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Comparative economics of cultivation of Lakadong turmeric under organic and conventional management in West Jaintia Hills, Meghalaya

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Abstract

Lakadong turmeric (*Curcuma longa* L.), a high-curcumin landrace of the Jaintia Hills, is central to Meghalaya's organic-horticulture policy, yet the private economics of its organic cultivation relative to the conventional system remain inadequately documented. This study compares the cost of cultivation, returns and profitability of organic and conventional Lakadong turmeric using primary data collected during 2025–26 from 128 farmers (64 organic and 64 conventional) in the Laskien and Namdong blocks of West Jaintia Hills district, Meghalaya, selected through a stratified random sampling design. Costs were built up component-wise on a per-hectare basis, and gross return, net return and the benefit–cost ratio were worked out for each system; differences between systems were tested using Student's two-sample t-test. The total cost of cultivation was marginally lower under organic management (₹2,10,286 ha⁻¹) than under conventional management (₹2,12,619 ha⁻¹), a difference of only 1.11 per cent. Organic growers applied 20.97 per cent more farmyard manure (₹23,627 against ₹18,672 ha⁻¹, significant at 5 per cent) in place of chemical fertiliser, on which conventional growers spent ₹8,222 ha⁻¹. Human labour was the largest single head of expenditure in both systems, accounting for roughly one-half of total cost. Organic turmeric yielded 3.94 per cent less (5,814 against 6,052 kg ha⁻¹), which, at a common farm-gate price of ₹40 kg⁻¹, translated into a lower gross return (₹2,32,541 against ₹2,42,083 ha⁻¹) and a lower net return (₹22,256 against ₹29,464 ha⁻¹). Both systems were privately profitable, with benefit–cost ratios of 1.11 (organic) and 1.14 (conventional). Organic Lakadong turmeric is thus privately viable but modestly less remunerative than its conventional counterpart, the shortfall arising almost entirely from the yield penalty rather than from any cost disadvantage. Bridging this narrow private gap through assured input supply, a certified organic price premium and manure-handling support would make organic cultivation of the crop attractive without a large recurring subsidy.

Keywords: Lakadong turmeric, organic farming, cost of cultivation, benefit–cost ratio, net return, Meghalaya

1. Introduction

Turmeric (*Curcuma longa* L.) is among the most valued spice crops of India, which is the world's largest producer, consumer and exporter of the commodity¹. Within the country, the north-eastern states have acquired a distinct identity in turmeric on the strength of quality rather than volume, and Meghalaya's Lakadong turmeric, a landrace of the Jaintia Hills celebrated for a curcumin content reported to reach 6–7 per cent against the 2–3 per cent typical of common cultivars, is the outstanding example². The crop is grown very largely by small and marginal tribal households under rain-fed, low-external-input conditions on the hill slopes of West Jaintia Hills, and it has become the flagship commodity around which the State's organic-mission and geographical-indication efforts are organised.

Meghalaya has committed itself to a large expansion of organic agriculture, and its certified organic area is

overwhelmingly horticultural, with turmeric, ginger, pineapple and black pepper accounting for the greater part of certified produce entering commercial channels³. Organic farming is promoted on the twin grounds that it conserves the fragile hill soils and that it commands a price premium in distant markets. Whether the promise translates into a viable farm-level proposition, however, depends on the balance between the costs a grower incurs and the returns a grower realises once chemical fertiliser and synthetic plant protection are withdrawn and replaced by bulky organic inputs and additional labour.

The wider evidence on organic–conventional profitability is mixed. A number of studies report that the price premium and the saving on purchased chemicals can offset a moderate yield penalty and leave organic cultivation at least as profitable as conventional⁴, while a substantial body of meta-analytical work finds an organic yield gap that is widest

precisely for the nutrient-demanding crops and during the transition years before soil biological function matures^{5,6}. For a perennial-rhizome spice such as turmeric, grown by resource-poor households for whom a season's income cannot easily be risked, the direction and size of this balance is an empirical question that has to be settled locally. Yet farm-level economic evidence specific to Lakadong turmeric, and specific to the organic versus conventional comparison, is scarce; most published work on the crop concerns its curcumin chemistry, agronomy or marketing rather than the comparative cost of cultivation.

The present study addresses this gap. It compares, component by component, the cost of cultivation of organic and conventional Lakadong turmeric in its home district and works out the gross return, net return and benefit–cost ratio of each system, testing the difference between them statistically. The objective is to establish whether organic cultivation of the crop is privately profitable, to locate the precise source of any difference in profitability between the two systems, and to draw from that the policy measures most likely to make organic Lakadong turmeric an attractive proposition for the smallholder who grows it.

2. Materials and Methods

2.1 Study area

The study was conducted in West Jaintia Hills district of Meghalaya, the principal turmeric-producing district of the State and the home tract of the Lakadong landrace. The State lies between 25°02' and 26°07' N latitude and 89°49' and 92°50' E longitude, and its agriculture is characterised by high rainfall, acidic hill soils and a predominance of small and marginal tribal holdings. Two blocks of the district, Laskien and Namdong, in which turmeric cultivation is concentrated and in which both certified-organic and conventional growers are present in numbers, were selected purposively. Within the selected blocks, clusters of villages representative of the prevailing turmeric-farming practice were identified for the survey.

2.2 Sampling design and data collection

A stratified random sampling design was adopted. Turmeric growers in the selected villages were first stratified into organic and conventional systems; organic growers were defined as those holding organic certification under the Internal Control System of their Farmer Producer Organisations, and conventional growers as those cultivating with chemical fertiliser and synthetic plant protection. Respondents were then selected randomly within each stratum. A total sample of 128 turmeric farmers was surveyed, comprising 64 organic and 64 conventional growers, so that the two systems were represented by separate groups of farmers cultivating separate plots. Primary data were collected during the 2025–26 crop year through a pre-tested, structured interview schedule that recorded the socio-economic profile of the household and the physical quantities and prices of every input used and output obtained per unit area.

2.3 Analytical framework

The data were analysed using cost, return and profitability measures together with a test of statistical significance. All values were expressed on a per-hectare basis in Indian rupees

(₹).

Cost of cultivation: The cost of cultivation was built up component by component and summed to a total cost per hectare. The component heads comprised the cost of rhizome (seed); farmyard manure; chemical inputs (fertiliser and plant protection); human labour, separated into family and hired labour, with family labour imputed at the prevailing wage rate; interest on working capital charged at 8 per cent; depreciation on implements; the rental value of owned land; and marketing cost. For each head, and for the total, the value under organic management was expressed as a percentage change over the corresponding conventional value, computed as

$$\% \text{ change} = [(\text{Organic} - \text{Conventional}) / \text{Conventional}] \times 100$$

so that a positive value denotes a higher expenditure under organic management. The share of each head in the total cost was also worked out for each system to examine the cost structure.

Returns and profitability: Gross return was obtained as the product of yield and the farm-gate price of the produce. Net return was computed as gross return minus total cost of cultivation, and the benefit–cost ratio (B:C ratio) as the ratio of gross return to total cost. A B:C ratio greater than unity indicates that the enterprise is privately profitable.

Test of significance: Whether the organic and conventional means of a continuous variable, the components of cost, yield, gross return and net return, differed by more than sampling variation was tested using Student's two-sample (unpaired) t-test⁷, which tests the null hypothesis of equal population means ($H_0: \mu_1 = \mu_2$) against the two-sided alternative. As the two systems were represented by independent groups of farmers, the unpaired form of the test is appropriate. Where the assumption of equal variance was not tenable, the Welch–Satterthwaite modification was applied. The computations were carried out in SPSS version 26. Significance was judged at the 1, 5 and 10 per cent levels, and the percentage difference between systems is reported alongside each test so that the magnitude of a difference and its statistical reliability can be read together.

3. Results

3.1 Socio-economic profile of the respondents

The turmeric growers surveyed were middle-aged, with a mean age of 51.3 years, and long-experienced, averaging 30.4 years in farming (Table 1). The sub-sample was very heavily female, at 93.0 per cent, reflecting the matrilineal social structure of the Jaintia community and the central role of women in horticultural cultivation and marketing in the State. Formal schooling was low, at 2.66 years on average, the combination of little schooling with long field experience being characteristic of smallholder systems in which agronomic knowledge passes through practice rather than instruction. Mean landholding was small, at 1.28 hectares, confirming that the sample is dominated by small and marginal farmers, and mean annual family income was ₹1,38,859. Awareness of, or training in, organic farming was reported by only 36.7 per cent of respondents, while

membership of a self-help group or cooperative was high at 76.6 per cent, reflecting the dense collective-institution network the State has promoted for horticultural aggregation and marketing.

Table 1: Socio-economic profile of the sampled turmeric growers (n = 128)

Characteristic	Mean / percentage
Age (years)	51.3
Female (%)	93.0
Education (years)	2.66
Farming experience (years)	30.4
Family size (no.)	6.8
Total land holding (ha)	1.28
Annual family income (₹)	1,38,859
Aware / trained in organic farming (%)	36.7
SHG / cooperative member (%)	76.6

Note: Values are sample means or percentages of respondents.

3.2 Cost of cultivation

The component-wise cost of cultivation of organic and conventional Lakadong turmeric is presented in Table 2. The total cost of cultivation was marginally lower under organic management, at ₹2,10,286 ha⁻¹, than under conventional management, at ₹2,12,619 ha⁻¹, a difference of only 1.11 per cent. The two systems therefore incur almost the same aggregate expenditure, but they differ markedly in its composition.

The clearest contrast is in the nutrient and plant-protection heads. Conventional growers spent ₹8,222 ha⁻¹ on chemical

inputs, a head that is absent altogether under organic management. In its place, organic growers applied substantially more farmyard manure, spending ₹23,627 ha⁻¹ against ₹18,672 ha⁻¹ under conventional management, a difference of 20.97 per cent that was statistically significant at the 5 per cent level. The organic system thus substitutes a larger quantity of bulky organic manure for the chemical fertiliser it forgoes, and the additional outlay on manure broadly offsets both the saving on chemicals and the slightly lower cost of the remaining heads.

Human labour was the single largest head of expenditure in both systems. Family and hired labour together accounted for ₹1,04,156 ha⁻¹ (49.5 per cent of total cost) under organic management and ₹1,00,253 ha⁻¹ (47.2 per cent) under conventional management, the organic figure being higher by 2.23 per cent for family labour and 7.03 per cent for hired labour, reflecting the extra labour needed to collect, transport and spread manure and to manage weeds without herbicide. The cost of rhizome (seed), the second-largest head, was marginally lower under organic management (₹54,276 against ₹56,387 ha⁻¹), and the smaller heads, interest on working capital, depreciation, rental value of land and marketing cost, were of similar magnitude in the two systems. The cost structure (Table 2, final columns) confirms that labour dominates both systems, that materials, seed and manure taken together, form the next-largest block, and that the withdrawal of chemicals under organic management is compensated chiefly by heavier manuring and marginally heavier labour rather than by any reduction in total cost.

Table 2: Component-wise cost of cultivation and cost structure of organic and conventional Lakadong turmeric (₹ ha⁻¹)

Particulars	Organic	Conventional	%change	Share%(Org.)	Share%(Conv.)
Rhizome (seed)	54,275.56	56,386.55	-3.89	25.81	26.52
Farmyard manure	23,626.67**	18,672.27	+20.97	11.24	8.78
Chemical inputs	0.00	8,222.35	—	0.00	3.87
Family labour	71,191.11	69,605.32	+2.23	33.85	32.74
Hired labour	32,964.44	30,647.43	+7.03	15.68	14.41
Interest on working capital @ 8%	8,869.33	9,274.29	-4.57	4.22	4.36
Depreciation	885.44	920.78	-3.99	0.42	0.43
Rental value of land	10,000.00	10,000.00	0.00	4.76	4.70
Marketing cost	8,473.33	8,890.01	-4.92	4.03	4.18
Total cost of cultivation	2,10,285.88	2,12,619.01	-1.11	100.00	100.00

Note: ** denotes that the organic-conventional difference is significant at the 5 per cent level (Student's t-test). '% change' is the organic value expressed as a percentage change over the conventional value. 'Share (%)' is the share of each head in the total cost of cultivation of the respective system.

3.3 Yield, returns and profitability

The physical yield, returns and profitability of the two systems are presented in Table 3. Organic turmeric yielded 5,813.54 kg ha⁻¹ against 6,052.07 kg ha⁻¹ under conventional management, a yield penalty of 3.94 per cent. This penalty is milder than that reported for the more disease-prone rhizome spices, and it accords with turmeric's comparatively low disease pressure and its tolerance of organic nutrition. At a farm-gate price of ₹40 kg⁻¹ common to both systems, the lower organic yield translated directly into a lower gross return of ₹2,32,541 ha⁻¹ against ₹2,42,083 ha⁻¹ under conventional management, a difference of 3.94 per cent. Because the total cost of cultivation was almost identical

between the two systems while the gross return was lower under organic management, the net return was lower under organic cultivation, at ₹22,256 ha⁻¹ against ₹29,464 ha⁻¹, a shortfall of ₹7,208 ha⁻¹ or 24.46 per cent. Both systems nonetheless remained privately profitable: the benefit-cost ratio was 1.11 under organic management and 1.14 under conventional management. Organic Lakadong turmeric is therefore a privately viable enterprise that returns ₹1.11 for every rupee spent, though it is modestly less remunerative than its conventional counterpart. The whole of the profitability difference is traceable to the yield penalty on the output side, since the two systems differ hardly at all in total cost.

Table 3: Yield, returns and profitability of organic and conventional Lakadong turmeric (₹ ha⁻¹ unless otherwise stated)

Particulars	Organic	Conventional	% change
Yield (kg ha ⁻¹)	5,813.54	6,052.07	-3.94
Price (₹ kg ⁻¹)	40.00	40.00	0.00
Gross return	2,32,541.44	2,42,082.80	-3.94
Total cost of cultivation	2,10,285.88	2,12,619.01	-1.11
Net return	22,255.55	29,463.79	-24.46
Benefit–cost ratio	1.11	1.14	—

Note: ‘% change’ is the organic value expressed as a percentage change over the conventional value. Net return = gross return – total cost of cultivation; benefit–cost ratio = gross return / total cost of cultivation.

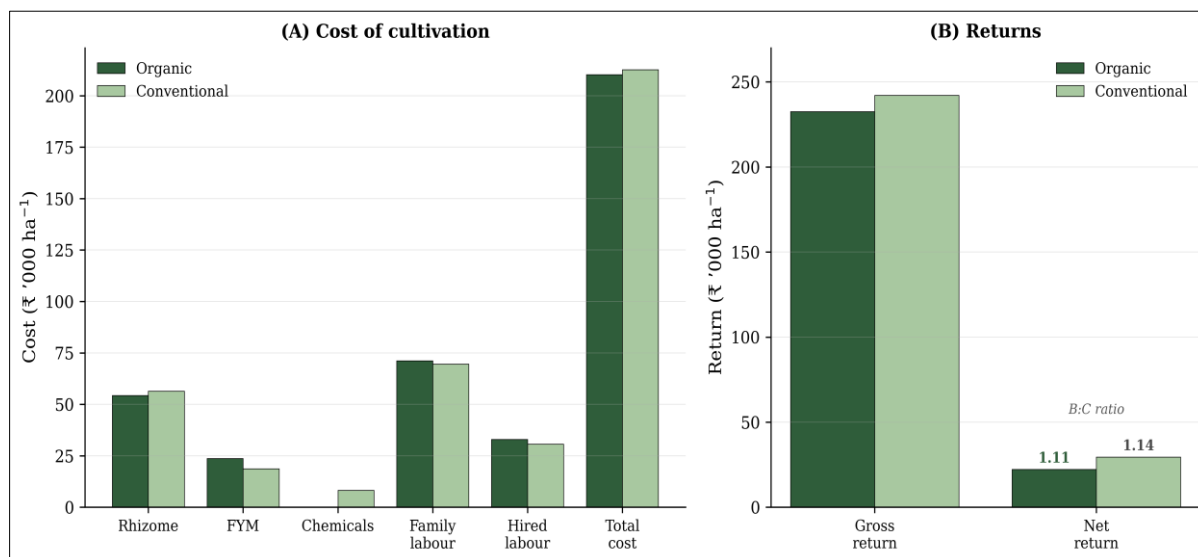


Fig 1: Comparative cost of cultivation, returns and benefit–cost ratio of organic and conventional Lakadong turmeric (₹ '000 ha⁻¹). Panel (A) major cost heads and total cost; Panel (B) gross and net return with the benefit–cost ratio marked on the net-return bars.

4. Discussion

The central finding of this study is that organic Lakadong turmeric is privately profitable but modestly less remunerative than the conventional crop, and that the difference arises on the output side rather than the cost side. That the two systems should cost almost the same to grow is itself instructive. It runs counter to the common expectation that organic cultivation is invariably the cheaper option because it dispenses with purchased chemicals: here the saving on chemical inputs (₹8,222 ha⁻¹) is very nearly cancelled by the additional ₹4,954 ha⁻¹ spent on farmyard manure and the additional ₹3,903 ha⁻¹ spent on labour. The organic grower does not spend less; the grower spends differently, exchanging a small cash outlay on concentrated chemicals for a larger outlay on bulky manure and the labour to handle it.

The significant 20.97 per cent higher expenditure on farmyard manure under organic management is the economic signature of the manure-for-fertiliser substitution that defines the system. Because manure must be collected, carried up-slope and spread by hand, the substitution is labour-intensive, which explains why both family and hired labour are higher under organic cultivation and why labour alone absorbs close to half of the total cost in each system. The dominance of labour in the cost structure is consistent with the wider literature on hill and smallholder cropping, in which human labour is repeatedly found to be the principal cost of cultivation⁴, and it identifies the handling of organic manure as the operation on which any effort to reduce the cost of organic cultivation should concentrate.

On the output side, the 3.94 per cent yield penalty under organic management is small by the standards of the meta-analytical evidence, which places the average organic yield gap nearer 20 per cent and finds it widest for the most nutrient-demanding crops⁵. The mildness of the penalty in turmeric is attributable to the crop's hardiness, its relatively low disease pressure and its tolerance of organic nutrition, and it is the reason organic cultivation remains profitable in this crop where, for more disease-prone rhizome spices, it may not. Because the penalty is shallow, the net-return shortfall of ₹7,208 ha⁻¹ is correspondingly modest, and the benefit–cost ratios of the two systems, 1.11 and 1.14, are close.

A feature of the present comparison that deserves emphasis is that the analysis was conducted at a common farm-gate price of ₹40 kg⁻¹ for both systems, that is, without any organic price premium. The result therefore measures the pure production economics of the two systems, and it shows that even before any premium is counted, organic Lakadong turmeric already covers its costs with a surplus. It follows that a certified organic price premium of even modest size, of the order of 10 per cent on the farm-gate price, would be more than sufficient to close the ₹7,208 ha⁻¹ net-return gap and to make organic cultivation the more profitable of the two systems. This is a materially more favourable position than obtains for the disease-prone spices, where the private penalty of conversion is far larger, and it marks Lakadong turmeric as a crop for which organic conversion can be made privately attractive at low public cost.

Two qualifications attach to these results. First, the

comparison is a cross-sectional one between established organic and conventional growers, not a measurement of the same plots through conversion, so the figures describe the steady-state economics of the two systems rather than the transitional years, during which the yield penalty is typically deeper. Second, the socio-economic profile of the growers, very largely women, with little schooling but long experience and small holdings, means that the capacity to bear even a modest and temporary loss of income is limited, so that measures which reduce the yield penalty or assure the price premium matter more to adoption than their monetary size alone would suggest.

5. Conclusion

Organic cultivation of Lakadong turmeric in West Jaintia Hills is privately profitable, returning ₹1.11 for every rupee invested, but it is modestly less remunerative than conventional cultivation, which returns ₹1.14. The two systems cost almost the same to grow, differing by only 1.11 per cent in total cost, because the saving on chemical inputs under organic management is offset by significantly higher expenditure on farmyard manure and marginally higher labour. The whole of the profitability difference between the systems is traceable to a small yield penalty of 3.94 per cent, which lowers the organic gross and net return. Human labour, and within it the handling of organic manure, is the largest single cost in both systems.

Because the private gap between the two systems is narrow and lies entirely on the output side, it can be bridged by policy at low cost. The following measures are suggested. First, a certified organic price premium, secured through the geographical-indication status of Lakadong turmeric and through aggregation by the Farmer Producer Organisations and self-help groups to which most growers already belong, of even 10 per cent on the farm-gate price would more than offset the net-return shortfall and make organic cultivation the more profitable system. Second, the assured and timely supply of quality organic inputs, together with support for on-farm composting and for the labour of manure handling, would attack the principal cost of the organic system and narrow the yield penalty. Third, extension and training must be strengthened, since only 36.7 per cent of the growers reported any awareness of organic practice, and the dense self-help-group network of the district offers a ready channel for delivering it. Taken together, these measures would allow Meghalaya to expand the organic cultivation of its flagship spice without a large recurring subsidy, converting a crop that is already privately viable under organic management into one that is unambiguously the more attractive choice for the smallholder who grows it.

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References

1. Ministry of Commerce and Industry, Government of

India. Spices Statistics at a Glance. Kochi: Directorate of Arecanut and Spices Development, Spices Board of India; 2024.

2. Sarma I, Phukan MK, Borah A. Curcumin content and quality attributes of Lakadong turmeric of Meghalaya: a review. *J Spices Aromat Crops*. 2023;32(1):1-9.
3. Agricultural and Processed Food Products Export Development Authority. Status of Organic Farming in India. New Delhi: Ministry of Commerce and Industry, Government of India; 2026.
4. Reganold JP, Wachter JM. Organic agriculture in the twenty-first century. *Nat Plants*. 2016;2:15221.
5. Seufert V, Ramankutty N, Foley JA. Comparing the yields of organic and conventional agriculture. *Nature*. 2012;485:229-232.
6. Ponisio LC, M'Gonigle LK, Mace KC, Palomino J, de Valpine P, Kremen C. Diversification practices reduce organic to conventional yield gap. *Proc R Soc B*. 2015;282(1799):20141396.
7. Snedecor GW, Cochran WG. Statistical Methods. 8th ed. Ames: Iowa State University Press; 1994.