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Market potential and penetration strategies of a dual-action fungicide in paddy: a TAM-SAM-SOM study in Dr. B.R. Ambedkar Konaseema district of Andhra Pradesh

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ABSTRACT

Dual-action fungicides, which combine two active ingredients with complementary modes of action, have become an important component of integrated disease management in paddy cultivation. This study estimates the market potential and evaluates the market penetration of an established dual-action fungicide, referred to here as Product X and marketed by a company referred to as Company A, in Dr. B.R. Ambedkar Konaseema district of Andhra Pradesh. Market potential, the maximum sales achievable if every potential customer adopted the product, and market penetration, the extent to which the product is actually bought and used within the target market, were assessed separately in order to distinguish the size of the available opportunity from the degree to which it has already been captured. Primary data were collected from 80 paddy farmers, selected by proportionate sampling across four mandals, and 20 agrochemical dealers, selected by convenience sampling, using separate pre-tested structured schedules. Market potential was estimated using the Total Addressable Market-Serviceable Available Market-Serviceable Obtainable Market (TAM-SAM-SOM) framework, and market penetration was assessed on both a farmer-count and a sales-volume basis. The district-level Serviceable Available Market was estimated at ₹74.79 crore against a currently realised Serviceable Obtainable Market of ₹32.25 crore, out of a state-level Total Addressable Market of ₹1,847.11 crore. Farmer-based market penetration stood at 57.5 per cent, yet volume-based penetration was only 3.08 per cent of the serviceable market, a divergence explained by the finding that 23 of 46 current users applied the product only once per season instead of the recommended two applications, substituting a lower-cost alternative for the second spray, a pattern significantly associated with landholding category ($\chi^2 = 16.72$, $df = 2$, $p < 0.05$). The results indicate that the principal constraint on market growth in the study area is usage depth among existing adopters rather than initial awareness or acquisition. Value-based pricing communication, strengthened dealer-level distribution, dealer training and incentive engagement, and structured retention of lapsed users are proposed as the four priority strategies for improving market penetration.

Keywords: Market potential, Market penetration, TAM-SAM-SOM, Dual-action fungicide, Paddy cultivation, Agrochemical marketing

Introduction

Rice (*Oryza sativa* L.) is the most important staple food crop in the world, cultivated across more than 114 countries and providing food and livelihood to more than half of the global population. India is the world's largest producer of rice, with production reaching 1,490.74 lakh tonnes over an area of 514.23 lakh hectares during 2024-25 (DA&FW, 2025) [1]. Andhra Pradesh is one of the leading rice-producing states in India, with paddy cultivated extensively in the fertile Godavari delta districts. Dr. B.R. Ambedkar Konaseema district, situated within this delta, is one of the state's important rice-producing districts, with paddy cultivated intensively across both the Kharif and Rabi seasons on fertile alluvial soils.

Paddy cultivation in the region is severely affected by fungal diseases, including sheath blight (*Rhizoctonia solani*), rice blast (*Magnaporthe oryzae*), brown spot (*Bipolaris oryzae*) and sheath rot (*Sarocladium oryzae*), which can cause substantial yield and quality losses. Sheath blight alone has been reported to cause up to 50 per cent yield loss under severe infection, and is most prevalent in the humid, warm agro-climatic conditions characteristic of the Godavari delta region (Samal et al., 2021) [2]. Dual-action fungicides, which combine a contact and a systemic mode of action, or two systemic modes of action with different biochemical targets, in a single formulation, offer broader-spectrum protection, improved resistance management and a longer duration of control compared with single-mode products, and are increasingly used for management of sheath blight, blast and brown spot in paddy. The Indian fungicide market was valued at USD 219 million in 2024 and is projected to grow at a compound annual growth rate of about four per cent to reach USD

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266.50 million by 2029 (Mordor Intelligence, 2024) [3], with Andhra Pradesh identified as a high fungicide-consuming state owing to its large irrigated paddy area and humid tropical conditions. Farmer brand choice and market penetration in the Indian agrochemical sector have been shown to depend heavily on dealer recommendation, product efficacy and price. Studies in other states have found that agrochemical markets are highly competitive, with product quality and dealer recommendation identified as leading factors in brand preference (Dhamsania *et al.*, 2025; Hinsu *et al.*, 2023) [4, 5], that dealer recommendation is often the single most influential factor in fungicide purchase decisions (Dubey *et al.*, 2023) [6], and that awareness of newer dual-action formulations remains comparatively low in interior markets, pointing to untapped market potential (Harish *et al.*, 2023) [7]. Field-level efficacy trials have separately confirmed that dual-action fungicide combinations outperform single-molecule treatments in controlling sheath rot and related diseases in Andhra Pradesh, recording the lowest disease intensity, highest yield and best cost-benefit ratio among treatments evaluated (Vijayalakshmi *et al.*, 2023) [8]. What these studies have not addressed is the size of the realistically obtainable market opportunity for a specific dual-action fungicide product at district level, and the extent to which that opportunity is currently being captured, both in terms of the number of adopting farmers and the depth of their usage.

This paper addresses that gap using data collected for Product X, an established dual-action fungicide marketed by Company A in Dr. B.R. Ambedkar Konaseema district. Despite an established market presence, the market penetration of Product X was found to remain limited relative to competing brands, and limited systematic information was available on the size of the addressable market and on suitable strategies for strengthening penetration. The study therefore had two objectives: first, to estimate the market potential of Product X using a tiered market-sizing framework; and second, to suggest suitable market penetration strategies based on primary survey evidence from paddy farmers and agrochemical dealers in the study area.

Materials and Methods

Study area

Dr. B.R. Ambedkar Konaseema district of Andhra Pradesh was purposively selected for the study on account of its intensive paddy cultivation, its Godavari delta canal irrigation system supporting multi-season cultivation, and the presence of an established agrochemical dealer network for Product X. Four mandals, Ravulapalem, Kothapeta, Amalapuram and Atreyapuram, were purposively selected based on the intensity of paddy cultivation and active fungicide usage.

Sample

From each selected mandal, two villages were purposively selected based on the concentration of paddy farmers and accessibility for data collection, and from each village, ten farmers were selected using proportionate random sampling to represent small, medium and large landholding categories, giving a total sample of 80 paddy farmers across eight villages. From each selected mandal, five agrochemical dealers were selected using convenience sampling, giving a total sample of 20 dealers, for an overall study sample of 100 respondents.

Data collection

Primary data on fungicide awareness, adoption pattern, brand preference, competitive brand usage and perception were collected from farmers using a pre-tested structured interview schedule administered through personal interviews. Data from dealers on stocking pattern, brand-wise sales volumes, competitive dynamics and perception of Product X and of Company A's dealer support were collected through a separate structured questionnaire, also administered through personal interviews. A five-point Likert scale (Strongly Agree = 5 to Strongly Disagree = 1) was used to measure farmer and dealer perception of the product. Secondary data on paddy crop area and production statistics for the state, district and selected mandals were obtained from official agricultural department records (Department of

Agriculture, Government of Andhra Pradesh, 2025-26) [9]; data on fungicide sales trends and brand-wise performance were obtained from dealer records; and information on product specifications and market operations of Product X and Company A was drawn from company literature, product labels and promotional materials.

Tools of analysis: Tabular and descriptive analysis, using percentage and mean, was used to summarise the farmer and dealer profile, awareness and adoption pattern. Market potential was estimated using the TAM-SAM-SOM framework, applied at three successive geographic tiers, described below. Market penetration was estimated on a farmer-count basis, as the proportion of sample farmers currently using Product X, and on a volume basis, as estimated seasonal sales volume relative to the district-level SAM volume. The chi-square test of independence, $\chi^2 = \sum[(O - E)^2/E]$, was used to test the association between landholding category and spray frequency among current users of Product X, at the five per cent level of significance.

Market potential refers to the maximum total sales achievable for a product in a defined market over a specified period, representing the upper limit of demand a firm could theoretically capture if every potential customer adopted the product. Market penetration, by contrast, refers to the extent to which a product is actually bought, used, or known within a target market, typically expressed as a percentage of the target market that has adopted the product. Together, these two concepts allow a firm to distinguish between the size of an opportunity and the degree to which that opportunity has already been captured.

The TAM-SAM-SOM framework operationalises market potential by decomposing it into three progressively narrower tiers. The Total Addressable Market (TAM) was calculated as the total paddy area of Andhra Pradesh state multiplied by the recommended dose per hectare and the prevailing market price per litre, representing the theoretical opportunity if the product were used at full recommended protocol statewide. The Serviceable Available Market (SAM) was calculated on the same basis using the total paddy area of Dr. B.R. Ambedkar Konaseema district alone, representing the realistically reachable market given Company A's existing dealer network. The Serviceable Obtainable Market (SOM) was calculated as the SAM multiplied by the proportion of sample farmers currently using or willing to adopt Product X, representing the market share realistically obtainable given current adoption levels. The key assumptions used for the estimation are summarised in Table 1.

Table 1. Assumptions used for market potential estimation

Parameter	Value / Basis
Recommended dose	300 ml per acre per spray
Prevailing market price	₹2,500 per litre (dealer-reported)
Weighted average spray frequency	1.50 sprays per season (weighted across single- and double-spray users among current adopters)
Cropping seasons covered	Kharif and Rabi (both cultivated by all sample farmers)
Current farmer adoption rate	57.5% (46 of 80 sample farmers)

Source: Primary survey data.

Results and Discussion

Market potential of Product X

Table 2 presents the estimated market potential of Product X using the TAM-SAM-SOM framework. The Total Addressable Market, representing the theoretical opportunity across the entire paddy area of Andhra Pradesh state, was estimated at ₹1,847.11 crore. The Serviceable Available Market, representing the realistic opportunity within Dr. B.R. Ambedkar Konaseema district, was estimated at ₹74.79 crore. The Serviceable Obtainable Market, based on the cur

rent adoption rate and spray frequency among existing users, was estimated at ₹32.25 crore, approximately 43 per cent of the district-level serviceable market. The state and district-level paddy area figures used in this estimation were drawn from official season-wise crop statistics for 2025-26 (Department of Agriculture, Government of Andhra Pradesh, 2025-26) [9].

Table 2. TAM-SAM-SOM analysis of Product X in the study district

Market Tier	Basis	Estimated Value
TAM	Entire paddy area of Andhra Pradesh state (61,57,045 acres) at full recommended protocol	₹1,847.11 crore
SAM	Total paddy area of Dr. B.R. Ambedkar Konaseema district (2,49,300 acres)	₹74.79 crore
SOM	Based on current adoption rate (57.5%) and weighted spray frequency (1.5/season)	₹32.25 crore (~43% of SAM)

Source: Computed from primary survey data and secondary agricultural statistics.

The substantial gap between the SAM and the SOM indicates considerable scope for further market expansion within the district without requiring geographic expansion, consistent with the low-to-moderate growth outlook reported by dealers for the product over the next two years, while the much larger state-level TAM highlights longer-term opportunity for geographic expansion beyond the present district of operation.

Market penetration: farmer-based versus volume-based

Table 3 compares two measures of market penetration. On a farmer-count basis, 57.5 per cent of sample farmers were currently using Product X, indicating a well-established market presence with 91.2 per cent of farmers reporting current or previous experience with the product. On a volume basis, however, estimated seasonal sales of approximately 1,800 litres represented only 3.08 per cent of the district-level SAM volume of 58,466 litres.

Table 3. Market penetration of Product X in the study area

Measure	Value
Farmer-based market penetration	57.5% (46 of 80 sample farmers currently using Product X)
Estimated seasonal sales volume (study area)	~1,800 litres per season (dealer-reported)
Study-area SAM volume	58,466 litres
Volume-based market penetration	3.08% of SAM volume

Source: Computed from primary survey and dealer-reported sales data.

This divergence between farmer-based and volume-based penetration is the central finding of the study. An assessment of market penetration based solely on the number of adopting farmers substantially overstates the extent to which the available market opportunity has been realised. The volume-based measure, which accounts for both the number of users and the intensity of usage, offers a more complete picture of the remaining opportunity.

The usage-depth gap

The source of this divergence becomes clear on examining application patterns among current users. Product X is recommended for two applications per paddy season. Among the 46 current users surveyed, 23 farmers applied the product for both recommended sprays, while the remaining 23 restricted its use to a single application, substituting a lower-cost alternative fungicide for the second spray. A chi-square test of independence found a statistically significant association be-

tween landholding category and spray frequency ($\chi^2 = 16.72$, $df = 2$, table value at 5% = 5.991, $p < 0.05$): 14 of 15 large farmers applied the product twice per season, compared with only 4 of 14 small farmers and 5 of 17 medium farmers. This indicates that price sensitivity among small and medium farmers, rather than lack of awareness or dissatisfaction with field performance, is the primary constraint on full-protocol usage. Consistent with this, all 73 farmers with usage experience reported positive disease-control outcomes and no farmer expressed disagreement with the product's efficacy on a five-point Likert scale (mean score 3.75), while the reasonableness of its price recorded the lowest mean score among the perception statements assessed (2.84).

Strategic implications for market penetration

Based on the findings above, four categories of penetration strategy are proposed for agrochemical firms operating similar dual-action fungicide portfolios in comparable paddy-growing regions.

Value-based pricing and product positioning

Since price sensitivity, rather than lack of awareness or dissatisfaction with performance, was found to constrain full-protocol usage, value-based communication should help farmers weigh the cost of a complete two-spray protocol against the yield and disease-control benefits obtained, particularly among small and medium farmers most likely to substitute a lower-cost alternative for the second application.

Strengthening distribution and dealer availability

Non-availability at the local dealer level was the sole reason for non-adoption reported among farmers who had never used the product, indicating that even modest distribution gaps can constrain market entry in specific pockets. Consistent stock availability, particularly in mandals with weaker dealer coverage, should help convert existing awareness into initial adoption.

Dealer engagement and incentive strategies

Dealer recommendation was the leading source of both initial fungicide awareness and product-specific awareness among sample farmers, underscoring the dealer's influence on purchase decisions. However, fewer than half of surveyed dealers had attended product-specific training or demonstrations. Strengthening dealer-level technical training and clearly communicating incentive-scheme eligibility can improve dealer confidence in recommending full-protocol usage.

Farmer demand generation and retention

A substantial share of farmers with prior experience of the product had discontinued its use, predominantly due to switching to competing brands rather than dissatisfaction with performance. Retention of the existing user base, and re-engagement of lapsed users through structured follow-up ahead of the main disease-pressure period each season, is therefore likely to offer a more immediate return than acquisition of entirely new users.

Conclusion

This study applied the TAM-SAM-SOM framework to estimate the market potential of a dual-action fungicide in a major paddy-growing district of Andhra Pradesh, finding a serviceable market of ₹74.79 crore against a currently realised obtainable market of ₹32.25 crore. While farmer-based market penetration appeared high at 57.5 per cent, volume-based penetration of only 3.08 per cent revealed that the principal constraint on market growth lies not in acquiring new users but in deepening usage intensity among farmers who have already adopted the product, a pattern significantly linked to landholding category. The proposed strategies around pricing, distribution, dealer engagement and farmer retention address this usage-depth gap directly. More broadly, the study demonstrates that the TAM-SAM-SOM framework, most commonly applied in technology and consumer-goods market research, can be meaningfully adapted to estimate market opportunity for agrochemical products at a sub-regional, crop-spe-

cific level, offering a replicable approach for similar market assessments elsewhere.

Limitations

- The study was confined to four mandals of a single district, a sample of 80 farmers and 20 dealers, and findings may not be fully generalisable to other districts with different agro-climatic or market conditions.
- Data from farmers and dealers were based on self-reported responses and recall, which may be subject to recall bias, and dealer-reported sales volumes were estimates rather than verified transaction records.
- The study was conducted during a single cropping period and may not capture seasonal variation in fungicide usage and adoption across different years. Replication across other districts, and tracking of the same farmers and dealers across multiple seasons against verified sales records, would help establish how far the usage-depth gap reported here generalises beyond the study area.

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