

## Article

# Exploring Consumer Acceptance of Environmentally Friendly Intermediate Farming: A Grouping Approach Based on Consumers' Purchase Preferences

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## Abstract

Debates on sustainability have focused mainly on conventional and organic farming. However, little attention has been given to intermediate production approaches with potential benefits for environmental protection, food affordability, and food safety. This study investigated consumers' acceptance of an intermediate farming method characterized by minimal use of agrochemicals. Using a preference-based grouping approach, 184 Japanese consumers were divided into organic-prone (OA-prone), conventional-prone (CA-prone), and balance-prone groups ( $\chi^2$  test,  $p < 0.001$ ). The results revealed clear differences in how these groups evaluated and responded to the produce from the intermediate farming method. OA-prone consumers tended to evaluate such produce against the standards associated with organic food and therefore showed more cautious acceptance. In contrast, CA- and balance-prone consumers demonstrated relatively higher acceptance when product safety and taste were assured, reflecting a more pragmatic evaluation based on functional attributes and affordability. These findings suggest that the promotion of environmentally friendly intermediate farming depends more on pragmatic CA- and balance-prone consumers rather than those value-driven organic consumers. By highlighting consumer heterogeneity in the evaluation of such farming systems, this study contributes to a broader understanding of sustainable food consumption and underscores the role of intermediate farming in bridging environmental sustainability and food security.

**Keywords:** purchase preferences; consumer grouping; consumer perception; intermediate farming; sustainable food consumption

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## 1. Introduction

Debates on sustainable agriculture have long been dominated by dichotomous framing that contrasts conventional and organic farming systems. Within this framework, conventional agriculture is often viewed as being associated with environmental degradation and food safety concerns, whereas organic agriculture is widely regarded as the benchmark for environmental sustainability [1–6]. This binary perspective has played an important role in shaping policy orientations and consumer perceptions. However, must environmentally friendly agriculture be defined exclusively by the complete avoidance of

agrochemicals, such as organic agriculture, or can intermediate approaches that substantially reduce inputs also be accepted as environmentally friendly?

Concerns about the impact of conventional agriculture on the environment, food safety and security, and human health have intensified in recent years, mainly because of the overuse of agrochemicals [7–11]. In response, organic agriculture, defined by the avoidance of agrochemicals, has been promoted as an alternative approach to achieve agricultural sustainability [12]. This trend has been reflected in many policy initiatives to expand organic farming. For example, the European Commission's Farm to Fork Strategy aims to convert at least 25% of the EU's agricultural land to organic farming by 2030 [13], whereas Japan's Green Food System Strategy (Midori Strategy) targets a similar share of arable land by 2050 [14]. These initiatives have reinforced the perception that sustainability in agriculture is primarily defined by avoiding the use of agrochemicals.

However, organic agriculture faces practical limitations that challenge its status as the sole benchmark of agricultural sustainability. Despite its environmental advantages, organic agriculture is often associated with lower yields and higher labor demands, raising concerns about its contribution to food security on a larger scale [15]. Moreover, with its expansion and commercialization, certain organic practices, such as excessive application of composted manure, may also generate environmental risks, including nitrate contamination in soil, water, and crops [16]. On the contrary, conventional agriculture has substantially reduced the harm to the environment, biodiversity, and human beings [17]. Practices such as precision fertilization and targeted pesticide application have significantly improved input efficiency while maintaining yield stability [18,19]. However, these developments are rarely reflected in public perceptions. Consumer evaluations remain largely anchored in the traditional organic–conventional divide. This mismatch between agronomic realities and public perceptions reveals a bias in prevailing sustainability narratives that assess farming systems mainly by the use or avoidance of agrochemicals [20,21].

Such a bias leaves little room for intermediate farming systems that fall between conventional and organic agriculture, particularly those that achieve substantial reductions in agrochemical inputs beyond existing intermediate standards. These systems have emerged globally, offering an alternative perspective on agricultural sustainability [22]. That is, sustainability is better understood as a spectrum of practices with varying degrees of input reduction rather than a simple choice between conventional and organic farming [23]. Policy initiatives such as Low Input Farming Systems (LIFS) in Europe [24,25], China's Zero Growth in Chemical Fertilizer Use policy [26], and Japan's Eco-Farmer program and Specially Cultivated Agricultural Products certification [27–30] provide concrete examples of such intermediate farming approaches.

Nevertheless, despite their agronomic rationale and policy support, these systems remain poorly understood in terms of consumer perception. Organic agriculture continues to be upheld as the exclusive gold standard for environmental sustainability, while all these intermediate farming approaches tend to be grouped in the non-organic group and are perceived as inferior alternatives [21,31]. A possible explanation is that even when these systems reduce agrochemical use by 30–50%, the actual inputs remain substantial, often accounting for 50–70% of conventional levels, which may lead consumers to perceive them as less environmentally sustainable. However, emerging agronomic evidence indicates that extremely low levels of agrochemical use, when properly managed, can maintain crop yields without evident environmental damage [32,33]. Therefore, based on the continuity of reducing agrochemicals, this study aims to investigate an intermediate farming method characterized by minimal agrochemical use. Given that the concept of 'minimal use of agrochemicals' lacks a clear definition in the existing literature, this study adopts a conservative and operational definition by setting the threshold at one-eighth of

the conventional-input level. This threshold is typically applied only under emergency or temporary auxiliary conditions, highlighting the potential of minimal agrochemical use to maintain yields while reducing environmental impact, thereby contributing to food security.

However, the adoption of such reduced-input systems ultimately depends on consumer acceptance, which in turn shapes food choice patterns and food system sustainability [34,35]. Extensive research has examined consumer perceptions and purchasing behaviors related to organic produce [35,36]. These studies have identified factors such as income, health awareness, convenience of purchase, environmental concern, and product knowledge as key determinants of purchase behaviors [37–39]. These findings have advanced understanding consumer motivations and helped promote organic produce. In contrast, consumer research on intermediate farming methods remains relatively limited. Moreover, the few existing studies have mainly focused on consumers' willingness to pay for reduced-pesticide produce [40–43], and have relied heavily on sociodemographic variables, such as age, gender, family income, and education level, to explain acceptance [37,44]. Consequently, it remains unclear which types of consumers are more likely to accept intermediate farming methods and why, particularly beyond observable demographic differences.

To address these gaps, this study adopts a preference-based grouping approach to explore consumer acceptance of an intermediate farming method characterized by minimal agrochemical use. Unlike demographic grouping, which assumes homogeneous preferences within demographic categories, preference-based grouping captures heterogeneity in consumers' values, attitudes, and motivations [45–47]. By applying a preference-based grouping method, we identified which consumer types are more likely to accept produce from intermediate farming systems and understood the underlying reasons for acceptance or rejection. Therefore, this study contributes to the literature by identifying distinct consumer groups with varying levels of acceptance of an intermediate farming method with minimal agrochemical use, an environmentally friendly method beyond conventional and organic divide. This study provides theoretical insights into consumer behavior and practical guidance for designing targeted communication strategies, while highlighting the implications of consumer acceptance for sustainability and food security.

To summarize, this study addresses the following research questions: First, can agricultural produce from an intermediate farming method be accepted by consumers as environmentally friendly? Second, does consumer acceptance of this produce differ across consumer groups with distinct food choice preferences? Third, what are the implications of these preference-based differences in acceptance for the promotion of produce derived from intermediate farming methods? By addressing these questions, this study seeks to clarify the role of intermediate farming in bridging environmental sustainability and food security from a consumer perspective.

## 2. Materials and Methods

### 2.1. Survey Design and Data Collection

This study conducted a consumer survey in Shizuoka Prefecture, which is famous for its tea and horticultural produce in Japan [48]. Shizuoka Prefecture was chosen as the investigation site for the following reasons. First, Shizuoka Prefecture is often known as a 'Goldilocks market' in Japan [49]. Its population and economic situation represent a medium-sized regional market that accounts for approximately 3% of Japan's national economy [50]. Therefore, Shizuoka Prefecture is generally regarded as stable and moderate in scale, making it suitable for market-level consumer surveys. It is located in central Japan, connecting the east and west and forming a unique microcosm of national diversity [49].

Second, Shizuoka Prefecture is a pioneer in promoting environmentally friendly farming practices. According to a survey report on the number of certified organic agriculture operators released in March 2024, there were 3945 certified operators in the country [51]. Shizuoka Prefecture had 126 operators, accounting for about 3.2% of the national total and ranking seventh nationwide [51]. This relatively high number of certified operators indicates that Shizuoka Prefecture has played an important role in promoting environmentally friendly agricultural practices in Japan. Such an environment provides consumers with more opportunities to access sustainable agricultural produce. Overall, these characteristics make Shizuoka Prefecture a suitable place to study consumers' views on an intermediate farming method that minimizes agrochemical use as a sustainable farming alternative.

The survey was conducted at two places, the Natural Farming Academy (the Oohito Farm) and the Sano Experimental Farm (the Sano Farm), both located in eastern Shizuoka Prefecture. The Oohito Farm in Izunokuni City (approximately 35°02 N, 138°57 E) is a multifunctional institution that combines agricultural production, education, and research, and is famous for its natural farming practices [52]. Seated in Mishima City (approximately 35°07 N, 138°55 E), Sano Farm serves local residents by providing hands-on opportunities to practice organic cultivation methods. It is not only an educational platform but also a community-based experimental field for environmentally friendly agriculture [53]. These two farms hold harvest experience activities between November and December every year. They provide community gatherings and opportunities for the public to participate and learn about local farming practices. Approximately 1400 participants visited the Oohito Farm on November 16, 2024, and the event at the Sano Farm on December 8, 2024, attracted around 400 participants. Both events included harvest experiences, sustainable farming demonstrations, and produce markets where agricultural produce was sold at lower prices than the market price. Due to the openness and community-oriented nature of these events, participants included not only consumers who were interested in organic produce but also many local residents and visitors who were attracted by agricultural experiences and opportunities to purchase fresh agricultural produce. This allowed our survey to capture the diverse views of consumers in the Shizuoka Prefecture.

Data were collected through on-site, self-administered questionnaires at the Oohito and Sano Farms on 16 November 2024, and 8 December 2024, respectively. Participants were first given a brief explanation of the purpose of this research and then completed the questionnaire independently. As the concept of intermediate farming produce was newly proposed in this study and was not expected to be familiar to respondents, all participants were provided with a standardized explanation of the concept prior to completing the questionnaire. The survey was carried out after this explanation was provided. To minimize interviewer bias and ensure data reliability, no additional explanations were provided during the survey unless explicitly requested by the participants. A total of 200 questionnaires were distributed, of which 193 were returned. The sample included 125 questionnaires from the Oohito Farm and 68 questionnaires from the Sano Farm, with a response rate of 95.5%. After excluding incomplete responses, 184 valid questionnaires were analyzed.

## 2.2. Questionnaire Design

The questionnaire aimed to examine consumers' perceptions and acceptance of agricultural produce grown under different farming systems. Particular attention was given to the intermediate farming method that minimizes agrochemical use ( $\leq 1/8$  of conventional levels). It covered 11 items, including sociodemographic characteristics, information sources, purchasing priorities and preferences, risk perception, and perceptions and acceptance willingness of produce from different farming methods. For the analysis,

the questions were grouped as follows: sociodemographic variables (Q1–Q2), information sources (Q3), purchasing priorities and preferences (Q4–Q5), risk perception regarding agricultural inputs (Q7), and perceptions/acceptance of produce from different farming methods (Q6, Q8–Q11). Question 3 asked the participants about the main sources of information, such as newspapers, television, social media and word of mouth. It was only collected for background reference and was not included in the analysis of this study.

The questionnaire design was based on previous research on organic and other sustainable agricultural produce [2,6,36,54,55]. Prior to implementation, the questionnaire was reviewed by specialists in agricultural economics and consumer behavior. It consisted of both ranking questions and Likert-type questions, which are commonly used in consumer studies to assess the relative importance of produce attributes and attitudes toward food quality, safety, and sustainability [56,57]. This mixed question type can capture how consumers weigh the pros and cons of different produce attributes and their related production methods from multiple perspectives.

### 2.3. Data Analysis

The present study adopts a preference-based grouping approach based on consumers' actual purchase preferences rather than conducting data-driven market segmentation. All statistical analyses were performed using IBM SPSS Statistics 27 (IBM Corp., Armonk, NY, USA). For the Chi-square analysis, the collected questionnaire responses were recoded and dichotomized. To allow respondents to express their views more comfortably, the questionnaire originally offered four response options rather than forcing a strict binary (yes/no) choice. This transformation was performed to satisfy the statistical assumptions of the chi-square test, ensuring that the expected cell counts were sufficient for reliable inference. Simultaneously, dichotomization makes it easier to compare consumer groups clearly [58,59]. We admit that this process may reduce some information compared with the original multilevel responses. However, this trade-off is common in studies using categorical tests and is necessary to ensure that the results are statistically valid and easy to interpret. The following section describes how each key variable was defined and coded for the analysis.

For example, age was coded as 0 (younger, <50 years) and 1 (older, ≥50 years), which reflects a common method of distinguishing between younger and older consumer groups. Similarly, the variables originally measured using the four-level scale were transformed into binary variables. For instance, the responses were coded as 0 = disagree/somewhat disagree and 1 = agree/somewhat agree. Ranking-based questions were similarly dichotomized. If the ranking was among the top three purchase priorities, the answer code was 1; otherwise, the code was 0. To be consistent with the analysis, gender, household financial status, and educational attainment were also dichotomized. Given the relatively homogeneous distribution of formal educational attainment of consumers in Japan, educational attainment was used instead of educational background, as it more directly reflects individuals' openness to and evaluation of new agricultural concepts. The complete definitions and coding schemes for all key variables are presented in Table S1.

Descriptive statistics are presented as percentages (%). According to consumers' purchase preferences (Q5), they were divided into three groups: organic-prone (OA-prone), balance-prone, and conventional-prone (CA-prone). Intergroup differences in demographic characteristics, purchasing priorities, and perceptions were assessed using Pearson's chi-square test or Fisher's exact test. When the overall chi-square tests showed significance ( $p < 0.05$ ), post hoc pairwise comparisons were conducted with Bonferroni correction to adjust for multiple testing and control of the error rate.

## 2.4. Ethical Approval Statement

This study was based on anonymous consumer questionnaires and did not involve the collection of personal identification or sensitive information. All participants participated voluntarily and signed an informed consent form before the study. All data were anonymized before analysis, and no foreseeable risks to the participants were identified. The Ethics Committee of Shizuoka University confirmed that this study did not require formal ethical approval on 3 March 2024.

## 3. Results

### 3.1. Sample Characteristics

The sample consisted of 184 consumers, with slightly more older consumers (>50 years, 57.6%) than younger consumers (42.4%), and more females (55.4%) than males (44.6%). Most respondents reported sufficient household income (64.7%), whereas 35.3% considered it insufficient. Attitudes toward education were relatively balanced, with 44.0% of the participants considering education important. Based on consumers' purchase preferences, they were classified as organic-prone (OA-prone, 47.2%), balance-prone (19.6%), and conventional-prone (CA-prone, 33.2%). This classification was based on relative purchase volumes of organic and conventional produce. There was a significant difference in the distribution of consumers among the three purchasing groups ( $p < 0.001$ ). Post hoc pairwise comparisons with Bonferroni correction further revealed that the OA-prone group was significantly larger than both the balance-prone ( $p < 0.001$ ) and CA-prone groups ( $p = 0.033$ ), and the balance-prone group differed significantly from the CA-prone group ( $p = 0.011$ ), suggesting that organic-prone consumers represent a dominant group in this sample. Given these significant variations in purchase preferences, we further examined whether demographic characteristics differed within and between the three groups.

### 3.2. Demographic Differences Across Purchase Preference Groups

Demographic characteristics were further examined within and between the three purchase preference groups (Table 1). Significant within-group differences were observed mainly in the OA-prone group, where older consumers (65.5%) were more prevalent than younger consumers (34.5%). In contrast, age distribution did not differ significantly between the balance-prone and CA-prone groups. Household financial status also differed significantly only within the OA-prone group, with 71.3% reporting sufficient resources compared to 28.7% reporting insufficient resources, while in the other groups, the differences were not significant. Regarding attitude toward education, within the OA-prone group, consumers were significantly more likely to consider education unimportant (60.9%) than important (39.1%), whereas the other groups showed no significant differences. Sex distribution showed no significant differences within or between the three groups.

In summary, significant within-group differences were observed in the OA-prone group for age, household financial status, and attitudes towards education, while sex showed no significant differences. However, the demographic characteristics did not differ significantly between the groups.

**Table 1.** Distribution of consumers by age, gender, income, and education across purchase preference groups (%).

| Demographic Characteristics | Group           | Purchase Preference Groups   |                                   |                              | $\chi^2$ | <i>p</i> -Value | Sig. |
|-----------------------------|-----------------|------------------------------|-----------------------------------|------------------------------|----------|-----------------|------|
|                             |                 | OA-Prone<br>( <i>n</i> = 87) | Balance-Prone<br>( <i>n</i> = 36) | CA-Prone<br>( <i>n</i> = 61) |          |                 |      |
| Age                         | Young           | 34.5                         | 50.0                              | 49.2                         | 4.233    | 0.120           | ns   |
|                             | Old             | 65.5                         | 50.0                              | 50.8                         |          |                 |      |
|                             | $\chi^2$        | 8.379                        | 0.000                             | 0.016                        |          |                 |      |
|                             | <i>p</i> -value | 0.004                        | 1.000                             | 0.898                        |          |                 |      |
|                             | Sig.            | **                           | ns                                | ns                           |          |                 |      |
| Sex                         | Female          | 57.5                         | 55.6                              | 52.5                         | 0.365    | 0.833           | ns   |
|                             | Male            | 42.5                         | 44.4                              | 47.5                         |          |                 |      |
|                             | $\chi^2$        | 1.943                        | 0.444                             | 0.148                        |          |                 |      |
|                             | <i>p</i> -value | 0.163                        | 0.505                             | 0.701                        |          |                 |      |
|                             | Sig.            | ns                           | ns                                | ns                           |          |                 |      |
| Household financial status  | Insufficient    | 28.7                         | 36.1                              | 44.3                         | 3.796    | 0.150           | ns   |
|                             | Sufficient      | 71.3                         | 63.9                              | 55.7                         |          |                 |      |
|                             | $\chi^2$        | 15.736                       | 2.778                             | 0.803                        |          |                 |      |
|                             | <i>p</i> -value | <0.001                       | 0.09                              | 0.37                         |          |                 |      |
|                             | Sig.            | ***                          | ns                                | ns                           |          |                 |      |
| Education attitude          | Unimportant     | 60.9                         | 58.3                              | 47.5                         | 2.705    | 0.259           | ns   |
|                             | important       | 39.1                         | 41.7                              | 52.5                         |          |                 |      |
|                             | $\chi^2$        | 4.149                        | 1.000                             | 0.148                        |          |                 |      |
|                             | <i>p</i> -value | 0.043                        | 0.317                             | 0.701                        |          |                 |      |
|                             | Sig.            | *                            | ns                                | ns                           |          |                 |      |

Notes: OA = organic agriculture; CA = conventional agriculture. OA-prone consumers predominantly purchase organic produce; balance-prone consumers purchase organic and conventional produce at similar levels; CA-prone consumers predominantly purchase conventional produce. Within-group comparisons are shown within columns, and between-group comparisons across rows. Between-group differences were examined using Bonferroni-corrected pairwise comparisons following chi-square or Fisher's exact tests, as appropriate. ns, not significant; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

### 3.3. Purchase Priorities and Risk Perceptions Difference Across Purchase Preference Groups

Consumers' purchase priorities differed significantly among the three purchase preference groups (Table 2). Price was the leading factor for consumers in the CA- and balance-prone groups, whereas OA-prone consumers placed substantially less emphasis on price ( $p < 0.001$ ). Safety emerged as the most salient priority for OA-prone consumers, with nearly all respondents in this group considering it important, whereas safety was less frequently prioritized by balance-prone and CA-prone consumers ( $p < 0.001$ ). Environmental concerns further distinguished OA-prone consumers from other groups, as a markedly higher proportion of OA-prone consumers considered it important ( $p < 0.001$ ). Taste, nutrition, and appearance were similarly valued across the groups, with no significant differences observed.

The perceived harmfulness of agricultural inputs to health and the environment was similar across the three purchase preference groups (Table S2). Regardless of purchase preference, most consumers regarded insecticides and herbicides as harmful, and a majority also perceived chemical fertilizers as harmful, accounting for 60–75% of the participants. Perceptions of genetically modified organisms were more heterogeneous, with

moderate levels (40–60%) of concern observed across all groups. However, none of these perceptions differed significantly between the purchase preference groups.

**Table 2.** Differences in purchase priorities across purchase preference groups (%).

| Purchase Preference Groups | Price  | Safety | Taste  | Nutrition | Appearance | Environmental Concern |
|----------------------------|--------|--------|--------|-----------|------------|-----------------------|
| OA-prone                   | 42.5 b | 98.9 a | 70.1 a | 47.1 a    | 11.4 a     | 33.3 a                |
| Balance-prone              | 75.0 a | 77.8 b | 77.8 a | 47.2 a    | 13.9 a     | 8.3 b                 |
| CA-prone                   | 86.9 a | 86.9 b | 67.2 a | 41.0 a    | 14.8 a     | 3.3 b                 |
| $\chi^2$                   | 32.988 | 15.119 | 1.242  | 0.627     | 1.867      | 24.560                |
| <i>p</i> -value            | <0.001 | <0.001 | 0.531  | 0.759     | 0.422      | <0.001                |
| Sig.                       | **     | **     | ns     | ns        | ns         | **                    |

Notes: Chi-square or Fisher's exact tests were used to assess group differences. Values in a column with different letters differ significantly (Bonferroni-corrected). ns, not significant; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

### 3.4. Consumers' Perceptions of Agricultural Systems Across Purchase Preference Groups

Consumers' perceptions of organic produce were generally positive across all purchase preference groups (Table S3). Differences between the groups were mainly found in the perceptions of nutrition ( $p < 0.001$ ) and taste ( $p = 0.002$ ). OA-prone consumers were most likely to perceive organic produce as highly nutritious (95.4%) and tasty (97.7%), whereas CA-prone consumers reported lower levels of these positive perceptions (75.4% for nutrition and 83.6% for taste). The balance-prone group showed intermediate perceptions of nutrition and taste comparable to those of CA-prone consumers. In contrast, perceptions of price, safety, appearance, and environmental impact did not differ significantly across the groups.

Regarding produce from the intermediate farming method with minimal agrochemical use (Table 3), consumer perceptions differed across purchase preference groups, particularly with respect to safety ( $p = 0.024$ ) and environmental impact ( $p = 0.010$ ). CA-prone consumers expressed the most favorable views, with more than four-fifths of consumers perceiving this produce as safe and environmentally friendly. In contrast, OA-prone consumers were less convinced of its high safety (67.8%), while balance-prone consumers showed the lowest level of agreement regarding its environmental benefits (55.6%). Perceptions of price, nutrition, taste, appearance did not differ significantly across the groups.

**Table 3.** Consumer perceptions of produce from the intermediate farming method with minimal agrochemical use across purchase preference groups (%).

| Purchase Preference Groups | High Price | High Safety | High Nutrition | Good Taste | Good Appearance | Low Environmental Impact |
|----------------------------|------------|-------------|----------------|------------|-----------------|--------------------------|
| OA-prone                   | 63.2 a     | 67.8 b      | 66.7 a         | 65.8 a     | 67.8 a          | 73.6 ab                  |
| Balance-prone              | 72.2 a     | 69.4 ab     | 63.9 a         | 58.3 a     | 63.9 a          | 55.6 b                   |
| CA-prone                   | 78.7 a     | 86.9 a      | 70.5 a         | 65.6 a     | 50.8 a          | 83.6 a                   |
| $\chi^2$                   | 4.190      | 7.447       | 0.489          | 1.280      | 4.487           | 9.120                    |
| <i>p</i> -value            | 0.121      | 0.024       | 0.819          | 0.521      | 0.109           | 0.010                    |
| Sig.                       | ns         | *           | ns             | ns         | ns              | *                        |

Notes: Chi-square or Fisher's exact tests were used to assess group differences. Values in a column with different letters differ significantly (Bonferroni-corrected). ns, not significant; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

### 3.5. Consumer Evaluation and Purchase Intention for Produce with Minimal Agrochemical Use

Tables 4 and 5 present consumers' comparative evaluations of produce from the intermediate farming method with minimal agrochemical use and their willingness to purchase it under specific conditions. When compared with organic produce (Table 4), evaluations differed across the purchase preference groups. OA-prone consumers were more likely to rate produce with minimal agrochemical use as inferior to organic produce than CA-prone consumers ( $p = 0.012$ ). By contrast, when compared with conventional produce, most consumers in all three groups rated produce with minimal agrochemical use as better, and no significant differences were observed between the groups.

**Table 4.** Consumer perceptions of intermediate farming produce versus organic and conventional produce across purchase preference groups (%).

| Purchase Preference Groups | Comparison with OA Produce |        |        | Comparison with CA Produce |        |        |
|----------------------------|----------------------------|--------|--------|----------------------------|--------|--------|
|                            | Worse                      | Same   | Better | Worse                      | Same   | Better |
| OA-prone                   | 59.8 a                     | 17.2 a | 23.0 a | 6.9 a                      | 19.5 a | 73.6 a |
| Balance-prone              | 58.3 ab                    | 22.2 a | 19.4 a | 13.9 a                     | 22.2 a | 63.9 a |
| CA-prone                   | 36.1 b                     | 31.1 a | 32.8 a | 3.3 a                      | 21.3 a | 75.4 a |
| $\chi^2$                   | 8.873                      | 3.946  | 2.686  | 3.658                      | 0.136  | 1.635  |
| $p$ -value                 | 0.012                      | 0.134  | 0.276  | 0.189                      | 0.943  | 0.459  |
| Sig.                       | *                          | ns     | ns     | ns                         | ns     | ns     |

Notes: Chi-square or Fisher's exact tests were used to assess group differences. Values in a column with different letters differ significantly (Bonferroni-corrected). ns, not significant; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

The willingness to purchase produce with minimal agrochemical use under specific conditions is shown in Table 5. Differences between the purchase preference groups were limited and occurred mainly between the OA-prone and CA-prone groups. Specifically, CA-prone consumers showed a higher willingness to purchase when provided with proof of no health impact and when the taste was equal to that of organic produce, compared with OA-prone consumers ( $p = 0.033$  and  $p = 0.001$ , respectively). In contrast, willingness to purchase under the remaining conditions, such as proof of no environmental impact, price and appearance equal to conventional produce, and nutrition equal to organic produce, did not differ significantly across the groups.

**Table 5.** Willingness to purchase intermediate farming produce under different conditions across purchase preference groups (%).

| Purchase Preference Groups | Price Equal to CA | Proof of No Health Impact | Nutrition Equal to OA | Taste Equal to OA | Appearance Equal to CA | Proof of No Environmental Impact |
|----------------------------|-------------------|---------------------------|-----------------------|-------------------|------------------------|----------------------------------|
| OA-prone                   | 69.0 a            | 75.9 b                    | 71.3 a                | 64.4 b            | 63.2 a                 | 73.6 a                           |
| Balance-prone              | 80.6 a            | 86.1 ab                   | 83.3 a                | 72.2 ab           | 72.2 a                 | 83.3 a                           |
| CA-prone                   | 85.2 a            | 91.8 a                    | 86.9 a                | 86.9 a            | 72.1 a                 | 83.6 a                           |
| $\chi^2$                   | 5.692             | 6.784                     | 5.788                 | 9.335             | 1.685                  | 2.715                            |
| $p$ -value                 | 0.059             | 0.033                     | 0.054                 | 0.001             | 0.456                  | 0.263                            |
| Sig.                       | ns                | *                         | ns                    | **                | ns                     | ns                               |

Notes: Chi-square or Fisher's exact tests were used to assess group differences. Values in a column with different letters differ significantly (Bonferroni-corrected). ns, not significant; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

In summary, the findings of this study demonstrate that consumer acceptance of produce from the intermediate farming method with minimal agrochemical use varies across preference-based consumer groups. OA-prone consumers show relatively cautious evaluations and tend to compare such produce with organic standards, whereas CA- and balance-prone consumers exhibit more favorable perceptions and stronger purchase intentions when key attributes such as safety and taste are ensured. Despite broadly similar risk perceptions regarding agricultural inputs, the three groups differ markedly in their purchase priorities and evaluation criteria. Overall, CA- and balance-prone consumers, show relatively higher acceptance of produce from intermediate farming systems than OA-prone consumers.

## 4. Discussion

The findings of this study provide new insights into how different consumer groups evaluate produce from an intermediate farming method with minimal agrochemical use. Rather than showing uniform acceptance, consumers with different purchasing preferences apply distinct evaluation criteria and value priorities when assessing such produce.

The following sections examine OA-prone consumers and CA- and balance-prone consumers separately.

### 4.1. The Organic Consumer Group: A Value-Based Barrier

OA-prone consumers exhibited a relatively conservative attitude towards agriculture produce from such an intermediate farming method. This may reflect their underlying value considerations, such as concerns about safety, environmental protection, and the symbolic aspects of food choice [60–64]. Nearly all OA-prone consumers in our study prioritized safety over other factors when purchasing fresh produce and paid more attention to environmental protection than CA- and balance-prone consumers. These findings are consistent with prior research showing that health and wellness are the main drivers of organic consumption and that ecological considerations influence food choices among committed organic buyers [60–62]. Price appeared to have little impact on OA-prone consumers' choices, in line with previous findings that older, higher-income consumers are more willing to pay a premium for organic produce, possibly because of their greater purchasing power and stronger risk and health awareness [65–67].

OA-prone consumers also rated organic produce higher in nutritional quality and taste than CA-prone consumers, with balance-prone consumers in an intermediate position. This is consistent with prior studies finding the importance of sensory and health-related attributes in maintaining organic loyalty [60,67,68]. Moreover, their preference for organic produce appears to reflect not just a consumption choice; it may also be seen as an expression of support for preferred agricultural practices, potentially reflecting their underlying ethical concerns and identification with organic values [63]. For this group, organic produce was often associated with a combination of several ideal attributes, including safety, taste, and ethical considerations [69]. Consequently, any alternative production system would be evaluated against this holistic 'organic' standard in their minds [5]. Therefore, when assessed under this standard, produce from intermediate farming methods face acceptance barriers.

Although they acknowledged several advantages of such produce (e.g., high nutritional quality, good taste, and low environmental burden), they generally perceived it as less safe than CA-prone consumers and inferior to organic produce. Drawing on previous studies, this can be understood in light of the concept of purity [70]. For OA-prone consumers, organic labels often serve as an important reference for evaluating produce purity and achieving risk avoidance [71]. In this context, production systems that permit agrochemical inputs, even at reduced levels, may conflict with the purity expectations

commonly associated with organic food [70]. As a result, the symbolic boundary between organic and conventional produce may become blurred, weakening the psychological reassurance associated with organic food choice.

Therefore, produce from such intermediate farming method does not fully meet expectations of OA-prone consumers, who tend to prefer the complete avoidance of agrochemicals and the symbolic purity associated with organic produce. Even when scientific evidence suggests that such produce is safe or comparable to organic produce in taste, OA-prone consumers showed substantially lower willingness to purchase than CA- and balance-prone consumers. A possible explanation for this may be related to differences in knowledge preferences and credibility perceptions [72]. In our survey, many OA-prone consumers reported placing limited importance on formal education, suggesting a greater reliance on experiential, traditional, or ecological forms of knowledge rather than on institutionalized scientific evidence [73–76]. Therefore, the assurances made by institutions are less credible for them. Additionally, OA-prone consumers constitute a relatively small market share. In most countries, organic food buyers account for less than 5% of the total consumers [77]. Taken together with their comparatively low acceptance of intermediate farming produce observed in this study, this suggests that OA-prone consumers are unlikely to play a dominant role in promoting the broader adoption of such produce.

#### *4.2. CA- and Balance-Prone Consumers: Health and Taste Assurance*

Compared with OA-prone consumers, CA- and balance-prone consumers showed higher acceptance of produce from the intermediate farming method. This pattern may reflect a more pragmatic approach to food choices, in which consumers assess produce based on practical produce attributes and affordability [78] rather than a strict binary distinction between organic and conventional food systems [79]. In our sample, most respondents in these two groups rated such produce as better than conventional produce in terms of overall impression. More importantly, they did not perceive it as being inferior to organic produce. This suggests that their evaluations might be guided by produce quality rather than production ideology [80].

This overall acceptance was further supported by the evaluation of specific produce attributes. Most CA- and balance-prone consumers perceived such produce positively in terms of safety, taste, and environmental impact. These attributes are commonly associated with organic food and widely recognized as key criteria in food choice decisions [61,75]. Importantly, these positive evaluations appeared to be driven mainly by sensory and functional attributes rather than organic labels. This indicates that such produce may fulfill many expectations typically associated with organic produce [81].

Price considerations further explain the higher acceptance of such produce among these groups. In our survey, CA- and balance-prone consumers perceived organic produce as relatively expensive, and their purchasing decisions were strongly influenced by price. Previous studies have similarly reported that pragmatic consumers tend to balance price with health and environmental benefits [82,83]. Therefore, for these consumers, a complete shift from conventional to organic produce is difficult to achieve because of cost considerations. In this context, produce from the intermediate farming method offers a practical alternative. It delivers many benefits typically associated with organic produce while remaining affordable. When such produce achieves a favorable cost-benefit balance, it is more likely to meet the expectations of CA- and balance-prone consumers, who represent a key target group for expanding sustainable food consumption in the future.

Additionally, in terms of consumer distribution, CA- and balance-prone consumers accounted for approximately 53% of the respondents in our sample. At the global level, organic consumption represents a relatively small share of total food consumption worldwide [84]. Most consumers continue to rely on conventional produce to satisfy their daily

needs. Given their large representation and favorable evaluations, these consumers are likely to play a central role in the broader adoption of produce from intermediate farming systems in the future.

#### *4.3. Strategic Implications for Promotion*

Our findings suggest differentiated strategic insights for promoting produce from this intermediate farming system across consumer groups in the context of food choice and security.

For OA-prone consumers, food choices were closely aligned with established organic preferences. Consequently, attempting to shift their purchasing behavior away from organic produce may not substantially contribute to the broader adoption of intermediate farming systems. Therefore, policies and related strategies should prioritize maintaining access to certified organic options for this group.

In contrast, CA- and balance-prone consumers represent larger and more responsive groups. Our findings suggest that willingness to purchase is driven primarily by assurances of food safety and acceptable taste, in line with previous research on pragmatic, function-oriented food choices. In this context, providing transparent and credible safety-related information, such as simplified certification labels indicating reduced agrochemical use, may reduce consumers' perceived risks and increase their trust and confidence in this produce, thereby supporting more informed food choices [85]. Simultaneously, sensory experience remains an important consideration; therefore, providing tasting opportunities and evaluations by trusted third parties may help consumers form concrete assessments of produce quality [86]. By appealing to pragmatic CA- and balance-prone consumers, this intermediate farming method can reach a broader consumer base and help expand sustainable food consumption beyond organic food.

#### *4.4. Limitations and Future Research*

The findings and promotional strategies discussed above are based on survey data collected in a single region of Japan. Shizuoka Prefecture was selected for its central geographic position and demographic and economic characteristics. Moreover, its level of agricultural development is broadly comparable to national conditions, providing an appropriate context for this analysis. While the results provide meaningful insights into differences in consumer acceptance across preference-based groups, caution is needed when extending these findings beyond Japan. Consumer composition and acceptance levels may vary across regions with different agricultural structures, cultural contexts, and consumption cultures. Therefore, future research should extend this analysis to broader geographic contexts and larger samples to examine whether similar preference patterns and acceptance are consistent across different regions.

In addition, this study adopted a preference-based grouping method rather than a market segmentation method. While this approach is suitable for theory-driven comparisons across groups, it does not support the identification of latent consumer segments or the uncovering of hidden preference structures. Therefore, the findings should be interpreted as differences among preference-based groups rather than as an empirically derived market segment. Future research could complement this preference-based grouping approach with data-driven segmentation methods, such as multivariate clustering or latent class analysis, to further explore latent consumer segments and preference structures.

## **5. Conclusions**

We moved beyond the conventional-organic dichotomy to investigate consumers' responses to produce from an intermediate farming method with minimal agrochemical use in this study. The results show that their acceptance varies across preference-based

groups. OA-prone consumers showed limited acceptance, which may be due to strong value-driven barriers. In contrast, CA- and balance-prone consumers show relatively high acceptance, particularly when health and taste are assured. This suggests that such produce may be favored more by pragmatic consumers than by those whose choices are guided by stronger value-driven considerations.

Theoretically, this study contributes by applying a preference-based grouping approach rather than relying on traditional demographic characteristics, which helps explain differences in consumers' perceptions of the produce from this intermediate farming method. Practically, the findings suggest that promotion strategies should primarily target pragmatic consumers, such as CA- and balance-prone groups, rather than attempting to shift the preferences of OA-prone consumers.

Overall, these findings indicate that promoting environmentally friendly agriculture requires not only reducing agrochemical inputs but also designing production systems to meet the food preferences of different consumer groups. By viewing sustainability as a continuum rather than a strict conventional-organic divide, intermediate farming systems can meaningfully support sustainable food consumption transitions. Recognizing this helps explain how agronomic feasibility can support wider social acceptance. It also provides a practical pathway toward more stable and sustainable food supply systems.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su18041712/s1>, Table S1: Variable definitions and coding used in the analyses; Table S2: Perceived harm of agricultural inputs to health and environment across purchase preference groups (%); Table S3: Consumer perceptions of organic produce across purchase preference groups (%).

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