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Good Agricultural Practices in FPOs and Contract Farming: A Comparative Study

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The adoption of Good Agricultural Practices (GAP) plays a critical role in improving farm productivity, ensuring food safety, and enhancing market access, particularly in the context of export-oriented crops like chilli. This study investigates the extent and economic implications of GAP adoption among chilli farmers in Andhra Pradesh across three different farming models: Farmer Producer Organizations (FPOs), contract farming, and non-contract farming. A total of 135 farmers were randomly selected from the NTR, Prakasam, and Kurnool districts for comparative analysis using an adoption index and Garrett's ranking technique. The results revealed that 73.33% of FPO farmers exhibited a high level of GAP adoption, while medium adoption was more prevalent

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among contract (68.89%) and non-contract (48.89%) farmers. The major drivers of chilli cultivation were soil-climate suitability, market demand, and higher returns. Conversely, high input costs and limited knowledge were the primary constraints to GAP adoption, especially among non-contract farmers. FPOs significantly outperformed other models in terms of compliance with certified inputs, integrated pest and crop management, and hygienic post-harvest handling. The findings underscore the importance of promoting GAP through institutional mechanisms, capacity building, and supportive policy frameworks to scale sustainable chilli production and enhance farmers' economic resilience.

Keywords: Chilli; Good Agricultural Practices (GAP); challenges; garret ranking test and adoption index.

1. INTRODUCTION

Chilli (*Capsicum annuum*) is one of India's most important spice crops, contributing substantially to domestic consumption, export revenues, and rural livelihoods. With its wide adaptability and high market demand, chilli cultivation has gained significant momentum across various agro-climatic zones. Among the chilli-growing states, Andhra Pradesh stands at the forefront, not only in terms of area and production but also in productivity and export readiness. As of 2022–2023, Andhra Pradesh cultivated chilli over 258.2 thousand hectares, producing 1,458.79 thousand metric tonnes (MT) at a productivity level of 5.65 MT/ha—considerably higher than the national average of 3.3 MT/ha. This strong performance underscores the state's potential as a global player in the chilli value chain.

India's chilli exports are directed mainly to China, Thailand, Bangladesh, and the United States. In 2023–2024 alone, China imported approximately 179,672 tonnes of Indian chilli, valued at ₹4,12,363 lakh. The growing international demand has placed new emphasis on improving chilli quality, traceability, and compliance with food safety standards. This, in turn, has amplified the relevance of Good Agricultural Practices (GAP)—a set of principles that promote sustainable and safe farming methods, ensuring environmental health, economic viability, and food safety throughout the agricultural process.

GAP adoption in India is still evolving, with wide disparities in awareness, accessibility, and implementation across different farming systems. Contract farming and Farmer Producer Organizations (FPOs) have emerged as institutional frameworks capable of facilitating GAP adoption. These models offer structured input supply chains, technical guidance, and better market linkages, compared to traditional non-contract farming where farmers operate in isolation. Contract farming involves formal or informal agreements between farmers and buyers/processors, offering a stable market and inputs in return for assured produce. FPOs, on the other hand, are farmer-led collective enterprises that aim to strengthen bargaining power, improve input/output efficiencies, and foster sustainable practices.

Despite the potential advantages, GAP adoption remains inconsistent. Farmers face multiple challenges such as lack of awareness, financial constraints, fragmented landholdings, and inadequate access to extension services. These limitations are more pronounced in non-contract settings where institutional support is minimal. On the other hand, contract and FPO farmers often benefit from exposure to training, credit facilities, and market intelligence, enhancing their ability to comply with GAP standards.

Recognizing this gap, the present study was undertaken to assess and compare the level of GAP adoption among chilli farmers operating under three different models—FPO, contract, and non-contract—in the districts of NTR, Prakasam, and Kurnool in Andhra Pradesh. Specifically, the study aims to:

1. Identify the key drivers behind chilli cultivation in the region.
2. Evaluate the extent of GAP adoption using the standardized adoption index.
3. Compare the practices across the three farming systems.
4. Identify the constraints faced by farmers, especially non-contract growers, in adopting GAP.

The study employed a stratified sampling technique to select 135 chilli farmers across nine villages (three from each district). Contract and FPO farmers were identified using lists provided by processing units and producer organizations, while non-contract farmers were randomly

chosen. Primary data was collected through structured interviews during the 2023–24 agricultural season.

To quantify adoption, the GAP adoption index developed by Sharma (2002) was used, classifying practices into three levels—full, partial, and nil. Scores were converted into percentage indices, and adoption levels were categorized as low, medium, and high. In addition, Garrett's ranking technique was employed to prioritize farmers' reasons for adopting or refraining from GAP, thereby providing insights into the motivational and constraint factors influencing their decisions.

Preliminary findings suggest that FPO farmers had the highest rate of GAP compliance, especially in areas such as the use of certified seeds, integrated pest and crop management, and post-harvest sanitation. Contract farmers followed closely, benefiting from input support and extension advice. Non-contract farmers lagged significantly, citing high input costs, lack of training, and market uncertainty as major constraints. Practices like child labour reduction, compliance with pesticide withdrawal periods, and adoption of silpaulin drying methods were most prevalent among FPO farmers.

The importance of this study lies in its potential policy implications. Given the international thrust on sustainable agriculture and traceability, enhancing GAP adoption is no longer optional but imperative for market access and food safety compliance. By demonstrating the superior outcomes associated with institutional farming models, the study advocates for a scale-up of FPOs and improved contract farming mechanisms. Extension agencies, NGOs, and policymakers must work in synergy to bridge the adoption gaps by offering targeted training, subsidized inputs, and market-linked incentives.

In conclusion, as chilli continues to be a crop of commercial significance and export potential, the adoption of GAP across various farming systems must be prioritized. Institutional models like FPOs and contract farming offer a promising pathway to promote adoption, improve farmer incomes, and position India competitively in the global spice market.

2. METHODOLOGY

Three districts in Andhra Pradesh—NTR, Prakasam, and Kurnool—rank second, third, and fourth, respectively, in chilli production and were therefore selected as the study locations. Although Guntur district holds the first position in chilli cultivation, it was excluded from the study as chilli farmers there do not participate in contract farming. To facilitate a comparative analysis among FPO, contract, and non-contract chilli farmers, one block was chosen from each selected district. Within each block, three villages were identified based on the distinct presence of contract, non-contract, and FPO-based chilli cultivation systems. From each village, 15 non-contract farmers were randomly selected, totaling 45 non-contract farmers. Similarly, lists provided by processing enterprises were used to randomly select FPO and contract farmers. In total, 135 sample farmers were selected using a random sampling method. Data collection was conducted through individual interviews using a well-structured and pre-tested interview schedule. Primary data collection took place during the 2023–24 agricultural year. Additionally, a preliminary survey was conducted to identify key stakeholders involved in the chilli value chain. Participants were selected from various stages of the supply chain, starting with farmers at the production level. All the datils above were presented in Table 1.

Table 1. Sample farmers selected for the study

S. No.	District	Blocks	Name of the Villages
1.	NTR	Nandigama	Ramireddypalli Jonnalagada Peddavaram/Cherukumpalem
2.	Prakasam	Markapur	Vengalareddypalli Jayaramapuram Yerragondapalem
3.	Kurnool	Adoni	Ralladoddi Kadimetla Sugur

2.1 Adoption Index

The good agricultural practices adoption index shaped by Sharma (2002) was employed. Three three-point continuums—full, partial, and nil—with numerical scores of 3, 2, and 1—were used to measure adoption. The average score for a certain technology was calculated using the adoption index. The average score was divided by the highest possible score on a particular practice, then multiplied by 100 to arrive at the final result.

$$\text{Adoption index} = \frac{\text{Respondents' score}}{\text{Total possible score}} * 100$$

2.2 Garrett's Ranking Technique

It offers the capacity to convert advantage ordering and constraint into numerical scores. The main benefit of this method over a straight forward frequency distribution is that respondents' subjective evaluations of the limitations' severity determine how they are organized. Because of this, the same number of respondents likely ranked two or more limits differently.

> Garrett's formula for converting ranks into a percent is Percent position = 100 * (Rij – 0.5)/Nj

Where

Rij = rank given for i^{th} constraint by j^{th} individual;
Nj = a number of constraints ranked by j^{th} individual.

The percentage position of each rank was converted into scores using the table provided by Garrett and Woodworth (1969). The total score for each factor was obtained by summing the individual scores given by all respondents. These total scores were then averaged to calculate the mean score for each constraint. The constraints were ranked in descending order based on their mean scores, following the method outlined by Jimjel et al. (2015).

3. RESULTS AND DISCUSSION

Farmers in Andhra Pradesh were asked to list the reasons behind their cultivation of chillies. The solution was evaluated using Garrett's ranking technique, and the results are shown in Table 2 and Fig. 1. Three groups of farmers grew chilli mostly because of the climate and soil suitability. The outcomes agree with the research done by Hussain et al (2021). The higher pungency, better pricing for the produce, and suitability for marketing were the three top reasons given by the contract farmers. Better produce prices, thicker red skin on crushed chillies, and increased pungency as determined by the Spice Board of India were the main factors driving FPO producers.

Table 3 and Fig. 2 present and analyze the adoption level of GAP technologies with mean adoption index values of 79.39 and 77.65, respectively, it can be inferred that medium adoption, followed by high adoption, was the most common adoption strategy for chilli cultivation practices among 68.89 and 48.89 percent of contract farmers and noncontract farmers, respectively. The findings corroborated those of studies by Thakur (2020), Mane (2012), Pawar (2008), Reddy et al. (2018), Rathore et al. (2016), Verma et al. (2015), Venkata Reddy et al. (2018) and Goudappa et al (2012). Conversely, 18 and 40.00 percent of them had low adoption levels, with mean technology scores of 3 and 6.67 percent. The adoption rate among FPO farmers was found to be high at 73.33 percent and medium at 24.44 percent. The outcomes matched those of Sharma et al. (2015).

Because knowledge restricts an individual's actions, it is likely that the majority of respondents in the contract and noncontract farming categories fall into the medium adoption category. This may be attributed to the fact that most respondents possess medium to high levels of knowledge. The results are outlined with the results of Ranish et. al., (2001), Reddy et al (2018) and Divya and Shiva Kumar (2014). Whereas most of the FPO farmers fall under the high adoption category.

Adoption of GAP technologies in chilli, categorized by practice is presented in Table 4.

When it comes to GAP technology, FPO farmers use more of them (79.17%) than contract farmers do. Compared to contract and FPO farmers, noncontract farmers used child labor more frequently. The findings of Manaswi et al. (2020) and Aruna Kumari et al. (2023) are reviewed with the results, which differ from those of Ravikishore et al. (2024).

Farmers prioritized their reasons for not using Good Agricultural Practices (GAP). The solution

was evaluated using Garrett's ranking technique, with the results presented in Table 5. The high cost of inputs was the main deterrent to the adoption of good agricultural methods. Contributing factors mentioned by the non-adopters included high labour costs, insufficient knowledge and training, low market prices and less land holdings. The findings by Chaudhary et al. (2023) and Nagadevi (2021) are summarized with the outcomes. The results differ from those of Chaudhary and Khodifad (2017), Sharma et al. (2015), and Kalidas et al. (2021).

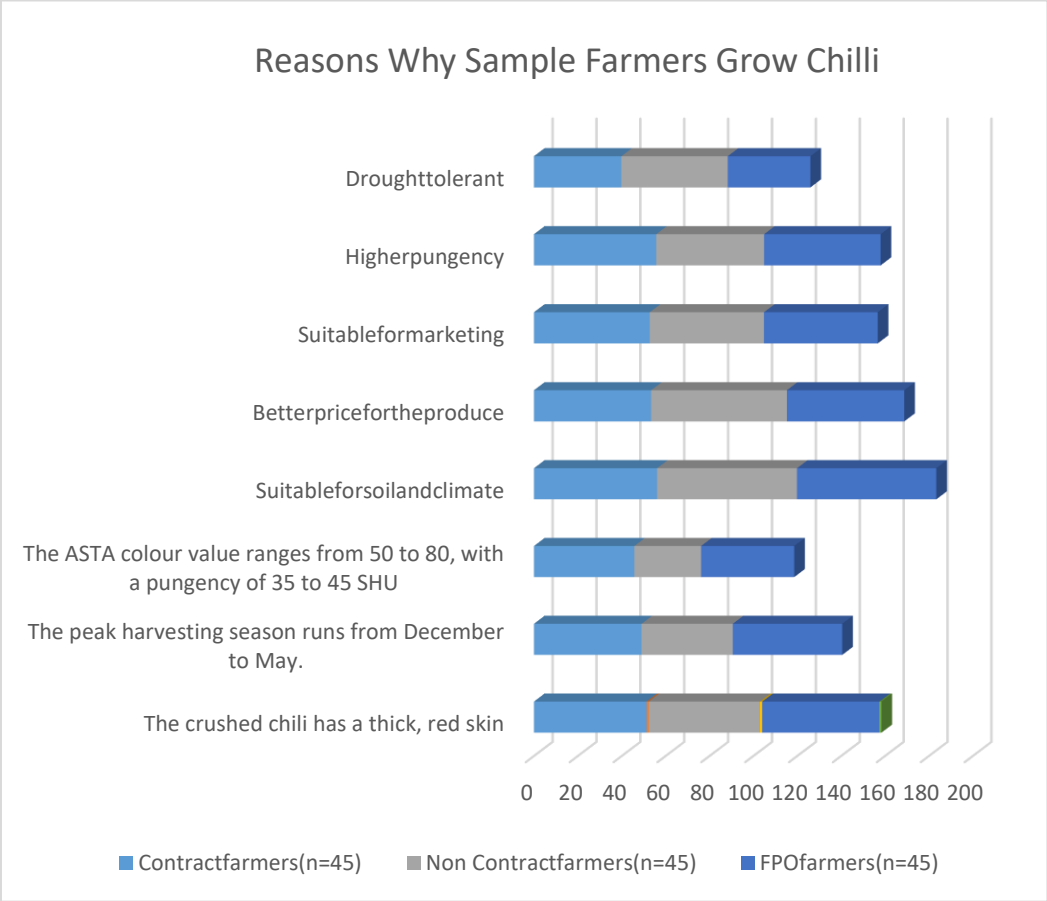

Fig. 1. Reasons why sample farmers grow chilli

Table 2. Reasons why sample farmers grow chilli

S. No	Reasons	Contract farmers (n=45)		Non Contract farmers (n=45)		FPO farmers (n=45)	
		Mean score	Rank	Mean score	Rank	Mean score	Rank
1	The crushed chili has a thick, red skin	51.33	V	50.69	IV	53.38	III
2	The peak harvesting season runs from December to May.	49.02	VI	41.58	VII	49.91	VI
3	The ASTA colour value ranges from 50 to 80, with a pungency of 35 to 45 SHU	45.76	VII	30.42	VIII	42.44	VII
4	Suitable for soil and climate	56.13	I	63.76	I	63.49	I
5	Better price for the produce	53.40	III	61.87	II	53.49	II
6	Suitable for marketing	52.80	IV	52.04	III	51.84	V
7	Higher pungency	55.71	II	49.18	V	53.09	IV
8	Drought tolerant	39.84	VIII	48.47	VI	37.71	VIII

Table 3. The adoption level of GAP technologies among FPO farmers, as well as contract and non-contract farmers

Adoption level	Categories	Contract (n=45)			Non Contract (n=45)			FPO farmers (n=45)		
		Nos	%	Mean score	Nos	%	Mean score	Nos	%	Mean score
Low	<73.61	3	6.67	67.59	18	40	68.36	1	2.22	72.22
Medium	73.61-84.72	31	68.89	79.39	22	48.89	77.65	11	24.44	88.64
High	>84.72	11	24.44	87.75	5	11.11	88.89	33	73.33	80.09
Total		45	100.00	78.24	45	100.00	78.30	45	100.00	80.32

Table 4. Adoption of GAP technologies in chilli, categorized by practice

S. No	Good Agricultural Practices	Contract farmers(n=45)	Non contract farmers (n=45)	FPO farmers (n=45)
1.	Certified seeds from an authorized source	84.44	91.11	100.00
2.	Seed Treatment method	80.00	80.00	95.56
3.	Following Nursery cultivation	88.89	86.67	95.56
4.	By using quality seed	97.78	100.00	97.78
5.	Customized fertilizer application	95.56	97.78	100.00
6.	Customized pesticide application	97.78	91.11	100.00
7.	By using integrated pest management kits (Sticky traps, Pheromone traps, Neem oil)	91.11	51.11	80.00
8.	By using integrated crop management kits (Trichoderma, Pseudomonas, Beauveria)	88.89	51.11	77.78
9.	Avoid applying chemicals between the flowering and pod formation periods	93.33	88.89	97.78
10.	Picking the pod upwards while harvesting	95.56	88.89	100.00
11.	Restricting animals, including livestock, poultry, and pets, from roaming in crop areas, particularly during harvest time.	42.22	48.89	55.56
12.	Excluding rodents, insects, and other pests from cultivation areas	97.78	80.00	95.56
13.	Reduction in weedicides	88.89	77.78	95.56
14.	By using drip or sprinkler irrigation	31.11	68.89	91.11
15.	Customized frequency of irrigation	95.56	75.56	88.89
16.	Giving wages as per government norms	46.67	37.78	33.33
17.	Engage the child labour or not	11.11	26.67	11.11
18.	Reduction in chilli drying over bare soil	95.56	73.33	97.78
19.	Increase in adoption of chilli drying over silpaulin	95.56	82.22	100.00
20.	Increase in adoption of chilli drying over foldable chilli dryer	86.67	95.56	100.00
21.	Cleaning and sanitizing harvest containers before use	93.33	91.11	95.56
22.	Avoid harvesting chillies within 120 days after chemical application.	86.67	86.67	100.00
23.	Excluding field debris from packing and storage facilities by cleaning the exteriors of harvest bins and ensuring that workers wear clean clothing in these areas.	93.33	95.56	97.78
24.	Using new, unused bags to package products for transportation and sale.	100.00	100.00	100.00

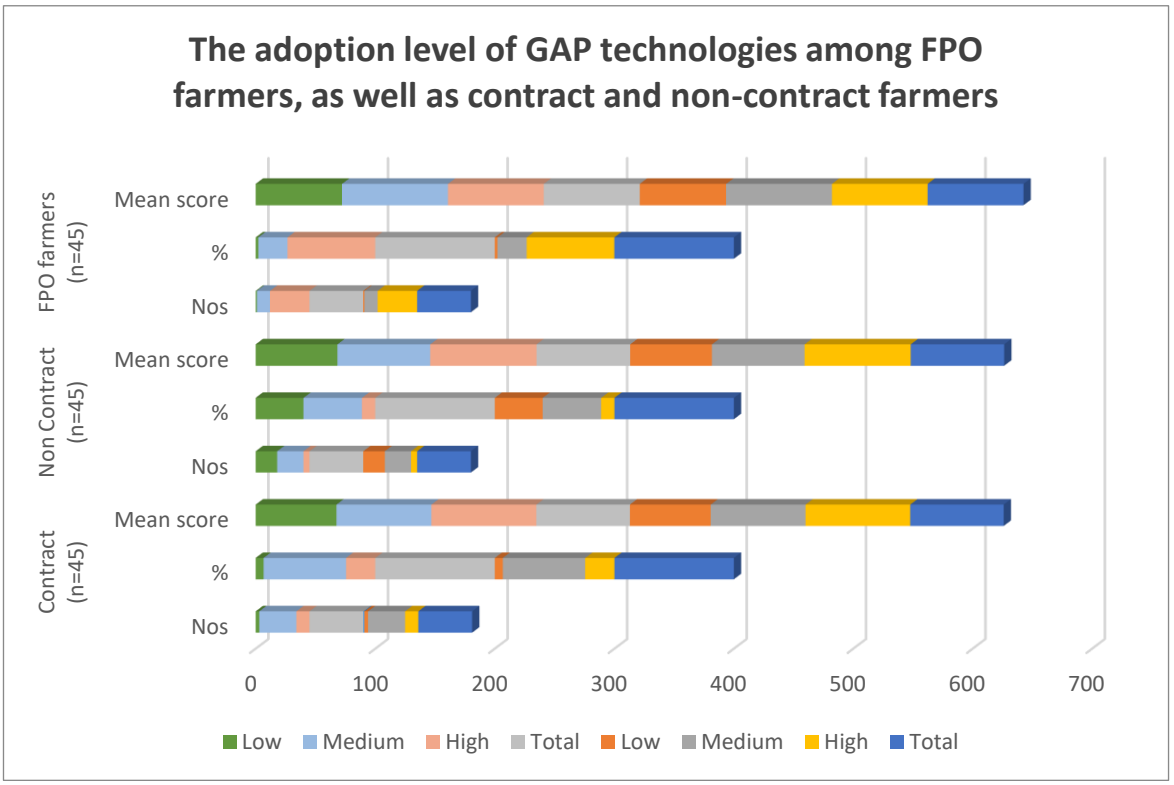

Fig. 2. The adoption level of GAP technologies among FPO farmers, as well as contract and non-contract farmers

Table 5. Challenges encountered by farmers in adopting good agricultural practices (GAP)

S. No	Constraints	Non contract farmers	
		Mean score	Rank
1	Insufficient knowledge and training	46.89	III
2	High input costs	67.44	I
3	High labour charges	50.44	II
4	Low market prices	46.44	IV
5	Less land holding	37.67	V

4. CONCLUSION

It may be concluded that three types of selected farmers produced chillies in Andhra Pradesh mainly because the soil and climate were suitable for them. Over half of the FPO farmers (73.33%) indicated a high degree of adoption, while 24.44% reported a medium level of adoption. Additionally, the survey discovered that FPO farmers had higher levels of adoption. It has been less typical for contract, noncontract, and FPO farmers to use child labor. The high cost of inputs is the main cause of nonadoption. To reduce input and labor costs and provide a fair price for farm produce, it is necessary to strengthen technology transfer initiatives to popularize GAP practices by the relevant extension agencies, provide timely and affordable supply of required inputs to farmers through government agencies, and offer a remunerative price for farm produce.

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1. Only chatgpt (Just 10 % i.e., editing)

CONSENT

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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