



Use of Biomix in Turmeric Cultivation: An Economic impact in Marathwada Region

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(Received 27 November 2023; Accepted 08 January 2024)

(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: India holds the position of the world's largest producer, consumer, and exporter of turmeric. In the fiscal year 2023, Maharashtra emerged as the leading turmeric producer, contributing over 278 thousand metric tons. This study focused on assessing the economic impact of the Biomix product on turmeric cultivation for the period 2022-2023, with the Biomix being developed by the VNMKV Parbhani, a state agricultural university. Farmers can use this knowledge to make informed decisions about crop choices, resource allocation, and investment in technology or infrastructure. Additionally, economic impact assessments can inform policymakers about the needs of the agricultural sector, potentially leading to better support and policies that benefit farmers. Required primary cross-sectional data was gathered using a pre-tested schedule, and the analysis utilized partial budgeting techniques and profit regression. The result of study revealed that integrating Biomix and optimizing input utilization led to reduced cultivation costs and increased net profit for cultivators. Adopters achieved a gross produce of Rs. 43.73 per hectare, with a benefit-cost ratio of 1.59, surpassing non-adopters. Additionally, adopters recorded a net profit of Rs. 127, 196.12, outperforming non-adopters. The positive impact of yield on farmers' income was notably significant, with information sources, loans, and access to credit showing a statistically significant influence at the 1% level, indicating that an increase in these factors is associated with a significant rise in yield. Therefore the adopter farmers benefited from the use of Biomix in turmeric cultivation.

Keywords: Turmeric, cost of production, economic impact, cost of cultivation, Biomix.

INTRODUCTION

Turmeric is an important spice grown in India since ancient times. It is referred as Indian saffron and commonly called as Haldi. India is the largest producer, consumer, and exporter of Turmeric in the world. Estimated production volume of turmeric in India financial year 2023, by state, the state Maharashtra with over 278 thousand metric tons, was the leading producer of turmeric in India, Telangana and Karnataka were second and third in the ranking during that year. The rhizomes are used fresh or boiled in water and dried, after which they are ground into a deep orange-yellow powder commonly used as a coloring and flavoring agent in many Asian cuisines, especially for curries, as well as for dyeing, characteristics imparted by the principal Turmeric constituent, Curcumin. In Turmeric powder there is 60 to 70 per cent carbohydrates, 6 to 13 per cent water, 6 to 8 per cent protein, 5 to 10 per cent fat, 3 to 7 per cent dietary minerals, 3 to 7 per cent essential oils, 2 to 7 per cent dietary fiber, and 1 to 6 per cent curcuminoids. The global production of Turmeric is around 11 lakh tones in year 2020. India dominates the world production scenario contributing 80 per cent

followed by China (8 per cent), Myanmar (4 per cent), Nigeria (3 per cent) and Bangladesh (3 per cent). Major Turmeric importing countries from India are Bangladesh (15,888.88 tonnes), Iran (11,859.50 tonnes), Morocco (7,225.72 tonnes), USA (6,318.45 tonnes) and UAE (5,938.10 tonnes). Since last 15 years researchers are working on use of bioagents consortia for management of plant diseases. The department of plant pathology VNMKV, Parbhani had also tried to develop the consortia of bio agent named "Biomix" for management of plant diseases, pests, and improvement of plant health. Its use in Turmeric has made revolutionary changes in Turmeric growing area of Marathwada region. The Biomix has resolved the major disease and pest problems viz., White grub, rhizome rot with improvement of yield and quality in Turmeric. Hence, the primary objective of the present study is to evaluate the economic influence of the Biomix product on turmeric in the Marathwada Region of Maharashtra.

METHODOLOGY

For the present study multistage sampling design was adopted in selection of district, tehsils, villages and

Biomix adopter in turmeric production. As large number of Biomix users are from Hingoli and Parbhani district, these two districts was selected for the study purposely. In the fourth stage, 10 farmers of Biomix adopters were randomly selected from each selected villages and 10 farmers who have not adopted of Biomix was randomly selected. Thus from 6 villages, 60 adopters and 60 non-adopters Biomix farmers was selected for the study period 2022-2023.

Partial budgeting technique and profit regression.

Economic impact of Biomix user was studied with help the partial budgeting technique. The technique is an analytical tool for determining answers to the first question about impact on profitability. Secondly, impact of adoption Biomix on farmer’s income was assessed with the help of profit regression.

$$Y = a + bX + E$$

Where,

Y = Gross return

X = Age, Education, Family size, Turmeric area, Yield,

Source of information, Farming experience, Annual income, Loan and Valuation of assets

a = I intercept

b = Slope

E = Error

RESULT AND DISCUSSION

A. Economic impact of Biomix product on Turmeric cultivation

The study evaluated the economic impact of the Biomix product on turmeric cultivation, and the results are presented as described above. Per hectare utilization of hired male labour was 37.78 by adopters and 43.7- man-days by non-adopters and hired female labour per hectare was 78.98 man-days for adopters and 57.62 for non-adopters. The per hectare utilization of machinery was found to be highest in non-adopters (11.92 hours) and in case of Adopter 11.31, respectively.

Table 1: Physical inputs and outputs of Adopter and Non-Adopter.

Sr. No.	Item	Unit	Adopter	Non-Adopter
			Quantity Used (Kg)	Quantity Used (Kg)
I	Input			
1	Hired Human Labour (Male)	Days	37.78	43.7
	Hired Human Labour (Female)	Days	78.98	57.62
2	Bullock labour	Pair Days	0.65	1.38
3	Machinery Charges	Hrs.	11.31	11.92
4	Sets	Qtl.	16.3	15.03
5	Seed Treatment		0.79	0.88
6	Biomix	g/Kg/qt	10.15	0
7	Manure	Kg/tonnes	923.4	838.82
8	Fertilizers	N(kg)	102.75	100.86
		P (kg)	217.53	179.33
		K (kg)	117.61	93.75
9	Herbicides		Nil	Nil
10	Micronutrient	kg/lit	39.4	2.01
11	Plant Protection	kg/lit	2.2	3.8
12	Family Human Labour(Male)	Days	32.02	31.07
13	Family human labour (Female)	Days	16.92	17.52
II	Output			
1	Main produce	Qtl	43.73	32.37
2	By-produce	Qtl	Nil	Nil

In case of Adopter per hectare utilization of sets was high (16.30 qtls) and for non-adopters it was 15.30 qtls per hectare. Per hectare utilization of Biomix by Adopter 10.15 kg and by non-adopter was nil. Use of nitrogen was observed highest in Adopters *i.e.*, 102.75 kg per hectare and by Non-Adopters *i.e.*, 100.86. While the use of Phosphorus was in highest by Adopter (217.75kg) and by non-adopter (179 kg) per hectare and use of Potassium was high in Adopter (117 kg) and non-adopter (93.75 kg) per hectare. Plant protection with 2.20 Liter was used by Adopters and 3.80 liters by non-adopter. Main produce was observed high in Adopter *i.e.*, 43.73 quintals and by Non-Adopter (32.37 quintals) per hectare. The main produce was achieved highest by Adopters, which was achieved by using the proper production technology and efficient utilization of resources. The seed which was used to the optimum level (16.30 kg) and maintaining the ideal plant population

resulted in less pest and disease incidence. Fertilizer use was also planned according to the soil testing reports and used as per its recommendation. Similar result observed by Kumar *et al.* (2019); Arora *et al.* (2012).

B. Per hectare cost of cultivation of turmeric by Adopter farmers

Per hectare cost of cultivation of adopters were studied and depicted in Table 2. It revealed that cost for hired male was Rs.300 per unit. Average total cost for hired male human labour was Rs. 11335.00 and average total cost for hired female was Rs. 15796.67. In case of bullock labour average cost was Rs.780. Average machinery charges were Rs. 7919.66. Expenditure on sets was average Rs. 34501.67. Cost required for seed treatment was Rs. 575.42. The average cost of biomix was observed Rs. 2030.cost for manure was average Rs. 3693.62. In case of fertilizers, expenditure on Nitrogen was average Rs. 1183.70 for adopters. Phosphorous was

used in large quantity, so average cost for phosphorous was Rs. 9843.38. Average cost potassium was Rs. 3076.85. In case of plant protection, the average expenditure by adopters was Rs. 1985.60. Thus, average total working capital was Rs. 95771.97. Average Cost A of adopters was observed to be

Rs.133297.07. Cost B which includes indirect expenses like rental value of land and interest on working capital was Rs. 200746.38. Cost C which includes family labour was noticed average Rs. 214580.55 for adopters.

Table 2: Per hectare cost of cultivation of turmeric by Adopter farmers.

Sr. No.	Item	Unit	Quantity used	Rate per unit	Total cost	Percent
1	Hired Human Labour (male)	Days	37.78	300.00	11335.00	5.28
	Hired Human Labour (Female)	Days	78.98	200.00	15796.67	7.36
2	Bullock labour	Pair Days	0.65	1200.00	780.00	0.36
3	Machinery Charge	Hrs.	11.31	700.00	7919.66	3.69
4	Sets	Kg/q	16.30	2116.67	34501.67	16.08
	Seed Treatment		0.79	724.04	575.42	0.27
	Biomix	g/Kg/qt	10.15	200.00	2030.00	0.95
5	Manure	Kg/Tones	923.40	4.00	3693.62	1.72
6	Fertilizers	N(kg)	102.75	11.52	1183.70	0.55
		P (kg)	217.53	45.25	9843.38	4.59
		K (kg)	117.62	26.16	3076.85	1.43
7	Microla	kg/lit	1.73	300.00	518.75	0.24
8	Micronutrient	kg/lit	39.40	50.00	1970.00	0.92
9	Plant Protection	kg/lit	2.20	900.92	1985.60	0.93
10	Land revenue	Rs.	0.00	0.00	561.67	0.26
11	Total WC				95771.97	44.63
12	Depreciation on implements	Rs.			29863.34	13.92
13	Expenses on acquisition of inputs	Rs.			1915.44	0.89
14	Interest on working capital @6%	Rs.			5746.32	2.68
15	Cost A	Rs.			133297.07	62.12
16	Rental value of land	Rs.			56962.78	26.55
17	Interest on fixed capital @12%	Rs.			10486.53	4.89
18	Cost B (Cost A+14+15)				200746.38	93.55
19	Family Human Labour (Male)	Days	32.02	300.00	9605.00	4.48
	Family human labour (Female)	Days	16.92	250.00	4229.17	1.97
20	Cost C i.e.. Total cost per ha.	Rs.			214580.55	100
	Yield					
	Gross Produce	Qtl	43.73	7815.61	341776.67	
	B:C Ratio	Rs.			1.59	
	Net profit	Rs.			127196.12	

Gross produce per hectare for adopters was Rs. 43.73 Qtls contributing average total cost of Rs. 341776.67. Benefit cost ratio of adopter was higher than that of non-adopter and it was 1.59. Net profit of adopters was Rs.

127196.12 which was more than non-adopters. It clearly showed that use of biomix and proper utilization of inputs leads to decrease in cost of cultivation and increases net profit of cultivar.

Table 3: Per hectare cost of cultivation of turmeric by non-adopter farmers.

Sr. No.	Item	Unit	Quantity used(kg)	Rate per unit	Total cost	Percent
1	Hired human labour(male)	Days	43.70	300.00	13110.00	7.02
	Hired human labour(Female)	Days	57.62	200.00	11523.33	6.17
2	Bullock labour	Pair Days	1.38	1200.00	1660.00	0.89
3	Machinery Charges	Hrs.	11.92	700.00	8345.96	4.47
4	Seed	Kg/q	15.03	2095.00	31494.83	16.86
	Seed Treatment		0.88	709.00	623.43	0.33
	Biomix	g/Kg/qt			0.00	0.00
5	Manure	Kg/tonnes	838.82	3.90	3271.41	1.75
6	Fertiizers	N(kg)	122.67	11.63	1426.70	0.76
		P (kg)	249.50	45.25	11289.88	6.04
		K (kg)	119.54	26.16	3127.17	1.67
	Microla	kg/lit	2.01	300.00	602.50	0.32
	Micronutrient	kg/lit	37.90	50.00	1894.90	1.01
	Plant protection	kg/lit	2.72	932.83	2533.08	1.36

10	Land revenue	Rs.	0.00	0.00	461.67	0.25
11	Total WC				91364.86	48.90
12	Depreciation on implements	Rs.			24703.70	13.22
13	Expenses on aquisition of inputs	Rs.			1827.30	0.98
14	Interest on working capital @6%	Rs.			5481.89	2.93
15	Cost A	Rs.			123377.75	66.04
16	Rental value of land	Rs.			41731.11	22.34
17	Interest on fixed capital @12%	Rs.			8027.58	4.30
18	Cost B (Cost A+14+15)				173136.44	92.67
19	Family human labour(Male)	Days	31.07	300.00	9320.00	4.99
	Family human labour(Female)	Days	17.52	250.00	4379.17	2.34
20	Cost C <i>i.e.</i> . Total cost per ha.	Rs.			186835.61	100
	Yield					
	Gross Produce	Qtl	32.37	7735.15	250386.67	
	B:C Ratio	Rs.			1.34	
	Net profit	Rs.			63551.06	

Per hectare cost of cultivation of non-adopters was studied and depicted in Table 3. It revealed that cost for hired male was Rs. 300 per unit. Average total cost for hired male human labour was Rs. 13110.00 and average total cost for hired female was Rs.11523. the average expenditure on hired male labour was greater than that of adopters. In case of bullock labour average cost was Rs.1660 which was much higher than adopters. Average machinery charges were Rs.8345.96. Expenditure on sets was average Rs. 31494.83 which was less as compare to adopters but still they are not found gaining high yield. Cost required for seed treatment was Rs. 623.43. The average cost of biomix was observed Rs. 0.They were not found using Biomix therefore they may be getting less yield. Cost for manure was average Rs. 3271.41. In case of fertilizers, expenditure on Nitrogen was average Rs. 1426.70 for non-adopters. Phosphorous was used in large quantity, so average cost for phosphorous was Rs. 11289.88. Average cost potassium was Rs. 3127.17. In case of plant protection, the average

expenditure by non-adopters was Rs. 2533.08. Thus, average total working capital was Rs. 91364.86. Average Cost A of non-adopters was observed to be Rs.123377.75.

Cost B which includes indirect expenses like rental value of land and interest on working capital was Rs.173136.44. Cost C which includes family labour was noticed average Rs. 186835.61 for non-adopters.

Gross produce per hectare for non-adopters was Rs. 32.37 Qtls contributing average total cost of Rs. 250386.67. Benefit cost ratio of non-adopter was found less than that of adopter and it was 1.34. Net profit of non-adopters was Rs. 63551.06 which was less than adopters. It clearly showed that use of biomix and proper utilization of inputs leads to decrease in cost of cultivation and increases net profit of cultivar. Due to improper practices cost of cultivation of non-adopter was high than that of adopters which affects their net profit. Similar result observed that adopters and non-adopters by Rao *et al.* (2010); Singh *et al.* (2019).

Table 4: Impact of Biomix on turmeric cultivation.

Sr. No.	Variables	Coefficients	Standard Error
1.	Intercept	-147488.21	264133.37
2.	Adopter and Non-Adopter	71304.23**	30901.02
3.	Age	-329.5	10411.74
4.	Education	-225.66*	1727.09
5.	Family size	9756.85	6351.08
6.	Turmeric area	220414.31***	37289.14
7.	Yield	6209.45***	748.65
8.	Source of information	-15926.82	23184.59
9.	Farming experience	1225.87	10530.66
10.	Annual Income	-0.14***	0.05
11.	loan	0.08	0.07
12.	Valuation of assets	0.03	0.03

Note: *, **, ***, represents significance at 10%, 5%, 1%, respectively.

Estimated the profit regression and the Table 4 showed that education has negative significance on farmers income. Significance increases in education level increase the farmers income, area under turmeric cultivation has significance positive effect on farmers income. Yield was another important factor which has

significantly positive effect on farmers income. Annual income has significantly negative effect on farmers income, Age, family size, Source of information, farming experience, Loan, valuation of assets has Non significance of effect on farmers income. Similar result observed by Kumar *et al.* (2020); Gajja *et al.* (2014).

CONCLUSIONS

In conclusion, the study found that adopters achieved a superior net profit of Rs. 127,196.12 compared to non-adopters with Rs. 63,551.04, resulting in a higher cost-benefit ratio for adopters (1.59) and a lower ratio for non-adopters (1.34). Furthermore, yield emerged as a significant positive influence on farmers' income. The source of information, loan, and access to credit demonstrated a positive and statistically significant impact at the 1% level, indicating their significant role in boosting yield. On the other hand, education negatively impacted farmers' income, with significance increasing with higher education levels. Conversely, the area under turmeric cultivation exhibited a significantly positive effect on farmers' income, along with yield. Meanwhile, annual income had a significantly negative effect, and factors such as age, family size, source of information, farming experience, loan, and valuation of assets showed non-significant effects on farmers' income.

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