***Original Research Article***

**Financial viability in Sugarcane Farming in Karnataka: A Comparative Study of Natural and Conventional Farming Approaches**

**ABSTRACT**

This study evaluates the economic viability of natural farming practices, specifically Zero Budget Natural Farming (ZBNF), compared to conventional methods in sugarcane cultivation in the Belagavi district of Karnataka during the year 2023-24. Natural farming emphasizes minimal monetary investment in inputs, promoting self-reliance among farmers and enhancing soil health and sustainability. A total of 120 farmers were surveyed, with 60 farmers practicing natural farming and 60 conventional farming methods. The research utilized cost and return analysis alongside a partial budgeting technique to assess financial outcomes like reduced costs and added return’s structure. Findings reveal that, while conventional farming yields higher outputs 150.73 t/ha, natural farming proves to be a more sustainable and economically favourable alternative, with lower cost of cultivation of Rs. 2,24,544.71 per hectare compared to Rs. 2,55,587.89 of conventional farming. Natural farming's better net returns amount to Rs. 2,07,633 per hectare, surpassing conventional farming's Rs. 1,81,532. Additionally, the net gain by adopting natural farming practices was calculated to Rs. 28,603.99, showcasing its financial advantage. Moreover, natural farming commands a higher price per tonne of sugarcane than the conventional farming (Rs. 3,300 vs. Rs. 2,900), reflecting the growing market demand for naturally grown products. The study underscores the importance of promoting sustainable agricultural practices and implementing supportive policies, such as developing training programs for farmers and simplifying the certification process. These initiatives can further encourage the adoption of natural farming techniques, highlighting their potential to improve both economic viability and ecological health in agriculture. Overall, natural farming emerges as a viable alternative for sustainable sugarcane cultivation.

**Keywords:** Financial viability,Net gain, Natural farming and partial budgeting.

**1.INTRODUCTION**

India is on track to reach its goal of becoming a trillion-dollar economy by 2024-25, with a current GDP growth rate of 8.4 per cent [1]. However, this progress raises concerns about the farming community, which has often been overshadowed by other sectors. During the COVID-19 pandemic, agriculture emerged as a crucial pillar of the Indian economy, contributing approximately 4.5 per cent to the GDP. It was the only sector that sustained the economy through challenging times. Nevertheless, traditional agricultural practices come with significant drawbacks, including high cultivation costs, environmental pollution, and health issues [4-6].

To address these problems, alternative agricultural methods such as organic and natural farming have gained attention. One notable method is Zero Budget Natural Farming (ZBNF), promoted by Padma Shree awardee Shri Subhash Palekar, who has advocated for this approach to benefit farmers [3]. The Indian Prime Minister has also encouraged the adoption of natural farming techniques to reduce costs and boost yields. ZBNF aims to lower input costs by eliminating the need for costly fertilizers and pesticides while promoting soil health and conserving water resources [7-10].

Natural farming is based on the principles articulated by Masanobu Fukuoka in his book "The One-Straw Revolution" and emphasizes minimal monetary investment in inputs. This approach promotes self-reliance among farmers and seeks to reduce their dependence on expensive external resources[11]. Shri Subhash Palekar developed Zero Budget Natural Farming (ZBNF) as a comprehensive method that includes four main components:

1. **Beejamritha**: A seed treatment made from cow dung and urine that supports plant growth from the outset.
2. **Jeevamrita**: A mixture of cow dung, urine, pulse flour, jaggery, soil and water designed to boost microbial activity and soil health.
3. **Acchadana**: A mulching technique using straw, soil, or live vegetation to retain soil moisture and enhance soil fertility.
4. **Whapasa**: The optimal condition where water and air molecules co-exist in the soil, promoting healthy root development.

Natural farming gained traction in Karnataka through the efforts of the Karnataka Rajya Raita Sangha (KRRS), which advocated for this practice as an alternative to conventional agriculture. In the year 2018, Government of Karnataka officially endorsed natural farming and launched the "Zero Budget Natural Farming Project" to demonstrate its effectiveness in improving soil health, reducing input costs and increasing yields. Later the "Chief Minister's Natural Farming Scheme" was introduced in 2022-23 to advance natural farming practices in Karnataka. This initiative, implemented through agricultural and horticultural universities, involved participatory research on 2000 hectares in each AEZ across five universities. The aim was to integrate best practices from previous natural and organic farming experiments and develop a comprehensive protocol for sustainable agriculture.

Karnataka's promotion of natural farming through government schemes reflects its commitment to sustainable agricultural practices. The state has conducted impact studies, such as in Belagavi district, to provide evidence-based insights beneficial to policymakers, researchers and practitioners. In light of these developments, this comparative study was undertaken to evaluate the impact of natural farming on the cost of sugarcane cultivation compared to conventional practices with this background the following objective was framed.

* To assess the net gain in sugarcane cultivation by comparing the economic outcomes of natural farming with conventional farming methods.

**2.MATERIALS AND METHODS**

The study was conducted in Belagavi district of Karnataka during the year 2023-24. The multi-stage purposive random sampling technique was employed to select the natural farming farmers in the study area. In first phase, Belagavi district was chosen purposively due to its high concentration of natural farming practitioners as identified by experts in the field. In the second stage, within Belagavi district, Belagavi and Hukeri taluks were selected purposively based on the highest number of natural farming In the third stage, two villages are selected from each taluk: Mutnal and Hirebagevadi from Belagavi taluk and Bellad Bagevadi and Hitni from Hukeri taluk. At village level, natural farming farmers were selected purposively by employing random sampling technique. A total of 120 farmers were surveyed, with 60 each from natural and conventional farming systems. For this study, sugarcane has been selected due to its prominence among the sample farmers, who primarily grow it as a major crop using natural farming practices.

This study employed the following analytical tools and techniques to quantitatively assess the outlined objective:

* 1. Costs and return analysis
	2. Partial budgeting approach

**2.1 Costs and return structure divided into two components viz, variable and fixed costs.**

**Variable costs** include several components: the expenses for sugarcane setts encompass both purchased and farm-produced setts; farm yard manure costs account for both purchased manure and imputed costs for manure produced on the farm. Additionally, the costs of biofertilizers and chemicals are based on the actual prices paid. Labour costs cover human, bullock and machine labour, with family labour being imputed at the same rate as hired labour. Machine labour charges are set at Rs. 700 per hour for hired machinery. Harvesting and transportation costs are contracted, while irrigation charges are calculated using the amortized costs of borewells and related infrastructure.

**Fixed costs** consist of land revenue and taxes based on government rates and the rental value of land determined by prevailing local rates. Depreciation is calculated using the straight-line method and interest on fixed capital is assessed at a rate of 12 per cent per annum.

In terms of returns, gross return refers to the total value of sugarcane sold, while net return is derived by subtracting total costs from gross returns. The return per rupee of expenditure is calculated by dividing gross income by total costs and the cost of production is determined by dividing the total cost per hectare by the average yield of sugarcane.

**2.2 Partial budgeting approach**

In the present study partial budgeting technique is used to assess the economic viability of natural farming in sugarcane cultivation over conventional farming. The partial budgeting technique includes two sides that is debit side/cost side and credit side/return side.



**Fig 1: An illustration of partial budget**

* + 1. **Debit side/cost side**
1. **Item of added expenditure due to the adoption of natural farming in sugarcane cultivation**

This includes the additional cost of sett treatment materials, farm yard manure, bullock labour, machine labour and miscellaneous costs.

1. **Reduced returns due to the adoption of natural sugarcane cultivation**

It includes reduced returns in main produce in monetary terms if any.

* + 1. **Credit side/return side**
1. **Reduced costs (or saving) due to the adoption of natural sugarcane cultivation**

It includes 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.

1. **Added returns due to the adoption of natural sugarcane cultivation**

It includes added returns from main produce in monetary terms if any.

**3. RESULTS AND DISCUSSION**

Table 1 presents a comparative analysis of inputs used in natural and conventional sugarcane cultivation per hectare, having samples size of 60 respondents for each method. Conventional farming typically requires more human labour than natural farming due to the intensive management and monitoring associated with chemical applications and mechanized operations. In contrast, natural farming relies more on manual labour for traditional practices, using less machine labour for harvesting as its yields are lower.

In terms of planting density, conventional farming employs more setts per hectare, with a spacing of 4.5 feet between plants and 6 feet between rows, while natural farming uses wider spacing of 5 feet between plants and 10 feet between rows. Additionally, natural farming utilizes on-farm prepared sett treatment materials, whereas conventional farming relies on synthetic treatments. Farmyard manure (FYM) serves as the primary source of nitrogen and other nutrients in natural farming, emphasizing organic practices. Conventional farming, on the other hand, typically supplies nitrogen through synthetic fertilizers like urea, which deliver nutrients more rapidly and in concentrated forms, reducing the need for organic inputs.

Natural farming incorporates practices such as green manures, vermicompost, and bio manures, which enhance soil organic matter and structure, increase microbial activity, and promote long-term sustainability. Techniques like mulching, compost addition, and cover cropping improve soil structure and water-holding capacity, ultimately reducing overall water demand and evaporation. In contrast, conventional farming's reliance on synthetic fertilizers and intensive tillage has degraded soil structure, necessitating more frequent irrigation.

Supporting these findings, a study by Kshirsagar (2013) on organic sugarcane farming in Maharashtra noted that organic farms used 11.44 per cent less seed, primarily due to the use of 2-bud setts and strip planting methods. Inorganic farmers, however, applied significantly higher amounts of chemical inputs, leading to deficiencies in micronutrients, land degradation, reduced productivity, and environmental pollution. Additionally, inorganic farmers used 18.65 per cent more chemical pesticides compared to organic farmers, who employed bio-pesticides along with various pest and disease management techniques.

**Table 1 : Input use pattern in Natural and Conventional sugarcane cultivation by the sample farmers in study area . (n=120) (Per ha)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Inputs** | **Units** | **Natural farming** | **Conventional farming** |
| **(n=60)** | **(n=60)** |
| 1 | Human labour | md | 75.02 | 90.74 |
| 2 | Bullock labour | pd | 5.26 | 4.79 |
| 3 | Machine labour | hrs | 24.22 | 25.03 |
| 4 | Setts | t | 7.54 | 8.40 |
| 5 |  Setts treatment materials |
|  a | Beejamrutha | l | 49.42 | - |
|  b | Carbendazim | g | - | 323.48 |
|  c | Chlorpyriphos | ml | - | 308.38 |
| 6 | FYM / Ganajeevamrutha | t | 18.83 | 16.38 |
| 7 |  Bio-fertilizer and organic manure/Chemical fertilizer |
|  a | Jeevamrutha | l | 1976.92 | - |
|  b | Green manure | kg | 52.21 | - |
|  c | Vermi compost | kg | 1138.66 | - |
|  d | Bio manures | kg | 49.62 |  |
|  e | Nitrogen | kg | - | 284.96 |
|  f | Phosphorous | kg | - | 118.21 |
|  g | Potassium | kg | - | 229.90 |
|  h | Zinc | kg | - | 36.97 |
| i | Iron | kg | - | 32.54 |
| j | Sulphur | kg | - | 30.07 |
| 8 |  Bio-pesticide/Plant protection chemicals |
| a | Aarka |  kg | 12.63 | - |
|  b | Neem oil | ml | 284.07 | - |
|  c | Atrazine | kg | - | 2.77 |
|  d | Coragen | ml | - | 63.60 |
|  e | Chlorpyriphos | l | - | 2.99 |
| 9 | Irrigation water | Acre/inch | 106.29 | 118.11 |

Natural farming offers a cost-effective alternative to conventional sugarcane cultivation, despite differences in practices and inputs. The total cost of cultivation in natural farming is Rs. 2,24,544.71 per hectare, lower than the Rs. 2,55,587.89 for conventional farming. While natural farming incurs slightly lower costs for setts (Rs. 22,619.53 vs. Rs. 25,221.50) due to reduced requirements and local materials, it has higher costs for sett treatment materials (Rs. 887.09 vs. Rs. 261.93). The expenditure on farmyard manure (FYM) is higher in natural farming (Rs. 29,214.63) compared to conventional farming (Rs. 28,505.46), reflecting its role as the main nutrient source.

Natural farming benefits from lower costs for bio-fertilizers and organic manure (Rs. 3,879.47) compared to synthetic fertilizers (Rs. 14,168.71) and also has lower bio-pesticide costs (Rs. 1,620.98 vs. Rs. 3,916.54). However, it faces higher miscellaneous costs (Rs. 2,421.58 vs. Rs. 988.40) due to traditional input preparation. Labour costs are generally lower in natural farming, with both hired (Rs. 33,314.02) and machine labour (Rs. 16,956.00) being less than in conventional farming. Interest on working capital and depreciation costs are also lower in natural farming, contributing to overall savings.

In terms of yield, conventional farming produces a higher output (150.73 tonnes per hectare) compared to natural farming (130.96 tonnes), but natural farming commands a higher price per tonne (Rs. 3,300 vs. Rs. 2,900). Gross returns are slightly higher in conventional farming (Rs. 4,37,119.90) compared to natural farming (Rs. 4,32,177.90), but net returns are better in natural farming (Rs. 2,07,633 per hectare vs. Rs. 1,81,532).Ultimately, while conventional farming excels in yield, natural farming is more economically favourable due to its lower cultivation costs and better net returns, highlighting its potential for long-term sustainability and reduced reliance on synthetic inputs.

The partial budgeting method was used to evaluate the financial impact of changes in farming practices by comparing the added costs and revenues associated with new practices against those of current practices. In this case, the partial budgeting compared the financial outcomes of adopting natural farming versus conventional farming for sugarcane cultivation.

By adopting natural farming in sugarcane cultivation, a favourable financial scenario was presented despite the initial lower yields. Natural farming required more organic inputs like farmyard manure and Ganajeevamrutha, contributing to increased costs. Adoption of natural farming resulted in an additional cost of Rs. 2,767.52 due to increased expenses for setts treatment, farmyard manure, and miscellaneous costs. These costs were attributed to the setts treatment materials (Rs. 625.16), increased expenditure on farmyard manure (Rs. 709.18), and miscellaneous costs (Rs. 1,433.18).

However, an additional revenue of Rs. 400 was obtained from selling sugarcane grown using natural farming practices, reflecting the premium price received for naturally grown produce used for organic jaggery preparation. There was no reduction in revenue reported for adopting natural farming, indicating that the transition did not impact revenue generation from the crop. Furthermore, natural farming significantly reduced several costs associated with conventional practices. These reductions included Rs. 2,601.96 saved on setts, Rs. 10,289.24 on bio-fertilizers, Rs. 2,604.43 on bio-pesticides, Rs. 6,506.14 on irrigation, and Rs. 8,969.73 on labour, bringing the total decreased costs to Rs. 30,971.51.

When combined, the total benefits from reduced costs and increased revenue amounted to Rs. 31,371.51. After subtracting the additional costs incurred in natural farming, the net gain was Rs. 28,603.99, making it a financially advantageous choice. Overall, while conventional farming excels in yield and gross returns, natural farming proves to be more economically favourable due to its lower total cultivation costs and better net returns, underscoring its potential for long-term sustainability and reduced reliance on costly synthetic inputs.

**Table 2 : Cost of cultivation of sugarcane under Natural and Conventional farming by the sample farmers in the study area. (n=120) (per ha)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Particulars** | **Natural farming (n=60)** | **Conventional farming (n=60)** |
| **Value (Rs.)** | **Value (Rs.)** |
| **I** | **Variable cost** |
| **A** | **Material cost** |
| 1 | Setts | 22,619.53 | 25,221.50 |
| 2 | Setts treatment material | 887.09 | 261.93 |
| 3 | FYM / Ganajeevamrutha | 29,214.63 | 28,505.46 |
| 4 | Bio-fertilizer and organic manure/Chemical fertilizer | 3,879.47 | 14,168.71 |
| 5 | Bio-pesticides/Plant protection chemicals | 1,620.98 | 3,916.54 |
| 6 | Irrigation charges | 12,799.78 | 13,108.66 |
| 7 | Miscellaneous cost | 2,421.58 | 988.40 |
|   | **Subtotal (A)** | **73,443.06** | **86,171.18** |
| **B** | **Labour cost** |
| 1 | Hired labour | 33,314.02 | 40,287.18 |
| 2 | Machine labour  | 16,956.00 | 18,952.57 |
|   | **Subtotal (B)** | **50,270.02** | 59,239.75 |
| C | Harvesting and transportation cost [contract] | 31,984.62 | 38,490.77 |
| D | Interest on working capital at 7% | 10,897.11 | 12,802.25 |
|  **I** | **Total variable cost (A+B+C+D)** | **1,66,594.82** | **1,96,703.96** |
|  **II** | **Total fixed cost** | **57,949.89** | **58,883.93** |
| **III** | **Total cost of cultivation (I+II)** | **2,24,544.71** | **2,55,587.89** |
| 1 | Yield (t/ha) | 130.96 | 150.73 |
| 2 | Price (Rs. /t) | 3,300 | 2,900 |
| 3 | Gross return (Rs. /ha) | 4,32,177.90 | 4,37,119.90 |
| 5 | Cost of production (Rs. /t) | 1,715 | 1,696 |
| 6 | Net return (Rs. /ha) | 2,07,633 | 1,81,532 |
| 7 | Return per rupee of expenditure | 1.92 | 1.71 |

**Table 3 : Estimated benefits of Natural farming practices over Conventional farming practices in sugarcane cultivation using partial budgeting. (n=120) (Rs. /ha)**

|  |  |
| --- | --- |
| **Debit** | **Credit** |
| **Added costs for adopting natural cultivation** | **Value (Rs.)** | **Added revenue for adopting natural cultivation** | **Value (Rs.)** |
| a) Additional cost on setts treatment material | 625.16 | a) Added revenue from naturally grown sugarcane | 400 |
| b) Additional cost on FYM | 709.18 |  |  |
| c) Miscellaneous cost | 1,433.18 |  |  |
| **Total increased cost** | 2,767.52 | **Total increased revenue** | 400 |
| **Reduced revenue for adopting natural cultivation** | **Value (Rs.)** | **Reduced costs by adopting natural cultivation** | **Value (Rs.)** |
|  |  | a) Cost on setts | 2,601.96 |
|  |  | b) Costs on bio-fertilizers | 10,289.24 |
|  |  | c) Costs on bio-pesticides and irrigation | 2,604.43 |
|  |  | d) Costs on harvesting and transportation | 6,506.14 |
|  |  | e) Costs on labour | 8,969.73 |
| **Total decreased revenue** | **0** | **Total decreased cost** | 30,971.51 |
| **Total debit** | 2,767.52 | **Total credit** | 31,371.51 |
| **Net gain** | 28,603.99 |  |  |

**4.CONCLUSION**

The comparative analysis of inputs in natural versus conventional sugarcane cultivation demonstrates that while conventional farming may yield higher outputs, natural farming emerges as a more economically viable and sustainable option. Despite requiring more human labour and synthetic inputs, conventional farming's reliance on chemical applications and intensive management leads to increased cultivation costs and environmental concerns. In contrast, natural farming employs organic practices, utilizing farmyard manure, green manures, and bio manures, which enhance soil health and reduce overall water demand. Financially, natural farming shows lower total cultivation costs (Rs. 2,24,544.71 per hectare) compared to conventional farming (Rs. 2,55,587.89 per hectare). Although it incurs slightly higher costs for certain inputs, these are offset by significant savings in bio-fertilizers, pesticides, and irrigation, resulting in better net returns (Rs. 2,07,633 per hectare) than conventional methods (Rs. 1,81,532). The overall net gain from adopting natural farming amounts to Rs. 28,603.99, making it a financially advantageous choice.

Moreover, natural farming commands a higher price per tonne of sugarcane, reflecting the growing market demand for organic products. Overall, while conventional farming may excel in immediate yield, the long-term sustainability and economic benefits of natural farming evidenced by reduced costs, better net returns and lower environmental impact, highlight its potential as a viable alternative for sugarcane cultivation. To further support this transition, it is essential to implement policies that promote organic farming initiatives. This includes developing training programs to educate farmers about sustainable agricultural practices, such as the benefits of natural farming techniques and the effective use of on-farm inputs. Additionally, simplifying the organic certification process and offering financial assistance for farmers seeking certification will help establish their credibility in the market. This analysis underscores the importance of adopting practices that promote both economic viability and ecological health in agriculture.

Competing interests

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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