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Changing the cropping pattern and economic efficiency - A study in Telangana

Jakkula Rajaiah
Research Scholar, Department of Economics, Kakatiya University, Warangal, Telangana, India
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Abstract
The present study examines the changing patterns of land ownership, irrigation sources, cropping patterns, cost of cultivation, income, and economic efficiency of paddy and maize cultivation in the Warangal district of Telangana during the period 2019–2024. The study is based on primary data collected from 90 respondent farmers, selected through a multistage random sampling method, from the villages of Mahabubnagar and Medepally in Warangal district. Secondary data were collected from published reports, books, journals, and government documents. The findings reveal significant changes in the agricultural structure during the study period. Own-land cultivation declined, while leased-land cultivation increased considerably. Wetland cultivation expanded, accompanied by a substantial rise in bore-well and tank irrigation, reducing dependence on rain-fed agriculture. Cropping intensity improved with increased cultivation of paddy, maize, and multiple crops. The average yields, market prices, and incomes of both paddy and maize recorded notable growth between 2019 and 2024. However, the cost of cultivation increased faster than income. Consequently, although profits increased marginally, the economic efficiency of both crops declined significantly. The study concludes that while agricultural production and income have improved, rising input costs have reduced profitability and sustainability. Appropriate policy measures are required to control cultivation costs and enhance the economic viability of food crop cultivation.

Keywords: Cost of cultivation, economic efficiency, paddy, maize, Telangana, changing input patterns

Introduction
Agriculture is a multidimensional sector essential for food production, employment, and economic growth. It advances through scientific innovation and sustainable practices that ensure food security, protect the environment, and promote rural development. Globally, agriculture contributes about 4.3% to GDP while employing 26.4% of the workforce. In developing economies, its share of employment is far greater than its share of GDP, with over 60% of the population depending on it for their livelihoods (FAO, 2021) [2, 6]. Since independence, agriculture has been a pillar of India's economy. Its share of GDP has declined from 59% in 1950–51 to about 17% today, yet it continues to support more than half of the rural population through employment, sustains the nation's food requirements for over 1.4 billion people, and contributes to exports (Dutt & Sundharam, 2023) [5]. Agriculture drives industrial growth by supplying raw materials to key sectors such as textiles, sugar, edible oils, fertilisers, and pesticides. Nearly half of industrial income stems from agricultural-based industries. Exports of products like basmati rice, tea, coffee, fruits, vegetables, meat, and fish help earn valuable foreign exchange. The sector also generates significant revenue for both central and state governments through land taxes and supports transport sectors like railways and ports that handle agricultural commodities (Dutt & Sundharam, 2023) [5].

Cropping Pattern and its Determinant Factors
Agriculture supplies most human food and non-food needs and has long relied on cultivating both food and commercial crops. Cropping patterns fall into two main categories: food crops (paddy, wheat, maize, coarse grains, pulses) and non-food crops (oilseeds such as groundnut, cotton, and sugarcane), along with plantation crops such as tea and coffee, and horticultural crops including vegetables, fruits, flowers, cashew, and coconut. Allied activities, such as dairy, poultry, and fisheries, also form integral parts of agricultural production (Felix & Ramappa, 2023) [7]. Cropping patterns are shaped by a range of interrelated factors, including climate, soil, irrigation availability, landholding size and ownership, market conditions, access to modern inputs, area specialisation, pest control, crop suitability and yield potential, farmer knowledge, cultivation costs, economic returns, and government policies. Climatic variables, temperature, rainfall and humidity, drive crop choice: high-rainfall zones favour water-intensive crops like paddy and jute, while arid areas suit drought-tolerant millets and pulses. Soil characteristics (fertility, water-holding capacity, drainage) further determine crop adaptability (Rao & Raju, 2005) [13]. Landholding size and tenure affect risk tolerance and crop selection: large farmers often opt for commercial cash crops (cotton, sugarcane, tobacco), whereas smallholders focus on food and vegetable crops or short-duration crops when leasing land. Reliable irrigation enables the cultivation of water-demanding, high-value horticultural crops; rainfed farms tend to favour less water-intensive species (Singh & Singh, 2010) [16]. Market signals and price history (the "cobweb" effect) influence farmers' choices, while mechanisation, labour availability, and traditional practices modify implementation. Pest/disease pressures encourage rotations or intercropping to protect yields and soil health. Economic factors, such as costs, credit access and policy instruments such as subsidies, price supports and irrigation projects, also steer cropping patterns (Bannayan & Khosla, 2015; Felix & Ramappa, 2023) [3, 7].

Profiles of Food Crops
Profiles summarise key information about crops to help understand their significance. Below are concise profiles of two major food crops: paddy and maize.

Paddy: Paddy (rice) is a staple for over half the world's population. Globally, about 165.04 million hectares are dedicated to paddy across more than 100 countries. India is the leading producer with roughly 48 million hectares under rice. The top producers include China, India, Indonesia, Vietnam and Bangladesh. According to USDA estimates for 2022–23 [21], global paddy output reached about 514.90 million tonnes, with the top five producers (China, India, Indonesia, Vietnam and Thailand) contributing approximately 342.88 million tonnes (68.2%); individual outputs cited include China 145.95 Mt and India 125.00 Mt. Global average paddy yield in 2022–23 was about 4.7 t/ha (2.1 t/acre); high-yield varieties have shown much higher yields in some contexts (e.g., China historically reported HYV yields up to 17 t/ha). For India, RBI data (2022–23) [14] indicate that 47.7 million hectares are under paddy, with total production of about 135.54 million tonnes and an average yield of 2.84 t/ha. Major Indian rice-producing states include Telangana, Tamil Nadu, Andhra Pradesh, Assam and Kerala, which together account for roughly 80% of paddy area in the referenced dataset. In Telangana (2022–23) [20], 2.323 million hectares were under paddy (about 42.2% of India's cited area), with district-level concentrations in Nalgonda, Suryapet, Nizamabad, Siddipet, Jagityal and others.

Maize: Maize (corn) is a versatile cereal grown across tropical and subtropical zones and ranks among the world's top crops after wheat. Diverse varieties of field corn, QPM, baby corn, waxy, sweet and high-oil maize serve food, feed and industrial purposes. FAO data for 2020–21 show maize cultivated on about 193.7 million hectares in over 170 countries, producing 1,147.7 million tonnes and averaging 5.57 t/ha. Major producers include the USA, China, Brazil, Argentina, Ukraine and India. Globally, maize use is dominated by animal feed (61%), industry (22%), and direct human consumption (17%), with thousands of industrial products derived from maize. In India (2018–19, ICAR), India ranked 4th in area and 6th in production; 2022–23 estimates report production of 34.613 million tonnes from 4.282 million hectares (avg. 7.85 t/ha), with 69% from kharif and 31% from rabi. Major Indian maize-consuming sectors include poultry (47%), starch, food/feed and processing, while leading producing states include Karnataka, Madhya Pradesh and Maharashtra.

In Telangana, during kharif season 2022-23 area under maize was 2.50 lakh ha (6.20 lakh acres) Major maize growing districts in Telangana include Kamareddy 0.36 lakh ha (0.90 lakh acres), Rangareddy 0.29 lakh ha (0.73 lakh acres), Bhadradri Kotthagudem 0.27 lakh ha (0.68 lakh acres), Vikarabad 0.23 lakh ha (0.57 lakh acres), Mahabubabad 0.21 lakh ha (0.54 lakh acres), Jagithyal 0.16 (39603 acres), Mahabubnagar 0.14 lakh ha (0.36 lakh acres), Nagarkurnool 0.13 lakh ha (0.32 lakh acres), Siddipet 0.13 lakh ha (0.2 lakh acres) contributing nearly 80% of total maize production. According to the 4th Advance Estimates of Production of Food Grains for 2021-22, the maize production estimate for Telangana State was 28.02 lakh tonnes (Telangana Socio-economic Outlook – 2023) [20].

Changing Patterns of Cost of Cultivation and Input Use

Over the past two decades (2001–2021), official CACP data reveal a sharp rise in cultivation costs for major food crops in India. Average growth rates in the cost of cultivation were 175% for paddy, 160% for wheat, and 145% for maize, translating into annual increases of 8.75%, 8%, and 7.25%, respectively. This radical shift is primarily driven by soaring input prices of labour, fertilisers, machinery, land rents, and seeds. According to NITI Aayog (2023) [12], labour alone accounts for over 50% of total cultivation costs. While mechanisation has reduced demand for unskilled labour, it has increased fuel costs and the need for skilled labour. Tractor usage in agriculture rose from 25% to 55% between 2000 and 2021 [2], 120% growth over two decades, with a 6% annual growth rate. Fertiliser and pesticide use also expanded significantly, driven by high-yielding varieties (HYVs) that demand more irrigation and chemicals. Fertiliser and HYV prices increased from 8 to 10% in 2000 to 18 to 20% in 2021, representing nearly a 100% change. For example, DAP prices rose from ₹450 per 50 kg bag in 2000 to ₹1,350 in 2022. Input use and costs vary widely by state. In Punjab, Haryana, and undivided Andhra Pradesh, paddy cultivation costs reached ₹1.35 lakh per hectare in 2022 almost double Bihar's ₹72,000, due to higher fertilizer, pesticide, HYV, machinery, and wage rates. Cereals like paddy and wheat have the highest costs due to intensive input use, while pulses remain lower. Overall, official data confirms a positive correlation between higher input use and rising cultivation costs. Amid technological shifts, policy changes, market dynamics, and environmental pressures, understanding these changing input patterns and their impact on cultivation costs is the core research problem, given concerns over long-term economic sustainability and shrinking margins for farmers.

Review of Earlier Studies

Samal *et al*. (2025) [15] analysed rice cultivation across 18 Indian states over three decades (1990–2021) using log-linear functions. Their findings reveal significant shifts in input use: machine labour, fertilisers, and pesticides increased, while animal labour, human labour, and manure decreased. Profitability varied sharply by region. States like Andhra Pradesh, Haryana, and Punjab showed positive returns, while eastern and northeastern states reported low or negative returns despite MSP. The study highlights unsustainable groundwater use in irrigated areas and emphasises the need for region-specific technological and policy interventions to enhance profitability while maintaining soil health.

Wei *et al*. (2025) [22], published in Nature Communications, examined optimizing crop allocation in India. The study found that shifting from rice to climate-resilient cereals such as millet, maize, and sorghum could reduce climate-induced production losses by 11% and increase farmers' profits. Farmers' crop choices are heavily influenced by price fluctuations, making economic incentives key to promoting diversification. The study notes that current pricing structures and subsidies favouring rice hinder this transition and advocates pricing reforms to support alternative cereals.

Srikanth *et al*. (2017) [17] conducted a field study in Khammam district, Telangana, analysing maize cultivation costs and resource use efficiency among 60 farmers. Using stochastic frontier production and marginal value product analysis, they found benefit-cost ratios highest for medium farmers (2.7:1) compared to marginal (1.5:1). Notably, labour, fertiliser, and machinery were under-utilised, contrary to the national trend of over-mechanisation. The study highlights suboptimal resource allocation and calls for

improved infrastructure and more efficient use of inputs to strengthen Telangana's maize economy.

Lal (2021) [10] presents expenditure particulars on cultivation and on food and non-food items. Land tilling and planting of seasonal crops (paddy) in the study area require more labour and sometimes technological inputs. Rupees 2000 to 4000 were spent by nearly 48 per cent of respondents, and rupees more than 5000 by 52 per cent of respondents to raise crops.

A recent study by Kannan Thoms Felix (2024) [9] on major millets (Bajra, Jowar, Ragi) across Indian states (2024) employed a primal Cobb-Douglas production function using CCPC data. Results showed that human labour, seed quantity, and fertiliser use positively affect millet cultivation. Technical inefficiency was prevalent among Bajra farmers in Rajasthan and Uttar Pradesh, and Jowar farmers in Maharashtra and Karnataka. Allocative inefficiency manifested as over-utilisation of machinery and fertilisers in Bajra, but under-utilisation in Jowar and Ragi. Both inefficiencies increased input demand and cultivation costs, underscoring the need for state-specific strategies.

Sunitha (2024) [19] evaluated the impact of complete mechanisation in maize cultivation in Telangana using the Economic Surplus approach. The study found a total surplus of Rs. 19.61 lakhs, with producers benefiting the most, at 72.0 per cent. The investment yielded a 23.0 per cent internal rate of return, a net present value of Rs. 3.2 lakhs, and a benefit-cost ratio of 1.67:1. The adoption of seed-to-seed mechanisation significantly increased farm income while reducing labour costs, offering a relevant model for understanding how mechanisation shapes cost structures in Telangana's food crop economy. It also examines issues that are closely related to MSMEs, such as the double whammy of supply-demand disruptions, Lack of labour force, Credit and liquidity conundrum, Logistical woes, and other challenges (Lal, 2020) [11].

Methodology

The present study uses both primary and secondary data. Primary data was collected through a structured questionnaire, designed using a multistage random sampling method to capture accurate information from farmers. In the first stage, the district is selected based on irrigation, crop intensity, and crop diversity. Warangal relies mainly on bore-well with high crop intensity and multi-cropping of maize and groundnut. In the second stage, two mandals, namely Rayaparthy and Nallabelly, in the selected district were selected based on high and moderate irrigation. In the third stage, two villages, namely Mhabubbnagar in Ryaparthy mandal and Medipally in Nallabelly mandal, have been selected using the same criteria. Finally, in the fourth stage, a total of 90 respondents were selected, with an equal share of 45 in each village, from those who had been cultivating crops in the two reference years of 2019 and 2024 over the 5-year reference period. Secondary data were drawn from published reports, books, and articles on agricultural production and livelihoods in India and Telangana.

According to the Mandal Statistical Handbook, the total number of farmers is 412 in Mahabubanagar village of Rayaparthy mandal and 398 in Medipally village of Nallabelly mandal. Of the total 810 farmers in each village, 45 respondents were chosen using a systematic random sampling method. In Mahabubnagar village, the total number of farmers is 412/45 = 9.1; in Medipally village, it is 398/45 = 8.8; and, finally, the total number of farmers in the two sample villages is 810/90 = 9. Therefore, the ratio of respondents to total farmers is 1:9, meaning every 9th farmer is a respondent in the study.

Objectives of the Study

1. To examine the Land particulars and irrigational sources of the respondent farmers during the reference period of 2019 and 2024 in the study area
2. To investigate the cost of cultivation, and economic efficiency of Paddy and Maize crops and its changing pattern during the reference period

Table 1: Land Ownership Pattern of the Respondents and its Growth from 2019 to 2024

Land Ownership	2019	2024	Growth
Own Land	78 (86.7)	56 (62.2)	-22 (-28.2)
Leased Land	39 (43.3)	52 (57.8)	13 (33.3)
Own + Leased	51 (56.7)	38 (42.2)	-13 (-33.3)
Total	90 (100.0)	90 (100.0)	90 (100.0)

Source: Field Study

Table 1 shows the land ownership pattern of the respondent farmers and its growth from 2019 to 2024 in the study. In the initial year 2019, of the 90 respondents, 78 respondents possessed their own land, accounting for 86.7 per cent, 39 respondents farmed leased land, accounting for 43.3 per cent and 51 respondent farmers farmed both owned and leased land, accounting for 56.7 per cent. After 5 years in the current 2024 years, the land ownership has been changed, out of 90 respondents, 56 accounted for 62.2 per cent of owning land, 52 respondents reported as 57.8 per cent have leased land and 38 per cent own and lease cultivation, which equals 42.2 per cent.

The data highlight variations in land ownership patterns: own land, leased land, and a combination of both. The total number of respondents cultivating their own land declined sharply from 78 in 2019 to 56 in 2024, a decrease of 22 respondents, or a negative growth rate of –28.2 per cent during the period. Their proportional share also dropped from 86.7 per cent to 62.2 per cent. On the other hand, leased land cultivation increased from 39 to 52 respondents, registering a growth of 33.3 per cent, with its share rising from 43.3 per cent to 57.8 per cent. The own plus leased land category declined from 51 to 38 respondents, showing a reduction of 56.7 per cent to 42.2 per cent during the period. The overall reduction is -33.3 per cent. This pattern indicates a clear shift from sole ownership to leased cultivation in the study area during the study period.

During the reference period, the land ownership pattern did not favour the respondent farmers, because a considerable number of respondent farmers, about 28.0 per cent of farmers, lost their land ownership, and another 33.3 per cent of combined cultivators also dropped their cultivation. On the other hand, cultivation on leased land increased by about 33.0 per cent. However, during the study period, the land ownership pattern was not viable for the farming community; a considerable number of respondent farmers were shifting their land ownership patterns, and this is an alarm bell for an agro-based economy like India.

Table 2: Type of Land and its Changing Patterns of the Respondents from 2019 to 2024

Type of Land	2019	2024	Changing Pattern
Wet Land	28 (31.1)	40 (44.4)	12 (13.3)
Dry-land	36 (40.0)	20 (22.2)	-16 (-17.8)
Wet + dry	26 (28.9)	30 (33.3)	4 (4.4)
Total	90 (100.0)	90 (100.0)	90 (100.0)

Source: Field Study

Table 2 presents the changing pattern of land types cultivated by the respondent farmers from 2019 to 2024. The land cultivated by the respondents has been classified into three categories: wet land, dry land, and a combination of wet and dry land. The distribution of these land types provides insight into the agricultural resources available to farmers and the changes that occurred during the study period.

In the initial year 2019, out of the total 90 respondent farmers, 36 respondents, accounting for 40.0 per cent, cultivated dry land, making it the dominant category. Wetland was reported by 28 respondents, constituting 31.1 per cent of the total respondents. The remaining 26 respondents, representing 28.9 per cent, possessed both wet and dry land. Thus, dry-land cultivation held a major position among the respondents during the base year. By the year 2024, the pattern of land utilisation had undergone noticeable changes. Wetland cultivation increased to 40 respondents, accounting for 44.4 per cent of the total and emerging as the predominant category. The number of respondents cultivating both wet and dry land also increased to 30 respondents, representing 33.3 per cent. In contrast, dry land cultivation declined considerably to 20 respondents, constituting 22.2 per cent of the total respondents.

During the period from 2019 to 2024, wetland cultivation increased by 12 respondents, representing a growth of 13.3 per cent. The wet and dry land category also increased by 4 respondents, with 4.4 per cent. On the other hand, dry land cultivation declined by 16 respondents, representing a 17.8 per cent decrease during the study period.

The overall trend clearly indicates a shift from dryland agriculture towards wetland and mixed-land cultivation. This change suggests improved irrigation facilities and access to water resources in the study area. The increase in wetland cultivation reflects better agricultural prospects, greater crop security and improved productive potential. Therefore, the changing pattern of land types during the study period may be considered as favourable growth for the respondent farmers and for agricultural development.

Table 3: Source of Irrigation and its Growth 2019 to 2024

Source of Irrigation	2019	2024	Growth
Rain-fed	39 (43.3)	18 (20.0)	-21 (-53.8)
Tank	9 (10.0)	18 (20.0)	9 (100.0)
Bore-well	42 (46.7)	54 (60.0)	12 (28.5)
Total	90 (100.0)	90 (100.0)	90 (100.0)

Source: Field Study

Table 3 reveals the sources of irrigation utilised by the respondent farmers and their growth during the period from 2019 to 2024. Irrigation plays a crucial role in determining agricultural productivity and crop stability. The sources of irrigation available to the respondents have been classified into three categories: rain-fed, tank irrigation, and bore-well irrigation. An assessment of these sources helps in understanding changes in irrigation practices and water availability among respondent farmers during the study period.

In the initial year, 2019, out of the total 90 respondent farmers, 42 respondents, accounting for 46.7 per cent, depended on bore-well irrigation, making it one of the predominant sources of irrigation. Rain-fed cultivation was reported by 39 respondents, accounting for 43.3 per cent of the total. Tank irrigation was utilised by only 9 respondents, representing 10.0 per cent of the respondents. Thus, bore-well irrigation occupied a major position among the irrigation sources during the base year, while tank irrigation played only a limited role in their cultivation of the study. In 2024, the irrigation pattern underwent significant changes. Bore-well irrigation further increased to 54 respondents, accounting for 60.0 per cent and remaining the dominant source of irrigation. Tank irrigation also increased considerably to 18 respondents, representing 20.0 per cent of the respondents. In contrast, the number of rain-fed farmers declined sharply to 18, constituting 20.0 per cent of the total.

During the period from 2019 to 2024, bore-well irrigation improved significantly, with 12 respondents reporting a 28.5 per cent increase. Tank irrigation showed the highest growth rate, increasing from 9 to 18 respondents, a 100.0 per cent increase. On the other hand, rain-fed cultivation declined by 21 respondents, registering a negative growth of - 53.8 per cent during the study period. The data indicate a gradual shift from dependence on rainfall towards assured irrigation sources such as bore-wells and tanks. The substantial decline in rain-fed cultivation and the increasing utilisation of bore-well and tank irrigation suggest improved irrigation infrastructure and better water availability in the study area. This transformation is likely to enhance cropping intensity, reduce production risks and improve agricultural productivity. Therefore, the changing pattern of irrigation sources during the study period may be considered a positive development for the respondent farmers and the agricultural economy of the study area.

Table 4: Cropping Pattern and its Growth during 2019 to 2024

Name of the Crops	2019	2024	Changing Pattern
Paddy	38 (42.2)	68 (75.6)	30 (33.3)
Maize	47 (52.2)	58 (65.6)	11 (13.3)
More than one	31 (34.4)	85 (94.4)	54 (60.0)
Total	90 (100.0)	90 (100.0)	90 (100.0)

Source: Field Study

Table 4 presents information on the cropping patterns of the respondent farmers and their growth during the period from 2019 to 2024. The major crops cultivated by the respondents include paddy, maize, and more than one crop. An analysis of the cropping pattern provides valuable insights into changes in crop preferences and diversification practices among farmers.

In the initial year, 2019, out of the total 90 respondent farmers, 47 respondents, accounting for 52.2 per cent, cultivated maize, the most widely grown crop. Paddy was cultivated by 38 respondents constituting as 42.2 percent. Further, 31 respondents, representing 34.4 per cent, practised cultivation of more than one crop. Thus, maize occupied a dominant position in the cropping pattern in the base year. By the year 2024, the cropping pattern will have experienced remarkable changes. Paddy cultivation increased substantially to 68 respondents, accounting for 75.6 per cent. Maize cultivation also increased to 58 respondents, representing 65.6 per cent. A significant change was observed in multiple cropping, with the number of respondents cultivating more than one crop rising sharply to 85, accounting for 94.4 per cent of the total respondents. This indicates a growing tendency among respondent farmers towards crop diversification and intensive cultivation practices.

During the period from 2019 to 2024, paddy cultivation increased by 30 respondents, representing a growth of 33.3 per cent. Maize cultivation increased by 11 respondents with a growth of 13.3 per cent. The most notable growth was observed in the cultivation of more than one crop, which increased by 54 respondents and grew by 60.0 per cent between the two reference years. The overall trend clearly indicates a substantial expansion in crop cultivation and diversification among the respondent farmers. The rapid increase in paddy cultivation may be attributed to improved irrigation facilities and favourable market conditions. The remarkable rise in multiple cropping reflects the farmers' efforts to maximise land utilisation and crop intensity, increase farm income and reduce production risks. Therefore, the change in cropping patterns during the study period may be considered a positive indicator of agricultural development in the study area.

Table 5: Cost of Cultivation of Major Crops of Paddy and Maize and their Change during 2019 to 2024

Crop-wise Average Cost Per Acre	2019	2024	Chance
Paddy	38475	69898	31423 (81.7)
Maize	34739	62118	27378 (78.8)

Source: Field Study

Table 5 presents the average cost of cultivation per acre for the major crops, namely paddy and maize, and the changes that occurred from 2019 to 2024. The cost of cultivation is an important indicator of farmers' investment in agricultural production and reflects the expenditure on various farm inputs and operations. In the base year 2019, the average cost of cultivation per acre for paddy was Rs. 38475, and for maize, Rs. 34739. Thus, paddy cultivation required comparatively higher investment than maize cultivation. By the year 2024, the cost of cultivation had increased considerably for both crops. The average cost of cultivation per acre of paddy rose to Rs. 69898, while the corresponding cost for maize increased to Rs. 62423. Paddy remained the more expensive crop compared to maize. From 2019 to 2024, the cost of paddy cultivation increased by Rs. 31,423 per acre, representing an 81.7 per cent increase. Similarly, the cost of maize cultivation increased by Rs. 27378 per acre, representing a growth of 78.8 per cent. The increase in cultivation costs was slightly higher for paddy than for maize.

The data showed a substantial rise in agricultural production costs during the study period. The increase may be attributed to rising prices of inputs, labour charges, irrigation expenses and mechanisation costs. The continuous growth in cultivation expenditure places additional financial pressure on farmers and highlights the need for higher productivity and better returns to sustain agricultural profitability in the study area.

Table 6: Average Yield, Price and Income Particulars of Paddy and Maize and their Change from 2019 to 2024

Particulars of Average Yield, Price and Income	2019	2024	Change
Average Yield of Paddy	22	26	4 (18.2)
Average Yield of Maize	28	34	6 (21.4)
Average Price of Paddy	1950	2900	950 (48.7)
Average Price of Maize	1800	2400	600 (33.3)
Average Income of Paddy	42900	75400	32500 (75.8)
Average Income of Maize	50400	81600	31200 (61.9)

Source: Field Study

Table 6 presents the average yield, price, and income details for the major crops, namely paddy and maize, and the changes that occurred from 2019 to 2024. These indicators are important in evaluating the crop-wise economic performance of the respondent farmers.

In the base year 2019, the average paddy yield was 22 quintals per acre, while maize recorded a comparatively higher yield of 28 quintals per acre. The average market price received by farmers for paddy is Rs. 1,950 per quintal, whereas maize gets Rs. 1,800 per quintal. Consequently, the average income from paddy cultivation was Rs. 42900 per acre, while maize cultivation yielded a higher income of Rs. 50400 per acre. By the year 2024, considerable improvements were observed in the yields, prices, and income levels of both crops. The average paddy yield increased to 26 quintals per acre, and maize to 34 quintals per acre. Likewise, the average price of paddy rose significantly to Rs. 2,900 per quintal, while the maize price increased to Rs. 2,400 per quintal. As a result of improvements in both yield and prices, the average income from paddy cultivation increased substantially to Rs. 75400 per acre, and maize income rose to Rs. 81600 per acre.

Between 2019 and 2024, the average paddy yield increased by 4 quintals per acre, registering growth of 18.2 per cent, while maize yield increased by 6 quintals per acre, registering growth of 21.4 per cent. The average price of paddy increased by Rs. 950 per quintal, up 48.7 per cent, while the maize price increased by Rs. 600 per quintal, up 33.3 per cent. Correspondingly, the average income from paddy cultivation increased by Rs. 32,500 per acre, recording a growth of 75.8 per cent, while maize income increased by Rs. 31200 per acre, showing a growth of 61.9 per cent.

The data indicate a positive trend in agricultural performance during the study period. The combined effect of increased productivity and favourable market prices contributed significantly to the rise in farm income. Although cultivation costs also increased during the period, the substantial growth in income suggests that paddy and maize cultivation became more economically rewarding. Therefore, the improvement in yield, prices and income may be considered a favourable development for the respondent

farmers and a positive indicator of agricultural progress in the study area.

Table 7: Average economic efficiency Particulars of Paddy and Maize and its Change during 2019 to 2024

Particulars of Average Cost and Income	2019	2024	Change
Average Income of Paddy	42900	75400	32500 (75.8)
Cost of Cultivation of Paddy	38475	69898	31423 (81.7)
Profit	4425	5502	1077
Average Income of Maize	50400	81600	31200 (61.9)
Cost of Cultivation of Maize	34739	62118	27378 (78.8)
Profit	15661	19482	3822
Net Average Efficiency of Paddy	15.2	7.2	-8.0
Net Average Efficiency of Maize	48.8	29.1	-19.7

Source: Field Study

Table 7 presents the changes in income, cost of cultivation, profit, and economic efficiency of paddy and maize cultivation between 2019 and 2024. The results indicate that while farmers experienced substantial increases in gross income, cultivation costs rose faster, leading to a decline in economic efficiency.

In the case of paddy**,** the average income increased from Rs. 42900 in 2019 to Rs. 75400 in 2024, registering an increase of Rs. 32500, accounting for 75.8 per cent. During the same period, the cost of cultivation rose from Rs. 38,475 to Rs. 69,898, an increase of Rs. 31,423, or 81.7 per cent. As a result, profit increased only marginally, from Rs. 4,425 to Rs. 5,502, representing an increase of Rs. 1,077 per acre. The net average economic efficiency declined sharply from 15.2 per cent in 2019 to 7.2 per cent in 2024, a reduction of 8.0 per cent over the study period. For maize, the average income increased from Rs. 50400 in 2019 to Rs. 81600 in 2024, representing an increase of Rs. 31200, or 61.9 per cent. However, the cost of cultivation also increased substantially from Rs. 34,739 to Rs. 62,118, an increase of Rs. 27,378, which is 78.8 per cent. Consequently, profit increased from Rs. 15661 to Rs. 19482, registering a gain of Rs. 3822 per acre. Despite this increase in profit, the net average economic efficiency declined significantly from 48.8 per cent to 29.1 per cent, reflecting a decrease of 19.7 per cent between the two reference years.

The data reveal that although both paddy and maize farmers benefited from higher incomes during the study period, the rising cost of cultivation absorbed a major portion of these gains. The increase in cultivation costs outpaced income growth for both crops, resulting in lower economic efficiency. The decline was particularly severe in maize, where efficiency fell by nearly 20 per cent, while paddy efficiency dropped by 8 per cent. These findings suggest that the changing pattern of input use, including higher expenditure on labour, fertilisers, irrigation, machinery, and other cultivation practices, has reduced the profitability and economic sustainability of food crop cultivation during the period 2019–2024.

Summary & Conclusion

The study examined the changing pattern of land ownership, irrigation, cropping pattern, cost of cultivation, income, and economic efficiency of paddy and maize cultivation in Warangal district during 2019–2024. The findings reveal five major changes. First, land ownership declined considerably, as own-land cultivation decreased from 86.7 per cent to 62.2 per cent, while leased-land cultivation increased from 43.3 per cent to 57.8 per cent, indicating growing dependence on leased farming. Second, the share of land cultivated shifted in favour of wet land cultivation, increasing from 31.1 per cent to 44.4 per cent, while dry land cultivation declined from 40.0 per cent to 22.2 per cent. Third, irrigation facilities improved significantly, with bore-well irrigation increasing from 46.7 per cent to 60.0 per cent and tank irrigation doubling from 10.0 per cent to 20.0 per cent, whereas rain-fed cultivation declined sharply. Fourth, cropping intensity and diversification increased substantially. Paddy cultivation rose from 42.2 per cent to 75.6 per cent, maize cultivation increased from 52.2 per cent to 65.6 per cent, and multiple cropping expanded from 34.4 per cent to 94.4 per cent. Fifth, although the yield, prices, and income of both paddy and maize increased considerably, the cost of cultivation increased at a faster rate. As a result, economic efficiency declined from 15.2 per cent to 7.2 per cent in paddy and from 48.8 per cent to 29.1 per cent in maize, indicating reduced profitability despite higher farm incomes.

The study concludes that agriculture in the study area underwent significant structural changes from 2019 to 2024. Improved irrigation facilities encouraged a shift from dryland to wetland cultivation and promoted the expansion of paddy, maize, and multiple-cropping practices. Farmers also benefited from higher crop yields, better market prices, and increased gross incomes. However, the benefits of rising agricultural production were largely offset by the rapid increase in cultivation costs. Expenditure on labour, fertilisers, irrigation, machinery, and other inputs increased substantially, reducing profit margins and economic efficiency. The growing dependence on leased land further reflects the changing nature of farming and the challenges faced by cultivators. While agriculture has become more intensive and commercially oriented, its economic sustainability has weakened as costs rise faster than returns. Therefore, policies aimed at reducing input costs, improving access to affordable credit, promoting efficient resource use, and strengthening market support are essential for enhancing farm profitability and ensuring the long-term sustainability of food crop cultivation in Telangana.

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