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## An economic analysis of onion cultivation under sprinkler irrigation system in Southern Haryana

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### Abstract

Onion (*Allium cepa*) is one of the important commercial vegetable crops grown in India. The present study was conducted in the southern Haryana districts (Bhiwani and Rewari), selected on the basis of high rate of adoption of sprinkler irrigation system. For the selection of sample farmers, multistage random sampling technique was used. Blocks named Tosham and Loharu in Bhiwani district and Khol at Rewari, Nahar were selected for sampling and a total of 45 onion farmers from various villages were chosen for this study. The profitability of adopter farmers was analyzed using Benefit cost ratio (BC ratio) concept. Information regarding cost and returns of onion crop were gathered from sampled farmers for the year 2021-22 and the net return was worked out accordingly. The total variable cost incurred for cultivation of onion accounted for ₹ 137438.20 and ₹ 133083.47 in Rewari and Bhiwani districts respectively. Total cost incurred was ₹ 217993.83 and ₹ 207634.36 in Rewari and Bhiwani district respectively. Farmers got higher net returns in Rewari district (₹ 126162.47) as compared to Bhiwani district (₹ 84799.84). The B:C ratio over total cost in Rewari, Bhiwani and overall were 1.57, 1.40 and 1.48 respectively.

**Keywords:** B:C ratio, economic analysis, net returns, onion, sprinkler irrigation system

### 1. Introduction

One of the most important commercial vegetable and condiment crops, the onion, is grown in India thanks to the Liliaceae family of plants, which is responsible for the production of these plants (*Allium cepa*). It contains a high concentration of compounds that include sulphur, which are what give these meals their characteristic odour and contribute to many of the health advantages they bring. This substance has a high concentration of these chemicals. It is cultivated in huge quantities over the whole of the United States in a diverse range of climatic conditions and geographic locations, mostly by low-income and small-scale farmers. It is used both while it is green and after it has fully matured, when it is used as a component in salads and when it is used as a spice in a broad variety of flavoured dishes and soups. Because of the key place it has in German cooking, it is known as the "Queen of the Kitchen" in that country. This moniker comes from the Germans. It has a lot of untapped promise as a therapeutic substance. The World Health Organization (WHO) recommends eating onions as a way to combat appetite loss and as a preventive strategy against atherosclerosis. Onions are rich in a compound called allicin.

India is the world's second largest producer of onions, with only China producing more than they do. China is the world's largest producer of onions. With an area of 1.94 million hectares<sup>[1]</sup> dedicated to onion farming<sup>[2]</sup>, it is predicted that India would produce around 32 million metric tonnes of onions during the fiscal year 2022<sup>[2]</sup>. The top onion producing states in India are Maharashtra, Karnataka, Madhya Pradesh, Gujarat, Bihar, Andhra Pradesh, Rajasthan, Haryana and Telangana. The state of Maharashtra ranked top in onion production in the year 2020-21 with a share of 39 percent, while the state of Madhya Pradesh ranked second with a share of 17 percent<sup>[3]</sup>. Onion output is greatly impacted by how well water resources on the farm are managed. This is one of the most essential aspects (Kumar *et al.* 2007)<sup>[4]</sup>.

The shortage of accessible water for irrigation is a major factor that is contributing to the global reduction in the total area of land that is used for agricultural purposes. Researchers and farmers have been putting a lot of effort into creating and putting into practise new approaches to the application of water in an effort to reduce the quantity of water that is wasted as a result of waste. The use of sprinkler irrigation systems is widely acknowledged as being among the most efficient methods for applying water. A sprinkler irrigation system is characterised by the fact that it works by delivering water at a relatively high pressure and does so with the aid of a

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pump. It releases water that is comparable to rain via nozzles of a very small diameter that have been inserted in the pipes. These nozzles were installed in the system. It is an innovative strategy with the dual objectives of increasing agricultural yield while simultaneously enhancing the efficiency with which water is used.

Because water is supplied to the plant at a gradual speed over an extended period of time, the plant is able to store the ideal quantity of irrigation that is required for generating the greatest amount of fruit. According to study that was conducted and published in 2012 in the International Journal of Environmental Sciences, the use of sprinkler systems on their own may be up to 63 percent more efficient than the use of flood irrigation (Mehra *et al.* 2012) [5]. In addition, the quantity of water that is used is often decreased by any number between twenty and fifty percent in comparison to the initial quantity. As a direct consequence of climate change, the typical sequences of our rainstorms have been disrupted. Because onion requires irrigation that is both regular and light in order to maintain a high level of soil moisture, producing onions that are profitable and sustainable is closely tied to the method of irrigation. Onion production that is profitable and sustainable is closely tied to the manner in which onion is irrigated. Flood irrigation is problematic for a number of reasons, including the fact that it may result in difficulties with soil erosion and an increased vulnerability to bulb diseases. As a result of these problems, the yield and market grade of the crop can both suffer. Taking all of this into consideration, we came to the conclusion that the best way to determine whether or not it would be feasible to cultivate onions with the help of a spray watering system would be to execute this experiment on onions.

## 2. Methodology

### 2.1 Selection of study area

The present study was conducted in southern Haryana. Multistage sampling design was adopted in selection of districts, blocks, villages and onion growers. In the first stage, Rewari and Bhiwani districts of Haryana state were selected purposively for the study, on the basis of high rate of adoption of sprinklers as there is scarcity of water in the area. From each district, two blocks with highest number of sprinklers were purposively taken for the study. These were Tosham and Loharu in Bhiwani district and Khol at Rewari and Nahar block in Rewari district. From the selected blocks in each district, a list of all the villages in a block was prepared separately where sprinkler irrigation system was used by the farmers and two villages randomly from each block was selected for further sampling. Thus, a total of 45 onion farmers from various villages were taken for the study. The primary data for 2021-22 was collected using survey method by conducting personal interviews of the selected farmers with the help of specially designed schedule.

### 2.2 Analytical tools

To achieve the study's goals, the collected data was analyzed

using various formulas and statistical tools.

- Gross return = Main product value
- Return over variable cost = Gross return – Total variable cost
- Return over total cost (Net return) = Gross return – Total cost
- B:C Ratio = Gross return/Total cost
- Cost of production per quintal = Total cost/Product quantity in quintals

## 3. Results and Discussion

On a per-hectare basis, comparative economic analyses of onion growing using spray irrigation in several areas were carried out. The table 1 provides an overview of the costs and returns associated with cultivating onions in the Rewari and Bhiwani districts of the state of Haryana. It was determined that the total cost would be Rs. 217993.83 per hectare in the Rewari district, and Rs. 207634.36 in the Bhiwani district. The different selling destinations of the producers in each area are the reason of the significant gap in the transportation costs between the two districts. Farmers from Rewari are selling their harvest at the markets in Delhi and Gurugram, where they are receiving a price of Rs. 6000 per round and Rs. 3500 per round respectively.

Whereas farmers in Bhiwani are selling their products in the local marketplaces, where the price is 800 rupees for Loharu and 2500 rupees for Bhiwani correspondingly. When onions were grown in Rewari and Bhiwani districts, respectively, the total variable costs accounted for 63.04 percent (Rs. 137438.20/ha) and 64.09 percent (Rs. 133083.47/ha) of the total cost incurred. The total variable costs and total costs that were observed came to a total of Rs. 135260.80 and Rs. 212814.10 respectively across each of the districts. Seed cost, harvesting cost, nursery rearing and transplanting cost, and irrigation costs contribute 11.86, 11.51, 11.10, and 6.85 percent of the total cost, respectively, according to the overall average of the primary components of variable cost. In the same vein, the primary components of fixed costs, in descending order, are the rental value of land, transportation charges, management charges, and risk factor, which accounted for 13.42, 10.29, 6.35, and 6.35 percent of the overall cost, respectively.

The yield that was achieved in Rewari was 297.60 quintals per hectare, whereas the yield that was obtained in Bhiwani was 290.52 quintals per hectare. Whereas it was determined that the gross return for Rewari was 344156.30 rupees per hectare, whereas the gross return for Bhiwani was predicted to be 292434.20 rupees per hectare. When compared to Bhiwani, Rewari's net return was much greater, coming in at 1,26162.47 rupees per hectare, whereas Bhiwani's came in at 84799.84 rupees per hectare. Sprinkler irrigation systems were shown to be advantageous in onion growing in the research region. The Benefit cost ratio (B:C ratio) was obtained for Rewari at 1.59 and for Bhiwani it was 1.40. This demonstrates that sprinkler irrigation systems should be used.

**Table 1:** Economic analysis of onion crop grown under sprinkler irrigation system in southern Haryana (₹/ha)

Sr. No.	Particulars	Rewari			Bhiwani			Overall Average		
		No./Qty	Value	Percent	No./Qty	Value	Percent	No./Qty	Value	Percent
1	Preparatory tillage	4.37	6562.50	3.01	4.26	6342.10	3.05	4.31	6452.30	3.03
2	Pre sowing irrigation		1188.33	0.54		1159.47	0.55		1173.90	0.55
3	Nursery raising & Transplanting		24132.50	11.07		23131.58	11.14		23632.04	11.10
4	Bed preparation		1619.79	0.74		1690.78	0.81		1655.28	0.77
5	Seed (kg)	8.33	24750.00	11.35	8.55	25746.71	12.40	8.44	25248.36	11.86
6	Total Fertilizer Investment	418.79	11536.98	5.29	401.28	10723.69	5.16	410.03	11130.34	5.23
7	Irrigation	12.45	14891.67	6.83	12.31	14279.61	6.87	12.38	14585.64	6.85
8	Hoeing/Weeding	1.58	9739.95	4.46	1.57	8526.31	4.10	1.57	9133.13	4.29
9	Plant Protection	2.16	2415.62	1.10	1.63	1815.78	0.87	1.89	2115.70	0.99
10	Harvesting		24937.50	11.43		24078.95	11.59		24508.23	11.51
11	Loading & Unloading Charges		6672.08	3.06		6882.10	3.31		6777.09	3.18
12	Interest on working capital @7%		8991.28	4.12		8706.39	4.19		8848.83	4.15
13	Total Variable Cost		137438.20	63.04		133083.47	64.09		135260.80	63.55
14	Management Charges		13743.82	6.30		13308.34	6.40		13526.08	6.35
15	Risk factor		13743.82	6.30		13308.34	6.40		13526.08	6.35
16	Transportation charges		24840.91	11.39		18986.84	9.14		21913.88	10.29
17	Rental value of land		28177.08	12.92		28947.37	13.94		28562.23	13.42
18	Total costs		217993.83	100		207634.36	100		212814.10	100
19	Production (Qtl)	297.60	344156.30		290.52	292434.20		294.06	318295.30	
20	Return over variable cost		206718.10			159350.73			183034.40	
21	Net return		126162.47			84799.84			105481.20	
22	Cost of production		732.50			714.69			723.59	
23	B:C Ratio		1.57			1.40			1.48	

#### 4. Conclusions

The research came to the conclusion that in a comparative economic analysis, the estimated total cost, gross return, net return, and B:C ratio of onion cultivation were as follows: Rs. 217993.83, Rs. 344156.30, Rs. 126162.47, and 1.57 respectively in the Rewari district, and Rs. 207634.36, Rs. 292434.20, Rs. 84799.84 and 1.40 respectively in the Bhiwani district. In the Rewari district, the estimated total cost was higher than the Bhiwani. When compared with their counterparts in the Bhiwani district, farmers in the Rewari district were successful in harvesting a bigger number of onions.

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