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ECONOMIC COMPETITIVENESS OF ORGANIC SUGARCANE IN BAGALKOTE DISTRICT OF KARNATAKA INDIA

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ABSTRACT

Sugarcane is recognized for its renewable and environmentally sustainable qualities, offering various products like sugar, biofuel, fiber and by-products. Considering sustainable yield and needs of future generation, organic farming is one of the best alternatives which offer a comprehensive approach. With the objective to understand the economic competitiveness of organic sugarcane cultivation over conventional method, the present study was carried out in Bagalkote district of Karnataka which has a significant number of organic sugarcane growers.Primary data was collected from 60 respondents regarding sugarcane cultivation for the agricultural year 2022-2023. The sample included 30 farmers each practising organic methods and conventional methods. The results of the analysis revealed that the cost of cultivation of sugarcane in conventional method was higher (Rs.1,12,726/acre) compared to organic method (Rs.1,05,171/acre). Though the average yield was high (67.84 t/acre) in conventional farming, gross returns (Rs.2,07,427/acre) and net returns (Rs.1,02,256) were more in organic farming due to premium price received by organic sugarcane. Returns per rupee of investment in organic and conventional method were Rs.1.97 and Rs.1.84, respectively. Findings of the study calls for necessary measures by concerned departments, organizations and institutions to create awareness and motivate farmers to adoption organic sugarcane cultivation on large scale.

***Key words*:** Sugarcane, Conventional, Organic, Premium price,Cost of Cultivation, Gross return, Net return, Partial budgeting.

Introduction

Organic farming is practised in India from centuries having sustained yield levels sufficient to feed countries population. However, post-independence with the increase in population and increased demand for food grains led to the Green Revolution in the 1960s marking a shift towards mineral-based farming and chemical advancements, significantly increasing agricultural productivity and alleviating food insecurity for India's growing population (Singh, 2000 and Ravisankar *et al*., 2016). Despite these benefits, it also led to severe ecological issues, including soil degradation, the rise of new pests and diseases, the loss of beneficial microorganisms and the infiltration of toxic chemicals into the food chain, threatening the biosphere's stability (Wani *et al*., 2013 and Kaur and Kaur, 2014). Now, to sustain agricultural production and protect environmental resources, an alternative farming system has become necessary. Organic farming has emerged as this solution, in which pest, disease and nutrient management will be done by using organic inputs without harming the environment (Avi and Batra, 2023).

Further, the Covid-19 pandemic has heightened awareness of the benefits of organic food, emphasizing its role in nutritional security and immune system support. Organic food, known for higher antioxidant levels, specific

micronutrients, and the absence of harmful chemicals, is increasingly valued for its superior taste and environmental sustainability. This shift has led to a rise in consumer adoption of organic food for its health and safety benefits (Magnusson *et al*., 2003 and Brandt and MØlgaord, 2001). India is having highest number of organic producers and ranks 2nd globally in organic agricultural land (FIBL & IFOAM Year Book, 2024). As of March 31, 2024, the total area under organic certification is 7.3 million hectares (5.24% of net sown area), with 4.48 million hectares of cultivable land and 2.85 million hectares for wild harvest. In 2023-24, India produced around 3.6 million MT of certified organic products which includes all varieties of food products (apeda.gov.in).

Sugarcane is a vital commercial crop globally, primarily cultivated for its high sugar content, making it the main source of sucrose and used in the production of sugar. Beyond sugar production, sugarcane is utilized in various industries. Its by-products, such as molasses, serve as a key ingredient in ethanol production, which is an important biofuel. Additionally, bagasse, the fibrous residue from crushed sugarcane, is used as a renewable energy source and in the production of paper, cardboard, and other biodegradable materials. The crop also contributes to the production of alcoholic beverages, animal feed, and various chemicals, underscoring its significance in multiple sectors and its economic importance to many countries (Solomon, 2014). In recent, farmers are thinking of cultivatingsugarcane organically to avoid some of the problems like low sugar recovery due to excessive use of chemical fertilizers and pesticides, resulting in soil degradation and higher cultivation costs. Organically grown sugarcane is attracting farmers with its potential for premium prices and lower cultivation costs, despite slightly lower yields.

Praveen (2017) studies on comparative economics of organic and inorganic sugarcane cultivation in Belagavi district of Karnataka and revealed that, the yield was lower (115 t/ha) in organic farming than inorganic farming (127.56 t/ha) but the net returns were high in organic (Rs. 1,89,450) as compared to inorganic (Rs. 1,73,160) sugarcane cultivation. Similarly, study results of Bhoge (2021) in Solapur indicated that total cost of cultivation of sugarcane was Rs. 34,345 per acre in organic farming and Rs. 44,500 in inorganic farming with per acre yield of 42.30 and 37.70, respectively. The benefit-cost ratio was also more in organic (2.33) compared to (1.29) inorganic farming. With this background, the important questions that emerge are; Can organic farmers generate higher profits and sustain? Can a commercial crop like sugarcane grown organically? Does organic farming reduces cultivation costs to offset lower yields. With all these thoughts, this study is an attempt to compare the economics and explore the profitability in organic sugarcane cultivation versus conventional methods. The goal is to highlight the benefits and viability of organic farming for sugarcane growers.

Materials and Methods

A purposive sampling technique was employed to select the study area (Bagalkote district of Karnataka which one of the major sugarcanes growing district) and random sampling design was used for the selection of farmer respondents. In Bagalkote district two taluks *viz*., Mudhol and Jamkhandi with highest area under sugarcane cultivation were selected. Six villages namely Mugalkod, Kulali and Nagaral from Mudhol taluk and Hulyal, Siddapur and Hunnur from Jamkhandi taluk were randomly selected. The necessary information was collected from a total of 60 respondents of which 30 farmers growing sugarcane using organic (15 from each taluk) and 30 using conventional (15 from each taluk) farming practices. The primary data was collected from the sample respondents during the month of May 2023 and the data was collected in respect of cultivation of sugarcane pertaining to the agricultural year 2022-2023.

Statistical tools:

1. Tabular analysis

The costs and returns were worked out on per acre basis for sugarcane sole crop.Variable costsinclude cost incurred onsugarcane setts, farmyard manure, biofertilizers, biopesticides, chemical fertilizers, micronutrients, plant protection chemicals, labour cost, machine labour charges, harvesting and transportation, irrigation and miscellaneous costs (cost of beejamrutha,

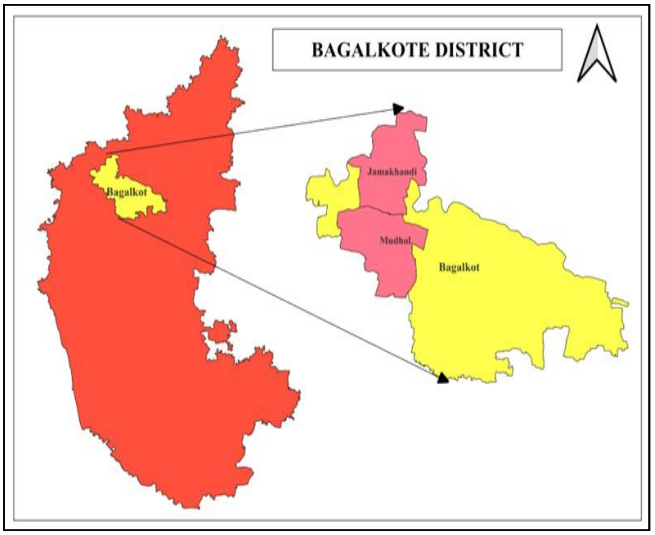

Fig. 1: Map showing Karnataka State and Bagalkote district.

Table 1: Labour use pattern in organic and conventional sugarcane cultivation in the study area(Per acre).

Sl. No.	Operation	SCFOP (n=30)				SCFCP (n=30)			
		M	W	BL	ML	M	W	BL	ML
1	Land preparation	-	-	2.13(100)	4.51(45.05)	-	-	1.94(100)	4.61(53.42)
2	FYM application	4.96(23.81)	-	-	1.42(14.19)	4.05(14.56)	-	-	1.23(14.25)
3	Sett treatment	1.15(5.52)	-	-	-	1.14(4.10)	-	-	-
4	Planting	4.09(19.64)	0.30(3.15)	-	0.20(2.00)	4.11(14.78)	0.35(3.30)	-	0.22(2.55)
5	Biofertilizer/chemical fertilizer application	-	-	-	1.57(15.68)	4.29(15.43)	1.26(11.89)	-	-
6	Biopesticide/PPC application	1.03(4.94)	-	-	-	3.10(11.15)	-	-	-
7	Intercultural operation	-	9.23(96.85)	-	2.31(23.08)	-	8.99(84.81)	-	2.57(29.78)
8	Irrigation	9.60(46.09)	-	-	-	11.1(39.99)	-	-	-
	Total	**20.83**	**9.53**	**2.13**	**10.01**	**27.81**	**10.60**	**1.94**	**8.63**

Note:- 1.M= Men labour (mandays), **W**= Women labour (mandays), **BL**= Bullock labour (pairdays) and **ML**= Machine labour (hrs)
2. Figure in parentheses indicate per cent share to total labour requirement.

jeevamrutha, panchagavya, etc.) andinterest on working capital. Fixed costs includeland revenue and taxes, rental value of land, depreciation and interest on fixed capital

In case of return, gross return is the total value of the sugarcane at prevailing post-harvest prices at which sugarcane farmers sold their produce in the study area and Netreturn was obtained by subtracting the total cost from gross return. Return per rupee of expenditure was also calculated by dividing gross income with total cost of cultivation. Lastly, Cost of production was calculated by dividing total cost of cultivation by average yield (per acre) obtained by the sample respondents.

2. Partial budgeting approach

Partial budgeting is a method of organizing experimental data and information about the cost and benefits of some change in the technologies being used on the farm. The aim is to estimate the change that will occur in farm profit or loss from some change in the farm plan. Partial budgets do not calculate the total income and expenses for each of the alternative plans, but list only those items of income and expense that change.

In the present study partial budgeting technique is used to assess the economic viability of organic sugarcane cultivation over conventional method.

A. Debit side/cost side: Item of added expenditure due to the adoption of organic sugarcane cultivationincludes the additional cost of sett treatment materials, FYM, bullock labour, machine labour and miscellaneous costs. While, reduced returns due to the adoption of organic sugarcane cultivationincludes reduced returns in main produce in monetary terms if any.

B. Credit side/return side: Reduced costs (or saving) due to the adoption of organic sugarcane cultivationincludes saving by using fewer setts, using biofertilizers and biopesticides instead of chemical fertilizers or plant protection chemicals, costs saved from harvesting, transportation and by using less human labour. While, added returns due to the adoption of organic sugarcane cultivationincludes added returns from main produce in monetary terms if any.

Results and Discussions

Labour use pattern in organic and conventional sugarcane cultivation

Labour plays a pivotal role in all agricultural operations. In present study the results on labour use pattern indicated that conventional sugarcane cultivation required more men labour (27.81 mandays) as compared to that of organic sugarcane cultivation (20.83 mandays). This difference can be attributed to increased labour usage in fertilizer and plant protection chemical applications in conventional farming. Conversely, in organic farming biofertilizers were applied along with FYM application and irrigation, which led 46.09 per cent of total men labour was required for irrigation followed by FYM application (23.81%), planting (19.64%), sett treatment (5.52%) and biopesticide application (4.94%). Whereas in conventional farming, men labour requirement was more for (39.99 %) irrigation followed by fertilizer application (15.43%) and planting (14.78%). Women labour were required slightly more in conventional farming (10.60 mandays) compared to that of organic farming (9.53 mandays). In organic farming, 96.85 per cent of the total women labour was utilized in intercultural operations, while rest for

planting. In contrast, 84.81 per cent of total women labour was utilized in intercultural operations in conventional farming, followed by chemical fertilizer application (11.89%) and planting (3.30%). In case of bullock labour and machine labour, it was 2.13 pairdays and 10.01 hours in organic sugarcane cultivation and 1.94 pairdays and 8.63 hours in conventional sugarcane cultivation, respectively. This discrepancy was primarily attributed by increased machine labour usage in planting and the incorporation of green manure in organic farming practices (Table 1).

Total labour requirement in organic and conventional sugarcane cultivation is depicted in Fig 2. This clearly indicates organic cultivation of sugarcane not only reduces production cost by using less labour, but also indirectly provide scope for farm mechanization.

Input use pattern in organic and conventional sugarcane cultivation

The comparative input use pattern between organic and conventional sugarcane cultivation are detailed in Table 2 supports the results on the total human, bullock and machine labour discussed in previous section.

Labour apart, the average quantity of setts required for planting was more (2.90 ton) in conventional method compared to (2.53 ton) organic method. In organic farming, azospirillum (2kg), PSB (2kg) and trichoderma (0.50kg) were used for sett treatment, while in conventional farming, carbendazim (130.91 gm) and chlorpyriphos (124.80 ml) were used. Slightly higher quantity of FYM was used in organic farming (9.43 t) compared to that of conventional farming (7.44 t).

In organic farming, nutritional requirement of sugarcane crop was provided through different biofertilizers like (21.13 kg) green manure seeds, (460.81 kg) vermicompost, (2.33 kg) trichoderma, (4.61 kg) azospirillum and (4.61 kg) PSB per acre. In conventional sugarcane farming, nitrogen (115.32 kg), phosphorous (47.84 kg), potassium (93.04 kg), zinc (14.96 kg), iron (13.17 kg) and sulphur (12.17 kg) per acre were used in the study area.

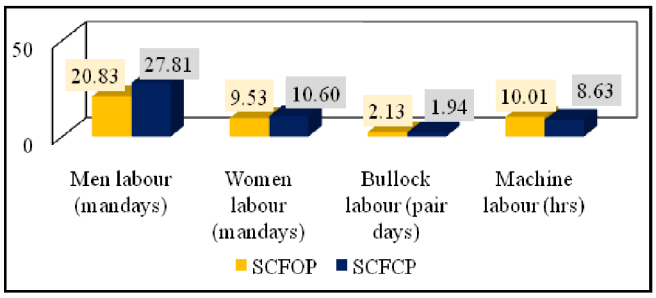

Fig. 2: Labour use pattern in organic and conventional sugarcane cultivation.

Table 2: Input use pattern in organic and conventional sugarcane cultivation (Per acre).

Sl. No.	Inputs	Units	Organic (n=30)	Conventional (n=30)
1	Human labour	manday	30.36	38.41
2	Bullock labour	pairday	2.13	1.94
3	Machine labour	hrs	10.01	8.63
4	Setts	t	2.53	2.90
5	Sett treatment materials			
a	Azospirillum	kg	2	-
b	PSB	kg	2	-
c	Trichoderma	kg	0.50	-
d	Carbendazim	gm	-	130.91
e	Chlorpyriphos	ml	-	124.80
6	FYM	t	9.43	7.44
7	Bio-fertilizer and organic manure/Chemical fertilizer			
a	Green manure	kg	21.13	-
b	Vermi compost	kg	460.81	-
c	Trichoderma	kg	2.33	-
d	Azospirillum	kg	4.61	-
e	PSB	kg	4.61	-
f	Nitrogen	kg	-	115.32
g	Phosphorous	kg	-	47.84
h	Potassium	kg	-	93.04
i	Zinc	kg	-	14.96
j	Iron	kg	-	13.17
k	Sulphur	kg	-	12.17
8	Bio-pesticide/PP chemicals			
a	Metarhizium	kg	5.11	-
b	Neem oil	ml	114.96	-
c	Atrazine	kg	-	1.12
d	Coragen	ml	-	25.74
e	Chlorpyriphos	ltr	-	1.21
9	Irrigation water[#]	acre inch	173.04	173.04
10	Miscellaneous (Beejamrutha and jeevamrutha).0	ltr	800	-

Note:-[#] data regarding irrigation water requirement was adopted from Prem Kumar, 2023.

Major pests and diseases were controlled using metarhizium (5.11 kg) and neem oil (114.96 ml) in organic method, while in conventional method atrazine (1.12 kg) was used for weed control and coragen (25.74 ml) and chlorpyriphos (1.21 litre) were used to control pests and diseases. In organic method of sugarcane cultivation, around 800 litres of beejamrutha and jeevamrutha per acre were used.

Costs and returns in organic and conventional sugarcane cultivation

To understand the profitability in organic sugarcane

Table 3: Cost of cultivation of sugarcane under organic and conventional methods of cultivation (Per acre).

Sl. No.	Particulars	SCFOP (n=30)		SCFCP (n=30)	
		Value (Rs.)	Per cent	Value (Rs.)	Per cent
I Variable cost					
A	Material cost				
1	Setts	9,100	8.65	10,150	9.00
2	Sett treatment material	355	0.34	105	0.09
3	FYM	14,616	13.90	11,532	10.23
4	Bio-fertilizer and organic manure/Chemical fertilizer	4,472	4.25	9,249	8.20
5	Bio-pesticides/Plant protection chemicals	1,555	1.48	1,623	1.44
6	Irrigation charges	5,305	5.04	5,305	4.71
7	Miscellaneous cost	980	0.93	-	-
	Sub total (A)	**36,383**	**34.59**	**37,964**	**33.68**
B	Labour cost				
1	Human labour	15,180	14.43	19,205	17.04
2	Bullock labour	3,195	3.04	2,910	2.58
3	Machine labour	7,007	6.66	6,041	5.36
	Sub total (B)	**25,382**	24.13	**28,156**	24.98
C	Harvesting and transportation cost [contract]	14,608	13.89	16,960	15.05
D	Interest on working capital at 7%	5,346	5.08	5,816	5.16
	Total variable cost	**81,719**	**77.70**	**88,896**	**78.86**
II Fixed cost					
1	Land revenue	35	0.03	35	0.03
2	Rental value of land	19,780	18.81	19,975	17.72
3	Depreciation	1,124	1.07	1,267	1.12
4	Interest on fixed capital at 12%	2,513	2.39	2,553	2.26
	Total fixed cost	**23,452**	**22.30**	**23,830**	**21.14**
III	**Total cost of cultivation**	**1,05,171**	**100.00**	**1,12,726**	**100.00**

cultivation over conventional method in Bagalkote district of Karnataka, comparative economics was worked out and the costs and returns involved in sugarcane cultivation on per acre basis are presented in Table 3 and 4.

The results of the study clearly indicated that the cost of cultivation of sugarcane under organic farming (Rs. 1,05,171) was comparatively less than that of conventional method (Rs. 1,12,726). Total variable cost (TVC) was the major cost component forming (Rs. 81,719) 77.70 and (Rs. 88,896) 78.86 per cent in organic and conventional methods, respectively. Total fixed cost was Rs. 23,452 in case of organic farming and Rs. 23,830 in conventional method (Table 3).

Other than labour, cost of FYM (13.90 %), setts (8.65 %) and Biofetilizers (4.25%) were major cost components of TVC under organic cultivation, whereas FYM (10.23 %), setts (9.00 %) and chemical fertilizers (8.20 %) were major cost of TVC under conventional method.Rental value of land was the major fixed cost in both organic and conventional methods. Harvesting and transportation cost was also major cost in sugarcane cultivation, which was 13.89 per cent of total cost in organic farming and 15.05 per cent in conventional farming.

Average yield was higher (67.84 t/acre) in conventional farming than that of organic farming (58.43 t/acre) leading to higher cost of production (Rs./ton) in organic farming (Rs. 1,800/t) compared to conventional farming (Rs. 1,662/t). But, the gross return and net returns in organic farming were higher (Rs. 2,07,427 and 1,02,256, respectively) than conventional farming (Rs. 2,06,912 and Rs. 94,186). Even though yield was lower in organic farming, the gross return and net returns were more due to premium price available for organic sugarcane (Rs. 3,550/t) and lower cost of cultivation. It

Table 4: Returns structure in organic and conventional sugarcane cultivation (Per acre).

Sl. No.	Particulars	Unit	SCFOP	SCFCP
1	Yield	t/acre	58.43	67.84
2	Price	Rs./t	3,550	3,050
3	Gross return	Rs./acre	2,07,427	2,06,912
4	Cost of cultivation	Rs./acre	1,05,171	1,12,726
5	Cost of production	Rs./t	1,800	1,662
6	Net return	Rs./acre	1,02,256	94,186
7	Return per rupee of expenditure	Rs./acre	1.97	1.84

Table 5: Economic benefits of sugarcane cultivation under organic over conventional farming (Per acre).

Debit		**Credit**	
Added costs for adopting organic cultivation	**Value (Rs.)**	**Added revenue for adopting organic cultivation**	**Value (Rs.)**
a) Additional cost on sett treatment material	250	a) Added revenue from organic sugarcane	515
b) Additional cost on FYM	3,084		
c) Additional cost on bullock labour	285		
d) Additional cost on machine labour	966		
e) Miscellaneous cost	980		
Total increased cost	**5,565**	**Total increased revenue**	**515**
Reduced revenue for adopting organic cultivation	**Value (Rs.)**	**Reduced costs by adopting organic cultivation**	**Value (Rs.)**
		a) Cost on setts	1,050
		b) Costs on bio-fertilizers	4,777
		c) Costs on bio-pesticides	68
		d) Costs on harvesting and transportation	2,352
		e) Costs on human labour	4,025
Total decreased revenue	**0**	**Total decreased cost**	**12,272**
Total debit	**5,565**	**Total credit**	**12,787**
Net gain	**7,222**		

was also observed that, return per rupee of expenditure was high in organic farming (Rs.1.97) than in conventional sugarcane cultivation (Rs. 1.84) (Table 4).

These results were in similar line with the study conducted by Praveen (2017) and Bhoge (2021) as discussed in introduction section of this paper.

Economic benefits of sugarcane cultivation under organic over conventional farming

The economic benefit of organic sugarcane cultivation over conventional sugarcane cultivation was analyzed using partial budgeting technique. The debit and credit side of partial budgeting is presented in Table 5. In debit side, increased cost for adopting organic cultivation practices was found to be Rs. 5,565 per acre which was mainly due to the additional cost on sett treatment materials, FYM, bullock labour, machine labour and miscellaneous cost in organic farming. Reduced revenue was nil in debit side. In credit side, the added revenue was Rs. 515 per acre due to the premium price available for organic sugarcane. While, decreased cost was mainly due to using fewer setts, bio fertilizers, bio pesticides, cost saved from harvesting and transportation due to lower yield and less human labour which accounted for Rs. 12,272 peracre. In total, total debit was Rs. 5,565 which was lower than total credit with Rs. 12,787. Thus, the total economic viability of organic over conventional sugarcane farming in the region was Rs. 7,222 per acre.

Conclusion

The study shows that organic sugarcane farming is more cost-effective than conventional method and offers higher returns to farmers. Despite lower yields, sugarcane grown organically will also attract premium price similar to other organic products. The return on investment is also higher for organic farming (Rs.1.97 per rupee) compared to conventional farming (Rs.1.84 per rupee). In general, organic farming not only promotes sustainability and environmental health, but also helps the farmers to get better profit margins. Farmers can produce many organic inputs themselves within farm which will further reduce the cost of cultivation. Though the results of the study clearly indicate cultivation of sugarcane under organic farming is economical, it is very important to create awareness about these facts to the farmers. Through these results, the study suggests policy maker to take up necessary measure to organise training programs to farmers on organic farming. Although the premium price for organic sugarcane is Rs. 3550/t, adoption rates are low due to yield concerns, market access issues and certification difficulties. To boost organic sugarcane farming, the government should introduce a price incentive scheme through sugar factories, encouraging more farmers to switch to organic practices. Overall, with lots of issues to be addressed for better future, considering the factors like, soil health, human health, environment, etc., organic farming can play a pivotal role. Hence, concerned departments, organizations and institutes should come up with programmes which encourage more farmers to adopt organic sugarcane cultivation.

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