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Characterization and impact of organic vis-à-vis conventional farming systems in Jammu District

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Abstract

This study characterized organic and conventional farming practices in Jammu district and assessed their implications for farm livelihoods. A multistage random sampling procedure was used to select 120 farmers, comprising 60 organic and 60 conventional producers. Propensity score matching, implemented through Kernel and Radius matching, was applied to estimate the effects of organic farming on employment generation and net farm income. The principal enterprise combinations observed in the study area were the Crop+Horticulture+Dairy (C-H-D) and Crop+Dairy (C-D) systems. The matching estimates indicated that organic cultivation generated more employment and produced higher net farm income than conventional cultivation. The constraint-facing index (CFI) showed that low output prices were the leading constraint under both production systems. Organic farmers also reported limited access to quality inputs, whereas conventional farmers identified the high cost of fertilizers as a major concern. These findings indicate that wider adoption of organic agriculture will require policy measures that improve access to reliable inputs, strengthen marketing arrangements, and enhance farmers' capacity to obtain remunerative prices.

Keywords: Organic farming; farming systems; propensity score matching; constraints; Jammu district

1. Introduction

Organic farming has received increasing attention because of its potential to address several environmental and resource-related challenges confronting agriculture. The approach may contribute to environmental protection, conservation of non-renewable resources, and improvement in food quality (Charyulu and Biswas, 2010) ^[1]. As a holistic production-management system, organic agriculture seeks to support agroecosystem functioning, biodiversity, and soil health.

Organic production generally relies on organic nutrient sources and minimizes dependence on synthetic chemicals for crop protection. Conventional production, by contrast, commonly uses chemical fertilizers and pesticides to raise yields, sometimes with insufficient attention to biodiversity and long-term soil health (Ramesh et al., 2010) ^[5]. Organic agriculture has expanded globally and has also gained policy attention in India. The source manuscript reports that approximately 3.2 million ha in India are managed under organic practices, with substantial areas located in Madhya Pradesh, Rajasthan, and Karnataka.

Despite this growing interest, accessible empirical evidence comparing the livelihood effects of organic and conventional farming systems in India remains limited. Such comparisons should consider not only crop production but also the integration of complementary farm enterprises, particularly on smallholder farms where resources are shared across activities. Examining enterprise combinations under the two production approaches is therefore necessary to understand their diversity and operational complexity (Raghavendra et al., 2022) ^[4]. Against this background, the present study characterized organic and conventional farming systems in Jammu district and evaluated their effects on employment and farm income.

2. Materials and Methods

A primary farm survey was conducted in Jammu district during 2022 to document and compare organic and conventional farming systems.

A multistage sampling design was adopted. Three blocks were selected from the district, followed by two villages from each block, giving a total of six villages. The reported sample design comprised 10 organic and 10 conventional farmers from each village, resulting in 120 respondents: 60 organic farmers and 60 conventional farmers.

Information was collected on household socioeconomic characteristics, farm organization and production practices, consumption patterns, and constraints encountered by farmers. The analysis first described the social characteristics and enterprise combinations of the sampled households.

$$E(\Delta Y) = (1/N) \sum_{i \in T} \{Y(i,1) - [\sum_{j=1}^{N_c} Y(j,0) K((P(X(j,0)) - P(X(i,1)))/b_v)] / [\sum_{j=1}^{N_c} K((P(X(j,0)) - P(X(i,1)))/b_v)]\}$$

Here, T denotes the set of treated observations and N is the number of treated cases. $Y(i,1)$ and $X(i,1)$ are the outcome and covariates for treated case i . $Y(j,0)$ and $X(j,0)$ represent the corresponding values for comparison case j within the neighborhood of treated case i , where $|P(X(i,1)) - P(X(j,0))| < b_v/2$. N_c is the number of comparison cases in the neighborhood of i , K is the kernel function, and b_v is the bandwidth.

2.2 Radius matching

$$R^M = (1/N^T) \sum_{i \in T} Y_i^T - (1/N^T) \sum_{j \in C} w_j Y_j^c; \quad w_j = \sum_i w_{ij}$$

In this expression, Y^T is the outcome for a treated individual, Y^c is the outcome for a control individual, N^T is the number of treated observations, and w_j denotes the matching weight assigned to control observation j .

2.3 Constraint-facing index

Farmer constraints were ranked using a constraint-facing index (CFI), following the severity categories described by Chunera (2020) [3]. Respondents classified each constraint as high, medium, low, or absent. Scores of 3, 2, 1, and 0, respectively, were assigned to these four response categories. The index for each constraint was calculated as:

$$CFI = (C_h \times 3) + (C_m \times 2) + (C_l \times 1) + (C_n \times 0)$$

where C_h , C_m , C_l , and C_n are the numbers of respondents

Costs, gross returns, net returns, and benefit-cost (B:C) ratios were then compiled for the five major farming systems identified in the district.

The effects of organic farming on employment generation and net farm income were estimated using propensity score matching (PSM). Kernel and Radius matching methods were employed. The covariates reported for the matching procedure were respondent age, landholding, family size, seed price, and use of extension services.

2.1 Kernel matching

reporting high, medium, low, and no constraint, respectively.

3. Results

The results are presented in five parts: household characteristics, distribution of farming systems, costs and returns, estimated impacts of organic farming, and production and marketing constraints.

3.1 Socioeconomic characteristics of sampled households

Table 1 summarizes the social characteristics of the surveyed households by farm-size category. Farmers were classified as marginal (<1 ha), small (1-2 ha), or medium and above (>2 ha). Among the 60 organic farmers, 22 were marginal, 28 were small, and 10 were in the medium-and-above category. Among the 60 conventional farmers, the corresponding numbers were 28, 17, and 15.

The source narrative reports mean ages of 47.5 years for organic farmers and 45 years for conventional farmers. Across the farm-size categories shown in Table 1, mean age ranged from 45.2 to 49.2 years for organic farmers and from 44.7 to 45.4 years for conventional farmers. Conventional farmers had larger average holdings in the marginal and small categories, whereas organic farmers had larger holdings in the medium-and-above category. The reported average family sizes were 5.7 persons for organic households and 5.4 persons for conventional households. Most respondents in both groups had completed primary or secondary education, while comparatively fewer had attained intermediate or higher education.

Table 1: Social characteristics of different categories of farmers in Jammu.

Variables	Organic <1 ha	Organic 1-2 ha	Organic >2 ha	Conventional <1 ha	Conventional 1-2 ha	Conventional >2 ha
No. of farmers	21	25	8	25	16	14
Age of farmer (years)	46.1	45.2	49.2	44.7	45.4	44.9
Farm size (ha)	0.73	1.14	2.63	0.81	1.22	2.26
Family size (no.)	5.1	5.8	6.2	4.8	5.9	5.5
Illiterates (no.)	3 (13.6)	4 (14.2)	-	3 (10.7)	2 (11.7)	1 (6.6)
Primary school (no.)	8 (36.3)	10 (35.7)	4 (40)	9 (32.1)	6 (35.2)	7 (46.6)
Secondary school (no.)	7 (31.8)	8 (28.5)	5 (50)	10 (35.7)	7 (41.1)	7 (46.6)
Intermediate & above (no.)	4 (18.1)	6 (21.4)	1 (10)	6 (21.4)	2 (11.7)	-

Note: Figures in parentheses indicate percentage share.

3.2 Distribution of major farming systems

Five major enterprise combinations were identified (Table 2). The Crop+Horticulture+Dairy (C-H-D) system was the most common overall, accounting for 30 households, followed closely by Crop+Dairy (C-D), which was reported by 29 households. Dairy was an important component of organic farms because it supplied organic manure for crop production.

Within the organic group, C-D was the most frequently observed system, adopted by 17 households (28.3%), followed by Horticulture+Dairy (H-D), adopted by 13 households (21.6%), and C-H-D, adopted by 12 households (20%). Among conventional farmers, C-H-D was the dominant system, with 18 households (30.0%).

Table 2: Distribution of sample households among major farming systems in Jammu district.

Farming system	Organic households	Organic (%)	Conventional households	Conventional (%)	Total households
Crop+Horticulture+Dairy (C-H-D)	12	20	18	30.0	30
Crop+Dairy+Poultry (C-D-P)	8	13.3	11	18.3	19
Crop+Dairy (C-D)	17	28.3	12	20.0	29
Horticulture+Dairy (H-D)	13	21.6	8	13.3	21
Crops+Horticulture (C-H)	10	16.6	11	18.3	21
Total	60	100	60	100	120

3.3 Costs and returns of major farming systems

Table 3 presents the estimated costs and returns for the five major systems. Under organic farming, Crop+Dairy+Poultry (C-D-P) generated the highest net return at Rs. 1,55,423 ha⁻¹. It was followed by Horticulture+Dairy (H-D) at Rs. 1,21,056 ha⁻¹, Crops+Horticulture (C-H) at Rs. 1,15,777 ha⁻¹, and

Crop+Dairy (C-D) at Rs. 98,656 ha⁻¹. The C-D-P system also recorded the highest organic B:C ratio, at 2.17, while C-H ranked next at 2.15. In conventional farming, C-D-P likewise produced the highest net return, at Rs. 1,45,528 ha⁻¹, and the highest B:C ratio, at 2.01. The remaining conventional systems recorded B:C ratios ranging from 1.83 to 2.00.

Table 3: Cost and returns of major farming systems in Jammu district.

Farming approach	Cropping pattern	Total cost (Rs. ha ⁻¹)	Gross return (Rs. ha ⁻¹)	Net return (Rs. ha ⁻¹)	B:C ratio
Organic	Crop+Horticulture+Dairy (C-H-D)	112550	201546	88996	1.79
Organic	Crop+Dairy+Poultry (C-D-P)	132120	287543	155423	2.17
Organic	Crop+Dairy (C-D)	121500	220156	98656	1.81
Organic	Horticulture+Dairy (H-D)	135256	256312	121056	1.89
Organic	Crops+Horticulture (C-H)	99865	215642	115777	2.15
Conventional	Crop+Horticulture+Dairy (C-H-D)	131258	261452	130194	1.99
Conventional	Crop+Dairy+Poultry (C-D-P)	143126	288654	145528	2.01
Conventional	Crop+Dairy (C-D)	129845	254621	124776	1.96
Conventional	Horticulture+Dairy (H-D)	147591	270153	122562	1.83
Conventional	Crops+Horticulture (C-H)	112543	225672	113129	2.00

3.4 Estimated effects of organic farming

The PSM estimates are reported in Table 4. Kernel matching estimated an average treatment effect on the treated (ATT) of 42 additional employment man-days, with a standard error of 20.17. Radius matching produced a comparable estimate of 43 man-days, with a standard error of 19.31. Both employment estimates were significant at the 5% level.

For net farm income, the estimated ATT was Rs. 12,678 ha⁻¹

under Kernel matching and Rs. 12,069 ha⁻¹ under Radius matching. The corresponding standard errors were 6,367.22 and 6,942.86. The Kernel estimate was significant at the 1% level, whereas the Radius estimate was significant at the 5% level. Within the reported matching specifications, organic farming was therefore associated with higher employment and net farm income than conventional farming.

Table 4: Impact of organic vis-à-vis conventional farming on selected outcome variables.

Outcome variable	Matching method	Average treatment effect (ATT)	Standard error
Employment (man-days)	Kernel matching	42**	20.17
Employment (man-days)	Radius matching	43**	19.31
Net farm income (Rs. ha ⁻¹)	Kernel matching	12678***	6367.22
Net farm income (Rs. ha ⁻¹)	Radius matching	12069**	6942.86

*** And ** indicate significance at 1% and 5%, respectively.

3.5 Constraints faced by farmers

The CFI rankings for eight constraints are shown in Table 5. Low market prices for farm outputs ranked first for both organic and conventional farmers, with CFI values of 111 and 98, respectively. For organic farmers, non-availability of quality inputs such as biofertilizers and biopesticides ranked second (CFI 95), followed by inadequate storage and

processing facilities (CFI 94). For conventional farmers, the high price of manure or fertilizer ranked second (CFI 85), while high labour prices ranked third (CFI 78). Lack of adequate extension services received the lowest rank in both groups, with CFI values of 69 for organic farmers and 68 for conventional farmers.

Table 5. Ranking of farmers by constraint-facing index.

Constraint	Org High	Org Medium	Org Low	Org CFI	Org Rank	Conv High	Conv Medium	Conv Low	Conv CFI	Conv Rank
Low market price of outputs	21	18	12	111	I	18	13	18	98	I
Non-availability of quality inputs	20	11	13	95	II	10	15	12	72	V
High price of manures/fertilizer	12	14	15	79	VI	12	15	19	85	II
High labour prices	14	17	11	87	IV	11	16	13	78	III
Lack of education and training facilities	12	18	14	86	V	12	11	13	71	VII
Lack of adequate extension services	9	12	18	69	VIII	10	14	10	68	VIII
Lack of nearby markets availability	11	12	14	71	VII	12	12	15	75	IV
Lack of storage and processing facilities	14	18	16	94	III	11	14	10	71	VI

N = 60 for organic farming and N = 60 for conventional farming.

4. Discussion

The findings show that farming in Jammu district is organized around diversified combinations of crops, horticulture, dairy, and poultry rather than around single enterprises. The predominance of the C-H-D and C-D systems illustrates the importance of crop-livestock integration. This integration is particularly relevant to organic production because dairy enterprises can supply manure and thereby support internal nutrient cycling.

The cost-return results indicate that the C-D-P system performed strongly under both production approaches. Among organic farms, it generated the highest net return and the highest B:C ratio, whereas C-H also achieved a comparatively high B:C ratio. These results suggest that enterprise diversification may contribute to farm profitability by combining several income sources and enabling complementary use of farm resources. However, the study reports accounting results for the sampled systems and does not provide measures of year-to-year variability or production risk.

The PSM estimates further suggest that organic farming was associated with additional employment and higher net farm income. The similarity of the Kernel and Radius estimates supports the internal consistency of the reported direction of effect. Nevertheless, the interpretation should remain confined to the observed covariates and matching procedures described in the study, because the manuscript does not report balance diagnostics, common-support statistics, sensitivity analysis, or tests for hidden bias.

Marketing and input-related constraints may limit the practical gains from organic production. Low output prices ranked as the most serious constraint in both groups, indicating that production-system improvements alone may not translate into stronger livelihoods unless farmers have access to remunerative markets. Organic farmers additionally emphasized the limited availability of quality bioinputs, while conventional farmers highlighted fertilizer costs. The importance of institutional and market constraints is consistent with the constraint-oriented observations reported by Choudhary et al. (2007)^[2].

The study is limited by its cross-sectional design, its focus on 120 farmers from six villages in one district, and the restricted methodological details reported for the PSM analysis. The manuscript also does not present seasonal or multi-year evidence, environmental indicators, or independent verification of organic management practices. Future research based on the same research problem should include a larger geographic area, repeated observations over time, clearer documentation of certification or practice status, and complete matching diagnostics. These additions would strengthen the assessment of livelihood effects without changing the questions addressed in the present study.

5. Conclusion

This study compared the characteristics and livelihood implications of organic and conventional farming systems in Jammu district. The sampled farms were dominated by integrated enterprise combinations, particularly C-H-D and C-D. The reported PSM estimates showed positive and statistically significant associations between organic farming and both employment generation and net farm income. At the same time, low output prices emerged as the leading constraint under both systems; organic farmers also faced shortages of quality inputs, whereas conventional farmers were affected by high fertilizer costs. These findings support

the development of stronger market channels, access to remunerative prices, reliable supplies of quality organic inputs, and targeted farmer training. State agencies and relevant institutions should strengthen awareness, production, harvesting, processing, storage, and transportation support, particularly for small and marginal farmers, to facilitate informed adoption of organic practices and improve farm livelihoods in the Jammu region.

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