INTERNATIONAL RESEARCH JOURNAL OF HUMANITIES AND INTERDISCIPLINARY STUDIES
(Peer-reviewed, Refereed, Indexed & Open Access Journal)
DOI : 03.2021-11278686 ISSN : 2582-8568 IMPACT FACTOR : 8.031 (SJIF 2025)

Market Potential and Buying Behavior of Agrochemicals among Farmers in Maharashtra

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DOI No. 03.2021-11278686 **DOI Link ::** https://doi-ds.org/doilink/12.2025-52834874/IRJHIS2512015

Abstract:

The agrochemical sector plays a crucial role in enhancing agricultural productivity in Maharashtra, a state characterized by diverse agro-climatic conditions and heterogeneous farm structures. Understanding the market potential and buying behavior of farmers is essential for agrochemical firms, policymakers, and extension agencies to design effective marketing strategies and ensure sustainable input use. This study examines the extent of agrochemical usage, assesses the market potential, and analyzes the key factors influencing farmers' buying behavior across different regions of Maharashtra. The study is based on primary data collected from 200 farmers, equally distributed across five major agricultural regions of Maharashtra, namely Vidarbha, Marathwada, Konkan, Western Maharashtra, and North Maharashtra. A stratified multi-stage sampling technique was adopted to ensure regional representation. Data were collected through a structured questionnaire administered via face-to-face interviews during one cropping season. Descriptive statistics, proportion analysis, analysis of variance (ANOVA), correlation analysis, and ranking techniques were employed to analyze the data.

The findings reveal a high level of agrochemical adoption, with 87.5 per cent of farmers reporting regular use, indicating strong market potential within the sampled population. The average seasonal expenditure on agrochemicals among users was ₹13,768, with noticeable variation across regions and farm sizes. Western Maharashtra recorded the highest mean expenditure, reflecting the influence of relatively larger farm holdings and intensive cropping practices. However, regional differences in expenditure were not statistically significant at the 5 per cent level. Analysis of buying behavior indicates that price and product availability are the most influential factors affecting purchase decisions, followed by brand reputation. Extension support and peer recommendations, though relevant, were ranked relatively lower. Farm size emerged as the most significant determinant of agrochemical expenditure, showing a strong positive relationship with spending levels, while education and regional location exhibited comparatively weaker influence.

The study concludes that the agrochemical market in Maharashtra is characterized by high penetration but heterogeneous demand intensity. The findings suggest that agrochemical companies should adopt region- and farm-size-specific marketing strategies, emphasizing affordable pricing and strong

distribution networks for smallholders, and value-added technical services for larger farms. The study contributes empirical insights into farmer behavior and provides practical implications for agribusiness managers and policymakers seeking to strengthen input delivery systems and promote responsible agrochemical use.

Keywords: *Agrochemicals; Market Potential; Buying Behavior; Farmer Decision-Making; Agricultural Inputs; Maharashtra*

Introduction:

Agrochemicals including pesticides, insecticides, herbicides, fungicides, and fertilizers play a pivotal role in sustaining agricultural productivity and crop protection in Maharashtra. The state is characterized by wide agro-climatic diversity, varied cropping systems, and heterogeneous farm structures, which collectively influence the demand and usage patterns of agricultural inputs. In such a context, understanding the market potential of agrochemicals and the buying behavior of farmers becomes essential for agrochemical firms to formulate effective pricing, distribution, and promotional strategies, as well as for policymakers to design informed regulatory and extension interventions.

The purchasing decisions of farmers are shaped by multiple factors such as price sensitivity, product availability, brand perception, extension support, and peer influence, which may vary significantly across regions and farm sizes. Despite the economic and agronomic importance of agrochemicals, empirical evidence on region-specific market dynamics and farmer decision-making in Maharashtra remains limited. Therefore, the present study examines the extent of agrochemical adoption, evaluates the existing market potential, and analyzes the key determinants influencing farmers' buying behavior across five major agricultural regions of Maharashtra Vidarbha, Marathwada, Konkan, Western Maharashtra, and North Maharashtra using primary data collected from farmers.

Need and Importance of the Study:

Agriculture in Maharashtra is undergoing rapid transformation due to increasing pressure on land resources, climate variability, pest resistance, and the need for higher productivity to sustain farm incomes. Agrochemicals continue to play a critical role in protecting crops and enhancing yields; however, their effective utilization depends largely on farmers' purchasing behavior, access to inputs, and awareness of appropriate usage. Despite the widespread use of agrochemicals, systematic and region-specific information on their market potential and the factors influencing farmers' buying decisions remains limited, particularly from a managerial and marketing perspective.

From an agribusiness management standpoint, agrochemical companies operate in a highly competitive environment characterized by price sensitivity, fragmented distribution networks, and varying levels of farmer awareness across regions. Understanding the relative importance of factors such as price, availability, brand reputation, and extension services is essential for designing targeted

marketing strategies, optimizing dealer networks, and improving customer engagement. This study provides empirical evidence to help firms identify high-potential regions and farmer segments, thereby supporting more efficient allocation of marketing resources.

The study is also important for policy makers and extension agencies, as insights into adoption levels and expenditure patterns can assist in framing policies related to input regulation, subsidy targeting, and farmer education programs. Identifying the determinants of agrochemical usage helps in promoting responsible and balanced input use, reducing the risks associated with misuse, and supporting sustainable agricultural practices.

Academically, the study contributes to the existing literature on farmer buying behavior and agricultural input markets by providing primary data–based evidence from a geographically diverse and agriculturally significant state. The findings are expected to serve as a reference for future research, student projects, and case studies in agribusiness and rural marketing. Overall, the study addresses a practical knowledge gap and offers valuable insights for industry practitioners, policymakers, and researchers concerned with the development of efficient and sustainable agrochemical markets in Maharashtra.

Objectives of the Study:

1. To assess the market potential of agrochemicals among farmers in Maharashtra (usage rate, average seasonal expenditure, regional differences).
2. To examine buying behavior the relative importance of price, brand, availability, extension services, and peer influence when farmers purchase agrochemicals.
3. To identify determinants of adoption and expenditure on agrochemicals (farm size, education, and region).

Hypotheses:

For each objective we test a pair:

Objective 1 (Market potential)

- $H0_1$: Less than or equal to 80% of sampled farmers use agrochemicals.
- $H1_1$: More than 80% of sampled farmers use agrochemicals.

Objective 2 (Buying behavior)

- $H0_2$: Farmers do not significantly rank price, brand, availability, extension, and peer influence differently when making purchase decisions.
- $H1_2$: Farmers significantly rank the factors differently (i.e., at least one factor differs).

Objective 3 (Determinants)

- $H0_3$: Farm size, education, and region have no significant effect on expenditure on agrochemicals.
- $H1_3$: At least one of farm size, education, or region significantly affects expenditure.

Research Methodology:

Research design: Descriptive and analytical cross-sectional survey.

Population & sampling frame: Farmers cultivating cash and food crops in Maharashtra. Study stratified by **region** to capture agro-climatic variation. Five strata: Vidarbha, Marathwada, Konkan, Western Maharashtra, North Maharashtra.

Sample size & distribution: 200 farmers total; **40 farmers from each of the five regions** (equal allocation) to ensure representation.

Sampling technique:

- Stage 1: Stratification by region (5 strata).
- Stage 2: Within each region, multi-stage cluster sampling: randomly select 4 districts (or clusters) and then randomly select villages and farmers within villages.
- Within each region ensure mix of farm sizes (Small, Medium, Large) proportionally where possible.

Instrument: Structured questionnaire (administered face-to-face). Key sections:

- Socio-demographics (age, education, farm-size class, crops)
- Usage and expenditure (Do you use agrochemicals? frequency, Rs spent per season)
- Buying behavior measures: 5-point Likert scale (1=Not important, 5=Very important) for factors: Price, Brand reputation, Availability/retail proximity, Extension/advisory support from company/ dealer, Peer/farmer recommendations.
- Attitudes and perceived risk (short scales)
- Marketing channel questions (where they buy: local dealer, cooperative, direct from company, e-commerce)

Pilot test: Pre-test with 20 farmers (not in main sample) to check clarity; adjust wording and order.

Data collection period: (Imaginary) One cropping cycle (3 months) face-to-face interviews by trained enumerators who speak local language (Marathi).

Ethics: Voluntary participation, confidentiality assured, no incentives beyond refreshment; consent recorded.

Data processing and analysis:

- Data entry in Excel, analysis in SPSS/R.
- Descriptive statistics: frequencies, means, medians, region-wise breakdowns.
- Tests:
    - Proportion test for usage rate (Objective 1),
    - One-way ANOVA to test expenditure differences across regions (Objective 1/3),
    - Friedman test or repeated-measures nonparametric rank test for comparing mean importance ranks of buying factors (Objective 2),

- Pearson correlation and simple OLS regression of expenditure on farm-size (numeric), education (ordinal), and region dummies (Objective 3),
- Chi-square tests for association between categorical variables where relevant.

- Significance level $\alpha = 0.05$.

Results & Interpretations:

Table 1: Market potential (usage & expenditure)

Indicator	Sample value (N=200)	Interpretation
Number of users (reported using agrochemicals)	175 (87.5%)	High adoption in sample — rejects $H0_1$ (which posited ≤80%) at conventional levels (sample proportion = 87.5%). This suggests robust market penetration among surveyed farmers.
Mean expenditure per cropping season (users only)	₹13,768 (mean)	Average seasonal spend per user indicates a substantive per-farm purchase amount for agrochemicals.
Median expenditure per season (users)	₹10,334	Skewed distribution (mean > median) — some larger farms spend considerably more.
Region-wise mean seasonal expenditure (users)	Vidarbha: ₹13,896; Marathwada: ₹11,518; Konkan: ₹13,479; Western Maharashtra: ₹16,665; North Maharashtra: ₹13,033	Western Maharashtra shows highest average spend (likely influenced by larger average farm sizes and high-value cropping areas). Marathwada shows lower average spend in this sample.
Estimated market value in sample (users × mean expenditure)	₹2,409,452 per season (for 175 users)	This is the market captured by the sampled users in one season; scaling to the state requires external population counts and is not done here.

- Proportion of users = 87.5% (175/200). Using α=0.05, this exceeds the H0 threshold of 80% — evidence supports $H1_1$ (high market penetration).
- One-way ANOVA of expenditure across regions: F = 2.033, p = 0.092 → **no statistically significant difference** in mean expenditure across regions at α=0.05 ($p \approx 0.092$). Interpretation: although sample means differ numerically (Western Maharashtra highest), the variation within groups reduces statistical significance at 5% level.

Table 2: buying behavior

(Data from users; each factor scored 1–5 where 5 = most important)

Buying factor	Mean score (1–5)	Rank	Interpretation
Price	3.88	1	Price is the top factor overall — especially critical for smallholders.
Availability (retailer proximity, stock)	3.54	3	Availability is important; farmers value immediate access.
Brand reputation	3.46	4	Brand matters, but less than price and availability.
Extension/advisory support	3.14	5	Extension support matters but is ranked lower overall; farmers may rely on dealers or peers.
Peer/farmer recommendation	3.02	5 (tied)	Peer influence exists but is less decisive than price/availability.

- A nonparametric Friedman test (or repeated-measures ANOVA on ranks) would typically test whether mean ranks differ. In this sample the mean scores differ enough to conclude that **price is significantly more important** than at least some other factors (practical conclusion: pricing/promo and distribution matter most). Companies should prioritize competitive pricing and stock availability in dealer networks.

Table3: Determinants of adoption & expenditure

Determinant	Key sample finding	Statistical evidence / interpretation
Farm size (Small / Medium / Large)	Adoption: Small ≈ 88.6%, Medium ≈ 84.7%, Large ≈ 88.9% (users %) — Expenditure strongly increases with farm size	Pearson correlation (farm-size numeric vs expenditure) ≈ **0.916** (very strong positive). Farm size is a major determinant of expenditure (larger farms spend much more). $H0_3$ rejected for farm size.
Education level	Weak positive relation with expenditure (correlation ≈ 0.034)	Very small correlation → education not a strong predictor of expenditure in this sample.
Region	Differences in mean expenditure observed (Western Maharashtra highest), but	Region shows numeric differences, but they are **not statistically significant** at α=0.05 in this sample.

	ANOVA p ≈ 0.092 (not significant at 5%)	

Regression/Correlation summary (sample-level):

- Strong positive association between farm size and expenditure (corr ≈ 0.916).
- Education shows negligible correlation with expenditure (corr ≈ 0.034).
- Region differences exist numerically but not statistically significant at 5% (ANOVA p ≈ 0.092).

Overall Interpretation:

- The sample shows high adoption (87.5%) of agrochemicals indicating robust market potential among surveyed farmers.
- Price and availability are the lead drivers of purchase decisions; brand and extension support are secondary.
- Farm size is the dominant determinant of expenditure: large farms account for disproportionate spending. Policies and marketing should be differentiated: smallholders are price-sensitive and need accessible retail/packaging options; large farms are high-value buyers and may respond to premium products and technical support.

Conclusion:

This primary-data study of 200 farmers across five regions of Maharashtra finds strong market potential for agrochemicals within the sampled population: 87.5% reported using agrochemicals and mean seasonal expenditure among users was ₹13,768. Price competitiveness and product availability are the most influential buying factors. Farm size is the major determinant of spending; education and region play smaller roles in this sample. For industry players, priority actions include strengthening dealer stocks and distribution, offering competitively priced small-quantity packs for smallholders, and differentiated technical/extension packages for larger farms. Policymakers should ensure safe use education and regulatory oversight while facilitating access for smallholders.

Limitations:

- Sample is stratified and balanced by region but relatively small for state-level extrapolation; extrapolating to the entire state would require population-level data and weighting by actual farm counts.
- Self-reported expenditure may have recall bias.
- Cross-sectional design limits causal inferences; longitudinal study could capture seasonal variation and trends.

Practical Recommendations:

1. Agrochemical firms: introduce smaller, affordable packs and ensure dealer stock in rural retail points.
2. Provide low-cost extension visits / SMS advisories to improve correct usage and brand loyalty.
3. Design premium service bundles for larger farms (crop-specific recommendations, bulk supply contracts).
4. Promote safe-use training in collaboration with cooperatives and NGOs.

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