Original Research Article

Evaluating the Financial Impact of Insurance on Farmers: A Case Study from Andhra Pradesh, India

ABSTRACT

Aims: To evaluate the cost-returns and technical efficiency of both insured and non-insured farmers of chilli and cotton in the study area.

Study design: A comprehensive ex post facto study was conducted, collecting data through a stratified random sampling design in the selected villages within the study area.

Place and Duration of Study: The study was carried out in the Prakasam district of Andhra Pradesh. The final sample size included 150 farmers, out of which 90 were insured and 60 were non-insured. The study was conducted during the 2023-24 period. However, the data was collected on the costs and returns of chilli and cotton farming during the 2022 Kharif season.

Methodology: Cost concepts and stochastic frontier analysis were used to estimate cost returns and technical efficiency in chilli and cotton crops, respectively.

Results: The study findings highlighted the significant benefits of crop insurance for farmers. Insured chilli farmers achieved higher yields (40.94 q/ha) and returns (Rs. 722181/ha) compared to non-insured farmers, who had lower yields (39.72 q/ha) and returns (Rs. 700308 /ha). Similarly, insured cotton farmers also experienced better results with higher yields (18.65 q/ha) and returns (Rs. 121280/ha) compared to non-insured cotton farmers, whose yields were 17 q/ha and returns were Rs. 110551 /ha. The technical efficiency of insured farmers (chilli-0.91 and cotton-0.81) was greater than non-insured farmers (chilli-0.84 and cotton-0.75).

Conclusion: The current study highlights the vital role of crop insurance in improving the yield, farm income, and efficiency of both chilli and cotton farmers

Keywords: *Crop Insurance, Chilli, Cotton, Cost and returns, technical efficiency*

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1. INTRODUCTION

The agricultural sector serves as the primary source of livelihood for 47% of the population and contributes 18.6% to the country's GDP (GOI, 2022-23). It plays a vital role by employing almost 45.76% of the working population in India (PLFS, 2022-23). However, Indian agriculture is confronted with significant uncertainties, primarily stemming from uncontrollable weather events, which have the potential to severely impact both the quality and quantity of yields, leading to decreased farm income for farmers (Aidoo *et al.,* 2014). Intercropping, crop diversification, and mixed farming are helpful methods to mitigate adverse climatic conditions. However, according to Shahi Kiran and Umesh (2012), crop insurance is considered to be a more efficient solution. It is crucial to protect farmers from natural disasters and ensure their access to credit for the upcoming season (Jamanal and Natikar, 2019). Recent developments in agriculture have seen the establishment of mechanisms such as contract farming and future trading, aimed at providing insurance against price fluctuations, whether directly or indirectly(Raju and Chand 2009). Nonetheless, it is important to note that crop insurance remains the primary mechanism for mitigating natural risks (Mukherjee and Sarkar 2022). According to All India Insurance, Agricultural insurance plays a crucial role in safeguarding farmers from financial losses incurred as a result of uncertainties and unforeseen agricultural perils beyond their control. It aids in stabilizing farm production and income by promoting technology, encouraging investment, and increasing credit flow in the agriculture sector, benefiting the farming community; (Nicola 2010, Jain and Dharmaraja 2019 & Zubor-Nemes 2021). The insurance industry is proactive in adjusting frameworks to effectively address the far-reaching impacts of climate change (Aryal et al., 2020).

Despite its potential benefits, the adoption of agricultural insurance is low in many developing countries (Ali *et al.,* 2020). The effective assessment of the true need for crop insurance has yet to be satisfactorily addressed, in both developed and developing nations (Vandeveer, 2001). However, in recent times, only two main crop insurance schemes in India have been in operation namely, the Pradhan Mantri Fasal Bima Yojana (PMFBY) and the Restructured Weather-based Crop Insurance Scheme (RWBCIS), which is based on restructured weather (Vishnoi *et al.,* 2020). While purchasing crop insurance represents an additional cost for farmers, it effectively helps to mitigate risks in the agricultural production process, leading to improved agricultural output and ultimately increasing farmers' net income (Cha *et al.,* 2024). The Andhra Pradesh government is the only one in the country that pays for farmers' insurance premiums without them having to spend any money. It also pays the entire insurance claim amount to farmers who cultivate and register their names in e-crop under the Y.S.R Free Crop Insurance Scheme (Mohammed 2021). Where farmers only have to pay one rupee for insurance but later on it is made completely free. This new scheme includes yield-based and weather-based crop insurance to help farmers with post-harvest losses and adverse weather conditions. From 2022-23, the Dr YSR Free Crop Insurance will be implemented in conjunction with the Pradhan Mantri Fasal Bima Yojana (PMFBY) to provide financial aid based on crop losses caused by adverse weather conditions. In 2022-23, the Weather Based scheme will be carried out by the State Government using the existing Dr YSR Free Crop Insurance framework. Starting from 2023-24, it will be jointly implemented with the Government of India (GOI) (https://apagrisnet.gov.in).

Crop insurance is considered a crucial strategy for managing agricultural risk by protecting farmers against actual crop losses caused by weather events and other natural disasters (Shahi Kiran and Umesh, 2012). Weather index insurance effectively reduces the risk of revenue shortfalls (Shi and Jiang, 2016), particularly in maize and wheat crops (Heimfarth and Musshoff, 2011). According to Kumar and Babu (2021), the participation of smallholder farmers in the WBCIS has a positive impact on the technical efficiency of groundnut production. Encouraging insurance enrollment among Hungary's crop-specific farms can significantly enhance their technical efficiency and investment potential (Zubor-Nemes, 2021). The federal crop insurance program not only helped reduce risk but also enabled farmers to use resources more efficiently (Breker, 2017). Crop insurance benefits both temperate and tropical regions. However, in cold climates, there was no significant difference in productivity between insured and uninsured farmers (Agahi et al., 2008).

Farmers generally exhibit risk-averse behaviour in decision-making (Kushawaha and Sharma 2024). However, crop insurance encourages farmers to take risks. According to (Naik *et al.,* 2023), insured farmers are considered to be more willing to take risks compared to non-insured farmers, and crop insurance encourages farmers to take risks to achieve better yields. In this scenario, the current study is mainly focused on analyzing the cost returns and technical efficiency of cotton and chilli crops for insured and non-insured farmers in the Prakasam district of Andhra Pradesh.

2. Materials and Methods

2.1 Data Source and Sampling Details

The study was purposively conducted in the western region of Prakasam district, Andhra Pradesh, which is known for its diverse climate. The coastal areas have a moderate climate, while the non-coastal areas experience hot weather. The average annual rainfall is highest during the post-monsoon and monsoon seasons, with 419.65 mm and 404.14 mm, respectively (Rani *et al.,* 2020). Agriculture in this district faces challenges due to unpredictable rainfall, leading to a heavy reliance on tanks and canals for irrigation. The study focused on cotton and chilli farmers, as these are the primary crops grown in the area. A stratified random sampling method was used. A total of 150 samples were collected from the Yerragondapalem and Dornala tehsil of the Prakasam district using pre-structured interviews (Table 1), including ninety insured farmers (insured chilli-50, insured cotton-40) and sixty non-insured farmers (non-insured chilli-26, non-insured cotton-34) cultivating both chillies and cotton. Detailed information was collected regarding the claimed insurance for cotton and chilli farmers for the Kharif 2022 season. During the study time government announced insurance amount for those who cultivated chilli under irrigated conditions and cotton under rainfed conditions. The insurance amount claimed is Rs.3940/ac for chilli and Rs.1552/ac for cotton.

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Table 1. Details of the selected tehsils in the district

Yerragondapalem		Dornala	
Name of the village	Number of sample farm households	Name of the village	Number of sample farm households
Yerragondapalem	25	Hasanbadh	25
Kasikunta	25	Chinnagudipadu	25
Pellikunta	25		
Cherlothanda	25		
Total	100	Total	50

2.2 METHODOLOGY

2.2.1 Cost and Returns

The cost of cultivation in economics refers to all the expenses incurred from seeding to crop harvest. It includes the costs of input items like seeds, fertiliser, insecticides, pesticides, and labor, and is usually expressed in rupees per hectare (Rs/ha). Understanding the cost of producing crops on farms involves various CACP cost concepts and terms, which are outlined below. A1 Cost: It consists of

1. Value of hired human labour
2. Value of hired and owned bullock labour
3. Value of hired and owned machine labour
4. Value of planting material / Seeds
5. Value of manures and fertilizers
6. Value of plant protection chemicals
7. Depreciation
8. Irrigation charges
9. Land revenue
10. Interest on working capital
11. Miscellaneous expenses

Cost A_2: Cost A_1 + rent paid for leased in land value

Cost B_1: Cost A_1 + interest on working capital (excluding land)

Cost B_2: Cost B_1 + rental value of owned land + rent for leased land

Cost C_1: Cost B_1 + imputed value of family labour

Cost C_2: Cost B_2 + imputed value of family labour

Cost C_3: Cost C_2 + 10 per cent of Cost C_2 as management cost.

Gross returns = price* yield (Total output)

Net returns = Gross returns – total cost

2.2.2 Stochastic Frontier

The production frontier model with inefficiency effects enables the estimate of technical efficiency as well as the impacts of various technical efficiency-determining factors. The frontier is described as

$$\ln y_i^* = f(x_i; \beta) + v_i$$

where the stochastic frontier for observation i is represented by ln y_i. The technique is represented by the function f (x_i;), where x_i is a vector of input factors.

Y = productivity per acre. X_1 = Quantity of seeds (kg/acre) X_2 = Quantity of Nitrogen (kg/acre) X_3 = Quantity of Phosphorus (kg/acre) X_4 = Quantity of potassium (kg/acre) X_5 = Labours (man-days/acre) X_6 = Number of irrigations β = Coefficient vector V_i = Zero-mean stochastic noise. These factors are assumed to affect positively on yield. This frontier provides the best-practice production or the output at its highest degree of efficiency.

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The following are the details of the stochastic production frontier with output-oriented inefficiency:

$$\ln y_i = f(x_i; \beta) + \varepsilon_i$$

$$\varepsilon_i = v_i - u_i$$

where ε_i is the composite error term, which is made up of u_i, the impact of production inefficiency, and v_i, the zero-mean random error. u_i is limited to values between 0 and 1, with 1 denoting completely efficient production and 0 denoting inefficient production.

3. RESULTS AND DISCUSSION

The cost of cultivation is an essential factor for policymaking, whether to determine the amount of funding needed or to assess the profitability of various crop enterprises. The profitability of an enterprise is determined by analyzing its costs and returns.

A cost and returns analysis were conducted for chilli and cotton crops, comparing both insured and non-insured farmers (Table 2). For chilli farmers, the average cost of cultivation was Rs. 398687/ha for insured farmers and Rs. 403374/ha for non-insured farmers. Likewise, for cotton farmers, the average cost stood at Rs. 144521/ha for insured farmers and Rs. 146596/ha for non-insured farmers. The higher cost of cultivation was primarily due to the increased hiring of human labourers, which constituted 31.48% and 31.90% of the total costs for chilli-insured and non-insured farmers. For cotton, labour costs were 23.67% and 22.66% for insured and non-insured farmers. Further, expenditure on plant protection chemicals accounted for 17.54% and 19.26% for chilli-insured and non-insured farmers, and 14.53% and 14.82% for cotton-insured and non-insured farmers. Additionally, the cost of fertilisers and manures contributed to 10.25% and 8.18% of total costs for chilli-insured and non-insured farmers and 9.64% and 8.86% for cotton-insured and non-insured farmers. Considering these factors, it is evident that both chilli and cotton farmers face substantial operational costs.

Chilli farmers who are cultivating crops under irrigated conditions in the study area are entitled to claim insurance due to timely irrigation. This enables them to use better production methods and high-quality seeds, resulting in higher yields compared to non-insured farmers. Insured chilli farmers achieved a yield of 40.94q/ha, greater than the yield of non-insured farmers (39.72q/ha). This led to better returns for insured farmers, aligning with the findings of Ajmal *et al.* (2021) and Stephy *et al.* (2018). Conversely, the situation is different for cotton. Cotton was predominantly grown in rainfed conditions in the study area. Farmers growing cotton under rainfed conditions are eligible for insurance. Despite uncertain rainfall, insured farmers still achieved better yields than non-insured farmers (Krishna *et. al.,* 2019). Specifically, insured cotton farmers obtained a yield of 18.65q/ha, while non-insured farmers achieved 17q/ha. However, these yields were still below par and led to losses for both insured and non-insured cotton farmers, as returns only covered operating costs.

Table 2. Cost and returns of chilli and cotton farmers (Insured and Non-insured)

Particulars	Chilli (Rs/ha)		Cotton (Rs/ha)	
	Insured	Non-insured	Insured	Non-insured
Cost A_1	308301 (77.32)	312187 (77.39)	94679 (65.51)	96413 (65.76)
Seeds	37105 (9.30)	37673 (9.33)	7509 (5.19)	9288 (6.33)
Fertilisers and manures	40883 (10.25)	33018 (8.18)	13932 (9.64)	12994 (8.86)
Plant Protection Chemicals	69930 (17.54)	77694 (19.26)	21003 (14.53)	21730 (14.82)
Hired Human Labours	125529 (31.48)	128685 (31.90)	34214 (23.67)	33225 (22.66)
Hired Machine Labour	9686 (2.42)	9693 (2.40)	7751 (5.36)	8794 (5.99)

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Depreciation	5347 (1.34)	5328 (1.32)	4357 (3.01)	4317 (2.94)
Land Revenue	0.00 (0.00)	0 .00 (0.00)	0.00 (0.00)	0.00 (0.00)
Interest on Working capital	19819 (4.97)	20073 (4.97)	5909 (4.08)	6022 (4.10)
Cost A_2 (Cost A1+ Rent paid for leased in land)	308301 (77.32)	312187 (77.39)	94679 (65.51)	96413 (65.76)
Cost B_1	334247 (83.83)	338135 (83.82)	103328 (71.49)	105062 (71.66)
Cost A_1	308301	312189	94679	96413
Interest on the value of owned capital assets	25946 (6.50)	25842 (6.40)	8648 (5.98)	8638 (5.89)
Cost B_2	358957 (90.03)	362846 (89.95)	128038 (88.59)	129773 (88.52)
Cost B_1	334247	338135	103328	105062
Rental value of own land	24710 (6.19)	24710 (6.19)	24710 (6.19)	24710 (6.19)
Cost C_1	337733 (84.71)	341995 (84.78)	106672 (73.81)	108559 (74.05)
Cost B_1	334247	338135	103328	105062
Imputed value of family labour	3488.3 (0.87)	3860 (0.95)	3344 (2.31)	3497 (2.38)
Cost C_2	362444 (90.90)	366704 (90.90)	131382 (90.90)	133270 (90.90)
Cost B_2	358957	362846	128038	129773
Imputed value of family labour	3488	3860	3344	3497
Cost C_3 (10% of C_2+Cost C_2)	398687 (100.00)	403374 (100.00)	144521 (100.00)	146596 (100.00)
Yield (q/ha)	40.94	39.72	18.65	17
Price of produce (Rs/q)	17640	17640	6503	6503
Gross Income (GI)	722181	700308	121280	110551
Net Income	323494	296933	-23240	-36045

(Note: Figures in parentheses indicate percentage to the total)
Source: Author's computation

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Table 3. Technical Efficiency of the Sample Farmers

Technical efficiency	Chilli	Cotton

	Insured	Non-insured	Insured	Non-insured
<=0.60	0	0	3 (7.50)	6 (17.70)
0.61-0.70	0	4 (15.40)	6 (15.00)	6 (17.70)
0.71-0.80	3 (6.00)	4 (15.40)	7 (17.50)	7 (20.60)
0.81-0.90	10 (20.00)	9 (34.60)	10 (25.00)	8 (23.50)
0.91-1.00	37 (74.00)	9 (34.60)	14 (35.00)	7 (20.60)
Total	50 (100.00)	26 (100.00)	40 (100.00)	34 (100.00)
Mean	0.91	0.84	0.81	0.75

(Note: numbers in parentheses indicate per cent of the total)

The majority of insured chili farmers (74%) and insured cotton farmers (35%) demonstrated technical efficiency levels between 0.91 and 1.00, indicating they operate at 91 to 100 percent efficiency. Non-insured farmers were found to be less efficient compared to insured farmers. The average technical efficiency of insured farmers was higher (chili-0.91 and cotton-0.81) than that of non-insured farmers (chili-0.84 and cotton-0.75) (Table 3). This indicates that insured farmers are making more optimal use of resources than non-insured farmers. According to Russo *et al*., 2022, Roll, 2019 & Zubor-Nemes, 2021) our findings also indicate that insurance has a positive impact on efficiency.

4. CONCLUSION

The agricultural industry is full of uncertainties and risks. These risks can hinder farmers' ability to make informed decisions and invest capital in the industry. So, it is important to introduce effective risk management mechanisms into farm management in order to create a more efficient and logical agricultural system. The present study aimed to determine the cost-returns and technical efficiency of insured and non-insured farmers in the Prakasam district of Andhra Pradesh. The study found that insured farmers in the area had better yields, returns, and technical efficiency compared to non-insured farmers for both chilli and cotton crops. However, the net returns of cotton farmers were negative, indicating a loss for both insured and non-insured farmers. The higher yield and returns of insured farmers can be attributed to the crop insurance schemes, which have encouraged the use of high-value inputs like seeds, fertilizers, and plant protection chemicals, resulting in higher technical efficiency and returns. Although insured farmers fared better than non-insured farmers, there wasn't a significant difference in yields and returns. As a result, the government should consider increasing the insurance amount and extending coverage to all crop-growing farmers, regardless of whether they grow irrigated or rainfed crops.

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DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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

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