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An economic analysis of varietal diversification and market share of paddy in Kabirdham district of Chhattisgarh

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Abstract

The present study was conducted to work out the varietal diversification, to examine the different sources of paddy seed and their market share and cost and returns of different major variety grown by the farmer in Kabirdham district of Chhattisgarh. The survey for specified objective was conducted in Kawardha, Pandariya, Sahaspur lohara, and bodla blocks of Kabirdham district of Chhattisgarh. Data were collected from 126 rice growers, respondents were selected proportionately the grower and stakeholder was chosen from total 8 villages. The primary data were collected from the paddy growers through personal interview method with the help of well-prepared questionnaire for the production and marketing year 2023-2024.

Result should that major grew variety was Arize (Bayer) followed by Swarna, Mahamaya, Safri, MTU1010 and HMT. The total area 259.89 ha. Overall Simpson index wes (0.61) which showed high varietal diversity index in the study area. There were 24 major paddy varieties supplied by different agencies in Chhattisgarh among them 15 varieties were developed by IGKV and contributed (13.35 percent) seed supply of state.

The study reveal that Arize (Bayer) was the most popularized variety in study area The overall cost of cultivation of Arize (Bayer) 67083.82 Rs/ha. The overall gross income with bonus was 201302.38 rs/ha, the overall input-output ratio was 1:3.07 and the overall BC ratio was 2:0.7 with bonus

Keywords: Paddy varietal diversification, paddy seed source, market share, simpson index, BC ratio, input output ratio, gross return, net return, cost concept.

Introduction

Rice (*Oryza sativa*), is a monocot plant in the poaceae family of grasses. It is a member of the genus Oryza. Over 60% of. The world popolation heavy an rice as a staple diet making it the most widely grown crop globally 738.20 million tonnes of rice across 167.25 million hectares, The won produced an impressive its importance in agricultural economies worldwide (Anonymous (a), 2018).

India, the second-largest Rice producer after China, The global rice market. 46.37 million hectares, yieldiThis marks a progressive increase fromng around 130.29 million tonnes each year (Directorate of Economics and Statistics, DAC&FW, 2022). The introduction of high- yielding rice varieties like IR 64, CR 2301, and Kudrat 5 has led to significant boosts in both production and productivity. India is a top exporter of rice, the exports reaching 17.78 million metric tonnes in 2022-23. The leading rice-producing states include West Bengal, Uttar Pradesh, Punjab, and Chhattisgarh, among others.

In 2023-24 Chhattisgarh reaffirmed its status as the "Rice Bowl of India," has a rich history of paddy farming, with rice being cultivated on about 13.72 lakh hectares and contributing nearly 10 million tonnes to the state's agricultural output. Thanks to its favorable climate and fertile soil, The region is perfect for extensive rice cultivation, especially in districts like Bemetara, Mahasamund, and Bilaspur. Institutions like Indira Gandhi Krishi Vishwavidyalaya (IGKV) in Raipur have worked hard to develop various rice varieties aimed at boosting productivity and sustainability, This like Swarna and Mahamaya, have really taken off. In Chhattisgarh, the Kawardha area is particularly notable for its rice production.

Methodology

This survey for specified objective was conducted in Kawardha, Pandariya, Sahaspur lohara and Bodla blocks of Kabirdham district of Chhattisgarh data were collected from 126 rice growers responedents were selected proportional. It the growers and stakholders was choosen from total 8 villages Arize (buyer), swarna, mahamaya, safri, MTU-1010, HMT has been selected for study on the basis of maximum cultivation in the study area. The primary data were collected from the paddy growers through personal interview method with the helpof well prepared questionnaire for the production and marketing year 2023-24. The data collected were analyzed using simple average and percentage and presented in tabular form and cost and return cost concept were used and for diversity index simpson index was used.

Diversity Index

Simpson Index

The diversity index technique was used to analyze the varietal diversification of paddy in the study area. These two indices are the most common indices used to explain diversification.

$$VDI = 1- \sum (aij/Ai)2$$

Where, aij = Area planted to the jth variety by the ith farmer Ai = Total rice area planted by the ith farmer.

1. Costs concept

Despite the costs & return was worked out by old concepts, a standard method of cost of cultivation of paddy was also used. This method is accepted by The Commission of Agricultural Costs and Prices (CACP). Under this method, the cost of cultivation was computed by using the 7 Cost concepts, which are known as cost A1, cost A2 cost B1, cost B2 and cost C1, cost C2, and cost C3. Cost A1: Consist of following 16 items of costs -

1. Value of hired human labour (permanent and casual)
2. Value of owned bullock labour
3. Value of hired bullock labour
4. Value of owned machinery
5. Hired machinery charged
6. Value of fertilizers
7. Value of manure (produced on farm and purchased)
8. Value of seed (both farm-produced and purchased)
9. Value of insecticides and fungicides.
10. Irrigation charges (both of the owned and hired tube wells, pumping sets *etc*.)
11. Canal-water charges
12. Land revenue, cesses and other taxes
13. Depreciation on farm implements (both of the bullock drawn and worked with human labour)
14. Depreciation on farm building, farm machinery.
15. Interest on the working capital.
16. Miscellaneous expenses (wages of artisans, and repairs to small farm implements)

Cost A2 = Cost A1 + Rent paid for Leased in Land.
Cost B1 = Cost A1 + Interest on value of Owned fixed Capital assets (excluding land) Cost B2 = Cost B1 + Rental value of owned land
Cost C1 = Cost B1 + Imputed value of Family Labour. Cost C2 = Cost B2 + Imputed value of Family labour.
Cost C3 = Cost C2 + 10 per cent of cost C2 taking as managerial allowances.

Income over different cost

Income over cost A1 = Gross Return - Cost A1 Income over cost A2 = Gross Return - Cost A2 Income over cost B1 = Gross Return - Cost B1 Income over cost B2 = Gross Return - Cost B2 Income over cost C1 = Gross Return - Cost C1 Income over cost C2 = Gross Return - Cost C2 Income over cost C3 = Gross Return - Cost C3.

Net income

It is the difference between total return and total expenses.
So, Net income = Gross income - Total expenses Input - output ratio It is the ratio of input and output, which is an under

Input - Output Ratio = Value of output / Value of input used

Cost of production per quintal

It is a total cost of cultivation divided by production of paddy. It is mentioned as Cost of production (Rs/q) = Total cost of cultivation / Production (output)

Results and Discussion

1. Varietal diversification of paddy

A total of 126 farmers who grow paddy are chosen in order to accomplish varietal diversification of paddy. Among all 70 farmers grow single variety, wheres 32 farmers grow two varieties, and 24 farmers grow more than two varieties in this instance. table 1 shows the name of the variety used by farmers in different situations. In which the major variety name is Arize (Bayer) followed by Swarna, Mahamaya, HMT, Safri, MTU- 1010 in the basis of higher area coverd.

Table 1: Varietal diversification of paddy in the study area

Sl no.	Number of farmers growing single variety	Variety name and number of farmers growing two variety	Variety name and number of farmers growing more than two variety
	70	**32**	**24**
1	Arize (bayer) (34)	Arize (bayer) (18)	Arize (bayer) (12)
2	Swarna (31)	Swarna (11)	Swarna (6)
3	Mahamaya (5)	Mahamaya (3)	Mahamaya (3)
4			Safri (1)
5			1010 (1)
6			HMT (1)

Table 1 showed among the farmers who were growing single variety at time.
34 farmers grew Arize (Buyer) followed by Swarna by 31 and Mahamaya by 5 farmer along kharif seasons of two varieties total 32 farmers were growing two varieties at time in which 18 farmers grew Arize (Buyer) as a major variety either with Swarna, Mahamaya or other variety in the study area followed by safri by 1 and MTU1010 by 1 variety in case of 3 variety.

Table 2: Varietal diversification of paddy as per area coverage

Sl. No.	Variety name	Area (ha.)	No. of farmers
1	Arize (Bayer)	131.88	64
		(50.74)	(50.79)
2	Swarna	93.66	48
		(36.04)	(38.09)
3	Mahamaya	19.30	11
		(7.43)	(8.73)
4	Safri	5.89	1
		(2.26)	(0.79)
5	1010	1.43	1
		(0.56)	(0.79)
6	HMT	7.73	1
		(2.97)	(0.79)
Total		259.89	126
		(100.00)	(100)

*Figure in the parenthesis are percentage to total area and no of farmers

Table 2 show that the area covered by major variety based on landholding of sampled farmers. The survey shows that the area covered by paddy variety diversity of marginal

farmers is 79.60 ha., small farmers 53.82 ha, medium farmers 77.44 ha, and large farmers 49.03 ha. The majority of variety is used by medium farmers in which Arize (bayer) and Swarna were is grown in 39.38 ha and 24.72 ha. respectively. Small farmers mostly grown Arize (bayer), Swarna and Mahamaya which covered 29.82 ha, 19.57 ha. and 4.43 ha respectively and Large farmers adopt more diversity of paddy than other group of farmers in the study area, in which Arize (bayer) covers 24.08 ha, Swarna 17.81 ha, Mahamaya 2.02 ha, HMT 7.73 ha respectively.

Paddy Varietal diversification under different farmers category

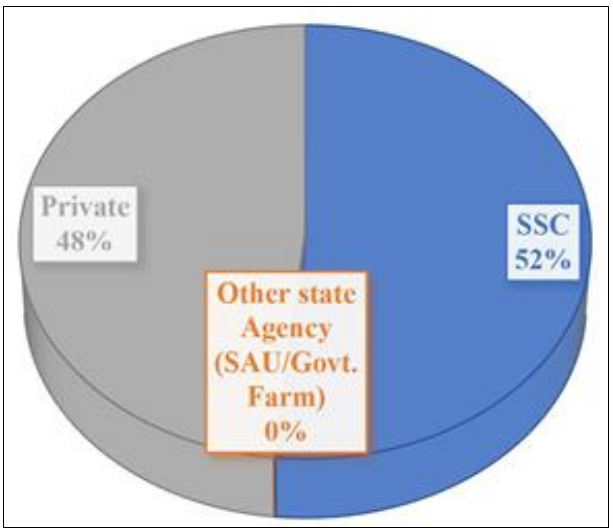
In this case, it is being used to measure the diversity of paddy varieties grown by farmers with different land holdings. Farmers with large land holdings have the highest Simpson value (0.64). indicating high diversity in paddy varieties. Farmers with medium land holdings and marginal land holdings have moderate Simpson values 0.6 and 0.59, respectively), indicating high diversity in paddy varieties and Farmers with small land holdings have the lowest Simpson value (0.55), also indicating high diversity in paddy varieties. The overall Simpson value for all land holdings is 0.61, which can also be interpreted as high diversity.

Table 3: paddy varietal diversification under differnent farmers category

Sl no.	Land holding	Simpson value	Diversity index
1	Marginal	0.59	High
2	Small	0.55	High
3	Medium	0.61	High
4	Large	0.64	High
5	Overall	0.61	High

2. Sources and market share of paddy seed from different agency in Chhattisgarh

Table 4 details the supply of certified paddy seed from various agencies in Chhattisgarh, listing 26 different varieties with contributions from SSC (C.G. state seed & Agri. Dev. Co. Ltd.), other state agencies (SAU/Govt. Farm), and private agencies. The total distribution is 892,277 quintals, with SSC contributing 460,308 quintals leads the supply of seed in state and other state agencies contributing 840 quintals, followed by private agencies contributing 431,129 quintals. Prices per quintal range from ₹2800 to ₹3400, with the total price amounting to ₹2,511,425,600. The most distributed variety is MTU 7029 Swarna, totalling 413,936 quintals and valued at ₹1,159,020,800. Other significant varieties include Hybrid dhan (132,145 quintals), Cottondora sannalu (MTU-1010) (109,711 quintals), and Vijetha (59,559 quintals). The data highlights the predominance of SSC and private agencies in the seed supply, with minimal contribution from other state agencies, and underscores the financial implications of paddy seed distribution in the region



Supply of certified seed from different agencies

Table 4: Sources and market share of paddy seed from different agencies in Chhattisgarh

Sl. No.	Variety	Distribution (in Qt.)			Total Distribution (in Qt.)	Percentage
		SSC (C.G. state seed & Agri. Dev. Co. Ltd.)	Other state Agency (SAU/Govt. Farm)	Private		
1	MTU 7029 Swarna	224656	0	189280	413936	46.39
2	Hybrid dhan	0	0	132145	132145	14.81
3	*Cottondora sannalu* (MTU- 1010)	74711	0	35000	109711	12.3
4	Vijetha (MTU-1001)	47559	0	12000	59559	6.67
5	Mahamaya	38837	0	0	38837	4.35
6	Karma mahsuri	0	0	37704	37704	4.23
7	Swarna sub-1	30500	0	3500	34000	3.81
8	IR-64	13725	0	3800	17525	1.96
9	PKV HMT	2715	0	9500	12215	1.37
10	Chhattisgarh devbhog	8063	0	0	8063	0.9
11	IGKVR-1	6640	240	0	6880	0.77
12	MTU-1156	5574	0	0	5574	0.62
13	MTU -1153	922	0	4500	5422	0.61
14	Tarun bhog selection-1	125	0	2500	2625	0.29
15	C.G. Zinc Rice-1	1472	0	0	1472	0.16
16	Chhattisgarh sugandhit bhog-1	1362	0	0	1362	0.15
17	Chhattisgarh madhuraj dhaan-55	140	0	1200	1340	0.15
18	Indira Arobic-1	1075	0	0	1075	0.12

19	IGKVR-2	372	320	0	692	0.09
20	C.G. Zinc Rice-2	654	0	0	654	0.08
21	DRR-44	625	0	0	625	0.07
22	Dubraj Selection-1	383	95	0	478	0.05
23	Indira Barani dhan -1	119	185	0	304	0.03
24	Badshah bhog selection-1	79	0	0	79	0.02
Total		460308 (51.58%)	840 (00.09%)	431129 (48.33%)	892277 (100.00%)	100.00

a. Sector wise supply of paddy seeds in the study area

The table 5 shows that sector-wise supply of paddy seed variety, public sector dominates the cultivation of Swarna variety of paddy with an area of 88.93 hectares (82.56%) followed by Mahamaya variety at 11.67 hectares (10.83%), the total area under paddy cultivation in the public sector is 107.71 hectares, representing 41.45% of the total area. In the private sector, Arize (bayer) and Swarna varieties were cultivated in an area of 131.88 hectares (86.66%) and 04.73 hectares respectively, the total area under paddy cultivation in the private sector is 152.18 hectares, representing 58.55% of the total area. So the share of seed supply from private sector dominants to public sector supply.

Sector wise distribution of paddy variety sector wise distribution of paddy Based on area in the study area

Table 5: Sector wise distributing of paddy variety sector wise distribution of paddy based on area in the study area

Sl. no.	Sector	Variety	Quantity (in Qt.)	Area covered (in ha.) by variety
A	Public	Swarna	71.14	88.93
			(85.96)	(82.56)
		Mahamaya	09.92	11.67
			(11.99)	(10.83)
		HMT	00.48	0.81
			(0.58)	(0.75)
		Safri	00.88	5.89
			(1.06)	(5.47)
		MTU-1010	00.34	0.41
			(0.41)	(0.38)
		Sub Total	82.76	107.71
			(100)	(100)
B	Private	Arize (bayer)	19.78	131.88
			(56.42)	(86.66)
		Swarna	03.78	4.73
			(10.78)	(3.11)
		Mahamaya	06.48	7.63
			(18.48)	(5.01)
		HMT	04.15	6.92
			(11.84)	(4.55)
		MTU-1010	00.87	1.02
			(2.48)	(0.67)
		Sub Total	35.06	152.18
			(100)	(100)
Total			117.82	259.89

b. Sources wise supply of paddy seed in the study area

The table 6 shows that the market share of different sources of paddy seeds; In Arize (bayer), the most common source of paddy seeds, with a market share of 131.88 Qt (50.74%), where 131.88 qt. seeds are bought from the only private dealers. Swarna variety paddy seeds, with a market share of 93.66 Qt. (36.03%) at, where 53.20 Qt. (56.80%) seeds are owned, 32.90 qt. (35.13) seeds borrowed from relatives, 2.83 qt. (3.02) seeds were brought from co-operative and 4.73 qt. (5.05) seeds were bought from the private dealers. The market share of Mahamaya, HMT and Safri varieties of paddy *viz* 19.30, 07.73 and 05.89 respectively. MTU-1010 has the lowest market share which was 01.43.

Overall the table suggests the different sources were used for paddy seeds supply in the Kabirdham district, with Arize (bayer) being the most popular variety. There was also a significant portion of farmers who use their own saved seeds. By paddy in table 6 it revealed that overall among sample farmers 259.89 Qt. (100.00%) of seed was supply by different sources. Among which share of private share was maximun as they supply 152.18 Qt. (58.56) seeds followed by own seed 68.57 Qt. (26.39%), seeds brought from relative 32.90 qt. (12.65%) and minimum from co-operative which was

Table 6: Different sources and market share of different varieties of paddy Seed in the studt area (in ha.)

Sl. no	Variety	Private dealers (Qt.)	Own seed (Qt.)	Relative (Qt.)	Co-operative (Qt.)	Total (Qt.)
1	Arize (bayer)	131.88 (100.00)	00 (00.00)	00 (00.00)	00 (00.00)	131.88 (50.74)
2	Swarna	4.73 (5.05)	53.20 (56.80)	32.90 (35.13)	2.83 (3.02)	93.66 (36.03)
3	Mahamaya	7.63 (39.53)	8.26 (42.79)	00 (00.00)	3.41 (17.68)	19.30 (07.43)
4	HMT	6.92 (89.53)	0.81 (10.47)	00 (00.00)	00 (00.00)	7.73 (02.97)
5	Safri	00 (00.00)	5.89 (100.00)	00 (00.00)	00 (00.00)	5.89 (02.27)
6	MTU-1010	1.02 (71.33)	0.41 (28.67)	00 (00.00)	00 (00.00)	1.43 (00.56)
Total		152.18 (58.56)	68.57 (26.39)	32.90 (12.65)	6.24 (02.40)	259.89 (100.00)

3. Per hectare input cost of swarna variety of rice on the sampled farms of

Table 1: Cost concept according to CACP Arize (bayer) variety

S.N.	Particulars		Marginal	Small	Medium	Large	Overall
1	Cost A1	Hired human labour	4385.39 (12.36)	4392.19 (11.93)	8001.27 (19.44)	10839.28 (24.49)	6904.53 (17.05)
		Own bullock labour	2489.56 (07.02)	2498.67 (06.79)	0.00 (00.00)	0.00 (00.00)	1247.06 (03.45)
		Hired bullock labour	0.00 (00.00)	0.00 (00.00)	2008.68 (04.88)	2194.59 (04.95)	1050.82 (02.45)
		Own machinery	1608.59 (04.53)	2084.69 (05.66)	5185.59 (12.59)	6594.79 (14.90)	3868.42 (09.4)
		Hired machinery charge and machinelabour	4025.00 (11.35)	4489.59 (12.20)	2107.39 (05.12)	0.00 (00.00)	2655.50 (07.16)
		Manure charges	1892.49 (05.33)	1907.78 (05.18)	2059.48 (05.00)	2211.23 (04.99)	2017.75 (05.13)
		Fertilizer charges	6289.48 (17.73)	6294.59 (17.10)	6257.47 (15.20)	6581.73 (14.87)	6355.82 (16.23)
		Plant protection	6017.73 (16.97)	6092.85 (16.55)	6274.29 (15.24)	6329.83 (14.30)	6178.68 (15.76)
		Seed cost	5560.74 (15.68)	5694.39 (15.47)	5698.49 (13.84)	5784.63 (13.07)	5684.81 (14.51)
		Irrigation charge	1244.67 (03.51)	1254.78 (03.41)	1287.57 (03.12)	1299.76 (02.93)	1271.70 (03.24)
		Miscellaneous expenses	606.78 (01.71)	700.74 (01.90)	707.67 (01.71)	787.83 (01.78)	700.76 (01.77)
		Interest on working Capital @3%	1229.84 (03.57)	1250.17 (03.50)	1318.53 (03.29)	1335.60 (03.11)	1283.54 (03.37)
		Depreciation on farm implements @10%	56.77 (00.16)	79.53 (00.21)	198.61 (00.48)	243.68 (00.55)	144.65 (00.35)
		Land revenue	13.00 (00.03)	13.00 (00.03)	13.00 (00.03)	13.00 (00.02)	13.00 (00.03)
Total Cost A1			35456.35	36792.75	41158.67	44257.86	39416.41
2	Cost A2	cost A1+ rent paid for leased in	35456.35	36792.75	41158.67	44257.86	39416.41
3	Cost A2+ FL	Cost A2 + Imputed value of family labour	43540.35	36792.75	41158.67	44257.86	39416.41
4	Cost B1	Cost A1+ interest on value of owned capital assets@7%	35743.24	37113.51	41521.66	44719.49	39774.49
5	Cost B2	Cost B1 + Rental value of owned land	58243.22	59613.58	64021.66	67219.49	62274.49
6	Cost C1	Cost B1+imputed value of family labor	43827.75	44701.56	47204.94	48012.78	45936.76
7	Cost C2	Cost B2+imputed value of family labor	66327.75	67201.56	69701.94	70512.78	68436.76
8	Cost C3	Cost C2+10% of cost C2 taking as managerial allowances	72960.52	72419.59	76675.44	77564.06	75280.44

Source: Survey done by investigator during kharif 2023-2024

The table 7 shows that the cost and cultivation of Arize (bayer) variety of paddy. The cost of cultivation is broken down into various categories, including hired human labour, bullock labour, machinery charges, manure charges, fertilizer charges, and seed cost etc. For marginal land holdings the cost A1 was Rs. 35456.35 including Hired human labour Rs.

4385.39 and fertilizer charges Rs. 6289.48 were the major cost components, for small land holdings the cost A1 increases for small land holdings at Rs. 36792.75 including,

hired human labor Rs. 4392.19 and fertilizer charges Rs. 6294.59 were the major cost components, for medium land holdings the cost A1 further increases as at Rs. 41158.67 including fertilizer charges Rs. 6257.47 remain the highest cost component, followed by hired human labour Rs. 8001.27 and for large land holdings the cost A1 was the highest as at Rs. 44257.86 including. Fertilizer charges Rs. 6581.73 and hired human labour Rs. 10839.28 were the major cost components. Overall fertilizer charges were the major cost component across all land holding sizes. Hired human labor is another significant cost component, particularly for larger land holdings. The cost of cultivation shows an upward trend for marginal, small, medium and large- scale paddy produce.

The cost and returns on the basis of cost concept in the production of paddy has been presented in Table showed that on an average cost-A1, cost-A2, cost-A2+FL, cost-B1, cost-B2, cost-C1, cost-C2, and cost C3 were worked out to 39416.41 Rs/ha, 39416.41Rs/ha, 45578.68 Rs/ha, 39774.49 Rs/ha, 62274.49 Rs/ha, 45936.76 Rs/ha, 68436.76 Rs/ha and 75280.44 Rs/ha respectively on the sample farms.

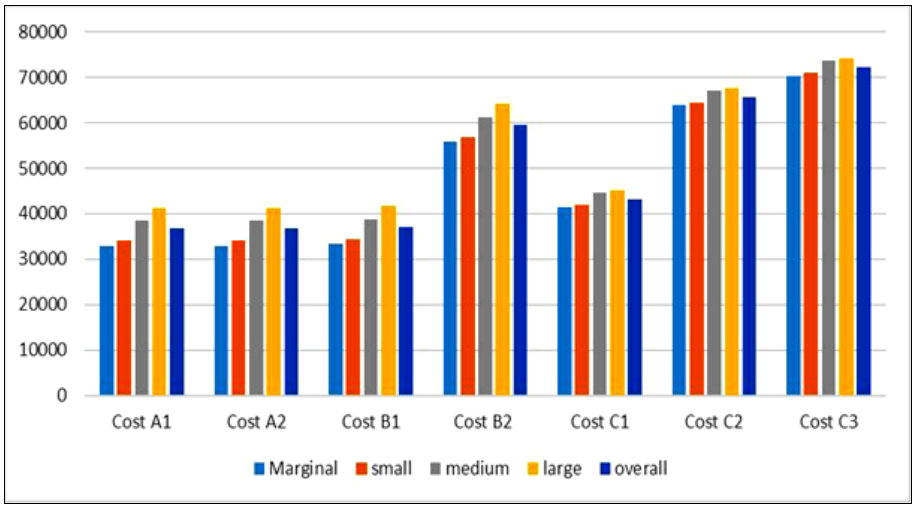


Fig 2: Cost concept according to CACP of Arize (bayer)

Cost and returns of Arize (bayer)

The table 7 shows that costs and returns, and benefit-cost (B:C) ratio of Arize (Bayer) variety of paddy, the total cost of cultivation (C2) categories includes variable costs and fixed costs. Variable costs include items like hired human labor, bullock labor, machinery charges, manure charges, fertilizer charges, and seed cost etc. The gross income from the paddy crop, which is calculated by multiplying the yield by the market price of paddy. The total cost of cultivation of the Arize (Bayer) paddy variety was determined to be Rs 68436.76 per hectare. In terms of production, the Arize (Bayer) variety yielded 63.34 quintals per hectare for the main product and 9716.40 Value of By Product @120 Rs/Q for the by product. The overall gross return for the selected families in the study area was calculated to be Rs 143221.90 hectare in MSP and 201302.38 with bonus. The gross return varied across different farm sizes, with marginal, small, medium and large farms earning Rs 142005.50 Rs 124105.50, Rs 151431.90 and Rs. 155344.70 per hectare in MSP and Rs 197704.08, Rs 180491.83, 210798.48 and Rs. 216215.16 per hectare with bonus respectively. It also shows the value of the by-product, which is likely straw.

Table 8: Cost and returns of Arize (bayer) padyy in the study area.

S.no.	Particulars	Marginal	Small	Medium	Large	Overall
1	Cost of production (Rs/q.)	1091.99	1092.89	1076.69	1062.26	1080.96
2	Main Product (Q./ha)	60.74	61.49	64.74	66.38	63.34
2a	which is sold at MSP (Q./ha)	52.50	52.50	52.50	52.50	52.50
2b	Remaining product selling as per market price (Q/ha)	8.24	8.99	12.24	13.88	10.84
3	By Product	77.25	79.15	82.47	85.01	80.97
4a	Value as per MSP (2023-2024) @ 2183 rs. / Q.	114607.5	114607.5	114607.5	114607.5	114607.50
4b	Value as per market @ 2200 rs / Q	18128	19778	26928	30536	18898
4c	Value of By Product@120rs/q	9270	9498	9896.4	10201.2	9716.40
5	Gross income without bonus	142005.50	124105.50	151431.90	155344.70	143221.90
6	Value as per Bonus (2023-2024) @ 917 rs. / Q.	55698.58	56386.33	59366.58	60870.46	58080.48
7	Gross income with bonus	197704.08	180491.83	210798.48	216215.16	201302.38

The B:C ratio was profitability measure used in agriculture it is calculated by dividing the gross income by the total cost of cultivation (C2). B:C ratio greater than 1 indicates that the crop was profitable, while a ratio less than 1 indicates that the crop was not profitable. The gross income from paddy cultivation increases with increasing land holding size, the total cost of cultivation (C2) also increases with increasing land holding size, the B:C ratio was relatively stable across all land holding sizes, ranging from 1.98 to 2.07. This suggests that paddy cultivation was profitable for all land holding sizes in this study.

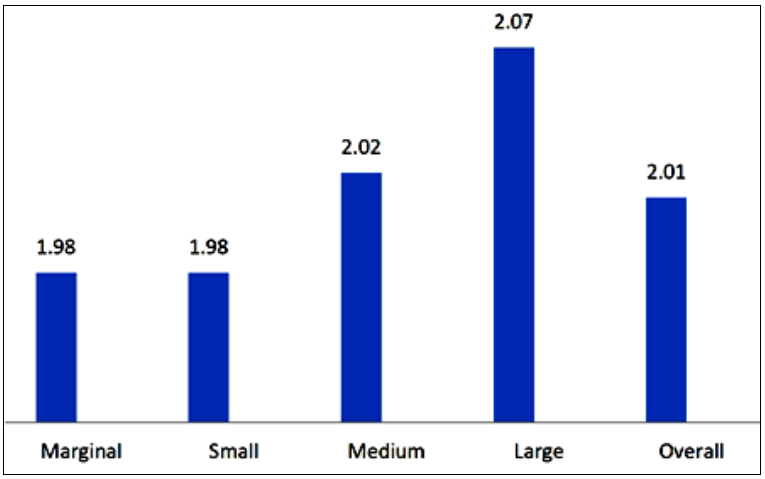


Fig 3: Input - output ratio

Table 9: Input output and B:C Ratio

Sl. no	Particulars	Marginal	Small	Medium	Large	Overall
1	Total cost (C2)	66327.75	67201.56	69704.94	70512.78	68436.76
2	Gross income	197704.08	200269.83	210798.48	216215.16	206246.89
3	Net income	131376.33	133068.27	141093.54	145702.38	137810.13
4	Input-Output ratio	1:2.98	1:2.98	1:3.02	1:3.07	1:3.01
5	BC Ratio	1.98	1.98	2.02	2.07	2.01

Among the overall sample households in the study area in production of Arize (bayer) variety of paddy in MSP, the input-output ratio was found to be 1:3.01. It is important to note that the input-output ratio represents the relationship between the inputs (such as costs or resources) and outputs (such as yield or production).

In this case, the input-output ratio was highest for large group (1:3.07), indicating that they achieved a relatively higher output in comparison to the inputs they invested. On the other hand, the input-output ratio was lowest for marginal (1:2.98) and small which was similar to (1:2.98), suggesting that their output was relatively lower in relation to the inputs they utilized.

Conclusion

Result showed that varietal diversification of paddy in the study area among the total 126 farmers 70 farmers grew single variety, 32 farmers two variety and 24 farmers grew moret han two variety at a same time. In the study area major grew variety was Arize (Bayer) followed by Swarna, Mahamaya, Safri, MTU1010 and HMT. All the grew varieties covers a total area of

259.89 ha, under which highest area covered by Arize (Bayer) was (131.88 ha) 50.74 percent result of paddy varietal divercification under farmers category showed that the overall simpson index was (0.61) which shows high diversity in the study area where as the simpson index was higher in the large farmers (0.64)

In Chhattisgarh distribution of certified paddy seed from 3 agencies *viz*. SSC (C.G. state seed and agri. Dev. Co. Ltd.), other state aegency (SAU/Govt. Farm) and private aegencies. There were 24 major varieties supply by different aegency in Chhattisgarh among 15 varieties were developed by IGKV and contributed (13.35%) seed supply. The Chhatigarh distribution of certified paddy seed from three aegencies the major distributed variety was MTU-7029 Swarna- 46.36% followed by Hybrid dhan 14.81% and Cotton dora Sannalu MTU-1010 12.30% supply of paddy variety in the study area the maximum area coverd by public sectors 79.1%. In public sector the major variety was Swarna 60.61% and private sector the major variety was MTU-1010 36.97%.

The overall total cost of production of Arize (Buyer) variety of rice (rs./ha.) 68436.76 The overall gross income with bonus of Arize (Bayer) 201302.38 (rs./ha.). The overall input output ratio of Arize (Bayer) of was 1:3.01 and the overall BC ratio of Arize (Bayer) of was 2.01 with bonus.

The study on the economics of major paddy varieties in Kawardha revealed that the cost of cultivation varied by farm size, with fertilizer and hired human labor being the major cost components. For the Arize (Bayer) variety, the total cost of cultivation (C2) was ₹68436.76 per hectare, yielding 63.34 quintals per hectare. The benefit-cost (B:C) ratio ranged from 1.98 to 2.07, indicating profitability across all farm sizes. The input-output ratio was 1:3.01, showing efficient resource utilization. Similarly, for the Swarna variety, the total cost (C2) was ₹63,672.03 per hectare. The profitability was lower than Arize but remained viable. Large farms had better cost efficiency, achieving a higher input-output ratio. Overall, both varieties demonstrated economic viability, with Arize being more profitable. The findings highlight the importance of optimizing input costs and farm size for improved returns in paddy cultivation.

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