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Understanding the Adoption Dynamics of Vegetable Contract Farming in Punjab: A Case Study of Amritsar District

Navbir Batth, Sanjeev Kumar, Kamal Vatta and Vinita Kanwal

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana, Punjab

Abstract

The present study was conducted in the Amritsar district of Punjab during the agricultural year 2023-24. Primary data from a sample of 60 contract and 60 non-contract vegetable farmers were collected through a simple random sampling technique. The socio-economic characteristics of the sampled farmers revealed that contract farmers were generally younger, more educated and had better access to credit compared to their non-contract counterparts. The findings also indicated that the primary reasons for adopting contact farming of vegetables by the farmers included the desire for diversification, assured income and timely payments. In contrast, high input costs, challenges in meeting quality standards and rejection of produce were identified as the main barriers to adoption. The logit regression analysis confirmed that younger farmers, those with higher education,and better access to credit were more likely to adopt vegetable contract farming. Based on these results, it is suggested to improve farmers' knowledge about vegetable contract farming through awareness programs, providing technical training on quality standards, enhancing digital literacy and establishing fair and enforceable contract mechanisms to facilitate the adoption of vegetable contract farming in the study area.

Keywords: Contract farming, Logit regression model, Adoption dynamics

JEL Classification: Q12, Q16, Q18

Introduction

The state of Punjab has experienced remarkable agricultural growth during the Green Revolution era of the 1960s and 1970s. This transformation enhanced food security and increased the farmers' income through the intensive cultivation of paddy and wheat crops. However, the continued reliance on wheat and paddy crops has led to alarming environmental consequences, including the depletion of groundwater resources and overuse of tube wells and submersible pumps (Singh *et al*, 2020). These adverse outcomes have generated widespread demands for agricultural diversification and the implementation of sustainable water management practices in cropping systems throughout the state (Kumar *et al,* 2024). In light of these concerns, researchers and policymakers have urged a shift towards alternative cropping systems associated with agribusiness models (Singh, 2000; Sidhu, 2002; Sharma and Singh, 2014). One such model that has gained attention is vegetable contract farming, which is emerging as a viable solution for promoting sustainable agriculture in the state.

The significance of contract farming in the vegetable sector stems from the perishable nature of vegetables, their sensitivity to quality parameters and fluctuating market conditions. This arrangement allows for pre-harvest agreements between farmers and private firms, covering aspects such as input provision, technical guidance, production practices, quality control and assured marketing. For farmers, especially those with small and marginal holdings, vegetable contract farming offers potential benefits such as price stability, reduced marketing risks and improved access to inputs and technology. Recognizing these advantages, the Government of Punjab has actively participated in promoting contract farming in the state. The state government enacted legal frameworks, such as the Model APMC Act, 2003 and the Punjab Contract Farming Act, 2013, to facilitate private sector participation and safeguard farmers' interests. These contractual agreements offer multiple benefits to vegetable farmers, including price assurance, access to quality inputs and technical support, and reduced marketing risks. These incentives make contract farming attractive, particularly in a region dealing with ecological and economic constraints.

However, despite these policy efforts and the theoretical advantages of contract farming, the actual adoption of vegetable contract farming remains relatively limited in

Corresponding author email: sharmask93@rediffmail.com

the state. A significant proportion of vegetable growers still rely on non-contract vegetable farming or traditional farming practices. The existing literature highlights issues such as inequitable distribution of benefits, gender-based wage disparities, unfavorable contract terms and lack of trust in agribusiness firms, which have hindered its broader acceptance (Bhogal and Vatta, 2021; Kaur *et al*, 2021). Moreover, concerns about market dependency, delayed payments and the dominance of corporate interests have raised questions about the long-term sustainability of such arrangements. In this context, understanding the dynamics influencing farmers' decisions to adopt vegetable contract farming is critical for guiding future policy and agribusiness strategies.

Data Sources and Methodology

The present study was conducted in the Amritsar district of Punjab purposively because the farmers in this district are significantly engaged in contract farming of vegetables. The preliminary field investigations and consultations with contracting firms revealed that the primary vegetables grown under contract in the district include tomato, potato, and sugar beet. A simple random sampling technique was employed to select the respondents for the study. A list of vegetable contract farmers was obtained from contracting companies operating in the district. From this list, a random sample of 60 vegetable contract farmers was selected to represent the adopters of contract farming. Further, to enable a comparative analysis, 60 non-contract vegetable farmers were randomly selected from the same study area. Thus, the final sample consisted of 120 farmers, ensuring balanced representation of both adopters and non-adopters of contract farming. Thereafter, a survey schedule was designed to gather detailed information on farmers' socio-economic profiles, farming practices, and experiences with contract farming. The primary data were collected during the crop year 2023–24.

The contract and non-contract vegetable farmers were asked to specify the reasons behind their adoption and non-adoption of vegetable contract farming, respectively. Further to systematically prioritize these reasons, Garrett's ranking technique was employed. This method provides a more robust analysis than simple frequency analysis by enabling the ranking of constraints based on their perceived severity from the respondents' perspective (Zalkuwi *et al*, 2015). The percentage position of each rank was calculated using the formula:

$$\text{Per cent position} = \frac{R_{ij} - 0.50}{N_j} \times 100$$

Where R_{ij} was the rank given for the i^{th} factor by the j^{th} respondent and N_j was the number of factors ranked by the j^{th} respondent.

Thereafter, the per cent positions calculated for each rank were subsequently converted into scores using Garrett's conversion table (Garrett and Woodworth, 1969). The average scores for each factor were computed and ranked in descending order. The factor receiving the highest average score was interpreted as the most influential driver or constraint affecting the decision to adopt or not adopt vegetable contract farming in the study area (Karthick *et al*, 2013).

Logistic regression analysis

A logistic regression analysis was employed to examine the socio-economic determinants influencing the adoption of contract farming of vegetables in the study area. This model estimated the probability of adoption of contract farming as a function of various socio-economic factors. The dependent variable in the model was binary, which was defined as Yi = 1 if the farmer has adopted contract farming of vegetables, and 0 if the farmer has not. The model used in the present study was expressed as:

$$\log \frac{P_i}{1-P_i} = \beta_0+\beta_1X_{1i} + \beta_2X_{2i}+ \beta_3X_{3i} + \beta_4X_{4i} + \beta_5X_{5i} + \beta_6X_{6i} + \beta_7X_{7i}$$

Where, P_i is the probability that the i^{th} farmer adopts contract farming; β_0 is the intercept; β_1, β_2,…,β_7 are the coefficients to be estimated; and X_{1i}, X_{2i}….. X_{7i} are the independent variables. The description of variables used in the model is given in Table 1.

Table 1: Description of explanatory variables used in the logit model

Variable	Description
Age (X_1)	Age of the farmer in years
Education level (X_2)	Binary: 0 if the farmer studied up to matriculation, 1 otherwise.
Family size (X_3)	The total number of individuals in a farmer's household
Owned land (X_4)	Area in acres
Leased-in land (X_5)	Area in acres
Farmer category (X_6)	Binary: 1 if operational holding is > 5 acres, 0 otherwise.
Amount of credit (X_7)	Total amount of credit available to the farmer (in lakhs)

Results and Discussion

Socio-economic characteristics of sampled farmers

The socio-economic profile of farmers significantly influences their decision to adopt agricultural innovations. The results in Table 2 present the key socio-economic characteristics of the sampled farmers of the study area. The data revealed that contract farmers were younger (41.42 years) compared to non-contract farmers (49.77 years).

The literacy rate was also higher among contract farmers (95%) than non-contract farmers (86.67%). Family size was nearly identical across both groups, averaging around 5.6 members. Non-contract farmers owned more land (9.15 acres) than contract farmers (8.33 acres), but contract farmers leased in more land (7.98 acres vs. 6.78 acres), resulting in a slightly higher total operational holding (16.32 acres vs. 15.52 acres). Only non-contract farmers reported leased-out land, averaging 0.41 acres. In terms of credit access, contract farmers had greater availability (Rs. 5.30 lakh) compared to non-contract farmers (Rs. 4.63 lakh).

Reasons for the adoption of contract farming of vegetables

The results presented in Table 3 revealed the major reasons that encouraged the farmers to enter into agreements with contracting companies in the study area. The highest-ranked reason was the desire to adopt a new enterprise, which received a Garrett score of 62. This suggests that farmers are highly inclined to diversify their agricultural activities, and contract farming provides a structured and potentially profitable pathway for such diversification. The second most important reason was the assured income, with a Garrett score of 61, followed by the timely payment of the produce, which had a score of 55. The timely input supply from contracting firms was ranked fourth, with a score of 51, followed by compensation provided in case of crop damage, with a Garrett score of 50. The next reason was the assured buy-back mechanism of the companies, which received a score of 42. Lastly, the adequate technical guidance provided by the companies, with a score of 36, was ranked the lowest. Overall, the results underlined that while economic incentives like assured income and timely payments are strong motivators, non-monetary factors such as the aspiration to diversify and institutional support in terms of inputs and compensation also play crucial roles in influencing the adoption of vegetable contract farming in the study area. These results align with those of Kharumnuid, 2017, who identified similar factors like assured prices and timely input supplies from contracting companies as key drivers for contract farming adoption.

Reasons for non-adoption of vegetable contract farming

To gain insight into the reasons discouraging farmers from participating in vegetable contract farming, non-contract farmers were asked to rank the reasons for their non-adoption, and the results are summarized in Table 4. The most significant barrier identified was the high investment in inputs, which received the highest Garrett score of 68.52 and was ranked first. This finding suggested that non-contract farmers perceive contract farming to be cost-intensive, possibly due to the need to meet strict production standards or invest in specialized inputs. The second-ranked reason was the inability to meet quality parameters of vegetables, with a Garrett score of 62.53. This highlighted a major structural challenge in contract farming, where quality requirements, often set by companies to meet market or export standards, exclude farmers who lack the resources, knowledge, or support to comply. This was followed by rejection of produce, with a score of 59.58. The other reasons for non-adoption included low prices for the produce, delay in payment, and the existence of middlemen. Overall, the non-adoption of vegetable contract farming is primarily driven by economic concerns, particularly high input costs and perceived unfair pricing, as well as production-related challenges, such as difficulty in meeting quality standards. These results highlighted the need for more inclusive, farmer-friendly contract models, greater access to affordable inputs and credit, and stronger extension services to enhance the feasibility of contract farming among the farmers in the study area. These results are consistent with previous studies by Singh, 2002 and Kharumnuid, 2017, who identified similar reasons for non-adoption of contract farming by farmers, such as delayed payments, inadequate support services, low price compared to prevailing market price and challenges in meeting quality standards.

From Tables 3 and 4, it is important to note that certain responses from adopters and non-adopters of vegetable contract farming in the study area appeared to be in contrast. For instance, adopters cited timely payment and input supply

Table 2: Socio-economic characteristics of sampled farmers

Particulars	Contract Farmers	Non-Contract Farmers	Overall
Age (years)	41.42	49.77	45.59
Literacy rate (%)	95.00	86.67	90.84
Family size (No.)	5.58	5.65	5.62
Owned land (acres)	8.33	9.15	8.74
Leased-in land (acres)	7.99	6.78	7.38
Leased-out land (acres)	-	0.41	0.20
Total operational holding (acres)	16.32	15.52	15.92
Credit availability (Rs. lakh)	5.30	4.63	4.96

Table 3: Reasons for the adoption of contract farming of vegetables

Reasons	Garrett Score	Rank
Wanted to adopt a new enterprise	62	1
Timely input supply from contracting firms	51	4
Assured income	61	2
Compensation is given in case of crop damage	50	5
Timely payment of the produce	55	3
Adequate technical guidance is provided by the companies	36	7
Assured buy-back mechanism of the companies	42	6

as key reasons for participation, whereas non-adopters expressed concerns about delayed payments and inadequate input provision. This contrast revealed the gap between actual experiences and perceived risks. Adopters, having direct engagement with contracting firms, base their response on the benefits they have received. In contrast, non-adopters often rely on hearsay or a lack of awareness, which shapes their apprehensions about contract farming (Singh, 2002; Kaur *et al*, 2021). These variations underscore the need for improving transparency, consistency and mutual trust in the contract farming mechanism to enhance its broader effectiveness and acceptance among farmers in the study area.

Determinants influencing the adoption of contract farming

The results of the logit regression model presented in Table 5 highlight that age, education level and credit availability significantly influenced the adoption of vegetable contract farming in the study area. The findings revealed that age had a negative and statistically significant effect, indicating that younger farmers are more likely to adopt contract farming. Specifically, the probability of adoption of contact farming of vegetables increased by 0.8 per cent points for each year decrease in a farmer's age. Similar findings were reported by (Behera, 2019), who revealed that older farmers are generally less inclined to participate in contract farming. Education level showed a strong positive effect, suggesting that farmers having education beyond matriculation are more inclined towards contract farming, with their probability of choosing contract farming increased by 23.9 per cent. Rokhani *et al*, 2020 and Dubbert *et al*, 2023 also observed that literate and educated farmers tend to prefer contract farming. Credit availability also positively influenced adoption, highlighting the importance of financial access in facilitating the adoption of vegetable contract farming. It was found that for every additional lakh of credit availability, the probability of choosing contract farming increased by 1.5 per cent. These findings are consistent with those of Tripathi *et al*, 2018 and Dubbert *et al*, 2023, who identified that age, farm size, availability of hired labour and credit access positively influenced farmers' participation in contract farming.

Conclusions and Policy Implications

The present study examined the reasons for adoption and non-adoption, and the determinants of vegetable contract farming in the study area. The findings of the study revealed that vegetable contract farmers in the study area were

Table 4: Reasons for the non-adoption of contract farming of vegetables

Reasons	Non-Contract Farmers	
	Garret Score	Rank
High investment in inputs	68.52	1
Input supply from contracting companies was not adequate	38.78	8
Rejection of produce	59.58	3
Unable to meet the quality parameters of vegetables	62.53	2
Non-provision of credit facility by the contracting companies	39.72	7
Low prices for the produce	53.05	4
Existence of middlemen	47.70	6
Lack of technical guidance	36.57	9
Delay in payments	47.88	5

Table 5: Logit model estimates and marginal effects for adoption of vegetable contract farming

Variable	Logit Coefficients	Marginal Effects
Constant	0.309	-
	(1.290)	
Age (X_1)	-0.038*	-0.008*
	(0.021)	(0.004)
Education level (X_2)	1.177**	0.239***
	(0.499)	(0.092)
Family size (X_3)	0.080	0.016
	(0.127)	(0.025)
Owned land (X_4)	-0.051	-0.010
	(0.037)	(0.007)
Leased in land (X_5)	0.003	0.001
	(0.021)	(0.004)
Farmer category (X_6)	0.565	0.115
	(0.619)	(0.124)
Amount of credit (X_7)	0.071**	0.015**
	(0.032)	(0.007)

*Note: Figures in parentheses are the standard errors; *,** and *** indicate significance at the 10%, 5% and 1% level of significance, respectively.*

younger, more educated, and had better access to credit compared to non-contract farmers. The primary reasons for adopting contract farming of vegetables were the desire to diversify agricultural activities, assured income, and timely payment. Conversely, the most significant barriers to adoption were high input costs, challenges in meeting quality standards and rejection of produce. The logit regression analysis further highlighted that younger farmers with higher education and those with better access to credit were more likely to adopt contract farming. These findings emphasize the need to address economic challenges, improve credit and input access to farmers, and enhance technical support to increase vegetable farmers' participation in contract farming. Additionally, misinformation and perceived risks among non-adopters, often arising from a lack of awareness, can be mitigated through targeted extension efforts and proactive engagement by contracting companies. Overall, the study recommends integrated policy measures, including farmer training workshops, technical guidance on quality standards, digital literacy programs for young farmers and robust contract enforcement to build trust and promote the adoption of contract farming of vegetables in the study area.

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