	966.31 (4.63)
Any other material used	825.26 (3.44)
Labour charges	1569.91 (6.55)
Total fixed cost	17130.87 (71.56)
Depreciation	1713.08(7.16)
Variable cost	2097.59 (8.76)
Cost of gunny bags	200 (0.83)
Packaging cost	280 (1.16)
Transportation cost	120 (0.50)
Protection chemicals	1517.59 (6.33)
Maintenance cost	2998.62 (12.50)
Upto 2 months	1307.45 (5.46)
2-4 months	982.82 (4.10)
4-6 months	708.45 (2.96)
More than 6 months	-
Overall total cost	23940.16

Figure in parenthesis are the percentage of total cost.
Storage structure of 20 quintals with a life span of 6-8 years

Conclusion

Onion is very important crop in the state as well as in the nation. India is the biggest producer in the globe. Haryana state is come under top ten production state in the nation. The present study was conducted to know the economics, marketing and storage aspect of onion cultivation. This was conducted in Haryana state. Mewat district was selected from the state because of higher area and production under cultivation. Two villages and one market were randomly selected and data was collected for the year 2019-20. The present study revealed that the cost of production in the study area was found ₹651.22 per quintal. The major cost incurred on items included rental value of land (₹19245.00), fertilizers (₹4188.81), plant protection (₹1368.26) and seed cost (₹8886.12), respectively. The average yield of onion was 118.23 quintals per acre. The average variable cost was ₹45343.00. The gross return per acre was ₹151334.40 and net return was recorded ₹74340.94 per acre. 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 6 months of storage duration, however farmers had to experience loss beyond 6 months. After 2 months, 4 months, and 6 months in storage, the farmer earned ₹125.89, ₹176.52, and ₹210.539 per quintal, respectively.

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