https://doi.org/10.48047/AFJBS.6.14.2024.626-641

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Economic Analysis of Onion (*Allium cepa L.*) Cultivation and It's Constraints in the Western Undulating Agroclimatic Zone of Odisha, India

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**OUAT: Odisha University of Agriculture and Technology, Bhubaneswar

Volume 6, Issue 14,2024

Received: 10 JULY 2024

Accepted: 31 JULY 2024

Published: 02 AUG 2024

doi:10.48047/AFJBS.6.14.2024.626-641

ABSTRACT

India produces onions, one of the agricultural products that is closely monitored. This crop has several personalities; it makes traders happy, farmers fear, and customer's tear. In order to gather primary data, a multi-stage selection strategy was used to choose 90 onion farmers at random from two districts and 6-GPsin the study area. The Rabi season of the agricultural year 2022–2023 was the subject of the data that was collected. The absence of suitable storage facilities and technological know-how, the high cost of labour, the scarcity of high-yielding seed, and the higher input costs in the study area were some of the primary issues that the onion growers had to deal with. Overall, per hectare gross return (GR), gross margin (GM), and net return (NR) were found to be Rs. 116590.44, Rs. 51943.73, and Rs. 26869.58 respectively in the study area. In Kalahandi district, these figures were found to be Rs. 112860.22, Rs. 47585.71, and Rs. 22140.71, while in Nuapada district, they were Rs. 120320.67, Rs. 56301.78, and Rs. 31598.46 respectively. In Kalahandi district, the average rate of return over variable cost was 1.73, and over total cost was 1.24; in Nuapada district, these figures were 1.88 and 1.36. Whereas, the overall average rate of return over total cost and variable cost was 1.3 and 1.8, respectively. These findings showed that onions are a lucrative crop in both areas when it comes to rate of return on production. The estimated DRCs in Kalahandi and Nuapada were 0.58 and 0.53, respectively, suggesting that Odisha has a comparative advantage over other nations in the production of onions.

Key Words: Onion, comparative advantage, Benefit-Cost ratio, Cost of cultivation.

INTRODUCTION

There are over 500 different species of onions (*Allium cepa L.)* in the northern hemisphere, with the USSR having the most varieties (Wright, 1992). Compared with other fresh vegetables, onions have a higher dietary value than other types, an intermediate protein content, and a high calcium and riboflavin content (Purse glove et al., 2000). Globally, onions are grown on an estimated 5.4 million hectares of land and produce 104.5 million tons of onion per year (FAO, 2020). The top five nations in the world that produce onions are Egypt, Turkey, China, India, and the United States. India leads the world in area (1.4 million hectares) according to FAO statistics (2020), with China coming in second (1.08 million hectares). India leads the world in onion output with 26.7 MT, followed by China with 23.7 MT (FAO, 2020). India is the world's greatest producer of onions, although its productivity is far lower than its peers. According to Beniwa, A. et al. (2022) the Republic of Korea has the greatest onion productivity in the world, at 79.61 tonnes/ha, followed by Australia (54.66 tonnes/ha), Spain (52.10 tonnes/ha), and Japan (49.31 tonnes/ha). India's daily diet largely consists of onions, which are cultivated and consumed across the nation (Premi, S., & Premi, B. R.,2017). After Spain and the Netherlands, India is the third-largest exporter (Horticulture Statistics, 2021) in onion. India leads the globe in the overall area under onion cultivation and produces 21.0% of the crop worldwide. In India, onions play a significant role in the everyday diet and are farmed and consumed throughout the nation. The world has a great demand for Indian onions. The Ministry of Commerce and Industry reports that in 2022–2023 the nation exported 2,525,258.35 MT of fresh onions to the world, valued at Rs. 4,522.79 crores (Horticulture Statistics, 2021). One of the most important and lucrative vegetable crops is the onion (Allium cepa), which is utilized as a spice in Indian daily meal. Besides India, it has also huge demand all over the world. It can be used in both mature and immature level as vegetable and spices, and increases the taste of food by its flavor that contains protein, calcium, carbohydrates and vitamin C (Dorrigiv, M. et al., 2021). It is also used as medicine to recover from insect injury and raw throat (Bose and Som, 1990). Some research have been conducted sporadically on the adoption practices and cultivation of onion (Anik, and Salam, 2015), economic assessments such as profitability, gross margin (Mahmood, 1995; Shaha, 1999; Hasan, 2010; Haque et al., 2011; Miah and Rashid, 2015; Bapari et al., 2016; Grema and Gashua, 2014), measurement of technical efficiency (Baree, 2012; Haile, 2015; Mari and Lohano, 2007; Banai et al., 2013), constraints to production and marketing (Ali et al., 2015).Meena et al. (2021) conducted an analysis of the Cost-Net Return and Cost Benefit Ratio of onions in Rajasthan, whereas Shivam et al. (2023) examined the production,

marketing, and storage constraints in Haryana's onion agriculture. Less focus has been paid to the assessment of onion production's profitability, comparative advantages, challenges, and future possibilities in India. As a result, the current study evaluates the comparative advantage, financial profitability, and economic profitability of onion production. It also examines the issues and the potential of onion production in the research region. Therefore, the findings of the study will help the policy makers and researchers to make appropriate policies and suggestions for the further development of onion production in India.

RATIONALE OF THE STUDY

The perishability, fragility, seasonality, and bulkiness of vegetables are widely perceived to make the marketing of these products a complex process. However, measures and program initiatives, such as the adoption of improved pre- and post-harvest technology and water and pest control practices, are expected to not only increase the productivity and quality of individual horticultural crops, but also to increase the total crop area cover, generate adequate surplus quality for conversion into value-added food products, and substantially minimize post-harvest losses. Owing to seasonal supply and inelastic demand, onion prices fluctuate throughout the year. Price fluctuations lead to uncertainty in the prices that consumers pay as well as the income levels of onion growers. The low share of producers in the consumer’s rupees, particularly during high production and arrival period has been a matter of serious concern for policy makers in IndiaA stabilization scheme requires an understanding of price changes.It provides the government procurement agency with some guidance on when purchases should be made. It is beneficial to farmers since it gives them advice on where and when it will be most profitable for them to dispose of their produce.In the past, various attempts have been made to investigate economic analysis of onion production by Anik, and Salam, 2015 and economic assessments such as profitability, gross margin(Mahmood, 1995; Shaha, 1999; Pajankar et al., 2000, Hasan, 2010; Haque et al., 2011; Miah and Rashid, 2015; Bapari et al., 2016; Grema and Gashua, 2014, Meena et al. 2020). And also, measurement of technical efficiency (Baree, 2012; Haile, 2015; Mari and Lohano, 2007; Banai et al., 2013)& constraints to production and marketing (Ali et al., 2015).Therefore, the above study was undertaken in the western undulating agroclimatic zone of Odisha, India with the following objectives.

OBJECTIVES

1. To analysis the cost, returns and yield gap of onion cultivation of sample farmers.
2. To ascertain the problems experienced by the onion growers and their suggestions.

REVIEW OF LITERATURE

Goyal (2011) reported that the cost of onion cultivation for different level of technology used and on the basis of different cost concepts, the data on cost of cultivation per hectare on sample holding revealed that the average cost A_1 comes to Rs.17341.52. This cost was found to be greater in the farm with a high adoption level, at Rs. 18999.01, compared to Rs. 15684.04 in the farm with a low adoption level. Due to the careful and increased use of inputs and the corresponding evolution in cost during the manufacturing process, onion production costs increased in the high technological adoption phase.

Vishnu S. M. et al.; 2021 reported that the cost of production, and profitability analysis of onion cultivation in the selected districts of Rajasthan. It shows cost and return per hectare of onion produced in the study area, which reveals that the total cost of cultivation was Rs. 75016.00 per hectare. Furthermore, the cost of fertilizer was Rs. 14234.00 per hectare, Rs. 6192.00 for transplanting, Rs. 4322.00 for weeding and hoeing, and Rs. 7825.00 per hectare for harvesting. This could be due to labour intensive nature of the enterprise. The results indicated that land preparation and rising nursery were also cost intensive operations in growing onion. The net return per rupee invested was found to be 1.71. Hence, the cost and return analysis indicated that onion production in the study area was profitable.

Sangam, Vaishnavi and Aski, S.G. (2018) reported that constraints faced by onion growers in adopting improved practices and suggestions from onion growers to overcome constraints. It was conducted in Vijayapur district of North-Karnataka during 2017- 18. The findings of the study revealed that cent per cent of the respondents faced the constraint of fluctuations in market prices, followed by scarcity and high cost of labour (86.67%), problem of electricity (81.33%), Lack of proper market (78.67%), High commission rates of middle men and commission agents (66.67%). Cent per cent of the respondents suggested that market price should be high, followed by timely input availability at cheaper rate (73.33%), availability of proper market to sell their produce (66.67%), availability of efficient credit facilities to meet crop production expenses (61.33%)

Shivam et al.; 2023 revealed that in production major constraints were high cost of seed (70.00, 93.33 and 83.33%), lack of knowledge about seed/ seedling treatment (70.00, 86.66 and 80.00%) and lack of knowledge about proper harvesting time (93.33, 53.33 and 90.00%).

METHODOLOGY

Primary and secondary data sources were used in this study, depending on the goals of the investigation. The districts of Kalahandi and Nuapada were specifically chosen

because, like other parts of Odisha, a significant portion of its farmers cultivate onions during the winter. In addition, the soil, climate, and surroundings are favourable for the production of onions. Ninety farmers in all, forty-five from the districts of Kalahandi and Nuapada, were chosen at random and conducted in-person interviews. Using a structured questionnaire covering the crop calendar for 2021, the relevant data regarding inputs and outputs on onion production was collected.

Analytical techniques

To estimate the cost of onion cultivation, the following equations were used:

$VC = \sum XiPi$, $TC = VC + FC$

Where, TC = Total cost of onion production Rs/ha) VC = Variable cost of onion (Rs /ha) FC = Fixed cost of onion (Rs /ha) Xi = Quantity of inputs (Kg/ha) except irrigation and pesticides; irrigation and pesticides used as (Rs /ha) for onion production Pi = Price of inputs (Rs /kg) used for onion

To estimate the profitability of onion production, the following equations were used:

$Gross\ return\ (GR) = \sum Y\ P$, $Net\ return\ (NR) = GR - TC$, $Gross\ margin\ (GM) = GR - VC$,

Benefit Cost Ratio (BCR)

The benefit-cost ratio (BCR) is a financial indicator of how a project's costs and benefits relate to one another. A greater BCR denotes a higher production return. Usually, BCR is computed using total cost. However, variable cost was also employed to determine BCR. The benefit-cost ratio (BCR) was calculated using the following formulae.

$Benefit\ cost - ratio\ (BCR) = \frac{GR}{TC}$, Where, GR = Gross return from onion (Rs/ha), NR = Net return from onion (Rs/ha), GM = Gross margin from onion (Rs/ha) Y = Quantity of output of onion (Kg/ha)

P = Price of onion (Rs/kg)

Domestic Resource Cost (DRC)

The calculation of Domestic Resource Cost (DRC) was utilized to determine the onion production efficiency in relation to comparative advantage. To save foreign exchange, it calculates the ratio of its inputs' shadow value to its outputs' domestic value. The domestic resource cost (DRC) of producing onions was calculated using the formula below (Bruno, 1965; Krueger, 1966; Monake, 1981):

DRC $= \frac{\sum D_i V_i}{B - \sum T_i V_i}$, Where, Di = Quantity of domestic resources and nontraded inputs for onion production per metric ton Vi = Price of domestic resources and non-traded inputs for onion production (Rs/mt), B = Border price of onion (Rs /mt), Ti = Quantity of tradable inputs for

onion production per metric ton and Vi = Border price of tradable inputs for onion production (Rs/mt). If domestic resource cost is less than one (DRC<1), benefits are negative; the country should not produce the crop domestically and should rather import.if domestic resource cost is greater than one (DRC>1), benefits are negative; the country should not produce the crop domestically and should rather import.

RESULTS AND DISCUSSION

Resource use level of Onion

The information on per hectare utilization of different inputs for Kalahandi district of India state of Odisha is presented in Table 1 Human labour According to the table, the total human labour used in Kalahandi district was 71.29-man days per hectare, with 27.00 male labour days and 44.29 female labour days. In a similar vein, the total human labour used for onion production was 74.47-man days per hectare, with 28.76 male labour days and 45.71 female labour days in the Nuapada district. The overall utilization of human labour was 72.88 per hectare, with 27.88 male labour days and 45.00 female labour days in the Kalahandi district of Odisha, India. This leads us to the conclusion that female human labour was required more than male labour in both parts of the study area, although labour efficacy is higher in the Nuapada district of the study area. Bullock power Overall, 15.39 pair days of bullock power were used per hectare, of which 15.11 pair days were used in the **Kalahandi** district and 15.67 pair days in the Nuapada district. In the Kalahandi district, the Category II (>1 ha) of holding (16.44 pair days) size group of holdings utilized bullock power more per hectare than the Category I ($\leq$ 1 ha) size group holdings had higher per-hectare bullock power use (4.25 hrs) than category I ($\leq$ 1 ha) size group (10.87 kg) than in the category I ($\leq$ 1 ha) size group (10.42 kg). The per acre consumption of seeds was higher in the Kalahandi district(10.65 kg) than in the Nuapada district (10.43 kg) of Odisha's Kalahandi district. The utilization of manure was 221.11 q/ha on an overall basis. More Category I group of holdings than Category II (>1 ha) size group of holdings used manure. Nitrogenous, phosphorus, and potash chemical fertilisers were used per hectare at the overall level at 136.73, 58.59, and 53.33 kg/ha, respectively. A little bit more fertiliser was used than what was advised. More fertiliser had been used by category II size group farmers than category I size groups. Irrigation and plant protection charges Irrigation fees per hectare were higher in category II (Rs. 10300/ha) than in category I (Rs. 9213.08/ha).The total cost of the plant protection fees was Rs 2307.23/ha. Utilization of plant protection per hectare showed a tendency toward

growth as holding sizes increased. More holdings in the category II size group used plant protection.

Cost of cultivation of Onion

Standard cost concepts were used to determine the cost of growing onions per hectare. Information on various costs associated with growing onions in the Kalahandi and Nuapada districts of Odisha have been provided in Table 2 for holdings of various sizes. As can be seen, the overall cost of cultivating onions per hectare, or Cost Cwas Rs 89720.86. Hired human labour accounted for the majority of the costs, accounting for Rs. 21221.67 (23.65%), followed by seed cost Rs. 13167.66 (14.68%), irrigation charges Rs 9515.00 (10.61%), depreciation on farm implements Rs 7757.6 (8.65%), family labour (men and women) Rs. 6435.37 (7.17%) plant protection Rs. 6416.00 (7.15%), interest on working capital Rs. 5171.74 (5.76%), bullock labour Rs. 5001.67 (5.57%), rental value of land Rs. 4761.11 (5.31%), manure Rs 2745.59 (3.06%), machine power Rs. 2165.83 (2.41%), potassium fertiliser Rs. 1536.8 (1.71%), phosphorus fertilizers Rs. 1510.05 (1.68%), nitrogenous fertiliser Rs. 1366.44 (1.52%), interest on fixed capital Rs. 833.33 (0.93%) and land revenue Rs. 115.00 (0.13%). Of the total cost of cultivation of Onion, Cost ‘A’ was Rs. 77691.05 (86.59%) and Cost ‘B’ was Rs. 83285.50 (92.83 %).

The per ha total cost of cultivation at cost "C" for one hectare of onion was Rs. 88580.38 and Rs. 92686.13 for Category I and Category II groups of holdings, respectively. On all types of sample farms, it has been observed that there was a substantial variability in the use of different inputs, which caused a large variation in the cost of growing onions in the two types of farms under study. Large farmers have easy access to capital and may borrow money from banks, which results in stronger resource utilization and, ultimately, higher agricultural production than other farmers, making it noteworthy that it was higher for large groups of holdings. The gross income per hectare for holdings in categories I and II was, respectively, Rs. 115071.35 and Rs. 120540.10. It produced an average of 125.34 quintals of onions per acre, amounting to Rs 116590.44. for the Category I and Category II groupings of holdings, the yield per hectare was 123.90 and 129.06 quintals, respectively. It demonstrates that when holding size increased, onion production per hectare increased as well. Compared to the category I size group of farms, the category II size group of farms had a greater per-hectare profit at cost C (Rs 27853.97 vs Rs 26490.97). Both the category I and category II groups had the same benefit-cost ratio at Cost "C." The benefit cost ratio was 1.30 overall. An at all cost and group level, the benefit-cost ratio was more than unity, demonstrating the economic viability of onion cultivation in the research area.

Table 1: Resource use level of onion growers per ha in the study areas

		Kalahandi			Nuapada			Overall		
		Category I (n=35)	**Category II (n=10)**	**Pooled**	**Category I (n=30)**	**Category II (n=15)**	**Pooled**	**Category I**	**Category II**	**Pooled**
Sl. No.	**Particulars**	**<1 ha**	**>1 ha**		**<1 ha**	**>1 ha**		**<1 ha**	**>1 ha**	
1	Human labour (Days)	70.12	75.4	71.29	72.4	78.6	74.47	71.17	77.32	72.88
	a. Male	26.93	27.29	27	30.41	25.47	28.76	28.53	26.2	27.88
	b. Female	43.19	48.11	44.29	41.99	53.13	45.71	42.64	51.12	45
2	Bullock labour (pair days)	14.8	16.2	15.11	15.2	16.6	15.67	14.98	16.44	15.39
3	Machine power (hrs.)	4.2	4.32	4.23	4	4.2	4.07	4.11	4.25	4.15
4	Seeds (kg)	10.6	10.82	10.65	10.2	10.9	10.43	10.42	10.87	10.54
5	Manure (q)	210	190	205.56	250	210	236.67	228.46	202	221.11
6	Fertilizers (Kg)									
	i) Nitrogen	132.5	140.4	134.26	138.4	140.8	139.2	135.22	140.64	136.73
	ii) Phosphorus	60.1	65.1	61.21	55.2	57.5	55.97	57.84	60.54	58.59
	iii)Potassium	50.6	55.8	51.76	54.8	55.1	54.9	52.54	55.38	53.33
7	Irrigation Charges (in Rs)	9550	10375	9733.33	8820	8820	10250	9296.67	10300	9515
7	Plant protection charges (in Rs)	6304.57	6442	6335.11	6403	6684.67	6496.89	6350	6587.6	6416

Table 2. Structure of cost of onion production in the study areas

Value (in Rs)

		Koraput			Nuapada			Pooled		
Sl. No	Cost items	Category I	Category II	Overall Average	Category I	Category II	Overall Average	Category I	Category II	Overall Average
1	Hired Human labour									

	a) Male	8894.64	11714.76	9521.34	7697.06	8261.61	7885.24	8341.92	9642.87	8703.29
	b) Female	12033.93	15402.74	12782.55	12558.36	11645.89	12254.20	12275.97	13148.63	12518.38
2	Bullock labour	5023.21	4942.50	5005.27	5017.50	4959.17	4998.06	5020.57	4952.50	5001.67
3	Machine power (hrs.)	1891.43	2616.25	2052.50	2263.33	2310.80	2279.16	2063.08	2432.98	2165.83
4	Manure (q)	2679.29	2915.00	2731.67	2644.92	2988.67	2759.50	2663.43	2959.20	2745.59
5	Seeds (Kg)	13018.14	12196.37	12835.52	13579.83	13339.72	13499.79	13277.38	12882.38	13167.66
6	Fertilizers (Kg)						0.00			
	i. Nitrogen	1345.71	1382.00	1353.77	1358.00	1421.33	1379.11	1351.38	1405.60	1366.44
	ii. Phosphorus	1405.71	1673.00	1465.11	1487.50	1690.00	1555.00	1443.46	1683.20	1510.05
	iii. Potassium	1423.21	1581.25	1458.33	1554.17	1737.50	1615.28	1483.65	1675.00	1536.80
7	Irrigation Charges (in Rs)	9550.00	10375.00	9733.33	8820.00	10250.00	9296.67	9213.08	10300.00	9515.00
8	Plant protection (in Rs)	6304.57	6442.00	6335.11	6403.00	6684.67	6496.89	6350.00	6587.60	6416.00
9	**Working capital (in Rs)**	**63569.84**	**71240.87**	**65274.51**	**63383.67**	**65289.35**	**64018.89**	**63483.92**	**67669.96**	**64646.71**
10	Int.on working Capital	5085.59	5699.27	5221.96	5070.69	5223.15	5121.51	5078.72	5413.60	5171.74
12	Depre.on farm impliments	7628.38	8548.90	7832.94	7606.04	7834.72	7682.27	7618.07	8120.39	7757.60
13	Land revenue and	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00
I	**Cost 'A'**	**76398.81**	**85604.05**	78444.42	**76175.40**	**78462.22**	76937.67	76295.70	81318.95	77691.05
14	Rental value of land	4800.00	5050.00	4855.56	4560.00	4880.00	4666.67	4689.23	4948.00	4761.11
15	Int .on fixed capital @ 10%	750.00	960.00	796.67	840.00	930.00	870.00	791.54	942.00	833.33

II	**Cost 'B'**	**81948.81**	**91614.05**	84096.64	**81575.40**	**84272.22**	82474.34	81776.47	87208.95	83285.50
16	Family labour				0.00	0.00	0.00	0.00	0.00	0.00
	a.Male	3328.90	2567.46	3159.69	2513.29	1956.51	2327.70	2952.46	2200.89	2743.69
	b. Female	3577.53	3062.94	3463.18	4171.00	3418.52	3920.17	3851.44	3276.29	3691.68
III	**Cost 'C'**	**88855.24**	**97244.45**	**90719.51**	**88259.69**	**89647.25**	88722.21	88580.38	92686.13	89720.86
IV	**Output (q)**	**122.51**	**129.30**	**124.02**	**125.53**	**128.90**	126.65	123.90	129.06	125.34
V	**Gross income @910/qtl.**	**111488.00**	**117663.00**	**112860.22**	**119251.92**	**122458.17**	120320.67	115071.35	120540.10	116590.44
VI	**Per quintal cost**	**725.26**	**752.08**	**731.22**	**703.11**	**695.46**	700.56	715.04	718.11	715.89
VII	**B:C ratio**									
	i) Cost ‘A’	1.46	1.37	**1.44**	1.57	1.56	**1.56**	1.51	1.48	**1.50**
	ii) Cost ‘B’	1.36	1.28	**1.34**	1.46	1.45	**1.46**	1.41	1.38	**1.40**
	iii) Cost ‘C’	1.25	1.21	**1.24**	1.35	1.37	**1.36**	1.30	1.30	**1.30**

Table 3. Profitability of per hectare onion production in the study areas

Sl. No.	Particulars	Koraput	Nuapada	Pool	t-ratio
1	Yield (Kg/ha)	**12402.00***	12665.00*	12534.00*	-1.44
2	Gross return (Rs /ha)	112860.22*	120320.67*	116590.44*	-1.21
3	Total variable cost (Rs /ha)	**65274.51***	**64018.89***	**64646.71***	-1.40
4	Total cost (Rs /ha)	**90719.51***	88722.21*	89720.86*	-1.22
5	Gross margin (Rs /ha) (2-3)	47585.71*	56301.78*	51943.73*	-0.71
6	Net return (Rs /ha) (2-4)	22140.71*	31598.46*	26869.58*	-0.68
7	**Rate of return (Rs /ha)**				
A	Over variable cost (2/3)	1.73*	1.88*	1.80*	1.28
B	Over total cost (2/4)	1.24*	1.36*	1.30*	1.11

Note: *** represents statistically significant at 1% level.

The information in Table 3 also shows that, in the Kalahandi district, the average rate of return over variable cost was 1.73, and the average rate of return over total cost was 1.24; in the Nuapada district, these values were 1.88 and 1.36. Additionally, the overall average rate of return over total cost and variable cost was 1.3 and 1.8, respectively. These findings showed that onions are a profitable crop in both areas when it comes to rate of return on production. In Kalahandi, the average production of onions was estimated to be 12402.00 kg, while in Nuapada district, it was 12665.00 kg. And overall, average yield of onion was estimated at12534.00 kg.The yield, gross return, total cost, gross margin, net return, and rate of return over variable and total cost of onion production were significantly varied (statistically significant at 1%) within the sampled producers in both Kalahandi andNuapada district. However, there were no significance mean difference exists between the producers in Kalahandi and Nuapada district.

Analysis of comparative advantage of onion production based on DRC method

A country has a comparative advantage when it can produce a particular crop at lower cost than any other county. A nation ought to produce more of the items whose relative costs of production are lower there. On the other side, it ought to decrease the manufacturing of things that can be imported at a more affordable cost. To determine the comparative advantage of onion production in the nation, the prices set by domestic producers were taken into account as the farm gate prices of onions, while the prices of onions imported were taken into account in world prices. The production of onions has a comparative advantage, as indicated by the domestic resource cost (DRC). When the cost of domestic resources exceeds unity, there are negative production advantages and foreign exchange losses from home output. The nation can grow the crop domestically and save foreign exchange if the cost of

domestic resources is less than one. Table 4 displayed the domestic resource cost (DRC) of producing onions in Kalahandi and Nuapada. In Kalahandi district, the predicted DRC for onion production was 0.58, whereas in Nuapada district, it was 0.53. In both districts, the DRC of the onion crop is less than one. It means that Odisha has comparative advantage in producing onion.

Table 4. Economic profitability and domestic resource cost of onion production

Sl No.	Particulars	Koraput	Nuapada
1	Cost of inputs (traded)*	0.00	0.00
2	Costs of inputs (non-traded Costs of inputs (non-traded	65274.51	64018.89
3	Total cost of input (A+B)	65274.51	64018.89
4	Price of output**	112860.22	120320.67
5	Net profit (4-3)	47585.71	56301.78
6	BCR (4/3)	1.73	1.88
7	Value added (tradable) (4-1)	112860.22	120320.67
8	DRC (2/7)	0.58	0.53

In an earlier study, Miah and Rashid (2015) conducted research on profitability and comparative advantage of oilseed production in Bangladesh, where they used DRC method to evaluate the comparative advantage of oilseeds in Bangladesh. They found that Bangladesh has comparative advantage of producing oilseeds. Yercan and Isikli (2009) conducted research on domestic resource cost (DRC) approach for international competitiveness of Turkish horticultural products, where they used DRC to estimate the competitive advantage of Turkish horticultural sector. They found that tomato and tangerine production were more competitive between 2000 and 2004.

Marketing constraints associated to onion marketing in study area

Table 5: Marketing constraints associated to onion marketing in study area

Sl. No.	Problems reported by the farmers	Total no. of Respondent	Total Score	Total Mean	Rank
1	High transportation cost	90	4691	52.12	III
2	Low price of onion during peak season	90	4275	47.50	IX
3	Lack of good storage Facilities	90	4718	52.42	II
4	Fluctuations in market price	90	4821	53.57	I
5	Delaying on payment by traders	90	4686	52.07	IV
6	Non availability of market	90	4654	51.71	V

	information				
7	Lack of appropriate credit facilities	90	4518	50.20	VIII
8	Open auction sale fetches low price for onion produce	90	4569	50.77	VI
9	Existence of large number of intermediaries in marketing process	90	4566	50.73	VII

The entire situation of onion farmers' marketing challenges suggests that fluctuation in market price of the onion was a big marketing concern (Table 4.22). This had an impact on the supply and demand for the produce. The farmer's problem of a lack of appropriate storage facilities in the mandi was placed second. Because the farmers were unable to return the food to their community owing to high transportation costs, they were forced to sell the goods at whatever price was available at the time. Thus, high transport cost came at third place in the ranking of problems of onion farmers. Farmers have also complained about delay on payment by traders; this is the third significant issue in the research region. It resulted in late sowing of the next crop and lead to unavailability of capital for next season gradually. Fifth rank difficulty mentioned by farmers in marketing is non-availability of market information at proper time. Farmers couldn't get the supply and demand rate of onion in market and thus couldn't sell their produce for a better and deserving price. The sixth key marketing concern in the research region was open auction sale of the produce which led to low prices of onion in market, due to which the profit earned by the farmers were lower. The seventh issue raised by farmers was the existence of high number of intermediaries in marketing process which results in no contact of farmers with the wholesalers and also reduction in selling price of produces. Lack of appropriate credit facilities was the eighth problem described by the farmers in the area. It was mainly caused due to lower literacy level of onion growers and also higher time taking process of credit granting facilities. According to farmers, low pricing of onion during the peak season was the ninth and last problem for the onion farmers in Kalahandi. Although the price of onion was less during peak season, but it was still profitable for farmers.

CONCLUSIONS AND POLICY IMPLICATIONS

Overall, per hectare gross return (GR), gross margin (GM), and net return (NR) were found to be Rs. 116590.44, Rs. 51943.73, and Rs. 26869.58 in the study area respectively. In Kalahandi district, these figures were found to be approximately Rs. 112860.22, Rs. 47585.71, and Rs. 22140.71, while in Nuapada district, they were approximately Rs.

120320.67, Rs. 56301.78, and Rs. 31598.46. In the Kalahandi district, the average rate of return over variable cost was 1.73, and over total cost was 1.24; in the Nuapada district, these figures were 1.88 and 1.36.Additionally, the overall average rate of return over total cost and variable cost was 1.3 and 1.8, respectively. These findings showed that onions are a profitable crop in both areas when it comes to rate of return on production. In Kalahandi, the average production of onions was predicted to be 12402.00 kg, while in Nuapada district, it was 12665.00 kg. Furthermore, an estimated 12534.00 kg of onions were produced on average. Onion production was lucrative in both Kalahandi and Nuapada areas, as evidenced by the BCRs of 1.73 and 1.88 above total costs, respectively. The estimated DRCs in Kalahandi and Nuapada were 0.58 and 0.53, respectively, suggesting that Odisha has a comparative advantage over other nations in the production of onions. It was found that yield disparities are caused by a number of variables, including biological, socioeconomic, physical, and institutional factors. Contract farming, government attention, and participatory research at many levels can all effectively enhance this. Markets have the power to accelerate the spread of technology if they place a stronger emphasis on e-NAM and digital literacy. The majority of producers had numerous issues in their onion production because of the high cost of inputs, the absence of contemporary technology, and market regulation. As a result, the government and policy makers in Odisha state, India, should implement the appropriate policies to support the growth of onion production.

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