
A Study on Awareness Level of Farmers Towards participation in Agricultural Commodity Derivatives in Terai Region of Uttarakhand.

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Abstract

Agricultural commodity derivatives serve as critical financial instruments for price risk management among farming communities. This study investigates the awareness level of farmers in the Terai region of Uttarakhand—a fertile alluvial belt spanning districts including Udham Singh Nagar, Nainital (plains), and Haridwar—towards commodity derivatives. Using a structured questionnaire administered to a stratified random sample of [530] farmers, the study employs descriptive statistics, independent T-test, and formation of farmers awareness index with Z-score, to identify awareness. Preliminary findings suggest that awareness remains critically low, with educational attainment, farm size, and access to financial services emerging as key determinants. The study recommends targeted extension programmes, digital financial literacy initiatives, and policy interventions to bridge the awareness gap and facilitate effective market participation.

Keywords: *Agricultural Derivatives, Commodity Futures, Farmer Awareness, Terai Region, Risk Management, Price Discovery*

1 Introduction

1.1 Background

Agriculture constitutes the backbone of the Indian economy, employing nearly 42% of the workforce and contributing approximately 18% to the national GDP (Economic Survey, 2023–24). Despite this significance, Indian farmers—particularly smallholders remain highly affected to price volatility arising from monsoon variability, supply chain disruptions, and global commodity market interference. In India, Uttarakhand Terai region, characterised by its rich alluvial soil, paddy–wheat cropping pattern, sugarcane cultivation, and emerging horticultural activity, represents a strategically important agricultural zone. However, the extent to which farmers in this region are aware of, or engage with, commodity derivative markets remain largely unexplored in the present literature review.

1.2 Commodity Derivatives

Future and option contracts are the contracts between buyers and seller which drives the value of

underline assets and commodity for the future prices of underline assets and commodity in future date where these contracts get executed. It is a contract between buyer and seller for the future course of action.

Agricultural commodity derivatives, traded are regulated exchanges, like in India the National Commodity & Derivatives Exchange (NCDEX) and the Multi Commodity Exchange (MCX), offer a regulated mechanism for price risk transfer through futures and options contracts.

1.3 Research Problem

Despite regulatory reforms—including the amalgamation of FMC with SEBI in 2015, the introduction of options on commodities (2017), and the launch of the e-NAM platform farmer participation in derivative markets in India remains negligible. While aggregate trading volumes on non-agri commodity exchanges have grown substantially, the benefits of price discovery and hedging have largely accrued to traders and processors rather than primary producers. A fundamental barrier is low awareness, compounded

by socioeconomic constraints and institutional gaps specific to regions like Terai belt of Uttarakhand which is rich in production but doesn't get appropriate prices for their produce.

1.4 Research Objectives

The study focuses awareness level of farmers with the following specific objectives:

- To assess the level of awareness among Terai farmers regarding agricultural commodity derivatives.
- **Hypothesis ((Ho):** There is no significant difference in the awareness level of farmers towards the commodity derivative market.

1.5 Research Questions

- What is the current state of awareness of agricultural commodity derivatives among Terai farmers?

1.6 Significance of the Study

This study contributed to the body of knowledge on agricultural finance and commodity markets of farmers in terai region of Uttarakhand. Practically, findings try to focus on or inform policymakers, commodity exchanges, agricultural departments, and financial institutions regarding farmers literacy understanding and help in designing targeted financial literacy programs. Theoretically, the study extends the literature on information diffusion and adoption behaviour in agricultural financial markets in major contexts with small and marginal farmers.

1.7 Scope and Limitations

The study is geographically confined to Terai belt in Uttarakhand. The analysis is cross-sectional; hence, causal inferences should be drawn with caution. Self-reported awareness scores may be subject to social desirability bias. Seasonal fluctuations in farmer availability and crop cycles may influence survey response quality.

2 Review of Literature

The present study draws upon an interdisciplinary body of literature focusing financial economics, agricultural economics, behavioural finance, and rural development studies. Organized into

theoretical foundations, empirical evidence, and research gaps, this review establishes the academic and practical urgency of investigating commodity derivative awareness among farmers in Uttarakhand's Terai region.

2.1.1 Theoretical Foundations

Theoretical literature converges from financial market theory, decision-making under uncertainty, innovation adoption, and financial literacy to explain farmer awareness and participation in commodity derivative markets. The Efficient Market Hypothesis (EMH), as articulated by Fama (1970) in his seminal *Journal of Finance* paper, posits that prices fully reflect available information, with weak, semi-strong, and strong forms implying no exploitable profits from historical data, public announcements, or even private knowledge, respectively; in Indian agricultural futures, the semi-strong form is most relevant, supported by the fair game model where futures prices unbiasedly forecast spot prices. Fama's empirical review reinforced weak-form efficiency via serial correlation and filter tests, semi-strong via event studies, but highlighted the joint hypothesis problem, urging caution in inefficiency claims. While EMH underpins derivatives' price discovery role, Indian markets' illiquidity, government interventions, and trader dominance—evidenced by Sahoo and Kumar (2009), Nair (2004), Kolamkar (2011), and Thomas (2013)—limit its applicability, creating an awareness-efficiency feedback loop that motivates this study. Post-Fama developments, including Fama (1991)'s risk premia rationale and behavioural critiques like Shiller (1981)'s excess volatility, De Bondt and Thaler (1985)'s overreaction, and prospect theory (Kahneman and Tversky, 1979), highlight cognitive barriers. Complementary frameworks include rational expectations (Muth, 1961), predicting informed hedging; Rogers' (1962) diffusion stages, emphasizing knowledge as adoption precondition; Davis (1989)'s technology acceptance via usefulness and ease; and Lusardi and Mitchell (2014)'s financial literacy dimensions, all underscoring multifaceted barriers to Terai farmer engagement.

2.1.2 Empirical Literature

Empirical evidence traces global, Indian, and Uttarakhand-specific patterns of farmer participation in derivatives. Globally, Goodwin and Schroeder (1994) linked education to forward contracting among Kansas farmers, while Musser et al. (1996) and Pennings and Leuthold (2000) highlighted human capital, attitudes, and norms; emerging economy studies echo low awareness as key barriers. In India, Nair (2004) noted structural impediments post-FCRA amendments, Sahoo and Kumar (2009) found spot-futures cointegration but inefficiencies, Kolamkar (2011) blamed speculator dominance, and Thomas (2013) critiqued regulatory and literacy gaps; post-2015 SEBI-FMC merger and options launch improved governance but not grassroots participation, with awareness low even in commercial states. Uttarakhand's Terai heartland—producing paddy, wheat, sugarcane, and mustard amid APMC mandis and KVKs—relies on spot markets, lacking derivative infrastructure, extension, and empirical study despite its national significance, per Uttarakhand Agriculture Department (2022) and NABARD reports; these void positions the present study to address farmer awareness gaps in this under-researched context.

2.3 Research Gap

An integrative reading of the theoretical and empirical literature reviewed reveals two interconnected and mutually reinforcing knowledge gaps that together define the academic space within which the present study operates. The first gap is theoretical and structural in nature: while Fama's (1970) Efficient Market Hypothesis provides the normative economic rationale for commodity futures markets as instruments of socially useful price discovery and risk transfer, the empirical evidence reviewed by Sahoo and Kumar (2009), Nair (2004), Kolamkar (2011), and Thomas (2013) demonstrates that this theoretical promise is imperfectly realised in Indian agricultural commodity markets due to the structural thinness and speculator-dominance of the hedger base — a condition that is itself a consequence of persistently low farmer awareness and participation. This circular causality between awareness, participation,

and market quality means that any serious policy effort to improve the efficiency and inclusiveness of Indian agricultural commodity markets must begin with the awareness precondition. The second gap is empirical and geographic: despite the existence of a modest but growing literature on farmer awareness of commodity derivatives in commercialised agrarian states, the Terai region of Uttarakhand remains entirely unrepresented in this body of work. No published study, to the best of the present researcher's knowledge, has systematically examined the awareness level, attitude, or participation behaviour of Terai farmers with respect to exchange-traded commodity derivatives. This absence is particularly striking given the region's agricultural importance, its reasonable infrastructure base relative to other hill states, and the availability on NCDEX and MCX of futures and options contracts for its major crops — wheat, mustard, paddy, and sugarcane. The present study addresses both gaps simultaneously: it tests the awareness precondition for commodity market participation in a theoretically motivated framework drawn from the EMH, rational expectations theory, and the diffusion of innovations, and it does so in a geographically neglected but strategically important agricultural region. So, it contributes original empirical evidence to a field that is currently deficient in regional diversity and offers actionable findings for policymakers, extension institutions, and commodity exchanges seeking to expand the developmental reach of derivative markets in context to primary producers in the Indian hill state.

3 Profile of the Study Area

3.1 Overview of Terai, Uttarakhand

The Terai region of Uttarakhand constitutes the narrow alluvial plain along the southern foothills of the Shivalik range, extending across districts including Udham Singh Nagar, Nainital (Haldwani–Ramnagar belt), Haridwar, and parts of Dehradun district. Characterised by deep fertile soils, high groundwater availability, and subtropical climate, the Terai hosts intensive cultivation of paddy, wheat, sugarcane, mustard, and increasingly, vegetables and aromatic crops

make it a food bowl of Uttarakhand. While the landholding patterns in the Terai exhibit coexisting of smallholders (below 2 hectares) with medium and large commercial farms, particularly in Udham Singh Nagar. The region accounts for over 60% of Uttarakhand's total food grain production and hosts several sugar mills, rice mills, and cold chain

infrastructure. However, commodity exchange-linked infrastructure (accredited warehouses, assay laboratories, broker networks) remains limited, with the nearest active commodity exchange delivery centres typically located in Haridwar and Pantnagar.

3.2 Crop Profile and Commodity Exchange Linkage

Table 1: Major Terai crops and their presence on commodity derivative exchanges. Source: NCDEX, MCX contract specifications (2024).

Major Crop	Exchange Platform	Futures Contract	Options Available
Paddy / Rice	NCDEX	Yes (Basmati)	No
Wheat	NCDEX	Yes	Yes
Sugarcane (Raw Sugar)	NCDEX / MCX	Yes	Partial
Mustard (Rapeseed)	NCDEX	Yes	Yes
Maize	NCDEX	Yes	No
Potato	NCDEX (limited)	Limited	No

4 Research Methodology

4.1 Research Design

The study employs a mixed-methods research design, combining a structured questionnaire survey (quantitative) with key informant interviews (qualitative). The quantitative component enables statistical generalisation of awareness levels, while the qualitative component provides help in systematically presenting the characteristics of the sample population and their response regarding agricultural commodity derivatives.

4.2 Population and Sampling Frame

The target population comprises all the marginal farmers in the Terai belt districts of Uttarakhand. The sampling frame is constructed using E-NAM registered farmers from the respective district office of E-NAM. The study focuses on three districts: Udham Singh Nagar, Haridwar, and Nainital and the major crops which are Rice, Wheat, sugarcane, mustered and Maize growing farmers were considered.

4.3 Sample Size Determination

4.5 Data Collection Instrument

4.5.1 Questionnaire Structure

Sample size is calculated using the Yamane's (1967) formula for proportions:

$$n = \frac{N}{1 + N(e)^2}$$

Assuming 93% confidence level ($Z = 1.96$), maximum variability 7%, the minimum sample size is 400. Accounting for a 15% non-response rate and design effect of 1.2, the target sample is adjusted to 530 respondents.

4.4.4 Sampling Technique

A multi-method sampling technique is adopted:

- ▶ Stage I: selection of 3 districts representing high, medium, and low agricultural commercialisation.
- ▶ Stage II: Random selection farmers from the list of E-NAM registered farmers of respected districts using probability proportionate to size (PPS) method.
- ▶ Stage III: Stratification of farmers by farm size (marginal <1 ha, small 1–2 ha, semi-medium 2–4 ha, medium/large >4 ha).

Table 2: Questionnaire structure and thematic coverage.

Section	Theme / Variables	Instrument Type	No. of Items
A	Socio-demographic Profile (age, education, land, income, household size)	Closed-ended, Likert, categorical	12
B	Awareness of Commodity Markets.	5-point awareness scale	7
C	Information Sources & Institutional Exposure	Multiple choice + 5-point Likert scale	10
D	Perception & Attitude towards Derivatives	5-point Likert scale	6
E	Perceived Barriers to Participation	Ranking+5-point Likert scale	8

4.5.2 Farmers Awareness Index Construction

A composite Farmer Awareness Index (FAI) were constructed using weighted scoring across knowledge, attitude, and information exposure dimensions using Z-score. Items will be validated

through principal component analysis (PCA), and internal consistency assessed using Cronbach's alpha (threshold: $\alpha \geq 0.70$). FAI scores were be classified as: $Z < -0.5$ (Low), $-0.5 \leq Z \leq 0.5$ (Medium), and $Z > 0.5$ (High).

4.6 Analytical Framework

Table 3: Analytical framework aligned with research objectives.

Objective	Statistical Method	Software
Describe awareness levels	Descriptive statistics (mean, SD, frequency, percentile)	Jamovi 2.6.26
Factor structure of awareness (FAI)	Independent t-test	Jamovi 2.6.26

5 Data analysis and Interpretation

5.1 Socio-demographic Profile of Respondents

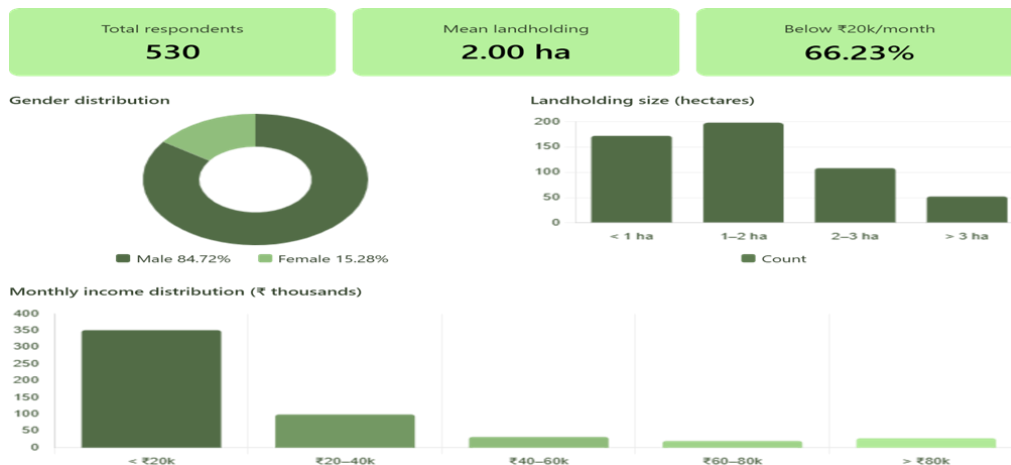
This section presents a tabular summary of respondent characteristics including gender, educational attainment, land holding categories and household income levels. Cross-tabulations will highlight inter-district variations.

The demographic and socioeconomic analysis of the 530 surveyed farmers in the Terai region reveals a profile that is predominantly male (84.72%), reflecting the entrenched patriarchal structure of agricultural decision-making in rural South Asian economies, where women remain largely excluded from formal market participation and financial dealings. In terms of landholding, the mean and median both converge at 2.00 hectares (SD = 1.15, range = 0.25–4.00 ha), indicating a relatively symmetric distribution cantered around smallholder thresholds, though the standard deviation suggests considerable heterogeneity within the sample. Notably, nearly 70% of respondents cultivate less than 2 hectares, classifying the overwhelming majority as small or

marginal farmers as per standard agricultural classifications, while only 9.81% hold more than 3 hectares, underscoring the near-absence of large commercial landholders in this farming community. The income distribution further corroborates the economic vulnerability of this population, with two-thirds of respondents (66.23%) earning below ₹20,000 per month, and the cumulative frequency rising steeply to 84.91% within the ₹20,000–40,000 bracket, suggesting that the vast majority of sampled farmers operate at or near subsistence income levels. Only a marginal 5.28% earn above ₹80,000 monthly, indicating extreme right-skewness in the income distribution and the presence of a small but distinct economically privileged minority within the sample. Taken together, these descriptive statistics paint a picture of a farming community characterized by small landholdings, low and highly concentrated incomes, and significant gender homogeneity — structural conditions that simultaneously heighten exposure to agricultural price risk and constrain meaningful participation in formal derivative markets, thereby establishing the foundational justification for the present study's

inquiry into agri-derivative accessibility and adoption in the Terai region.

Frequencies of Gender							
Gender:	Counts	% of Total		Cumulative %			
Male	449	84.72%		84.72%			
Female	81	15.28%		100.0%			
Descriptives of landholdings							
	N	Missing	Mean	Median	SD	Min.	Max.
Landholding size	530	0	2.00	2.00	1.15	0.250	4.00
Frequencies of Landholding size In Hectares							
Landholding size In Hectares	Counts	% of Total		Cumulative %			
Less than 1	172	32.45%		32.45%			
1-2	198	37.36%		69.81%			
2-3	108	20.38%		90.19%			
more than 3	52	9.81%		100.0%			
Frequencies of Monthly Income							
Monthly Income	Counts	% of Total		Cumulative %			
Less than 20	351	66.23%		63.60%			
20-40	99	18.68%		84.91%			
40-60	32	6.04%		90.95%			
60-80	20	3.77%		94.72%			
More than 80	28	5.28%		100.00%			



5.2 Awareness Level Assessment

5.2.1 General Market Awareness considering participation

The frequency distribution of the study variables provides important insights into the level of agri-derivative participation and the factors associated with it. With respect to the dependent variable, the majority of respondents (81.89%, n = 434)

recorded low participation in agri-derivative markets, while only 18.1% (n = 96) demonstrated high participation, indicating that farmer engagement with such instruments remains extremely limited in the Terai region. Turning to the independent variables, awareness level was found to be low among 47.2% of respondents and high among only 24.9%, suggesting that a significant proportion of farmers lack adequate knowledge of agri-derivative instruments.

Similarly, infrastructural facility was rated low by 60.6% of respondents and high by merely 9.6%, reflecting considerable deficiencies in the physical and digital infrastructure necessary for market access. Institutional support was likewise reported as low by 48.1% of respondents, with only 26.6%

rating it as high, indicating that support from government bodies, cooperatives, and financial institutions remains insufficient for a large section of the farming community. In contrast, risk perception exhibited a notably different distribution, with 62.1% of

Frequencies of Variables			
Participation (dependent variable)	Counts	% of Total	Cumulative %
HIGH	96	18.1%	18.1%
LOW	434	81.89%	100.0%
Awareness Level	Counts	% of Total	Cumulative %
HIGH	132	24.9%	24.9%
LOW	250	47.2%	72.1%
MEDIUM	148	27.9%	100.0%
Infrastructural Facility	Counts	% of Total	Cumulative %
HIGH	51	9.6%	9.6%
LOW	321	60.6%	70.2%
MEDIUM	158	29.8%	100.0%
Institutional Support	Counts	% of Total	Cumulative %
HIGH	141	26.6%	26.6%
LOW	255	48.1%	74.7%
MEDIUM	134	25.3%	100.0%
Risk Perception	Counts	% of Total	Cumulative %
HIGH	329	62.1%	62.1%
LOW	126	23.8%	85.8%
MEDIUM	75	14.2%	100.0%

respondents reporting high risk perception, suggesting that farmers are well aware of the price uncertainties inherent in agricultural markets. However, this heightened risk awareness has not translated into greater market participation, likely because the barriers of low awareness, poor infrastructure, and weak institutional support collectively outweigh the incentive to hedge. Overall, the frequency distributions indicate that structural and informational constraints are the primary impediments to agri-derivative participation among smallholder farmers in the study area, and these findings provide a strong empirical basis for further inferential analysis.

5.3 Determinants of Awareness

By considering Farmer Awareness Index and a hypothesis was considered for analysis that “There is no significant difference in the awareness level of farmers towards the commodity derivative market” was tested using an Independent Samples T-Test and Welch’s t-test.

An independent samples Welch's t-test was conducted to examine whether awareness level differed significantly between participants and non-participants in agri-derivative markets. Welch's t-test was appropriately employed in place of the standard Student's t-test given the unequal sample sizes across the two groups (participants: n = 96; non-participants: n = 434). The results revealed a statistically significant difference in awareness levels between the two groups ($t(127) = 6.76, p < .001$), leading to the rejection of the null hypothesis that the mean awareness level of participants and non-participants is equal.

The effect size, measured by Cohen's d, was 0.802, which by standard benchmarks (small = 0.2, medium = 0.5, large = 0.8) falls at the threshold of a large effect. This is a substantively important finding, indicating that the difference in awareness between participants and non-participants is not merely statistically significant but also practically meaningful — awareness level is a strong discriminating factor between the two groups.



Independent Samples T-Test										
							93% Confidence Interval			
		Statistic	d.f	p	Mean difference	SE difference	Lower	Upper		Effect Size
Awareness level	Welch's t	6.76	127	<.001	0.792	0.117	0.578	1.01	Cohen's d	0.802
Note. $H_0: \mu_{\text{Participant}} = \mu_{\text{non-participant}}$										
Group Descriptives										
		Group		N	Mean	Median	SD	SE		
Awareness level		Participant		96	0.450	0.618	1.07	0.109		
		Non-Participant		434	-0.342	-0.567	0.901	0.0432		

The relatively higher standard deviation among participants (1.07) compared to non-participants (0.901) also suggests greater variability in awareness within the participating group, which may reflect the heterogeneous pathways through which farmers enter derivative markets.

Overall, these results provide robust empirical evidence that awareness level is a significant and substantively important determinant of agri-derivative participation among Terai farmers. The large effect size in particular strengthens the argument that informational interventions — such as farmer awareness programmes, financial literacy campaigns, and extension education — could meaningfully enhance participation rates.

The study examined agri-derivative participation among 530 farmers in the Terai region across three levels of analysis. The demographic profile revealed a predominantly male sample (84.72%) with smallholder landholdings averaging 2.00 hectares, and over 66% of respondents earning below ₹20,000 per month, collectively portraying an economically vulnerable farming community with limited capacity to access formal risk management instruments despite high exposure to price risk.

The frequency distribution of key variables confirmed that agri-derivative participation remains critically low, with 81.89% of respondents classified as low participants and only 18.1% as high participants. This limited engagement was consistently reflected across the independent variables — awareness was low among 47.2% of

respondents, infrastructural facility was rated low by 60.6%, and institutional support was reported as inadequate by 48.1% — indicating that structural and informational barriers are pervasive across the sample. Notably, risk perception diverged from this pattern, with 62.1% reporting high risk perception, suggesting that while farmers recognise price volatility, this awareness alone is insufficient to drive participation in the absence of enabling conditions.

The independent samples Welch's t-test revealed a statistically significant difference in awareness levels between participants (mean = 0.450, SD = 1.07) and non-participants (mean = -0.342, SD = 0.901), with $t(127) = 6.76$, $p < .001$, and a large effect size (Cohen's $d = 0.802$). These results confirm that awareness is a strong and practically meaningful determinant of participation, with the mean difference of 0.792 (93% CI: 0.578–1.01).

Conclusion

The findings collectively establish that agri-derivative participation in the Terai region is critically constrained by informational deficits, infrastructural inadequacies, and weak institutional support, despite farmers demonstrating high awareness of price risk. The demographic vulnerabilities of the sample — low income, small landholdings, and limited market exposure — further compound these barriers. Addressing the awareness gap through financial literacy programmes, improving rural market infrastructure, and strengthening institutional outreach are therefore identified as essential policy priorities for



enhancing derivative market adoption among smallholder farmers in the region.

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