Working Paper #05

CGIAR | Fruit and Vegetables for Sustainable Healthy Diets

Increasing traditional vegetable consumption in Cavite, Philippines

Understanding consumer and market vendor preferences

Gonzales, B., de Chavez, H.D, Sister, L.E., Anunciado, M.S., Monville-Oro, E., Gonsalves, J., Hunter, D., Borelli, T., Mendonce, S.

July, 2023

The CGIAR Research Initiative on Fruit and Vegetables for Sustainable Healthy Diets (FRESH) aims to use an end-to-end approach to increase fruit and vegetable intake and in turn improve diet quality, nutrition and health outcomes while also improving livelihoods, empowering women and youth and mitigating negative environmental impacts.

The FRESH Initiative activities are bundled into six packages, namely:

- Work Package 1: Understanding and Influencing Consumer Behaviour
- Work Package 2: Biodiversity, genetic innovation, and seed systems
- Work Package 3: Safe and sustainable production systems
- Work Package 4: Post-harvest and inclusive markets
- Work Package 5: Food Environments
- Work Package 6: Strengthening the enabling environment.

To learn more about this Initiative, please visit:
Fruit and Vegetables for Sustainable Healthy Diets (FRESH) - CGIAR

Citation:
Gonzales, B., de Chavez, H.D., Sister, L.E., Anunciado, M.S., Monville-Oro, E., Gonsalves, J., Hunter, D., Borelli, T., Mendonce, S. 2023. Increasing traditional vegetable consumption in Cavite, Philippines. Understanding market vendor and consumer preferences. Alliance of Bioversity International and CIAT. Rome, Italy. 44 pages.

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Increasing traditional vegetable consumption in Cavite, Philippines

Understanding consumer and market vendor preferences

Authors

Gonzales, Bambi[1],
de Chavez, Hidelisa D.[2],
Sister, Lorna E.[2],
Anunciado, Ma. Shiela[1],
Monville-Oro, Emilita[1],
Gonsalves, Julian[1],
Hunter, Danny[3],
Borelli, Teresa[3],
Mendonce, Sharon[3]

Organizations

[1] International Institute of Rural Reconstruction
[2] University of the Philippines Los Baños
[3] Bioversity International

Alliance Bioversity & CIAT

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Acknowledgements

The authors would like to gratefully acknowledge the support and assistance of the city governments of Bacoor and Dasmariñas, Cavite, the market administrators of Zapote public market in Bacoor and Denco, Central, and Area 1 (DBB1) Wet and Dry Markets in Dasmariñas, and the officials of *barangay* Molino IV in Bacoor and *barangay* Paliparan III in Dasmariñas. The authors also thank the administrative support staff of the International Institute of Rural Reconstruction and the Food Environment and Consumer Behavior communications team at the Alliance of Bioversity International and CIAT.

Summary

The study conducted in Cavite province sheds light on the factors that influence the availability and accessibility of indigenous vegetables in urban and peri-urban markets. The study specifically looked at the perspectives of both market vendors and consumers in the two primary urban areas of Dasmariñas and Bacoor.

One of the key findings of the study is that adult women predominantly make household decisions when it comes to buying vegetables. This suggests that targeting women consumers with information and education about indigenous vegetables could be an effective strategy for promoting their consumption. Nutrition, freshness, and price are the primary considerations for consumers when purchasing vegetables, and they perceive indigenous vegetables as nutritious and affordable. Vendors prioritize shelf life in addition to price, freshness, and nutrition when selecting indigenous vegetables to sell.

The results highlight the importance of the supply chain for indigenous vegetables. In Cavite, it extends from the north to the south of Luzon. Understanding the dynamics of this supply chain is crucial for improving the availability and accessibility of indigenous vegetables in urban and peri-urban markets. Overall, the findings provide valuable insights into the challenges and opportunities for promoting the consumption of indigenous vegetables in urban areas. By addressing the gaps in awareness and knowledge about these food plants and their growth requirements, improving the supply chain to meet consumer and vendor requirements, and improving women consumers' access to education and information, we can work towards a future where these nutritious, locally-adapted, and culturally significant crops are widely known and available.

Keywords

Traditional and indigenous vegetables, consumer behavior, market vendor preferences, urban and peri urban.

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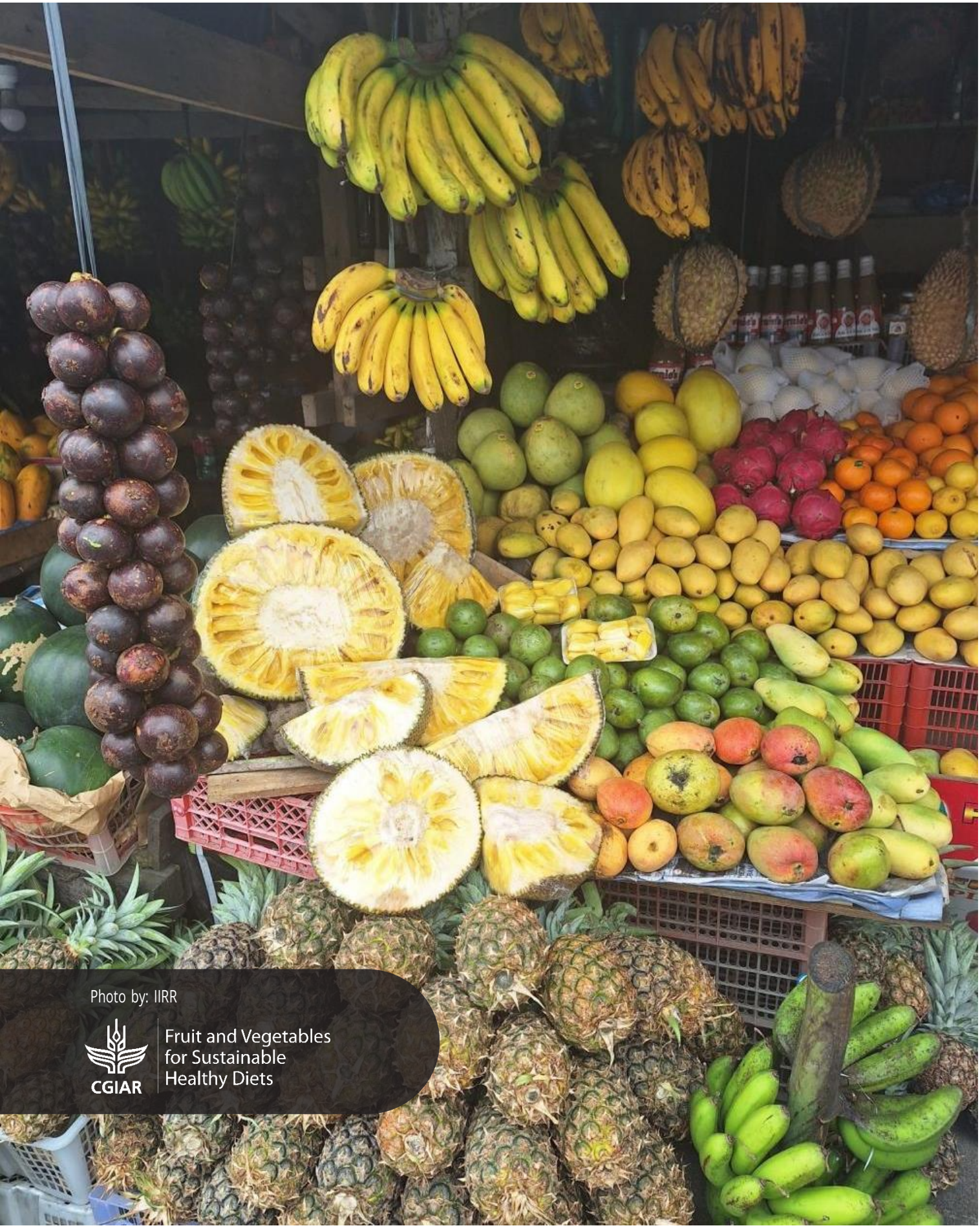

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Fruit and Vegetables
for Sustainable
Healthy Diets

1. Introduction

The World Health Organization (WHO) recommends the consumption of at least 400 grams of each fruit and vegetable daily, or five servings of 80 grams each. However, consumption levels in many parts of the world are estimated to be approximately two-thirds of this recommendation (FAO, 2020). In the Philippines, per capita daily consumption of fruits and vegetables is only 37 and 123 grams for fruits and vegetables respectively, based on the 2015 National Nutrition Survey conducted by the National Nutrition Council of the Philippines. According to Wolfenden et al., 2021, consumption patterns are linked to consumer choices, availability, and affordability.

The Food and Agriculture Organization of the United Nations (FAO) discussed the importance of fruits and vegetables for balanced diets to prevent malnutrition and to reduce the risk of diseases, among other benefits (FAO, 2020). Indigenous fruits and vegetables make such diets more accessible to communities and could play a major role in more diversified and sustainable food production systems (Ebert, 2014).

Indigenous vegetables are “species that are locally important for the sustainability of economies, human nutrition and health, and social systems but which have yet to attain global recognition to the same extent as major vegetable commodities” (Keatinge et al., 2015).

In the Philippines, there is a rich diversity of indigenous vegetables, but these are not readily available in urban and peri-urban markets - or at least, not widely (Altoveros et al., 2020). With modernization, most indigenous vegetables have become neglected and underutilized as fewer and fewer people hold information or knowledge about them. Increasing public awareness of indigenous vegetables will be key to increasing demand for, and market potential of, these species.

In rural areas where they are consumed for the most part, indigenous vegetables are either gathered from the wild or cultivated, mostly in small plots or home gardens making them a cheaper and accessible alternative to vegetable imports. Locally important species, particularly those that are part of local food culture find their way to wet markets (Altoveros et al., 2020). Thus, there is a need to promote indigenous vegetables and their associated knowledge more widely and bring them back into household consumption patterns as part of healthy food options.

Understanding and influencing consumer behavior requires work on various aspects of supply and demand. Thus, this short-term exploratory study was conducted to determine market vendor and consumer selling/buying considerations and perceptions of traditional/indigenous vegetables. It also explored related issues of availability and affordability.

Focusing on two (2) highly populated cities in the province of Cavite, this study sought to address the following research questions:

1. What are the most important factors that drive consumers to buy traditional and indigenous vegetables?
2. What are the important factors that drive market vendors to sell traditional and indigenous vegetables?
3. What traditional and indigenous vegetables are available in the urban/peri-urban markets of Cavite?

Understanding and influencing consumer behavior requires work on several aspects of supply and demand

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2. Methodology

2.1 Selection of study sites

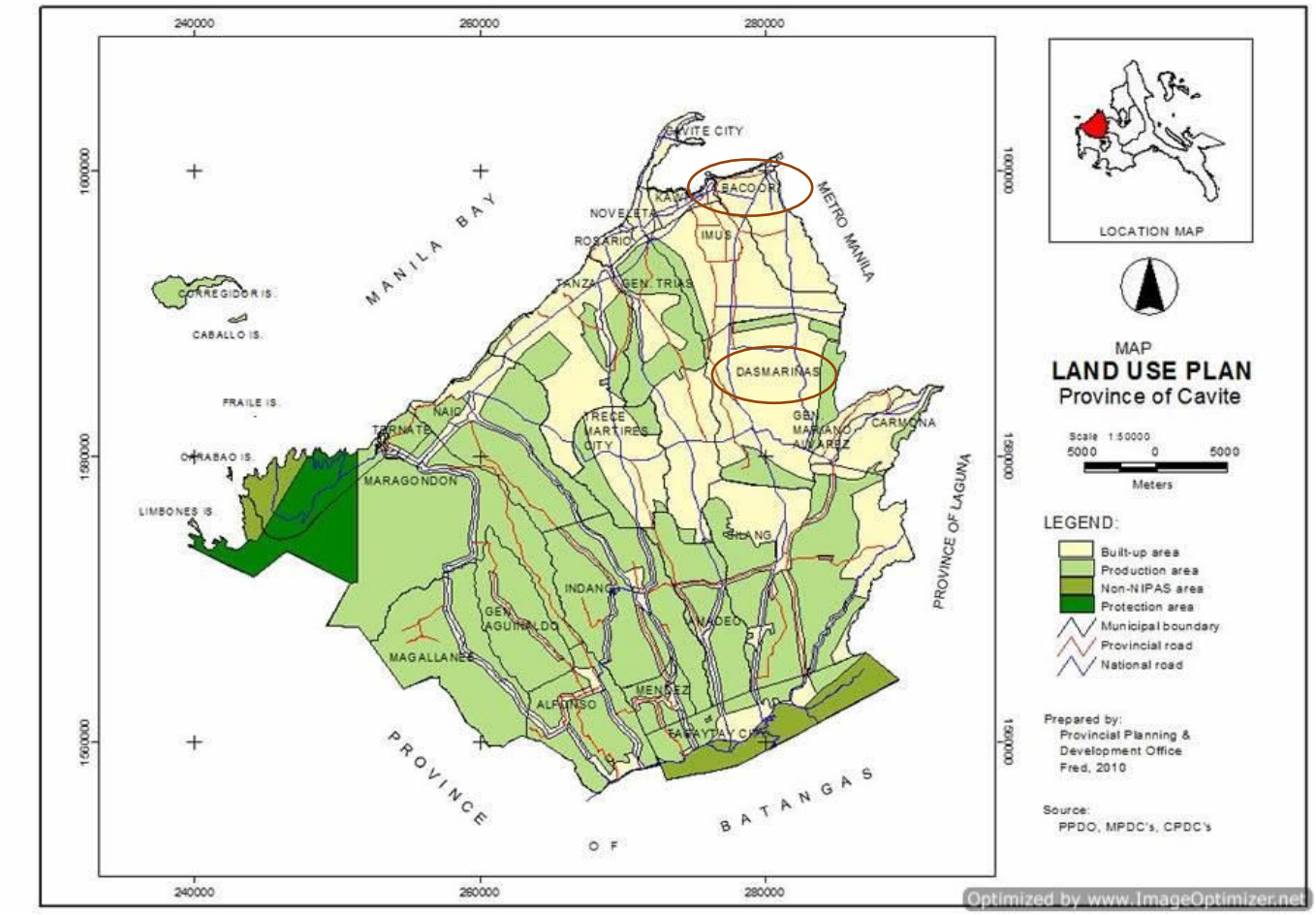
The study was conducted in the province of Cavite, in the two largest cities in the area, Dasmariñas and Bacoor (Figure 1). Dasmariñas is the largest city in Cavite, both in terms of area and population. Bacoor has a land area of 46.17 km^2 and a population of 664,625.

A consumer survey was conducted in the villages (*barangay*) of Molino IV in Bacoor and Paliparan III in Dasmariñas. Molino IV is the most populated village in Bacoor while Paliparan III has the second largest population in Dasmariñas. The market survey was conducted in four major markets located in these two cities (Table 1).

Socio-demographic data from the Philippine Statistics Authority (PSA) show that in Bacoor and Dasmariñas average household size is less than 5, with slightly more household members in Dasmariñas. Out of every 100 people of working age, 36-47% are economically inactive youth and 4-5% are elderly dependents (Table 2).

Figure 1: Land use map of Cavite province.

The map shows the study locations - Bacoor and Damariñas - and adjoining provinces.



Source: (Provincial Planning and Development Office, 2011).

Table 1: Demographic data for Bacoor and Dasmariñas and the study sites.

	Bacoor	Dasmariñas
Population (2020)	664,625	703,141
% of Cavite province population	15.30%	16.18%
Consumer survey sites	Bgy Molino IV	Bgy Paliparan III
Population at study sites (2020)	66,886	72,945
% of city population	10.06%	10.37%
Market vendors survey sites	Zapote Wet and Dry Markets	Denco, Central and Area 1 (DBB1) Wet and Dry Markets

Source: (PhilAtlas, n.d.-a,-b,-c,-d,).

Table 2: Socio-demographic data on population and households (HH) at the study sites.

	Bacoor	Dasmariñas
Consumer survey site	Barangay Molino IV	Barangay Paliparan III
No. of HH (2015)	13,632	15,247
Average HH size (2015)	3.76	4.47
Youth dependency ratio (%) (2015)	36.58	47.82
Elderly dependency ratio (%) (2015)	5.36	4.29

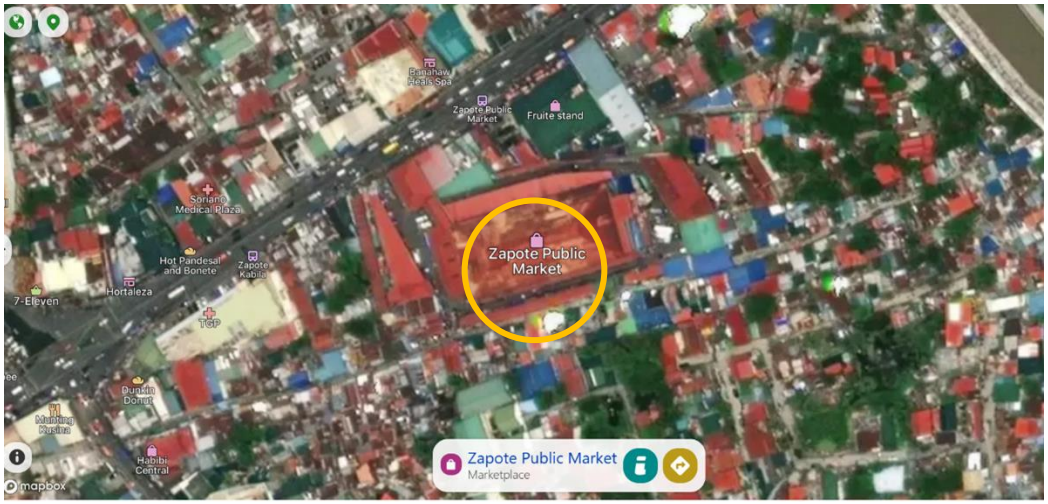
Source: (PhilAtlas, n.d.-c,-d.).

Figure 2: Aerial view of the study sites in Dasmariñas, Cavite.

From top right, clockwise to bottom, Area1 Market (DBB1), DENCO and Central Market

Source: (Mapcarta, n.d.)

Figure 3:. Aerial view of the study site in Bacoor, Cavite



Source: (Mapcarta, n.d.)

2.2 Sampling

Systematic random sampling of consumer households was undertaken by sampling every 3rd household in each site with a random start. The same sampling procedure was adopted for the market survey using market stalls at the market sites as sampling points instead of households. For lack of a master list of household consumers and market vendors in the four markets covered, an equal number of respondents for each city was secured.

After careful review and validation, 420 and 60 consumer and market vendor interviews, respectively, were included in the analysis (Table 3). Sixty (60) data points were discarded from each of the surveys due to questionable/incomplete entries that cannot be verified.

Table 3: Distribution of respondents across the study sites in Cavite province.

	Consumer survey sites	No. of respondents in the consumer survey	Market vendor sites	No. of respondents in the market survey
Bacoor	Bgy Molino IV	210	Zapote Wet and Dry Markets	30
Dasmariñas	Bgy Paliparan III	210	Dengco Market Central Market Area 1 Wet and Dry Markets	30
Total		420		60

2.3 Data collection

Data was gathered using the conventional Pen and Paper Personal Interview (PAPI) method. Participation in the survey was voluntary. All survey participants were informed of the purpose of the study and the use of the data, emphasizing that the information requested would be exclusively used for research, and guaranteeing confidentiality.

To check for questionnaire flaws and ensure that the survey questions were understood by the target groups, pre-testing of the survey tools was undertaken with six (6) consumers and six (6)

market vendors. Issues with question content and comprehension were identified, and adjustments made. The revised questionnaires were tested in mock interviews during the enumerators' training. A final version of the questionnaire was then developed.

Prior to starting the household interviews, permissions were obtained from the cities' chief executives and the City Agriculture Offices. The conduct of the market vendor interviews was coordinated with the market administrators, with whom key informant interviews were also conducted.

1. Household consumers and market vendor profiles

Socio-demographic and socio-economic factors that were expected to influence household decision-making with respect to buying vegetables were collected through face-to-face interviews. Sex, ethnicity, and age of household heads, household size, age distribution of household members, income and budget allocations for food and vegetables were collected to describe household consumers in the study sites.

2. Factors that affect the decision of consumers on which traditional and indigenous vegetables to buy

Vegetable-buying behavior was described in terms of the household member who makes the buying decision, who makes the purchase, and chooses the preferred markets. Price, nutritional value, taste, freshness, absence of signs of pest/disease infestation, absence of product deformities, ease of preparation/cooking, origin (local/imported), and production method (organic/non-organic), and packaging were considered important in consumers' buying decisions. Using a 4-point scale, consumers scored these factors according to their perceived importance, where 1=not important, 2=slightly important, 3= important, and 4=very important.

3. Factors that influence how market vendors choose which traditional and indigenous vegetables to sell

Based on key informant validation of a priori information, price, demand, availability, seasonality, shelf-life, origin (locally grown/imported), production method (organic/inorganic), nutritional value, quality/freshness, physical appearance, ease of preparation, and packaging were rated by market vendors in terms of their perception of importance in decisions to sell indigenous vegetables. Using a 4-point scale, vendors scored each factor in terms of their perceived importance, where 1=not important, 2=slightly important, 3= important, and 4=very important.

4. Availability of vegetables in urban/peri-urban markets

An inventory of vegetables available in urban and peri-urban markets was obtained from market survey respondents. Accounts of sources and flows of indigenous vegetables sold in major markets in Bacoor and Dasmariñas were obtained from key informant interviews with

local government representatives (e.g., City Agriculture Office), and from market administrators during groundwork and later validated with some market vendors.

To further assess consumers' and market vendors' knowledge and experience with indigenous vegetables, yes/no questions were asked for 24 selected indigenous vegetables from the inventory presented in Altoveros et al. (2020). Pamphlets showing indigenous vegetables were used as visual aids and reference to ensure clarity. Consumers indicated their familiarity and past/present experience in eating and buying each of the vegetables. Market vendors indicated their familiarity, past/present experience in selling, and their interest in selling each of the vegetables.

To further validate information collected from the questionnaire, key informant interviews were conducted with local government officials, such as the City Agriculture Office staff, the City Mayor, and representatives/administrators of markets visited.

Secondary data from other studies, particularly from the DOST-PCAARRD-supported project Documentation of Indigenous Vegetables of the Philippines in 2018-2020 (Altoveros et al., 2020), were used as a reference.

2.4 Data analysis and presentation

Data was analyzed using descriptive statistics to show trends and presented in either tabular or graphical form. Google Sheets was used as a platform for collaboration during data validation and cleaning. Data processing and analysis were performed using Microsoft Excel.

A product flow sketch (section 3.2.3) of the indigenous vegetables' suppliers identified in the vendor survey and the key informant interviews provided a visual representation of how selected indigenous vegetables reach consumers in the study markets, while the consumer survey revealed information on other ways households obtain indigenous vegetables.

2.5 Study limitations

The consumer survey focused on two (2) highly populated villages (barangay Molino IV in Bacoor and barangay Paliparan III in Dasmariñas), while the market vendor survey was undertaken in the cities' main markets. Thus, trends observed may not represent some, but not all, other urban/peri-urban areas in the country.

3. Results and discussion

3.1 Consumer survey

3.1.1 Profile of respondents

Distribution of survey respondents by sexr across study sites

In both settings, most consumer respondents (78%) were women and married (58%) suggesting that women are the main caregivers and are responsible for the food needs of household members (Figures 4 and 5).

Figure 4: Consumer distribution by sex

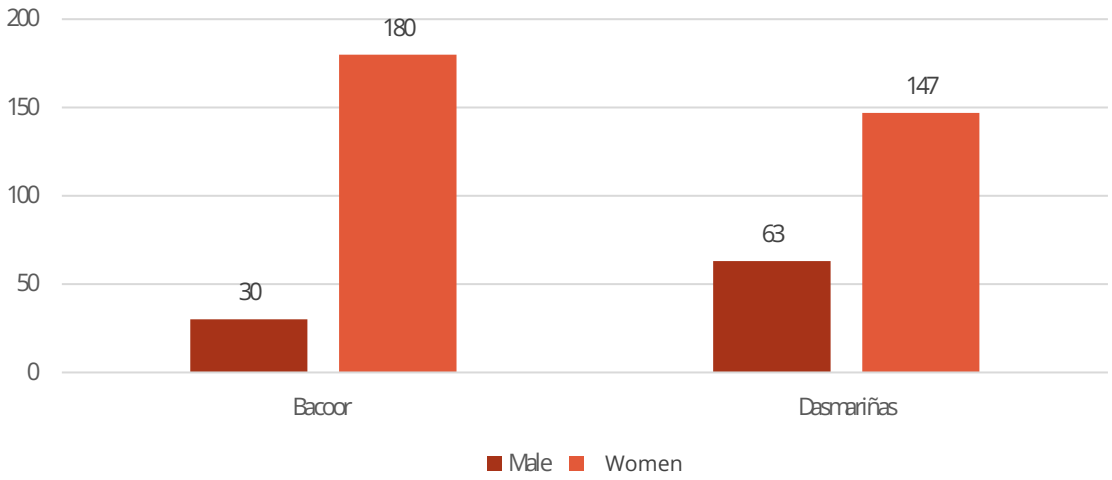
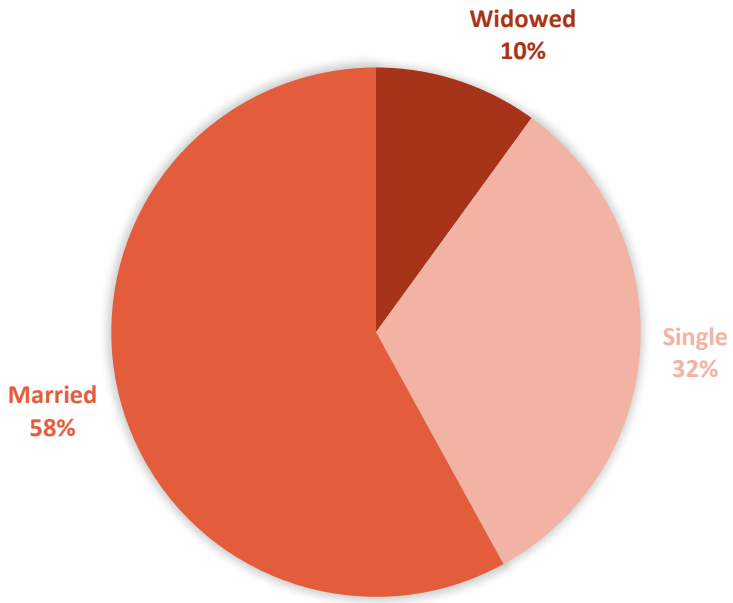


Figure 5: Marital status of respondents in the consumer survey



Household incomes of consumers familiar with indigenous vegetables

The frequency of consumer households that were familiar with indigenous vegetables is shown in Table 4, accompanied by monthly household income indicated by survey respondents. Only 9 of the 420 respondents acknowledged being unfamiliar with indigenous vegetables. These households had a higher-than-average monthly income, almost twice that of households that knew and were accustomed to buying/consuming indigenous vegetables. This indicates that significantly higher income households may be less knowledgeable about traditional and indigenous vegetables, and that the majority – who have lower incomes – are familiar with these vegetables. This can lead to inroads towards increasing consumption of these relatively more readily available nutrient-dense vegetables.

Table 4: Monthly income of consumer survey respondents based on familiarity with IVs

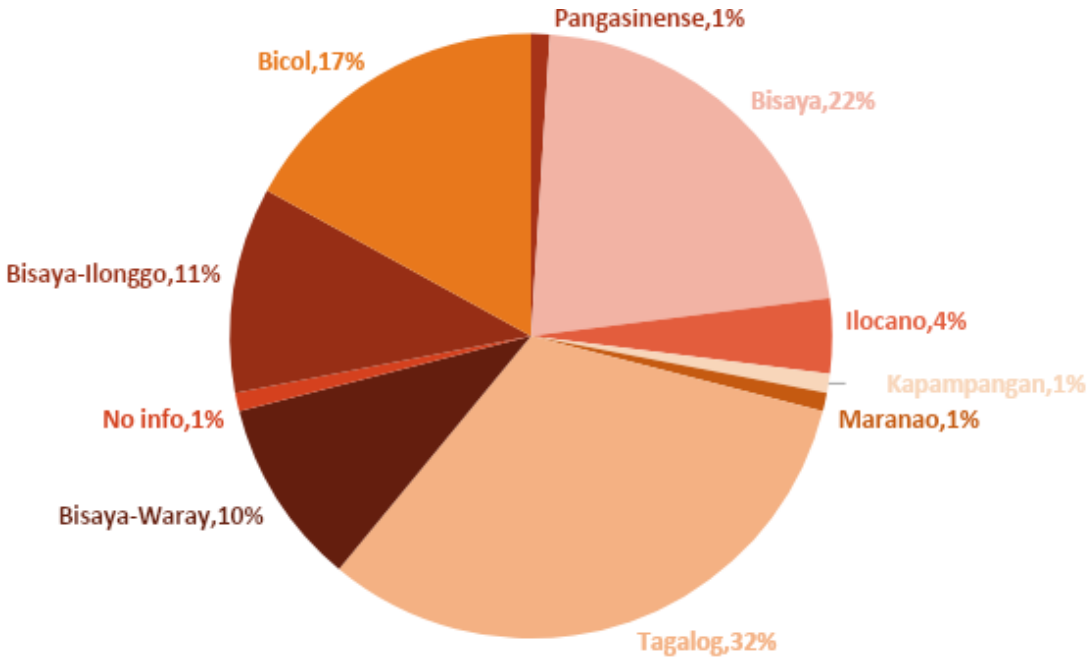
	Frequency	Average monthly income (PhP)
Unfamiliar	9	27,504.44
Familiar	411	14,348.81

3.1.2 Profile of household heads

Ethnicity of household heads

The heads of consumer households that participated in the survey came from various ethnolinguistic groups. While 32% of respondents were Tagalog (32%), a large proportion (47%) were from different ethnic groups from the Visayas and Mindanao and consisted of Ilonggo, Waray and the Cebuano often collectively referred to as “Bisaya” (Figure 4). This reveals the existence of migration patterns from various areas of the country towards Cavite, which is a highly urbanized province in the periphery of the Greater Manila Area. These migrants may have brought their food culture with them, including several indigenous vegetables. Altoveros et al. (2020) note that geographic niches of some indigenous vegetables reflect the unique food cultures across the country.

Figure 6: Ethnicity of household heads



Age and sex of household heads

Household heads were 46.70 years old on average (Table 5). The youngest household head was 19 years old (man), while the oldest was 88 (woman). More than half of the consumer households were headed by men, with an average age of 45.14 years. In 12 households, the sex of the household head could not be determined due to missing data.

Table 5: Age of heads of consumer households

	Frequency	Average age	Min Age	Max Age
Women	158	49.49	23	88
Men	250	45.14	19	75
No info.	12	42.25	28	57

3.1.3 Profile of consumer households

Household size

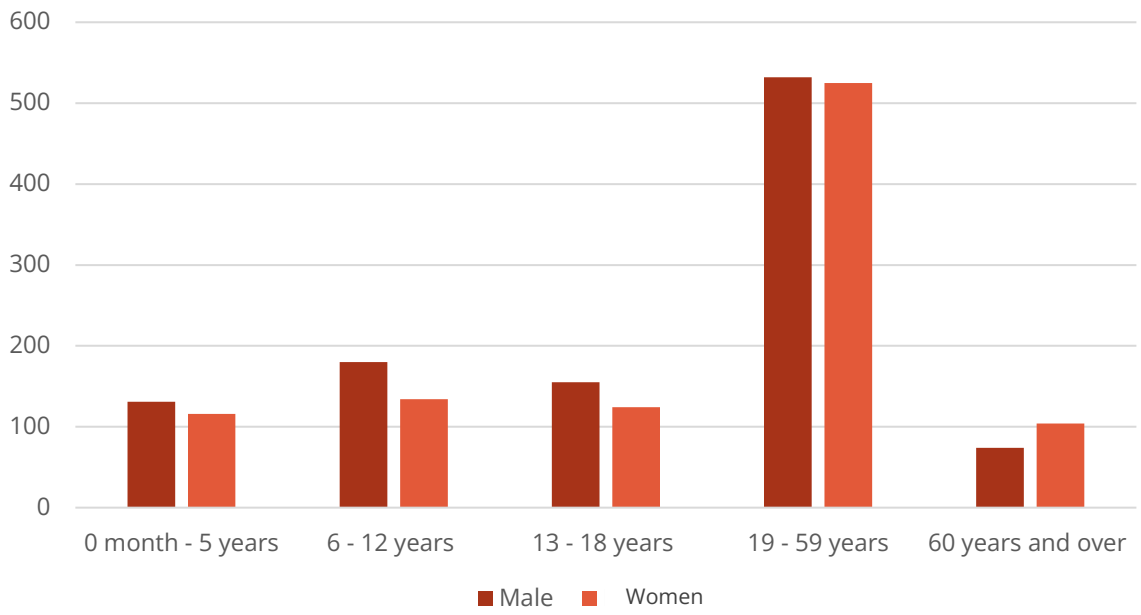
Households in the study areas were slightly larger than the average household sizes of each city, but some households had as many as 13-15 members (Table 6).

Table 6: Household size of consumer survey respondents.

	Average HH size	Min. No. of Members	Max. No. of Members
Bacoor	5	1	13
Dasmariñas	5	1	15

The average household composition of respondents by age group is illustrated in Figure 7. With 4 dependents for every 10 household members (generally elderly people and children/adolescents), this translates to an overall dependency ratio of around 0.4.

Figure 7: Household composition by age group.



3.1.4 Household allocation for food expenses

On average, households in Bacoor and Cavite spend equivalent amounts of their household budget on food (Table 7). However, when experiencing budget shortages, they resort to different strategies to reduce their dependence on food purchases. This is particularly true for households with only one income-earning member and/or bigger households.

Table 7: Weekly household budget for food and vegetables

	Average HH income (PhP)	Average HH size	Average weekly food expenses (PhP)
Bacoor	12,056	5	2,022
Dasmariñas	17,293	5	2,057
Mean	14,648	5	2,040

Note: USD1=PhP55.20 as of March 1, 2023, Bangko Sentral ng Pilipinas
Source: https://www.bsp.gov.ph/statistics/external/day99_data.aspx

Consumers with higher incomes may spend more on food, particularly vegetables. Sufficient funds also give them more options. Households with budget limitations reduce their dependence on market purchases by growing low-maintenance vegetables, gathering traditional and indigenous vegetables from the wild/surrounding areas, or through community sharing of backyard vegetables. Table 8 presents some of coping strategies mentioned by respondents during the surveys and vegetables that prominently figure in these coping strategies. Thus, while the promotion of value chains for indigenous vegetables provides incentives for conservation through use (livelihoods), it is also the key to making vegetables accessible to communities, particularly to the food insecure.

This calls for attention to vegetable seeds systems. While conventional vegetable seeds are readily available, they are not cheap and production is still risky even on a small scale, given the limited resources of poorer households. Indigenous vegetables, on the other hand, hold potential as nutrient-rich and highly adapted species that mostly require little management. However, many of these species are disappearing, and seeds or planting material may not be readily available. Thus, community awareness of these species and school/community programs that improve availability of planting material can be an initial strategy to address these constraints. These include school gardens managed jointly by students and parents, as well as community gardens that may be managed by village associations such as the 4Ps and subdivision homeowners.

Table 8: Coping strategies mentioned by household consumers to make ends meet.

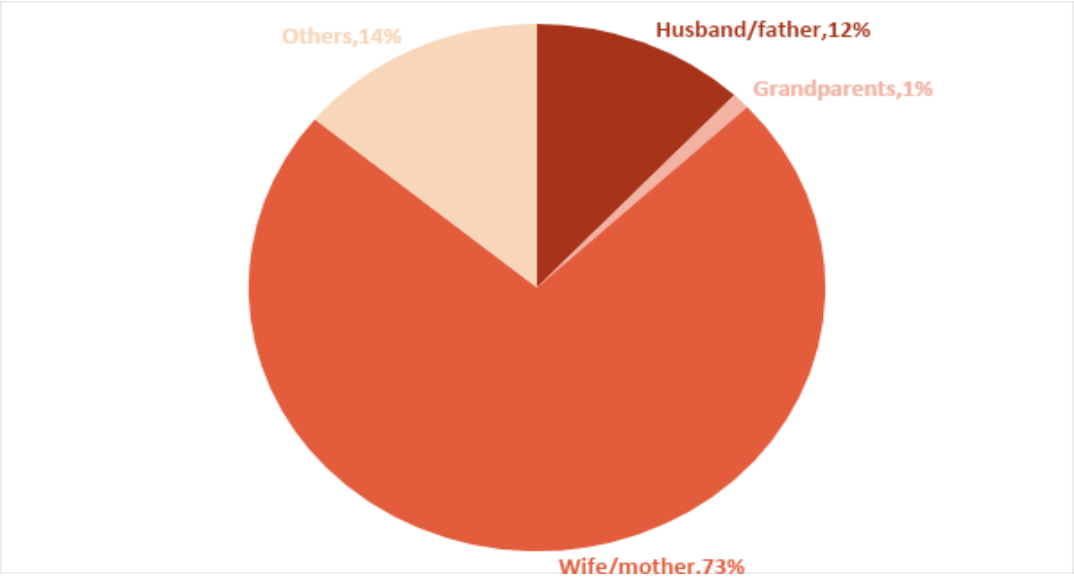
Coping strategy	Bacoor	Dasmariñas	Total
Take out an informal loan	12	3	15
Plant vegetables in homegardens/vacant plots	7	11	18
Reduce vegetable budget/prepare more traditional vegetable dishes	148	104	252
Low-cost food preparations, usually using vegetables	6	39	45
Work for extra/additional income, family effort	36	52	88
No answer	1	1	2

3.1.5 Household Decision-making and Buying Behavior

Household decision makers for vegetable purchases

Buying vegetables is decided mainly by an adult woman within the household - the wife or mother (or grandmother), with daughters also occasionally making decisions (Figure 8).

Figure 8: Household decision makers regarding vegetable purchases.



As shown in Table 9, of the 420 respondents, only twelve (12) did not purchase vegetables for the household. Among those who did buy vegetables, the vast majority were women. This is

consistent with the fact that women are the main decision-makers regarding food purchases. For this reason, information campaigns about indigenous vegetables should ideally target women.

Table 9: Number of vegetable buyers among respondents

	Men	Women	Total
No	4	8	12
Yes	89	319	408
Total respondents	93	327	420

Preferred markets for buying vegetables

Most consumers (71.67%) prefer buying vegetables in wet and dry public markets, followed by makeshift local markets called "talipapa" (Table 10). This is because vegetables purchased in these locations are perceived as being fresh and cheaper compared to other places like supermarkets. Also, wet markets are perceived to offer more options, with a high likelihood of finding vegetables that are unavailable in the "talipapa". The "talipapa" are usually closer to household clusters so are more convenient for urgent food purchases.

Table 10: Locations where consumers most commonly buy vegetables

Area	Frequency	Percentage of respondents
Wet and dry markets	301	71.67%
Makeshift markets (*talipapa*)	97	23.10%
Roadside vendors (*naglalako*)	3	0.71%
Supermarkets	2	0.48%
On farm	2	0.48%
Retail stores (*sari sari*)	2	0.48%
Others	1	0.24%

No answer	12	2.86%
Total	420	100%

3.1.6 Household considerations when deciding to buy traditional and indigenous vegetables

Consumer perceptions of indigenous vegetables

In terms of consumer awareness of indigenous vegetables, all respondents considered them to be nutritious and more than 90% deemed them affordable and tasty (Table 11). Only nine (9) respondents were unfamiliar with indigenous vegetables, indicating they may be unaccustomed to consuming vegetables in general. The concept of "indigenous" is also closely coupled with the notion of growing naturally, with low inputs, and being accessible and cheap. These perceptions can be exploited through affirmative action in promoting the consumption and use of indigenous vegetables.

Table 11: Perceptions consumers associate with indigenous vegetables.

Perception	Frequency*	Percentage of respondents (N=420)
Nutritious	420	100%
Affordable	387	92.1%
Tasty	383	91.2%
Food for the poor	28	6.7%
Poor taste	2	0.5%
Fresh	6	1.4%

*: Multiple responses

Perceived importance of some factors in consumers' vegetable purchase decisions

Consumer perceptions on the importance of product price, nutrition, taste, freshness, free from pest and disease infestation, absence of deformities, ease of preparation, origin (local/imported), production method (organic/non-organic), and packaging are presented in

Table 12, providing insight into several factors that affect consumer decisions when buying vegetables. Main considerations include nutritional value, freshness, and affordability, which were consistent with consumers' notions about indigenous vegetables discussed above. None of the factors were considered unimportant, although packaging and origin scored the lowest.

The data indicate the importance of shorter market chains and preservation of knowledge on food preparation. Short market chains would require the preservation of environmental conditions that promote the growth and productivity of indigenous vegetable species, as well as food safety of gathered food plants for human consumption. This includes biophysical aspects as well as the associated species. This may also require a review of urban zoning and development policies and programs, as the pace of urbanization is very fast in these areas. Gathering areas can be preserved near food insecure communities, doubling as urban greenery and areas for education pursuits.

Table 12: Perceived importance of factors that influence vegetable-buying decisions among consumers.

Factors	Average score*	Importance
Nutrition	**3.8**	**Very important**
Freshness	**3.7**	**Very important**
Price	**3.6**	**Very important**
Taste	**3.5**	**Very Important**
Pest and disease free	**3.5**	**Very Important**
No deformities	**3.5**	**Very Important**
Easy to prepare/cook	**3.4**	**Very Important**
Production (organic/nonorganic)	3.0	Important
Packaging	2.8	Important
Origin (locally grown/imported)	2.8	Important

*Note: Score 0-1=not important, 1.1-2=slightly important; 2.1-3=important; 3.1-4=very important

Knowledge about food preparation requires both the promotion of traditional food preparations and the development of novel preparations that do not degrade nutritional quality.

3.2. Market Survey

3.2.1 Profile of respondents

Out of the 60 vendors surveyed, 48 were women and the majority sold at the Zapote Wet and Dry Public Market (Table 13). Although many respondents live in Cavite and Metro Manila, the vast majority come from far-away provinces such as the Visayas and Mindanao (Figure 9).

Table 13: Distribution of market respondents across market sites.

Factors	Men	Women	All
Area 1 – Wet and dry markets	0	2	2
Central Market	3	10	13
Dengco – Burol1	3	12	15
Zapote Wet and dry public market	6	24	30
Total	**12**	**48**	**60**

3.2.2 Factors that influence how market vendors choose which traditional and indigenous vegetables to sell.

Price, demand, availability, seasonality, shelf-life, origin (locally grown/imported), production method (organic/non-organic), nutrition, freshness, physical appearance, ease of preparation, and packaging, were considered as potential variables that might affect market vendors' choice of which vegetable to sell.

Table 14 illustrates how price and freshness are the two most important factors affecting vendor decisions. These are followed by shelf-life, nutrition, physical appearance, availability, demand, seasonality, origin (local/imported), and ease of preparation, which were considered as "very important". Shelf-life can be challenging for many indigenous vegetables which are

characterized by fragile leaves and flowers that quickly deteriorate. Organic quality and packaging scored slightly lower but were still considered “important”. The findings are consistent with answers obtained from consumers.

Figure 9: Province/area of origin of market survey respondents.

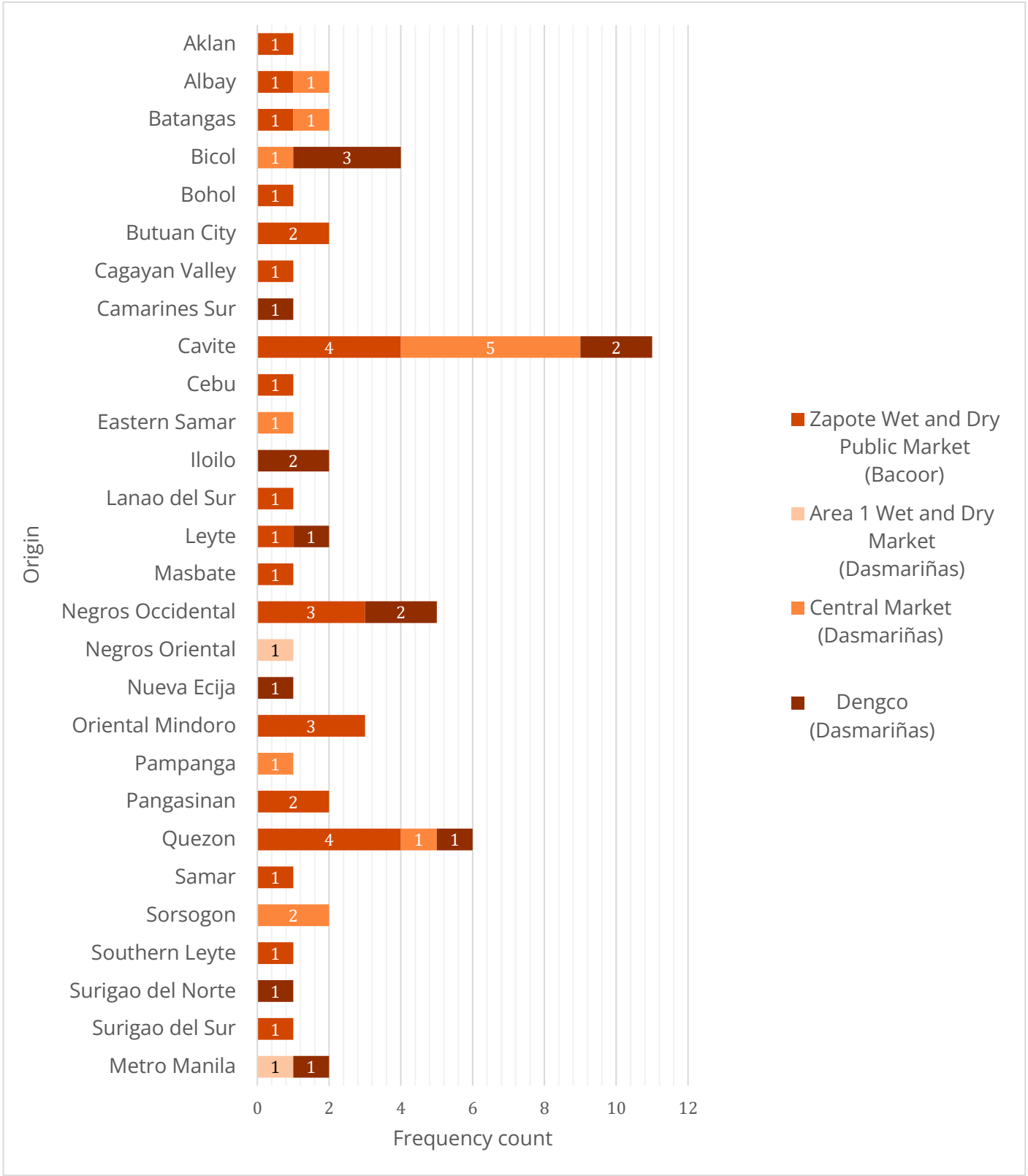


Table 14: Perceived importance of factors that influence vegetable selling decisions among vendors.

Factors	Average score*	Importance
Price	**3.9**	**Very Important**
Freshness	**3.9**	**Very Important**
Shelf life	**3.8**	**Very Important**
Nutrition	**3.7**	**Very Important**
Physical appearance	**3.3**	**Very Important**
Availability (supply reliability)	**3.2**	**Very Important**
Demand	**3.1**	**Very Important**
Seasonality	**3.1**	**Very Important**
Origin (locally grown/imported)	**3.1**	**Very Important**
Easy to prepare/cook	**3.1**	**Very Important**
Production (organic/nonorganic)	3.0	Important
Packaging	2.3	Important

*Note: Score 0-1=not important, 1.1-2=slightly important; 2.1-3=important; 3.1-4=very important

3.2.3 Availability of traditional and indigenous vegetables in the peri-urban market

Species in markets

The survey helped establish the availability of traditional and indigenous vegetables on sale in the peri-urban markets covered by this study. This availability reflects what vendors can supply based on their knowledge of consumer demand.

Table 15 illustrates the top 10 indigenous vegetables ranked and sold by market vendors. The survey confirmed findings by Altoveros et al. (2020) who showed that taro (known locally as *gabi*) is widely consumed as a vegetable in the Philippines. Depending on the local food culture, the leaves, corms, or the whole plant are consumed.

Vendors listed potato (*Solanum tuberosum*) and ginger (*Zingiber officinale*) among the indigenous vegetables usually sold, indicating a gap in awareness about what constitutes a native vegetable. Notably, potato is not indigenous to the Philippines, nor are sweet potato, papaya, or chayote, while ginger is used mostly as a spice - except among rural folk in Panay and Mindanao. With regards to squash, eggplant, and okra, although they are naturalized, the market supply consists mainly of modern varieties while traditional varieties are sold in markets where there is demand for local ingredients (Altoveros et al., 2020).

Table 15: Traditional and indigenous vegetables commonly sold in the study markets according to market vendors.

Traditional and indigenous vegetables*	Rank	No. of mentions
Green papaya (*Carica papaya*)	1	31
Yardlong beans (*Vigna unguiculata* subsp. *sesquipedalis*)	2	28
Squash (*Cucurbita moschata*)	3	25
Eggplant (*Solanum melongena*)	4	22
Bitter gourd (*Momordica charantia*)	5	21
Banana flowers (*Musa* x *paradisiaca*, *Musa balbisiana*)		21
Taro or Gabi (*Colocasia esculenta*)	6	18
Potato (*Solanum tuberosum*)	7	12
Okra (*Abelmoschus esculentus*)	8	10
Chayote (*Sicyos edulis*)		10
Sweet potato tops (*Ipomoea batatas*)	9	9
Malabar spinach (*Basella alba*)	10	8
Ginger (*Zingiber officinale*)	1	8

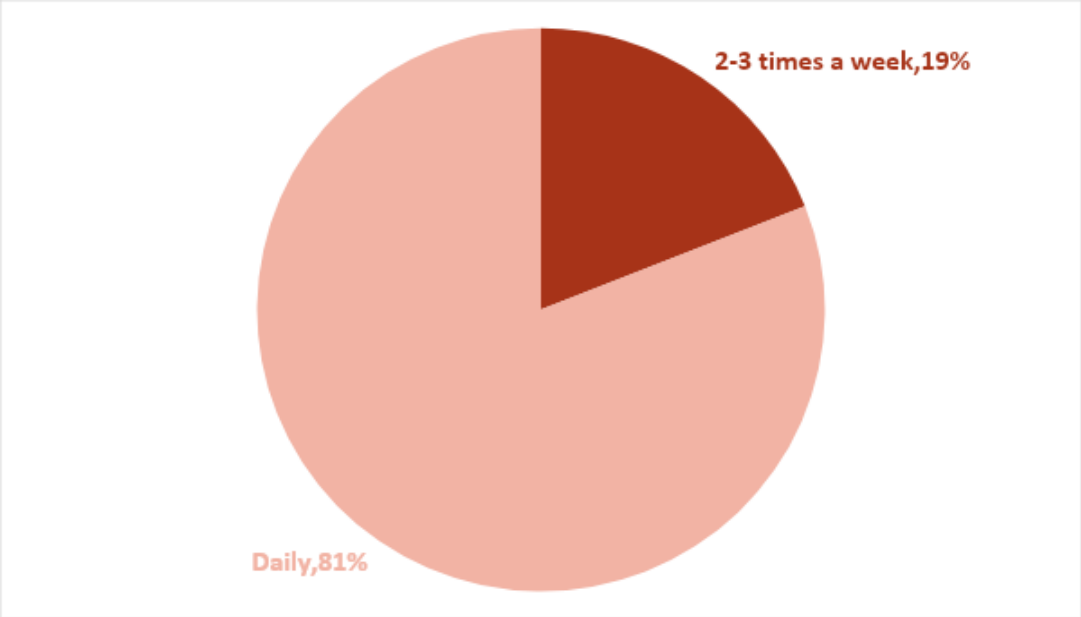
*Note: As perceived by market vendors.

Other vegetables mentioned by fewer respondents are Jute mallow leaves (*Corchorus olitorius*), water spinach or *kangkong* (*Ipomoea aquatica*), calabash or *upo* (*Lagenaria siceraria*), Chinese okra or *patola* (*Luffa acutangula*), bamboo shoots or *labong* (e.g., *Bambusa* spp., *Gigantochloa* spp.), moringa (*Moringa oleifera*), cabbage (*Brassica oleracea*), green beans (*Phaseolus vulgaris*), Philippine amaranth (*Amaranthus spinosus*, *A. viridis*), jackfruit (*Artocarpus heterophyllus*), mung bean (*Vigna radiata*), cucumber (*Cucumis sativus*), Hyacinth bean (*Lablab purpureus*), Breadnut fruit (*Artocarpus camansi*), tomato (*Solanum lycopersicum*), radish (*Raphanus sativus*), Lima bean or *patani* (*Phaseolus lunatus*), field mustard or *Pechay Tagalog* (*Brassica rapa*), winged bean (*Psophocarpus tetragonolobus*), taro runners (*Colocasia esculenta*), native eggplant (*Solanum melongena*), mung bean sprouts (*Vigna radiata*), and coconut pith (*Cocos nucifera*).

Supply frequency

Traders and wholesalers supply vegetables to vendors in the main markets of Bacoor, Dasmariñas and Cavite. Most vendors prefer to buy small quantities daily from vegetable suppliers to ensure that their vegetables are always fresh (Figure 10). Post harvest and transit handling, including packaging and transit facilities are important areas to focus on in efforts to commercialize indigenous vegetables. Expanding production by incentivizing small-scale production in urban areas can address issues related to freshness for species that are easy to manage such as moringa, water spinach, and sweet potatoes.

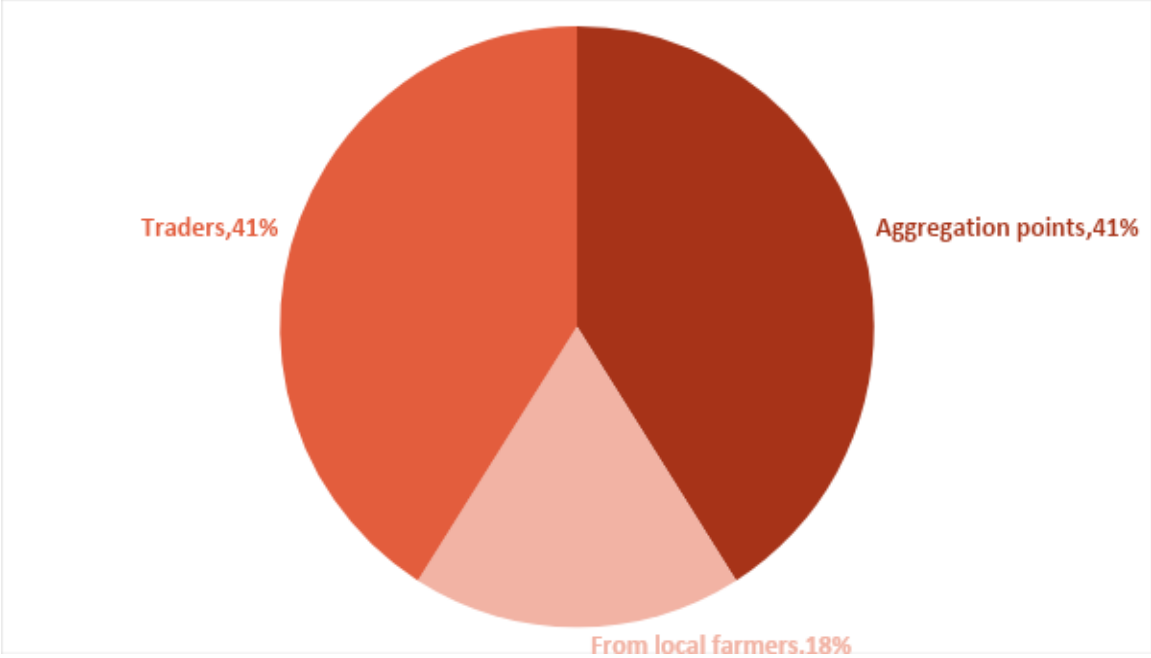
Figure 10: Frequency of vegetable supply in the market



Sources of supply

Just like conventional vegetables, indigenous vegetables are supplied by traders to/from aggregation points (*bagsakan*). In Cavite, now a growing peri urban production area, local farmers play a significant role in supplying vegetables to major markets. Due to their proximity to markets, transaction costs involved are lower than in longer market chains (Figure 11). Traders from further away normally carry indigenous vegetables with their load of conventional vegetables to/from aggregation points, except for indigenous vegetables and root crops that are traded in larger volumes such as banana flowers and taro.

Figure 11: Supply chain actors involved in bringing indigenous vegetables to Bacoor and Dasmariñas markets.



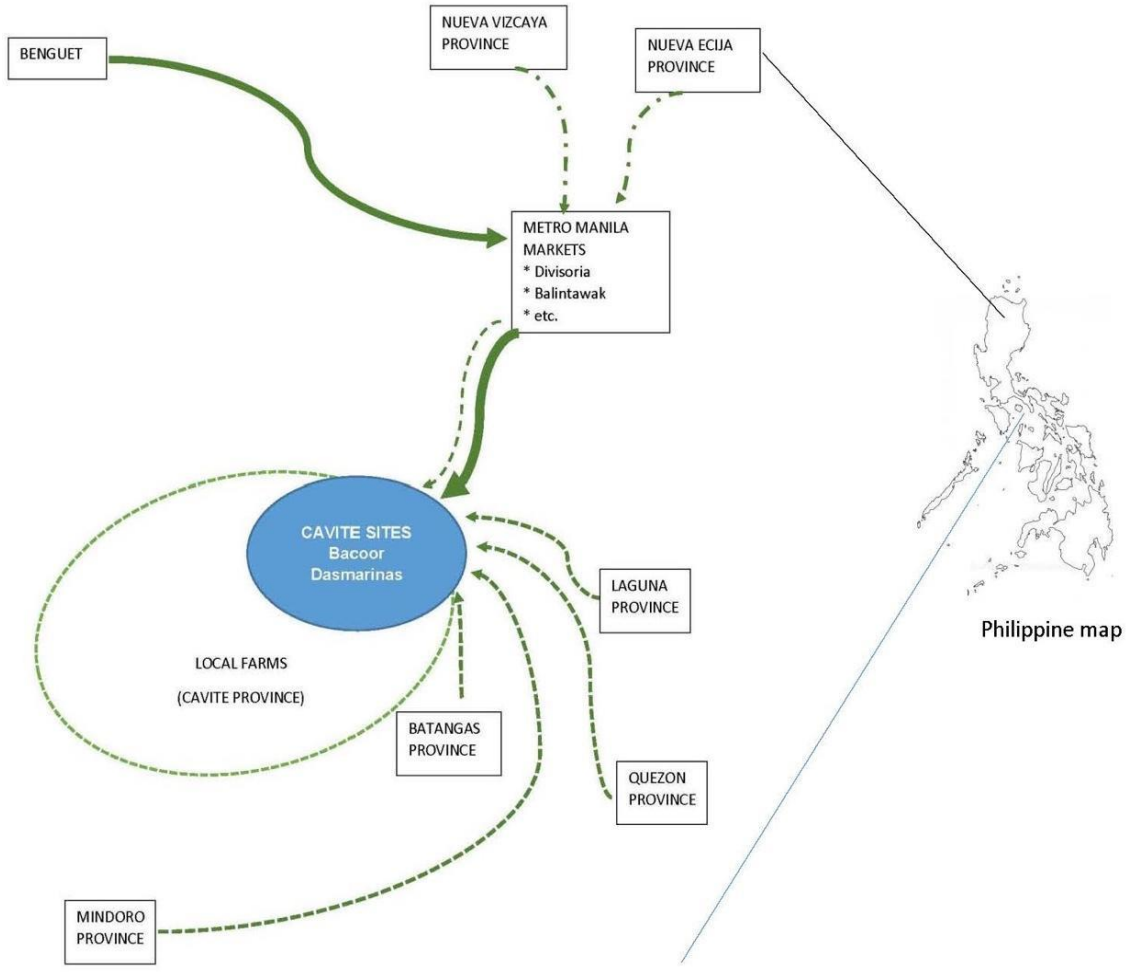
The provinces to the north of Manila (Benguet, Nueva Ecija and Nueva Vizcaya) and south of Manila (Batangas, Cavite and Laguna) supply vegetables to the main markets of Bacoor and Dasmariñas in Cavite (the area covered in this study). Conventional and highland vegetables mostly come from the North, while the provinces south of Cavite and some of the low-lying provinces in the North supply the bulk of the indigenous vegetables. Local markets in Cavite receive most of the supply of other conventional vegetables from Benguet. Some indigenous vegetable originating in the low-lying northern provinces find their way to Cavite via wholesale traders in Manila (Figure 12).

For instance, the catkins of Himbabao (*Broussonetia luzonica*) are unique to Ilocano food culture but they are highly prized in major Manila markets. For them to be made more widely available, harvest handling, packaging and transit handling issues along the supply chain need to be addressed. In general, optimizing handling and packaging can maintain freshness and

nutritional quality while ensuring food safety. Marketing via digital platforms can also be explored to facilitate market linkages and reduce transaction costs.

Figure 12: Vegetable flow to market sites in Bacoor and Dasmariñas, Cavite.

Dashed lines indicate flows of conventional vegetables with indigenous vegetables; solid lines indicate conventional vegetables.



Source: Authors' own market key informant interviews

3.3 Familiarity and Experience with Selected Indigenous Vegetables by Household Consumers and Market Vendors

Twenty-four pamphlets on indigenous vegetables, produced by a documentation project supported by the Philippines Department of Science and Technology (DOST) in collaboration with the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD), were used to assess the familiarity of household consumers and vendors with indigenous vegetables. Some species are widely known and consumed. Others

are either only popular in specific localities or defined by local cultures (and not known elsewhere). The pamphlets served as visual and memory aids, particularly since local names may vary across dialects and ethnolinguistic groups. The sections that follow present the findings related to consumers' and market vendors' knowledge of and experience with indigenous vegetables.

3.3.1 Household consumers' knowledge of and experience with indigenous vegetables

Three sets of stacked bar graphs appear in Figure 13. These show consumer familiarity and experience with eating and growing selected indigenous vegetables species. As expected, consumers were familiar with the more popular vegetable species, e.g., green papaya, squash flowers, moringa, malabar spinach, bamboo shoots, breadnut, green onions, the edible fern called *pako*, native bitter gourd or *ampalaya*, taro, and even cassava leaves. The market presence of these indigenous vegetables is increasing, and they have well-established market chains, as indicated by the longer bars illustrating the continuous purchase from consumers.

Weedy species, such as the highly nutritious amaranths, talinum (*Talinum triangulare)*, and the medicinal pepper elder (*Peperomia pellucida*) listed in Annex 1 in this document are not usually sold in markets. These species are also sensitive to environmental degradation and pollution, which make them less productive, as well as unsafe for human consumption in case of soil, air and water contamination.

3.3.2 Market survey respondents' knowledge about and experience with indigenous vegetables

Market vendors' familiarity and interest with selling selected indigenous vegetables were also assessed. Figure 14 shows that of the 24 indigenous vegetables, 17 were familiar to the market survey respondents. Although most of these vegetables are readily available in markets, there are a few species that many vendors have rarely (if ever) sold such as amaranths, squash flowers, Sesbania and moringa tree flower buds, breadnut, edible fern, garlic greens, cassava leaves, and the highly- priced Himbabao (*Broussonetia luzonica*).

The combined stacked bar graphs show that, although some indigenous vegetables are known or familiar, they are not always present in Bacoor and Dasmariñas markets. Some plant parts such as flower buds are highly perishable, are often used in small quantities and generally sourced from home gardens. Other vegetables (e.g., ferns and Himbabao) can be sourced from preserved natural habitats.

Figure 13: Household familiarity and experience with consuming and buying selected indigenous vegetables.

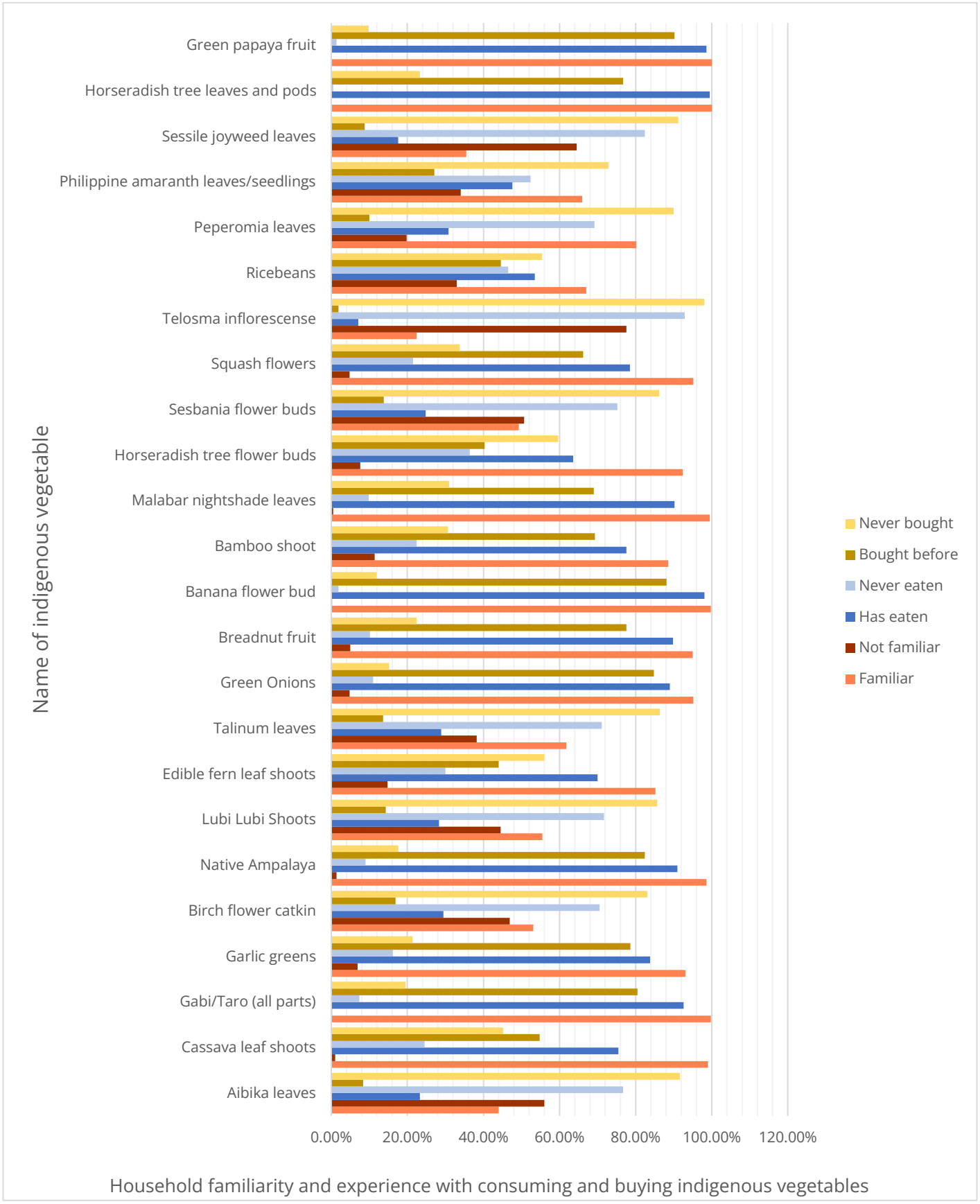
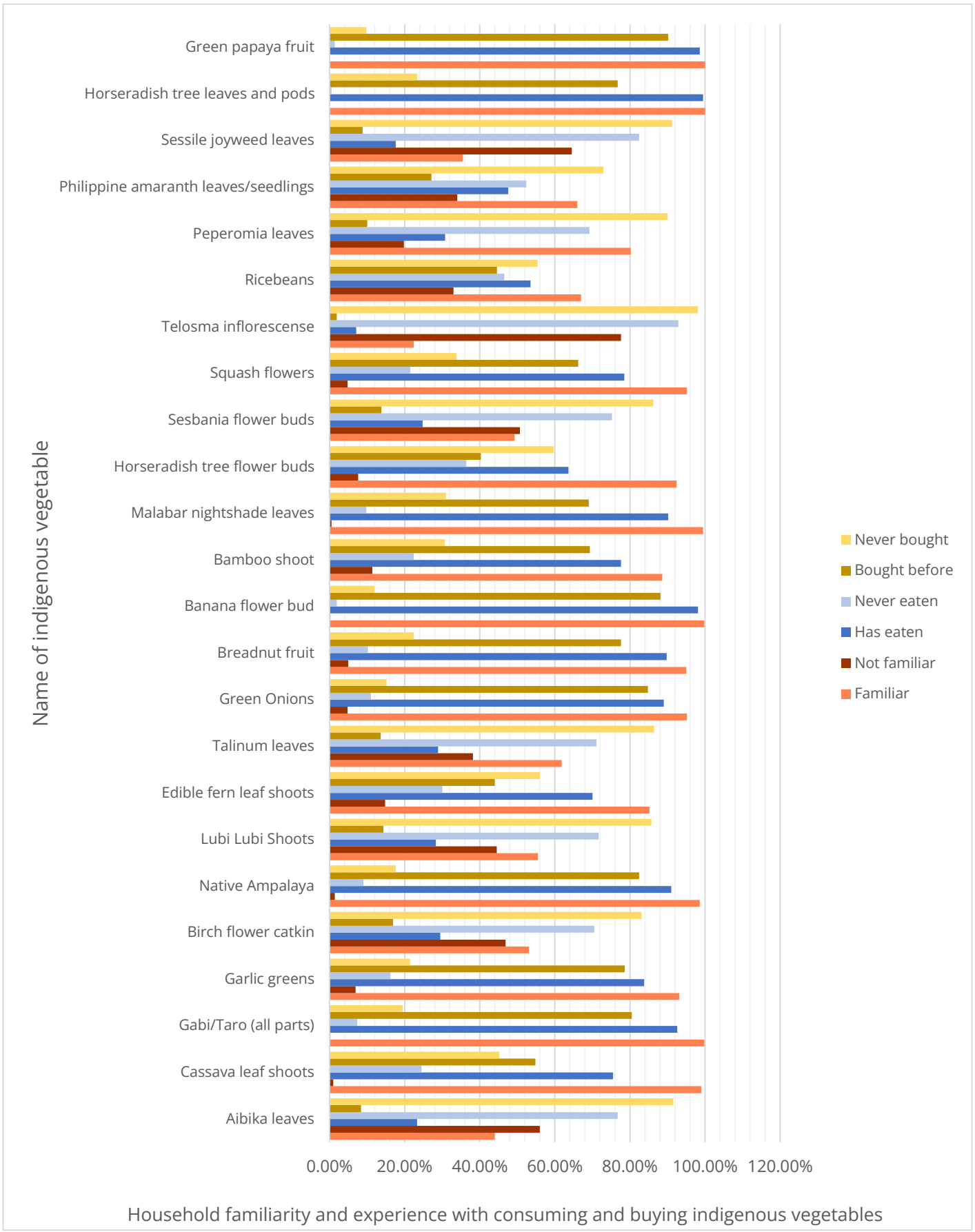


Figure 14: Market vendors' familiarity and interest in selling selected indigenous vegetables



4. Conclusions

Household decisions to buy vegetables are predominantly taken by adult women. Although a significant proportion of vendors report that most buyers are women, both men and women within the household are known to purchase.

Nutrition, freshness, and price are key factors affecting the purchase of indigenous vegetables by consumers. Other important factors include origin (locally grown/imported) while production method (organic/non-organic) scored lowest. Consumers primarily perceive indigenous vegetables as nutritious and affordable.

Vendors on the other hand consider price, freshness, shelf-life, and nutrition to be "very important" in vegetable selection. Packaging was considered only somewhat important.

The indigenous vegetables that are commonly consumed are also available in the markets, reflecting consumer demand and vendors' access to supply, and prices that are considered acceptable to both. Thirteen species were identified by market vendors although some are not strictly indigenous vegetables – e.g., potato, ginger, and cabbage. Gaps in awareness and knowledge about indigenous vegetables among sellers and buyers were noted. Also, for many of the indigenous vegetables in markets, traditional varieties are no longer available.

The supply chain extends from north to south of Luzon, including the island of Mindoro. Much of the indigenous vegetables supply comes from the southern provinces, while the North supplies these alongside conventional vegetables. Traders facilitate the flow from Manila markets to the South.

5. Recommendations

Opportunities exist to promote traditional and indigenous vegetables based on consumer and market vendor perceptions and preferences. Following are some key recommendations to increase the sale and consumption of indigenous vegetables in the Philippines.

Review of relevant national and local policies

At the local level, zoning and housing policies affect the natural growing habitats and ecosystems of many indigenous vegetables. Food and nutrition security, in addition to the potential of indigenous vegetables to improve household livelihoods, have multiplier effects on the economy through reduced disease incidence, reduced dependence on external food sources, and a productive population enjoying health and wellbeing.

Promotion and value chain development

- Initially, focus public information and education campaigns on crops of interest to buyers (want to buy) and sellers (want to sell).

- Considering the reduced shelf life and postharvest handling requirements/costs of many potentially health promoting indigenous vegetables, short market chains should be strengthened, with production systems that are more attuned to preserving the natural resource base. However, the potential of high-value market chains for indigenous vegetables should not be overlooked, as many indigenous vegetables can fetch high market prices. However, for some of these vegetables, the lack of general awareness has led to diminishing populations. Himbabao (*Broussonetia luzonica*), for instance, is a highly coveted flower vegetable that is well-known and highly priced, but many of the trees have been lost as result of loss of natural habitats. Propagation is a challenge, although with the recent rise in interest in indigenous vegetables and Himbabao the issues of propagation, reintroductions and domestication could be addressed. Development of market chains and communication channels between urban consumers and rural sources (including "gathering sites" that require the preservation of natural habitats and biodiversity). This can be the value proposition of indigenous vegetables for urban consumers in addition to their nutritional and health-giving benefits, which is complementary to agro-ecotourism concepts.

- Higher mobility of people resulting in mixed cultural backgrounds in urban areas - a phenomenon that needs to be understood well vis-à-vis promotional efforts and the agro-ecological requirements. Mixed populations provide opportunity for wider promotion of indigenous vegetables, as migrants are generally rooted to their food cultures. Opportunity lies in addressing the low availability of culturally relevant vegetables in urban areas (where populations from distant provinces have settled) through the distribution of planting materials, the establishment of community gardens and revitalization of home gardens.

- Information and technologies for postharvest handling/processing for many indigenous vegetables need to be more widely disseminated.

Short supply chains

- In contrast to conventional vegetable market chains, value chains for traditional and indigenous vegetables could be an opportunity for realizing more sustainable short chains that promote the consumption of food that is grown nearby.

- Thus, it will be important to increase investment in characterizing and evaluating indigenous vegetables genetic resources, improving cultural management *in situ* or on-farm, as well as exploring the sustainable use of these resources within biodiversity-friendly enterprises contextualized in a food systems framework.

Seed systems support

Seed systems/exchange needs to be supported and information about indigenous vegetables disseminated more widely. Digital platforms and social networks hold potential for doing this efficiently, but communications infrastructure in the countryside needs to be expanded and upgraded.

Food and Nutrition Education Program

A food and nutrition education program can be designed to promote healthier food purchases (i.e., vegetables and indigenous vegetables in particular). Incentivizing the purchase of vegetables and fruits can be an effective means of influencing food purchases and should be discussed by a multi-stakeholder platform that includes communities, the private sector, and policy makers.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Annexes

Annex 1

List of twenty-four indigenous vegetable species selected to assess consumer and market vendor familiarity with indigenous vegetables.

English name	Local name	Scientific name
Aibika	Lagikway	*Abelmoschus manihot*
Cassava	Talbos ng Kamoteng Kahoy	*Manihot esculenta*
Taro	Gabi	*Colocasia esculenta*
Garlic	Bawang gulay	*Allium sativum*
Birch Flower	Himbabao	*Broussonetia luzonica*
Bitter gourd	Ampalaya	*Momordica charantia*
Philippine fig leaf shoots	Lubi-Lubi leaf shoots	*Ficus pseudopalma*
Vegetable fern leaf shoots	Pako leaf shoots	*Diplazium esculentum*
Waterleaf	Talinum	*Talinum triangulare*
Shallot	Lasona Gulay	*Allium cepa var. aggregatum*
Breadnut	Kamansi	*Artocarpus camansi*
Banana flower	Puso ng Saging	*Musa x paradisiaca; M. balbisiana*
Bamboo shoots	Labong	*Bambusa blumeana; B. philippinensis; Gigantochloa atter; G. Levis*
Malabar spinach	Alugbati	*Basella alba*
Moringa flower buds, leaves and pods[1]	Malunggay	*Moringa oleifera*

[1]Moringa flowers and moringa leaves and pods were treated as separate vegetables.

This research is being implemented by CGIAR researchers from IFPRI, CIMMYT, The Alliance of Bioversity International and CIAT, IWMI, and CIP in close partnership with World Vegetable Center, Applied Horticultural Research, the University of Sydney, the Institute of Development Studies, Wageningen University & Research, and the University of California, Davis.

We would like to thank all funders who support this research through their contributions to the CGIAR Trust Fund: www.cgiar.org/funders

Alliance of Bioversity International and CIAT
Alliance Headquarters | Via di San Domenico, 1, 00153 Rome, Italy

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