

INVESTIGATION AND COUNTERMEASURES ON THE PROBLEM OF INCREASED LITCHI YIELD BUT NOT INCREASED INCOME: TAKING CHINA MAOMING LITCHI AS AN EXAMPLE

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Abstract: The 2025 litchi harvest in Maoming, Guangdong achieved record yields, however, increased production didn't translate into proportional profit growth. This study investigates the phenomenon of "increased production without corresponding income growth" from both supply-side and demand-side perspectives. From the supply side, the findings indicate that factors such as concentrated market entry, oversupply, labor shortages, rising production costs, limited regional brand premium capacity, and insufficient product quality and technological innovation have constrained income growth. From the demand side, Consumer survey results reveal a general preference for low-priced litchis. However, a considerable proportion of consumers are willing to pay premium prices for higher quality, strong brand, and specific consumption scenarios. Most consumers accept a regional brand premiums of up to 10% for Maoming litchis, while demonstrating strong repurchase intention. Notably, 44.3% of respondents reported never having purchased Maoming litchis, highlighting the coexistence of high repurchase potential and significant untapped market segments. A comprehensive supply–demand analysis identifies several core contradictions: rigid supply structures versus weak demand upgrading; high channel dependency versus diversified consumption patterns; misalignment between weak brand awareness and rising quality expectations; and technological limitations combined with evolving consumption experiences that create "last-mile" barriers. Based on these findings, this study proposes targeted policy recommendations to address these structural issues and promote sustainable development in the litchi industry.

Keywords: Increased production without income growth; Maoming litchis; Supply-side analysis; Demand-side analysis

1 INTRODUCTION

1.1 Research Objectives and Significance

The year 2025 marks a bumper harvest for China's litchi industry, with the national planting area reaching 500,800 hectares. Guangdong Province accounted for 280,000 hectares, yielding about 2.06 million tons—an increase of 135% compared to 2024. As the primary litchi-producing region in Guangdong, Maoming produced approximately 630,000 tons.

However, this substantial increase in production did not result in corresponding income growth for farmers, leading to the paradox of "increased production without increased earnings." Some growers even reported reduced profits or financial losses compared to the previous year.

This phenomenon reflects a structural imbalance between supply and demand. This study examines the issue from both perspectives, while also analyzing the attitudes and behaviors of farmers, buyers, and consumers. By constructing a comprehensive analytical framework, the research aims to identify key contradictions and challenges in the development of the litchi industry.

Furthermore, this study proposes innovative solutions to address supply–demand asymmetry in Maoming's litchi sector. The findings provide practical insights for government policymaking, enterprise strategy, and agricultural production, thereby contributing to the high-quality development of the litchi industry and supporting rural revitalization and agricultural modernization.

1.2 Review of Studies

A persistent paradox in agricultural economics is that increases in productivity and output do not necessarily translate into higher farm incomes.

1.2.1 Market supply, demand, and structural factors

Benton and Bailey argue that productivity growth in agriculture, while improving food availability, can paradoxically reduce farm profitability by driving down output prices through excess supply[1]. Furthermore, farmers often lack market information and guidance, making them prone to switching or expanding crop cultivation when prices are high. When these products enter the harvest period simultaneously, they can trigger oversupply and cause prices to plummet[2-3]. There are structural contradictions in variety and quality. Some industries rely heavily on traditional varieties, resulting in a narrow range of options and a lack of differentiated competitive advantages. There is insufficient

variety control during planting and processing, leading to mixed quality, difficulty in standardizing quality, and limited expansion of the consumer market. There are limitations in market reach and distribution channels. This is especially true for specialty agricultural products, which often suffer from low market recognition and narrow sales channels. The primary market remains confined to areas near the production region, with low recognition in other markets[4].

1.2.2 Production and cost factors

Production costs have increased rigidly. Prices of agricultural inputs, labor, and land continue to rise. For example, in Henan Province's 2023 soybean cultivation, the average per-mu costs of fertilizer, machinery operations, and labor increased by 105.73%, 6.18%, and 2.50% year-on-year, respectively[5]. Fragmented operations and diseconomies of scale. Fragmented land management leads to low production efficiency and weak bargaining power. The average cultivated land area per farming household in China is only 5.6 mu, making it difficult for small-scale farmers to cope with market risks or bear the costs of adopting new technologies. There is an imbalance between technology application and costs. The application of chemical fertilizers and pesticides presents a contradiction of "increased output but not income." Empirical evidence shows that fertilizer application has a positive but insignificant effect on farmers' operational income, while pesticide application has a significant negative effect[6].

1.2.3 Distribution and processing factors

Inadequate distribution infrastructure and information lags. Insufficient storage, logistics support, and asymmetric market information. Weak deep processing and branding. Low value-added of agricultural products and insufficient brand premium capacity. Lack of quality control and traceability. Inadequate quality control throughout production and distribution links harms product reputation. Another key explanation lies in the structure of modern agri-food supply chains. Increasing concentration among downstream actors—such as processors, wholesalers, and retailers—has shifted bargaining power away from farmers. As a result, producers capture a declining share of the final retail price (Sexton, 2013). Fruit is highly perishable, which limits farmers' ability to delay sales in response to unfavorable prices. This weakens bargaining power and often forces producers to accept lower prices[7-8].

1.2.4 Policy and institutional factors

Limitations of government intervention models. Some local governments adopt a "problem-response model" and lack long-term planning for the industrial chain. In some regions, agricultural funds are used in a "fragmented" manner, which, while boosting output, does not significantly increase income[9]. Imperfect price and subsidy mechanisms. Inadequate coverage of agricultural price protection policies, and some products lack risk hedging tools. Biased evaluation system orientation. The existing performance evaluation system encourages "firefighting"-style administrative actions. Some local governments, seeking short-term performance gains, encourage the expansion of single crop varieties while neglecting market capacity and industrial supporting facilities, exacerbating the contradiction of increased output without increased income[4]. The lychee industry in Maoming faces the problem of "increasing output without increasing income." The main reasons include a narrow range of lychee varieties with concentrated ripening periods, unstable fruit quality, severe cutthroat competition in market sales, and limited sales channels. The lychee industry has shifted from being highly profitable to only marginally profitable, making it difficult for farmers to increase their income. To enhance the competitiveness of lychees and achieve genuine income growth, a multi-pronged approach is needed, focusing on fruit quality, industrialized production, building the Maoming lychee brand, developing preservation technologies, and cooperating with the government to foster sustainable and healthy industrial development.

Some scholars have conducted research on strategies to improve fruit farmers' income. Cui Guangxun and Yao Hui proposed optimizing financial support and risk protection: consolidating agricultural funds and increasing supporting investments along the industrial chain; expanding the pilot scope of agricultural price insurance to effectively mitigate the risk of "increasing output without increasing income"[10]. Other scholars have suggested promoting precision planting techniques to reduce production costs, such as soil testing for formulated fertilization and green pest control, to improve the utilization rate of fertilizers and pesticides and reduce ineffective inputs[11]. Extending the industrial chain to increase product value-added. Support deep-processing enterprises for industries like torrefaction and garlic to develop snack foods, condiments, and other products[3,5]; promote the integration of agriculture with cultural tourism, e-commerce, and other industries to broaden income channels[2].

1.2.5 Research review

Existing studies have generated substantial insights into the causes and manifestations of "increased production without income growth." However, several gaps remain.

First, most studies focus primarily on the supply side, with limited integration of consumer-side analysis. Second, research specifically targeting the litchi industry remains insufficient. Third, empirical studies on farmers' cost structures, sales channel constraints, and consumer preferences are relatively scarce.

To address these gaps, this study combines interviews and questionnaire surveys to analyze the issue from both supply-side and demand-side perspectives. By incorporating empirical data, it aims to identify root causes, influencing factors, and feasible solutions, thereby providing a more comprehensive understanding of the problem.

2 RESEARCH CONTENT AND METHODS

2.1 Research Content

This study consists of two main components.

First, a supply-side analysis examines the phenomenon of increased production without income growth in Maoming's litchi industry in 2025. Through surveys of producers and purchasers, the study compares production and sales conditions between 2024 and 2025, identifies key constraints, and explores potential development pathways.

Second, a demand-side analysis investigates consumer behavior through questionnaire surveys. It examines purchasing patterns, price sensitivity, brand awareness, and channel preferences, aiming to identify key demand-side factors and provide strategic insights for policymakers and enterprises.

2.2 Research Technique

2.2.1 Field survey method

Field investigations were conducted to collect first-hand data on litchi production and sales.

(1) Interview method

Semi-structured interviews were conducted with litchi farmers and purchasers to understand production conditions, cost structures, profitability, and industry development challenges. The interviews were conducted online and involved participants from the Maoming region.

(2) Questionnaire survey

Questionnaires were distributed nationwide via platforms such as Wenjuanxing and Tencent Questionnaire. The survey collected data on consumer attitudes toward litchi quality, price, branding, and purchasing channels.

2.2.2 Mixed-methods approach

This study combines qualitative and quantitative methods. Qualitative analysis is used to examine supply-side issues, while quantitative analysis is applied to consumer survey data. In addition, production and cost data from Gaozhou and Xinyi were analyzed to evaluate cost-benefit relationships.

2.3 Data Collection

2.3.1 Interview data

A total of nine participants (seven farmers and two purchasers) were surveyed through online interviews, providing insights into production and sales conditions.

2.3.2 Questionnaire data

A total of 477 questionnaires were collected, of which 474 were valid after excluding incomplete or inconsistent responses, resulting in an effective response rate of 99.37%. The data passed reliability and validity tests and are considered representative of the target population.

3 SURVEY RESULTS

3.1. Supply-Side Analysis: Why Does Increased Litchi Production Not Lead to Income Growth

To investigate the supply-side factors, this study conducted interviews with nine participants, including seven litchi farmers (coded A–G) and two purchasers (H and I) from Maoming.

Farmer A operates approximately 2 hectares of litchi orchards in Xinyi and represents large-scale producers. Farmer B, a small-scale producer in Gaozhou, manages around 130 trees. Farmer C cultivates approximately 13.5 hectares in Genzi Town, focusing on Feizixiao and Baitangying varieties, while Farmers D–G operate smaller orchards ranging from 0.7 to 6.7 hectares. Purchaser H is primarily engaged in orchard harvesting operations, while Purchaser I provides agricultural services, including online sales platforms and consulting.

3.1.1 Concentrated market entry and oversupply

The simultaneous release of multiple litchi varieties during the harvest season has led to severe market oversupply, which is a primary cause of declining prices.

Maoming is China's leading litchi-producing region, accounting for approximately one-fourth of national output and half of Guangdong Province's production. Major varieties include Heiye (Black Leaf), Guiwei, Feizixiao, Nuomici, and Baitangying.

In 2025, extreme weather conditions accelerated ripening, causing both low-end and high-end varieties to enter the market simultaneously. This disrupted the normal price hierarchy, creating a situation in which premium varieties maintained relatively high prices while lower-quality varieties experienced significant price declines.

Large-scale farmers, such as Farmer A, benefited from high yields due to economies of scale but suffered from falling prices and weak bargaining power, as they relied heavily on intermediaries. At the same time, high labor costs further compressed profit margins, resulting in a "high output but low profit" dilemma.

Small-scale farmers, such as Farmer B, experienced modest income improvements due to yield recovery but faced unstable sales channels and limited pricing power. Similarly, harvesting contractors (e.g., Purchaser H) encountered fluctuating profits due to volatile market prices.

Overall, the combination of synchronized harvesting, dependence on traditional distribution channels, and insufficient processing capacity resulted in oversupply and declining profitability.

3.1.2 Labor shortages and rising production costs

Although total production increased by approximately 50% in 2025, farmers' incomes did not improve significantly due to rising costs and labor shortages.

Interviews revealed two major challenges:

First, the concentration of the harvest period created severe labor shortages. Farmers reported difficulties in hiring sufficient workers during peak harvesting periods, leading to delays and fruit losses. In some cases, ripe fruit fell from trees due to a lack of timely harvesting.

Second, declining market prices forced some farmers to sell below cost or even abandon harvesting altogether. For example, the purchase price of traditional varieties such as Heiye dropped to as low as 1.2 RMB/kg, while production costs (including land rent, fertilizers, pesticides, and labor) ranged from 1.5 to 2 RMB/kg.

Although higher-end varieties such as Guiwei and Baitangying maintained relatively stable prices, their profitability was still constrained by increased yields and rising costs. As a result, even in a bumper harvest year, farmers faced the risk of reduced profits or financial losses.

3.1.3 Limited regional brand premium

Although “Maoming Litchi” is a well-known geographical indication product, its brand premium remains limited.

Interview results indicate that brand influence plays a relatively minor role in price formation, especially during periods of oversupply. Prices are primarily determined by market supply and demand rather than brand value.

For example, Farmer A noted that even high-quality Gaozhou litchis struggle to achieve higher prices during peak supply periods. In contrast, Farmer B was able to obtain better prices by focusing on quality differentiation and early market entry.

Some farmers have explored online sales channels to enhance brand value. Farmer C reported that online prices were approximately 20% higher than offline prices, demonstrating the potential of digital platforms to improve profitability.

However, consumer awareness of litchi varieties and regional brands remains limited. As Purchaser H observed, experienced consumers value brand and quality, while most consumers prioritize price. This weak brand recognition reduces the effectiveness of branding strategies and limits premium pricing.

3.1.4 Constraints in product quality and production technology

Product quality and technological limitations are key factors restricting income growth.

Litchi cultivation in Maoming is still largely based on traditional farming practices. Many orchards rely on older varieties such as Heiye and Baila, which are less competitive in terms of taste and market demand. Approximately half of the planting area still uses these traditional varieties.

In addition, production quality is highly dependent on natural conditions, including climate, sunlight, and fertilization practices. The lack of standardized cultivation techniques results in inconsistent quality, leading to price competition rather than quality-based differentiation.

Post-harvest preservation is another major challenge. Litchis are highly perishable, and inadequate cold chain logistics significantly limits long-distance transportation. High logistics costs further reduce profit margins, forcing many farmers to sell locally at lower prices.

Furthermore, limited adoption of e-commerce and modern marketing strategies restricts market expansion. Many farmers lack the skills or resources to utilize online platforms effectively, further constraining income growth.

3.1.5 Limitations of government support

Government support for the litchi industry is primarily focused on short-term measures, such as assisting with sales during periods of oversupply.

While these initiatives help reduce unsold inventory, they do not significantly improve farmers’ incomes. For example, government-supported purchasing programs often operate at market prices, which are already low during bumper harvests.

In addition, some farmers reported limited access to government support due to information asymmetry or geographical constraints. Collaboration between government agencies and private platforms also remains insufficient.

Overall, current policies emphasize production and short-term problem-solving rather than long-term income enhancement and structural reform.

3.2. Demand-Side Analysis: Consumer Behavior and Market Characteristics

3.2.1 Consumer demographics and sample characteristics

In the survey sample, female respondents accounted for 59.9% of the total sample, while male respondents made up 40.1%. The proportion of females was significantly higher than that of males, which aligns with the common social role of women being the primary purchasers of fresh household food products. The sample characteristics effectively reflect the actual situation of the core consumer group. The age distribution showed that respondents were predominantly middle-aged and young adults. Among them, those aged 18-25 accounted for the highest proportion at 48.5%, followed closely by the 26-40 age group at 37.8%. Together, these two groups accounted for a high proportion of 86.3%, which may be related to the use of online questionnaires, as older individuals have less exposure to such methods. Additionally, litchis are highly sweet, and consumer enthusiasm for litchis may decline with age. Geographically, respondents were widely distributed: consumers from non-litchi-producing regions accounted for 53.0% of the total sample, while consumers from the five major litchi-producing regions—Guangdong, Guangxi, Hainan, Fujian, and Sichuan—represented 36.9%, and consumers from other litchi-producing areas accounted for 10.1%. In terms of long-term residence locations, the vast majority of respondents (64.6%) lived in urban centers with convenient express delivery services, while respondents from urban-rural fringe areas and township centers accounted for 17.1% and 10.3%, respectively, and those residing in rural areas accounted for 7.4%. This distribution structure aligns well with China's

current population distribution and the demographic profile of the primary consumer base for fresh e-commerce, indicating that the sample effectively reflects the mainstream consumption environment for litchis. The feedback provided provides valuable reference for optimizing online and offline sales channels.

3.2.2 Consumption patterns and trends

(1) Purchase Volume and Trend Trends

The survey results show that the vast majority of households (95.1%) purchased litchis this year, demonstrating its widespread market acceptance and high consumption penetration as a seasonal fruit. The purchase volume distribution (Table 1) shows that nearly half of households (48.7%) bought litchis in quantities ranging from 0 to 5kg, while about one-third (32.5%) purchased between 5 and 10 kilogram. Families buying over 10 kg accounted for 13.9% of total purchases. This distribution pattern indicates that current litchi consumption is characterized by small-to-medium sizes and immediate consumption habits, reflecting consumers' preference for "small frequent purchases" when buying litchis—a fresh produce with short shelf life—rather than bulk stockpiling as a mainstream consumption model.

Table 1 Purchase Volume of Households Surveyed

Number of litchis purchased by a household this year	frequency	percentage (%)
0	23	4.9
0-5kg	231	48.7
5-10 kg	154	32.5
More than 10 kg	66	13.9
Total	474	100.0

Compared to last year, litchi consumption has shown a positive growth trend this year (Table 2). Data reveals that nearly half (49.2%) of households reported increased purchases, while 43.7% maintained stable spending levels. Only 7.2% of households experienced reduced purchases. The significantly higher proportion of households with increased consumption compared to those with decreased spending indicates an overall expansion trend in the litchi market. This phenomenon may be attributed to multiple factors: this year's bumper litchi harvest ensuring ample supply and relatively affordable prices, as well as the continuous rise in consumer preference and market acceptance for litchis.

Table 2 Changes in Purchase Volume of Households Surveyed

An increase or a decrease compared to the same period last year	frequency	percentage (%)
increase	233	49.2
Almost unchanged	207	43.7
reduced	34	7.2
total	474	100.0

(2) Reasons for Consumption Changes

An in-depth analysis of purchasing motivations among consumers with increased purchase volume this year (Figure 1) reveals that consumption growth was primarily driven by channel improvements and promotional campaigns. The most significant factor was "the widespread availability of multiple purchasing channels," selected 154 times (66.09% of respondents), indicating that expanded online and offline retail networks have enhanced purchasing convenience and substantially lowered accessibility barriers. The second most influential factor was "significant price reductions," observed 134 times (57.51% of samples), highlighting the substantial impact of pricing on consumption of seasonal fresh products like litchis. Additionally, "increased promotional activities" (127 instances, 54.51% of samples) played a notable role in stimulating trial purchases. These three factors collectively formed a powerful driving force behind the growth in litchi consumption.

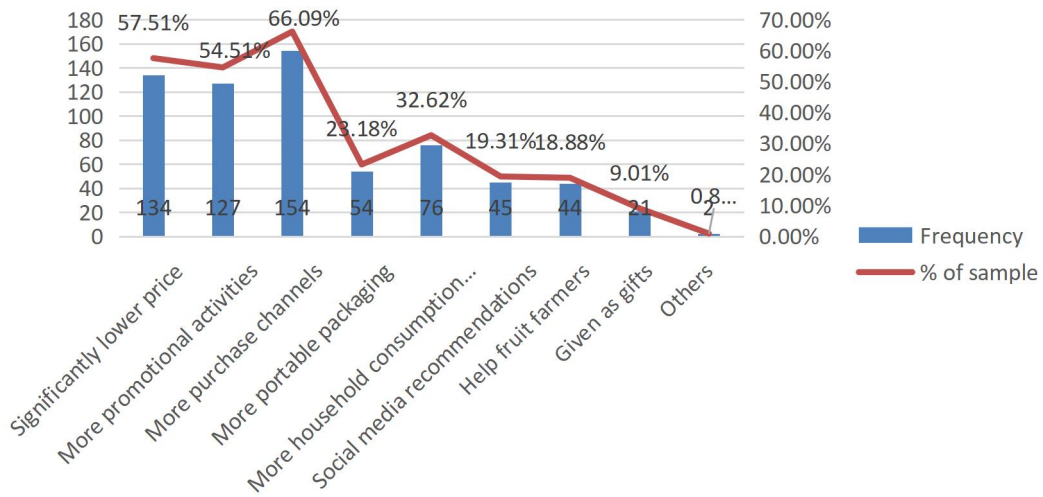


Figure 1 Reasons for Increased Consumer Purchase Volume

An analysis of purchasing motivations among consumers with reduced purchases this year (Figure 2) reveals that "concerns about high sugar content and heatiness" accounted for the highest proportion at 44.12%, reflecting heightened health awareness. Price dissatisfaction and storage convenience issues each accounted for 32.35% – the former reflects consumers' perception of litchi pricing relative to other fruits, while the latter highlights challenges posed by litchi's perishability. The "tendency to purchase seasonal alternatives" factor (23.53%) indicates that litchis face competition from watermelons, peaches, and mangoes in summer fruit markets, with diversified choices diverting demand. "Food safety concerns" (17.65%) demonstrate existing quality apprehensions during purchases. A notable micro-market factor (5.88%) is reduced litchi supply from local fruit stores/supermarkets, suggesting potential supply chain issues affecting consumer purchasing decisions. Both "self-cultivated litchis meeting needs" (14.71%) and "declining interest in litchis" (14.71%) reflect regional production-consumption overlaps and shifting consumer preferences. While 17.65% of respondents selected "other options," valid explanations included "remaining inventory at home" and "abundant household stock," further confirming consumption patterns influenced by litchi perishability and localized self-sufficiency practices.

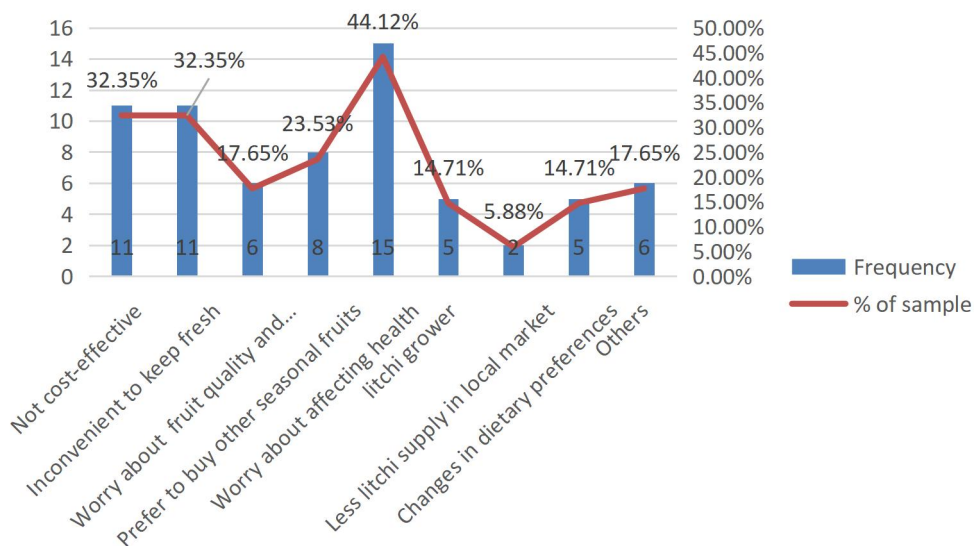


Figure 2 Reasons for Reduced Consumer Purchase Volume

(3) Factors Consumers Pay Attention to When Purchasing litchis

Survey data (Figure 3) reveals that freshness (84.81% of responses, 402 instances), price (73.00%,346 instances), and sweetness/taste (64.35%,305 instances) are the top priorities for litchi consumers. This indicates that product freshness, cost-effectiveness, and basic eating experience are primary considerations in purchasing decisions. Variety awareness reaches 50.00% (237 instances), reflecting consumers' recognition and preference for different litchi varieties. In contrast, brand/origin (20.68% of samples, 98 instances), promotional activities (18.35%,87 instances), and personal health factors (17.51%,83 instances) show relatively lower engagement, suggesting current litchi consumption remains product-centric with limited brand influence and marketing effectiveness. Packaging design receives the least attention

(5.27%,25 instances), indicating consumers prioritize intrinsic product quality over visual packaging. Additionally, 12.45% of respondents (59 instances) chose "other factors," with further analysis revealing mentions of "after-sales service" and "purchasing convenience" (originally listed as key factors in the open-ended survey; adjusted according to Figure 4). These findings demonstrate that logistics experience and purchasing channels also significantly influence consumer decisions beyond the aforementioned attributes.

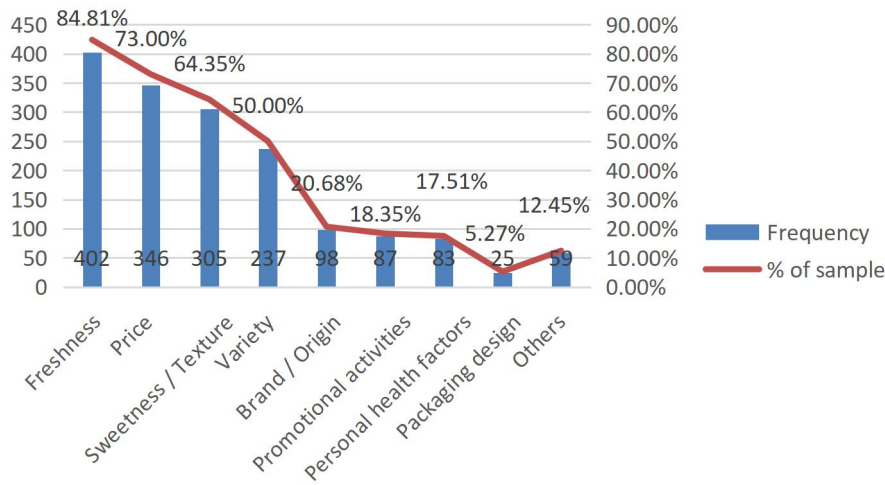


Figure 3 Factors of Concern in Purchasing Decisions

(4) Consumers' Channel Preference for Purchasing

Survey data reveals that offline channels remain the dominant choice for litchi purchases, accounting for 79.1% of effective responses (Figure 4). This indicates that litchi consumption still heavily relies on traditional physical retail formats such as supermarkets, specialty fruit stores, and street vendors. Consumers favor immediate purchase-and-delivery models, which align perfectly with litchi's nature as a fresh produce emphasizing freshness and instant consumption. In contrast, online channels show relatively lower adoption rates at 17.7%, suggesting that emerging retail models like fresh e-commerce platforms and live-streaming sales have achieved some penetration but haven't yet become mainstream. This may be attributed to cold chain logistics costs, consumer trust in online freshness quality, and unmet demand for instant delivery. Additionally, 0.8% of respondents chose "other" channels. Analysis of these responses reveals that some consumers obtain litchis through unconventional means such as "purchasing from rural areas," "friend gifts," or "home cultivation." While these channels are unconventional, they reflect unique consumption patterns (e.g., direct sourcing from production sites, social gifts, or self-sufficiency needs), warranting further investigation in specialized studies.

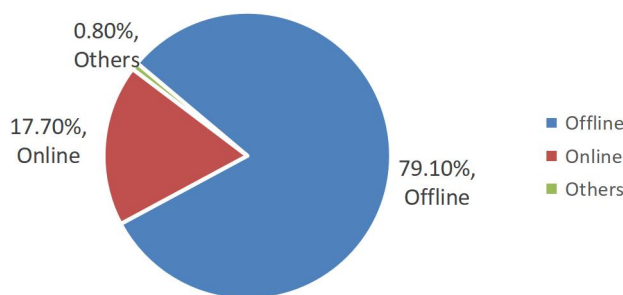


Figure 4 Consumer Purchase Channel Preferences

(5) Online Purchase Preference and Consumer Experience

Statistical analysis (Figure 5) reveals that "fruit freshness" emerged as the most critical consideration for online shoppers, with 385 selections accounting for 81.2% of total samples. "Logistics delivery speed" (262 selections, 55.3%) and "discount levels" (277 selections, 58.4%) followed closely. Additionally, "after-sales guarantees (e.g., damage compensation)" (227 selections, 47.9%) and "consumer reviews and word-of-mouth" (182 selections, 38.4%) demonstrated significant attention, reflecting consumers' comprehensive evaluation of quality, timeliness, cost-effectiveness, and purchase protection when purchasing fresh produce online. Factors such as "sealing integrity," "weight discrepancies," and "agricultural support attributes" showed relatively lower selection rates, indicating that they were not core decision-making factors for the majority of consumers.

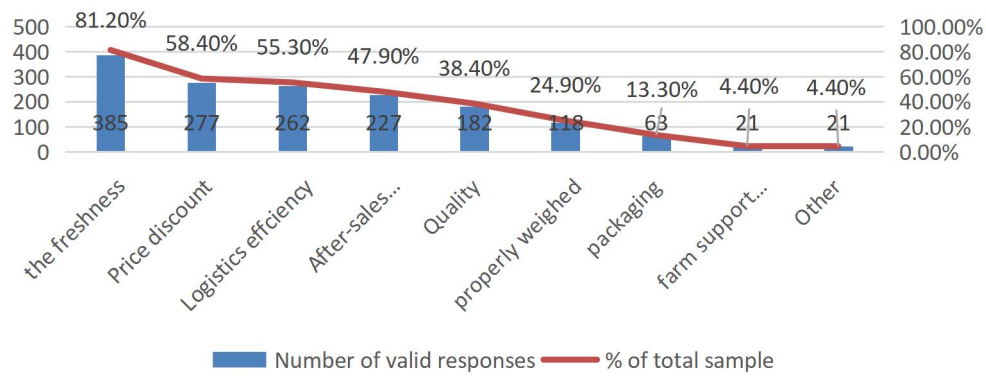


Figure 5 Online Purchase Preferences

The study evaluated consumer satisfaction across six core experience dimensions of online litchi consumption. Data analysis (Figure 6) revealed that "logistics delivery speed" received the highest satisfaction rating, with combined percentages of "satisfied" and "very satisfied" reaching 74.3%. However, evaluations for "freshness upon delivery," "litchi preservation duration," "fruit flesh integrity rate," and "taste stability" were notably lower, showing dissatisfaction rates exceeding 25% in each category. The highest dissatisfaction rate (33.3%) was recorded for "taste stability," highlighting persistent quality control and preservation challenges in online consumption. Additionally, while "after-sales service attitude" achieved a 40.2% satisfaction score (combining "satisfied" and "very satisfied"), over 40% of consumers rated it as "unsatisfactory" or below, indicating significant room for improvement in after-sales service.

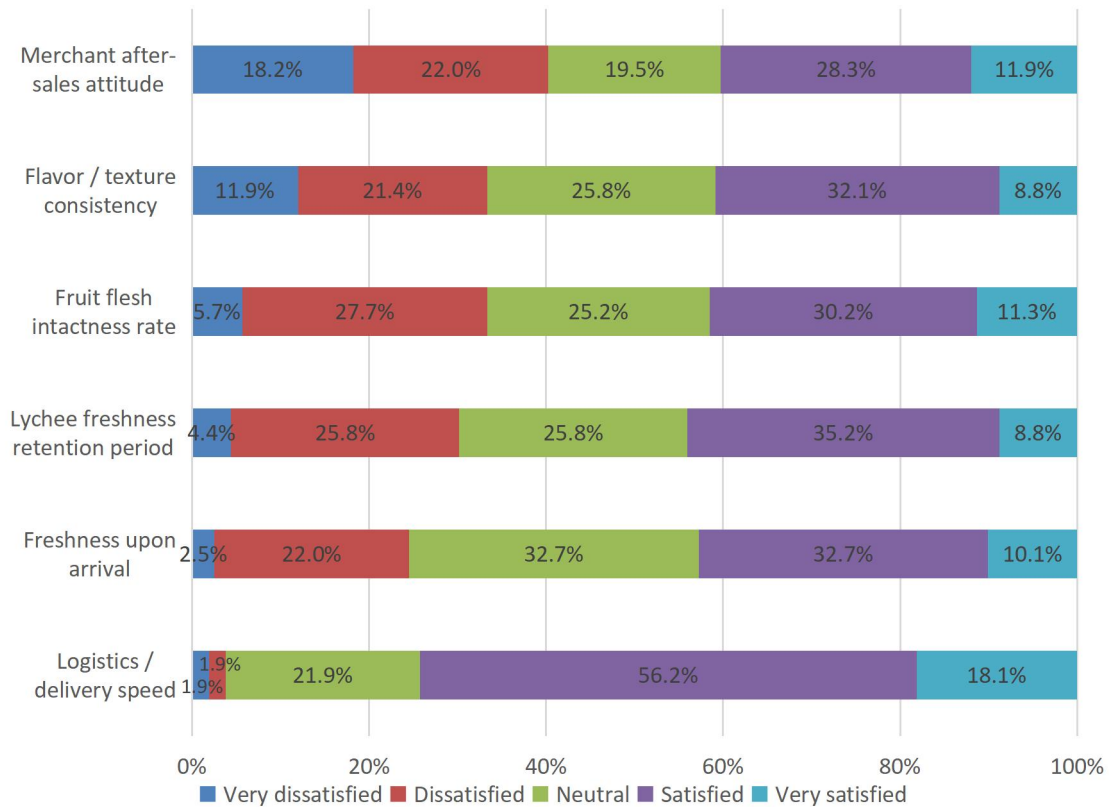


Figure 6 Consumer Online Shopping Experience

3.2.3 Cross analysis of basic information of surveyed consumers and consumer purchase behavior

(1) Cross Analysis of Consumer Age and Litchi Purchase Behavior

Consumers of different age groups exhibit variations in litchi purchase quantities. Among those under 18 years old, 83.3% purchased 0-5kg. In the age groups of 18-25,26-40, and 41-55 years, the proportion of purchases within 0-5kg exceeded 40%, representing the most concentrated purchase range within each age group. The purchase distribution among individuals aged 56 and above was relatively dispersed, with 5-10 kg accounting for 50% of purchases (Table 3).

Table 3 Consumer Age and Purchase Quantity of Litchi

age	purchase quantity (percentage)	Not purchased				total
		0-5kg	5-10 kg	More than 10kg		
Under 18 years old	count	0	10	2	0	12
	Percentage of age in years	0.0%	83.3%	16.7%	0.0%	100.0%
18-25 years old	count	13	119	77	21	230
	Percentage of age in years	5.7%	51.7%	33.5%	9.1%	100.0%
26-40 years old	count	8	79	52	40	179
	Percentage of age in years	4.5%	44.1%	29.1%	22.3%	100.0%
41-55 years old	count	1	20	18	4	43
	Percentage of age in years	2.3%	46.5%	41.9%	9.3%	100.0%
Over 56 years of age	count	1	3	5	1	10
	Percentage of age in years	10.0%	30.0%	50.0%	10.0%	100.0%
total	count	23	231	154	66	474
	Percentage of age in years	4.9%	48.7%	32.5%	13.9%	100.0%

The chi-square test revealed a Pearson chi-square value of 26.074 with a corresponding p-value of 0.010, indicating that age differences significantly influence litchi purchase quantity selection. Consumption habits and demands across different age groups result in distinct distribution patterns of purchase volumes. Analysis of the relationship between litchi consumers' age, purchase quantity changes (increase/decrease), magnitude of changes, and purchasing channels demonstrated that the progressive significance levels for age versus purchase quantity changes (p=0.497), magnitude of changes (p=0.439), reduction magnitude (p=0.674), and purchasing channels (p=0.112) were all >0.05. This suggests that age differences do not significantly affect these purchasing behavior characteristics, and no evident age differentiation was observed in consumption patterns across different age groups.

(2) Cross Analysis of Consumers' Geographic Location and Litchi Purchase Behavior

Survey results indicate that consumers predominantly purchase litchis in quantities ranging from 0-5kg (48.7%), followed by 5-10kg (32.5%). Notably, 4.9% of respondents reported never having bought litchis in 2025. Among buyers exceeding 10kg, consumers from litchi-producing regions showed the highest preference (19.4%), while consumers from Non-litchi producing areas were more inclined to purchase 0-5(53.4%) (Table 4).

Table 4 Geographic Distribution of Consumers and Quantity of Litchi Purchases

region	purchase quantity (percentage)	Not purchased	0-5kg	5-10 kg	More than 10kg	total
Main litchi production areas (Guangdong, Guangxi, Hainan, Fujian, Sichuan)	Percentage of your location	6.3%	42.3%	32.0%	19.4%	100.0%
	count	0	23	17	8	48
Other litchi-producing areas	Percentage of your location	0.0%	47.9%	35.4%	16.7%	100.0%
	count	12	134	81	24	251
Non-litchi producing areas	Percentage of your location	4.8%	53.4%	32.3%	9.6%	100.0%
	count	23	231	154	66	474
total	Percentage	4.9%	48.7%	32.5%	13.9%	100.0%

The chi-square test results indicate a significant correlation between consumers' geographic location and litchi purchase volume (p=0.038), as well as a significant association with purchasing channels (p=0.024). Specifically, while offline purchases dominate across all regions, consumers from non-litchi-producing areas exhibit the highest proportion of online purchases (21.4%). This demonstrates that geographical differences significantly influence both purchase volume and channel selection patterns: consumers from primary production areas tend to buy larger quantities, whereas non-local consumers show greater acceptance of online purchasing channels (Table 5).

Table 5 Geographic Distribution of Consumers and Purchase Channels for Litchi

region	Purchase channels (percentage)	Offline (supermarkets/fruits stores/stall vendors, etc.)	Online (e-commerce platforms/live streaming sales, other etc.)	total	
		count	142		22
Main litchi production areas (Guangdong, Guangxi, Hainan, Fujian, Sichuan)	Percentage of your region	84.5%	13.1%	2.4%	100.0%
	count	38	9	0	47

	Percentage of your region	80.9%	19.1%	0.0%	100.0%
Non-litchi producing areas	count	195	53	0	248
	Percentage of your region	78.6%	21.4%	0.0%	100.0%
total	count	375	84	4	463
	Percentage of your region	81.0%	18.1%	0.9%	100.0%

3.2.4 Price, quality, and regional brand of litchi

(1) Price and Quality Perception Analysis of Litchi

An analysis comparing consumers' actual purchase prices with acceptable price ranges reveals that the 10-20 RMB/kg range serves as the core price zone for both actual purchases (40.3%) and ideal acceptance (53.2%) among the majority of consumers. This suggests that this price bracket represents the current equilibrium between market demand and supply, while also being the most widely accepted mainstream pricing point. Notably, the actual purchase rate for low-priced products (below 5 yuan) (20.7%) exceeds their perceived acceptance rate (15.6%), demonstrating that promotional discounts or specific product varieties still hold appeal in real-world purchasing decisions. Within the mid-to-high price range of 21-40 RMB/kg actual purchase rates (31.9%) surpass acceptable rates (24.7%), suggesting that although some consumers psychologically prefer mid-to-low prices, they may still opt for slightly higher-priced products due to factors like product quality, variety selection, or purchasing scenarios. For premium litchis priced above 40 RMB/kg, both actual purchase rates and perceived acceptance levels remain relatively low (combined <10%), reflecting the niche market status of high-end litchis. Enhancing product quality experience and building brand value could become key strategies to break through price ceilings (Table 6).

Table 6 Psychological Acceptance of Litchi Price Versus Actual Purchase Price in 2025

RMB/kg adjustment	Litchi Price Acceptance Range per Actual purchase unit price of litchi in 2025			
	frequency	percentage (%)	frequency	percentage (%)
Under 10 yuan	74	15.6	98	20.7
10-20 yuan	252	53.2	191	40.3
20-40 yuan	117	24.7	151	31.9
40-60 yuan	26	5.5	21	4.4
Over 60 yuan	5	1.1	13	2.7
total	474	100.0	474	100.0

Regarding consumer perceptions of litchi quality and pricing, nearly half of respondents (51.1%) rated the product as "quality matching price," followed by positive feedback of "high quality at low price" (29.3%). Negative evaluations of "low quality at high price" accounted for 10.3%, while opinions of "high quality at high price" and "low quality at low price" stood at 7.8% and 1.5% respectively. Overall, over 80% of consumers expressed neutral or positive views on the cost-performance ratio of litchis in 2025 (Table 7).

Table 7 Evaluation of Litchi Quality and Price in 2025

Evaluation of Litchi Quality and Price in 2025	frequency	percentage (%)
High quality, high price	37	7.8
High quality with low price	139	29.3
Quality matches price	242	51.1
Low quality with high price	49	10.3
Low quality with low price	7	1.5
total	474	100.0

(2) Payment Intention and Premium Acceptance

As shown in Figure 7, consumers demonstrate a clear concentration trend in willingness to pay premium prices for litchis from specific production areas (e.g., Gaozhou) under comparable quality standards. The majority of consumers (42.5%) accept price premiums within 10%, while another 19.4% are willing to pay 11%-20% more. Only 5.4% of consumers are willing to pay premiums exceeding 21%. Notably, 32.8% explicitly stated they "are unwilling to pay premium prices and consider production origin irrelevant." This indicates that although regional branding holds appeal for certain consumers and generates modest premium pricing power, its value has not yet gained widespread market

acceptance, with consumers generally preferring moderate price adjustments.

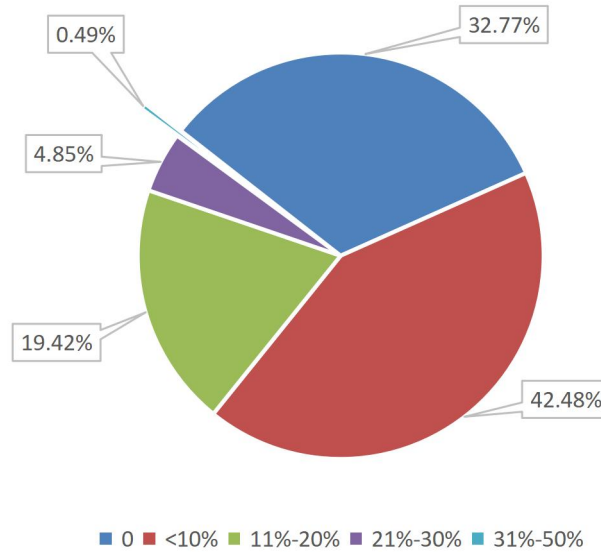


Figure 7 Willing to Pay for the Production Origin

As shown in Figure 8, consumers demonstrate significantly stronger and broader willingness to pay premium prices for "longer preservation technology for litchis" compared to premium pricing based on production region attributes. Over half of consumers (51.4%) are willing to accept a price increase of up to 10%, while another 21.9% are open to 11%-20% premium. Only 6.8% of consumers are willing to pay a premium of 21% or more. Notably, the proportion of consumers explicitly stating "unwilling to pay premium prices as preservation duration is not important" (19.8%) is markedly lower than those holding similar attitudes toward production region attributes. This strongly indicates that preservation capability remains one of the core pain points in current online litchi consumption, with improved preservation technology emerging as both a more urgent consumer expectation and a direction for which consumers are more willing to invest.

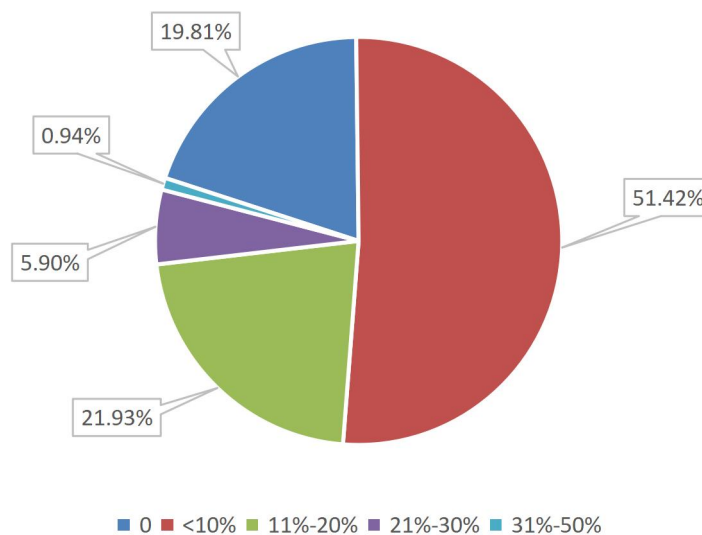


Figure 8 Willing to Pay for the Freshness

(3) Brand Trust and Consumption Restraining Factors

The survey results on factors influencing brand trust in litchi products (as shown in Figure 9) reveal that "user reviews/reputation" emerged as the most critical factor, with 314 respondents selecting it (66.2%) – significantly higher than other options – highlighting the pivotal role of social proof and peer experiences in brand trust formation. Following closely were "price affordability" (55.9% of respondents) and "packaging hygiene/safety" (55.1%), indicating consumers' dual emphasis on cost-effectiveness and physical product safety. "Geographical indication certification" was also chosen by 218 respondents (46.0%), demonstrating sustained appeal for certain consumers regarding product origins. In contrast, "brand awareness" (15.2%) and "user experience feedback" (16.2%) received

lower proportions, suggesting consumers prioritize tangible usage experiences over brand reputation or abstract perceptions.

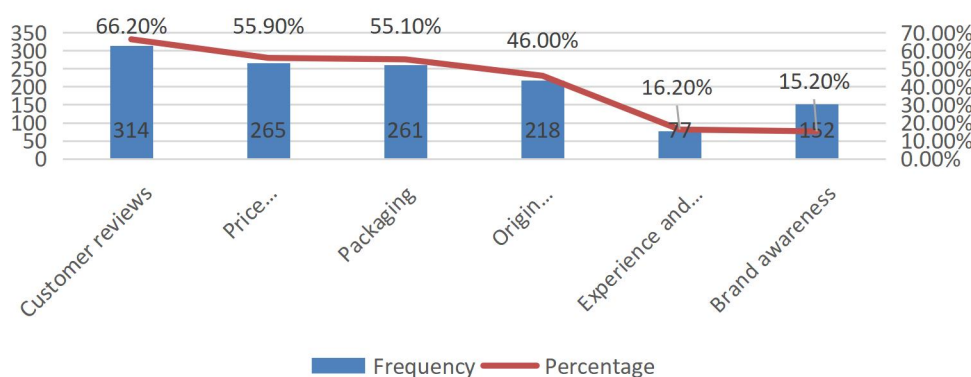


Figure 9 Factors Influencing Brand Trustworthiness of Litchi

(4) Brand Recognition and Consumer Behavior

The survey results on brand awareness in litchi production areas (Table 8) reveal that consumers demonstrate significantly higher recognition of "Maoming Litchi" compared to "Gaozhou Litchi". Specifically, 62.2% of consumers described their familiarity with "Maoming Litchi" as "never heard of" or "heard but unfamiliar," while 37.7% reported being "relatively familiar" or "very familiar." In contrast, awareness of "Gaozhou Litchi" remains notably lower, with 69.4% of consumers stating they were "never heard of" or "heard but unfamiliar," and only 30.6% indicating "relatively familiar" or "very familiar." These findings suggest that although "Maoming Litchi" has established a certain level of regional brand recognition, there remains substantial room for deeper consumer engagement and enhanced brand promotion efforts compared to "Gaozhou Litchi."

Table 8 Brand Awareness of Maoming Litchi

project Level of understanding	Have you heard of the regional brand 'Maoming Litchi'?		Have you heard of the regional brand 'Gaozhou Litchi'?	
	frequency	percentage (%)	frequency	percentage (%)
	Never heard of it	62	13.1	139
Hearing but not familiar	233	49.2	190	40.1
Relatively familiar	139	29.3	114	24.1
Very familiar	40	8.4	31	6.5
total	474	100.0	474	100.0

Regarding quality perception (Table 9), 42.9% of consumers agreed or strongly agreed that "Maoming or Gaozhou litchis outperform litchis from other regions in the same category." Neutral consumers accounted for the highest proportion at 46.4%, while those who disagreed made up only 7.8%. This indicates that the majority of consumers hold positive or neutral attitudes toward the quality of Maoming and Gaozhou litchis, laying a solid foundation for their brand reputation.

Table 9 Consumer Quality Recognition of "Maoming Litchi" or "Gaozhou Litchi"

Quality recognition of "Maoming Litchi" or "Gaozhou Litchi"	frequency	percentage (%)
Strongly disagree	7	1.5
disagree	30	6.3
same as self-identity	234	49.4
Strongly agree	169	35.7
total	34	7.2
	474	100.0

Table 10 reveals compelling purchase behavior patterns: consumers with prior purchase experience demonstrate strong repeat purchase intent, with 48.5% stating "I've bought it before and will buy again," while only 7.2% explicitly indicated they would not repurchase. Notably, 44.3% of consumers have never purchased the product, representing a potential target market for future expansion. The coexistence of high repurchase rates and a substantial untapped customer base indicates that the brand's litchi products have gained consumer recognition for their quality and

experience, though market coverage and channel penetration still require enhancement.

Table 10 Consumer Loyalty of Maoming Litchi

Loyalty to "Maoming Litchi" / "Gaozhou Litchi" frequencypercentage (%)		
Not purchased	210	44.3
I have purchased it and will not buy again	34	7.2
I have purchased it and will buy it again	230	48.5
total	474	100.0

3.2.5 Consumer needs and recommendations

(1) Consumer social responsibility

Regarding agricultural support behaviors, over half of respondents (77.2%) have supported local farmers by purchasing products packaged under the "Agricultural Assistance Program," reflecting consumers' willingness to purchase socially valuable products. Participation rates for sharing news about farmers' challenges (36.7%), joining litchi adoption initiatives (34.6%), and directly purchasing from farmers' cooperatives (34.2%) were similar, indicating that some consumers prefer to engage through information dissemination or direct collaboration. Notably, 24.5% of consumers reported having "never participated" in any agricultural support activities, suggesting room for increasing consumer engagement. Other methods accounted for a relatively low proportion (15%), indicating that mainstream support approaches remain dominant (Figure 10).

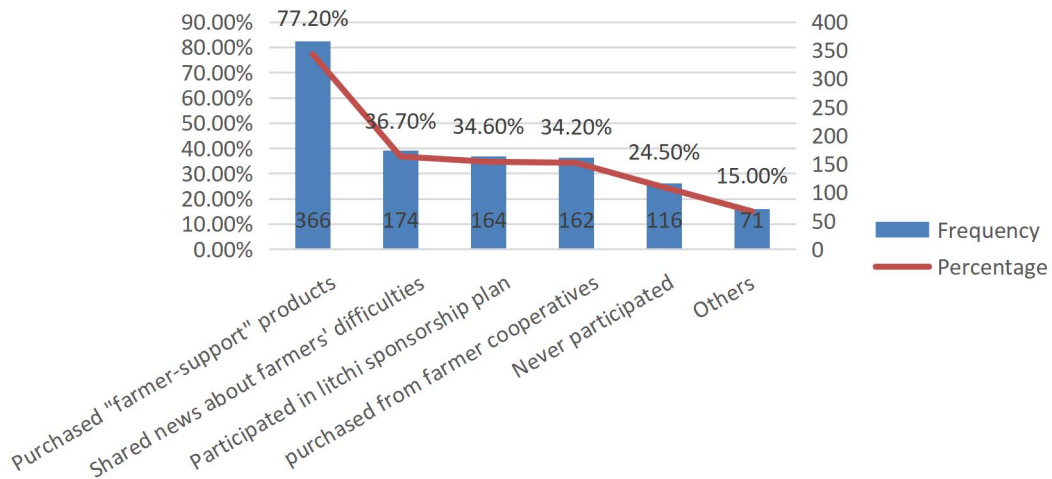


Figure 10 Agricultural Support Actions

(2) Product Improvement Requirements and Deep Processing Preference Analysis

Survey results on consumer expectations for litchi product improvements (Figure 11) reveal that "longer shelf-life packaging" emerged as the most urgent demand, with 290 respondents (61.2%) selecting this option. This aligns closely with the previously identified constraint of "short preservation periods," highlighting the critical role of extended shelf life in unlocking consumption potential. The second most popular suggestion was "smaller portion sizes/portable packaging" (54.6%, 259 respondents), reflecting modern households' preference for convenient, portion-controlled packaging in compact lifestyles. Additionally, "organic certification" was chosen by 227 respondents (47.9%), indicating clear consumer demand for healthier production methods. In contrast, demands for "expanded product variety" (38.0%) and "price reduction" (33.8%) showed relatively weaker traction, suggesting that product diversity and pricing strategies aren't currently the primary focus areas for improvement.

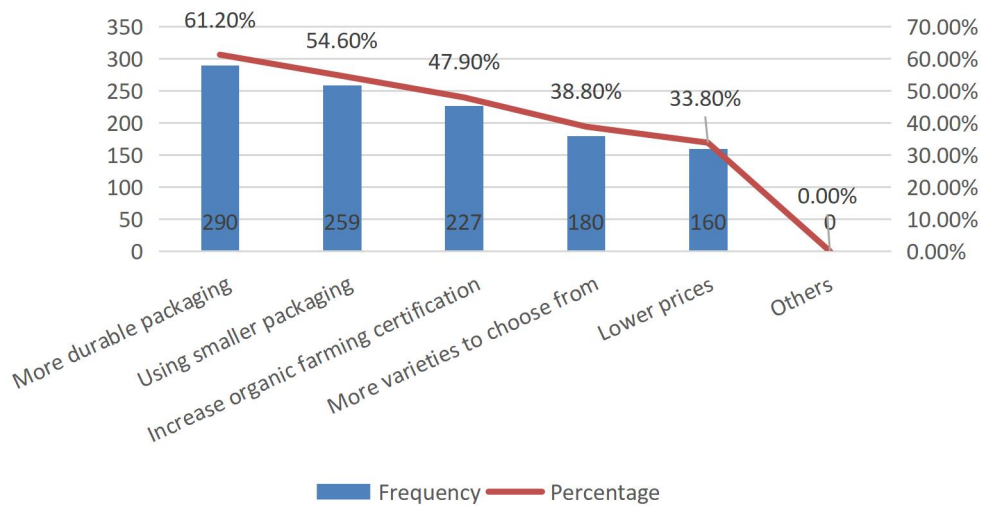


Figure 11 Consumer Expectations for Improvement Directions of Litchi Products

Regarding deep-processed litchi products (Figure 12), "litchi juice" demonstrated the highest consumer preference, with 246 respondents selecting it (51.9%), likely due to its ready-to-drink nature and broad market acceptance. "Litchi fruit wine" followed closely at 231 selections (48.7%), highlighting the appeal of alcoholic beverages to younger demographics. "Litchi dried fruit" and "litchi jam" were chosen by 189 respondents (39.9%) and 169 (35.7%) respectively, primarily attributed to their long shelf life and versatile consumption scenarios. Overall, preferences for deep-processed products are closely tied to preservation requirements and convenience, providing clear direction for value enhancement and industrial expansion in the litchi sector.

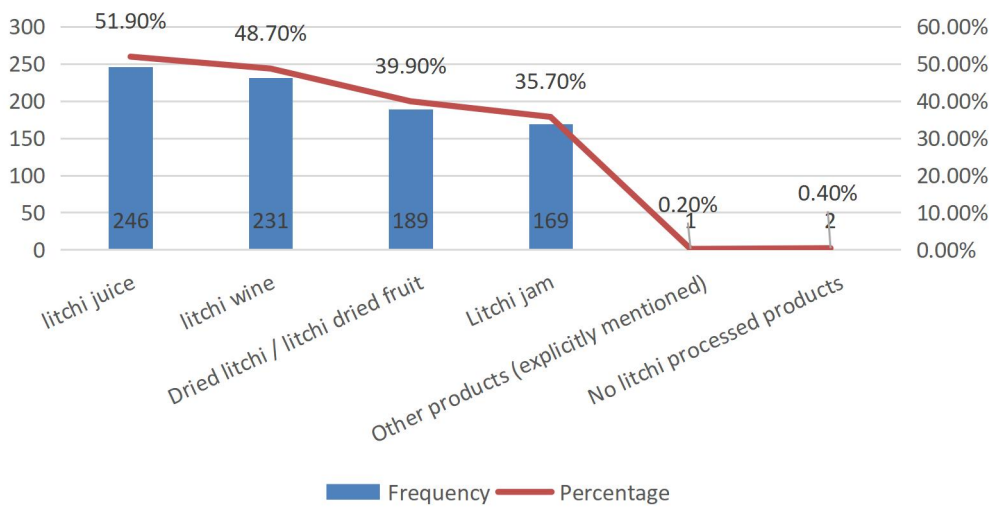


Figure 12 Deep-processed Litchi Products Consumers are Willing to Try

(3) Consumer demands

To gain a more comprehensive understanding of consumer demands, this study conducted textual analysis on responses to the open-ended question (Question 29: "What suggestions do you have regarding the production, management, logistics, and marketing of Guangdong litchis?"). We utilized WPS Micro Word Cloud to generate a visual analysis chart of high-frequency consumer suggestions, specifically a word cloud diagram (Figure 13), which provides a clear and intuitive statistical representation of key terms. The size of words in the word cloud diagram is positively correlated with their frequency of occurrence.



Figure 13 Visualization Analysis of Consumer-Suggested High-Frequency Terms

Through analysis of the word cloud chart, we identified that consumer suggestions predominantly focused on logistics and supply chain optimization, product and marketing innovation, price and quality control, as well as sustainable development. These qualitative insights corroborate the quantitative data conclusions, collectively forming a comprehensive and multidimensional understanding.

The word cloud analysis highlights keywords such as "logistics," "freshness preservation," "loss," and "speed," directly reflecting consumers' strong demand for improving cold chain efficiency, reducing transportation losses, and adopting innovative preservation packaging technologies. This precisely explains why quantitative data shows 62.9% of consumers reduce purchases due to "short shelf life" concerns, as well as their generally average evaluation of "freshness upon delivery" in online purchases. Meanwhile, high-frequency terms like "collaborative brands," "beverages," "processed products," and "diversification" demonstrate consumers' expectations for product innovation and expanded consumption scenarios. For instance, suggestions to partner with tea brands for co-branded beverages and develop deep-processing product lines align perfectly with the survey results showing over half of consumers willing to try litchi juice and fruit wines. These findings confirm that product innovation remains a crucial pathway to breaking consumption barriers and enhancing product value-added.

In terms of price and quality, terms like "reduction," "pricing," "quality," and "transparency" frequently appear, indicating that consumers are not solely pursuing low prices but seeking a balance between reasonable pricing and stable quality. They also hope to build trust through transparent supply chain information—a finding supported by survey data showing 73.0% of consumers prioritize price and 51.1% believe this year's litchis "match quality with price." Additionally, long-tail keywords such as "cultivation," "technology," "branding," "farmers," "agricultural support," and "sustainability" in the word cloud, though less frequent, carry profound significance. These reveal that some consumers have moved beyond individual consumption perspectives to focus on industry-wide issues like farming techniques, agricultural support models, and sustainable brand practices. This aligns with quantitative data showing over one-third of consumers have participated in agricultural support activities, suggesting brands can leverage these insights to build emotional connections and differentiated value propositions.

4 DISCUSSION AND POLICY RECOMMENDATIONS

4.1 Discussion: Core Contradictions in the Litchi Industry

By integrating supply-side and demand-side findings, this study identifies several structural contradictions that explain the phenomenon of "increased production without income growth."

4.1.1 Rigid supply structure vs. weak demand upgrading

On the supply side, production is characterized by homogeneous varieties, traditional cultivation methods, and limited technological innovation. On the demand side, consumers primarily focus on price and basic quality attributes, with limited willingness to pay for branding or differentiation.

This mismatch results in a market equilibrium dominated by low-price competition, preventing producers from capturing higher value.

4.1.2 Channel dependence vs. diversified consumption patterns

Producers rely heavily on traditional offline channels and intermediaries, which weakens their bargaining power. In contrast, consumers are gradually adopting diversified purchasing channels, including e-commerce and social commerce.

The lack of alignment between supply-side distribution methods and demand-side consumption patterns creates inefficiencies and limits market expansion.

4.1.3 Weak brand awareness vs. rising quality expectations

Although consumers place limited emphasis on branding, they have increasingly high expectations regarding freshness, taste, and overall quality. However, weak brand development and inadequate quality signaling prevent producers from effectively communicating product value.

As a result, high-quality products often fail to achieve premium prices, leading to value distortion in the market.

4.1.4 Technological constraints vs. upgraded consumption experience

Consumers increasingly demand convenient purchasing experiences, reliable logistics, and high product quality. However, supply-side limitations—particularly in preservation technology, cold chain logistics, and standardized production—create a “last-mile” barrier.

This technological gap restricts the ability of producers to meet evolving consumer expectations and capture higher-value market segments.

4.2 Policy Recommendations

4.2.1 Optimize production structure and promote variety differentiation

Local governments should spearhead the development of a "Litchi Seasonal Distribution Plan" by providing planting subsidies to guide farmers in cultivating early-maturing, mid-maturing, and late-maturing varieties in batches, or employing technical measures to regulate harvest timing to prevent price fluctuations caused by concentrated short-term sales. The adoption of protected cultivation methods such as greenhouses and cold storage sheds can also extend fresh fruit supply periods and alleviate market pressure. Additionally, extending the industrial chain through the establishment of deep-processing industrial parks to develop high-value-added products like dried litchis, litchi wine, and lyophilized litchis will reduce reliance on fresh fruit sales and meet consumers' demand for diversified products.

4.2.2 Build an multichannel system to break channel dependency

Establish e-commerce incubation bases in production areas to provide fruit farmers with training on live-streaming sales and logistics subsidies, enabling more litchis to reach consumers through online platforms. Collaborate with community group-buying platforms to create "litchi specialty zones" that meet consumers' demand for next-day delivery services. Optimize traditional distribution channels by facilitating partnerships between farmers and buyers through a "guaranteed minimum price + floating premium" model, preventing cutthroat price competition and enhancing farmers' bargaining power.

4.2.3 Strengthen brand building and quality standardization

Enhance promotional efforts for the geographical indication certification of "Maoming Litchi," establish unified quality standards (such as sugar content and fruit diameter), and boost brand awareness through advertising campaigns and exhibition participation. Encourage fruit growers to create independent brands, improve product packaging and labeling, and develop a traceability system for branded litchis. Consumers can scan QR codes to access full-process information covering cultivation, harvesting, and transportation, thereby strengthening trust.

4.2.4 Addressing technological gaps and upgrading consumer experience

Introduce intelligent preservation technologies and popularize pre-cooling equipment in production areas. Provide equipment purchase subsidies to fruit farmers adopting new technologies to minimize post-harvest loss rates. Collaborate with logistics enterprises to establish cold chain warehouses in production regions, promoting an integrated "pre-cooling + cold chain + e-commerce" model to reduce transportation costs and enhance delivery speed, achieving next-day delivery coverage in core cities.

4.2.5 Establish collaborative mechanisms to drive comprehensive chain upgrades

Establishing industrial alliances to integrate resources from fruit growers, processing enterprises, logistics providers, and e-commerce platforms, we create a shared-interest mechanism that drives the transition from "fragmented cultivation" to "cluster-based development." These alliances consolidate resources across planting, processing, logistics, and sales channels. Through profit-sharing mechanisms, risk-sharing arrangements, and resource pooling, they facilitate technological upgrades, product innovation, skills training, and joint brand marketing. By breaking down fragmented business models and forming tightly-knit collaborative networks, we empower the litchi industry to shift from "quantity competition" to "quality and value competition." The ultimate goal is to achieve industrial upgrading and income growth through stable production output, unimpeded distribution channels, premium-branded products, high-quality customer experiences, and increased farmer incomes.

5 CONCLUSION

The phenomenon of “increased litchi production without corresponding income growth” in Maoming reflects a complex interaction of supply-side inefficiencies and demand-side constraints.

This study demonstrates that oversupply, rising costs, weak branding, technological limitations, and mismatches between production and consumption patterns are the primary causes of this issue. At the same time, consumer behavior remains highly price-sensitive, with limited brand awareness and strong emphasis on freshness and quality.

Addressing this problem requires a comprehensive approach that integrates production optimization, technological innovation, market development, and policy support. By aligning supply-side improvements with evolving consumer demand, the litchi industry can transition from quantity-driven growth to high-quality, value-oriented development.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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