

Diversity of edible plants sold in two traditional markets of Wonosobo District, Indonesia

DITA OKTAVIA¹, DANAR THOORIQ AZIZ FATHURROHMAN¹, EUNIKE ISLAMI FAIRUZ SALSABILA¹,
EVIRAHMALIA NABILA AXELANDRA¹, RATNA WIDYANINGTYAS¹, JOHAN ISKANDAR²,
DARLINA MD. NAIM³, AHMAD DWI SETYAWAN^{1,4,*}

¹Department of Environmental Science, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta 57126, Central Java, Indonesia. Tel./fax.: +62-271-663375, *email: volatileoils@gmail.com

²Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran. Jl. Ir. Soekarno Km. 21, Jatinangor, Sumedang 45363, West Java, Indonesia

³School of Biological Sciences, Universiti Sains Malaysia. 11800 Penang, Malaysia

⁴Biodiversity Research Group, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta 57126, Central Java, Indonesia

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Abstract. Oktavia D, Fathurrohman DTA, Salsabila EIF, Axelandra EN, Widyaningtyas R, Iskandar J, Md, Naim D, Setyawan AD. 2025. Diversity of edible plants sold in two traditional markets of Wonosobo District, Indonesia. *Biodiversitas* 26: 5334-5351. The existence of food plants at the Wonosobo Traditional Market in Wonosobo District, Central Java, Indonesia, contributes significantly to supporting biodiversity. This study explores the diversity of edible plants in Kertek Market (*Pasar Kertek*) and Wonosobo Central Market (*Pasar Induk Wonosobo*), Central Java, Indonesia. These markets, beyond being trading centers, serve as vital spaces for preserving local culture and bolstering local food security. Through observation and interviews with 102 edible plant traders at Kertek Market and Wonosobo Central Market, we identified a total of 106 species and 161 varieties from 49 families were identified, with the main categories including staple foods, substitute food, vegetables, fruits, and seasonings. The Solanaceae, Fabaceae, Poaceae, and Brassicaceae families dominated. The results showed 88.58% similarity of edible plants sold in both markets, with the Wonosobo Central Market showing higher species and local varieties diversity. Most of the crops sold are cultivated and can be grown all year round. The price interval of edible plants sold ranged from IDR 2,000 to IDR 200,000. The distribution system in this traditional market involves a supply chain from farmers and distributors to consumers, which includes suppliers from Wonosobo District 71% and others (29%). Collaboration between local and external suppliers can support the sustainability of traditional markets underscore the importance of traditional markets as biodiversity reservoirs, and inform local food policy for sustainable agri-food systems.

Keywords: Diversity, edible plants, local food security, socio-cultural values, Wonosobo Traditional Market

INTRODUCTION

Food security reflects a nation's capacity to produce adequate plant-based food to meet its population's nutritional needs. Plants are vital for human survival, providing both nourishment and medicinal benefits (Cozzolino et al. 2024). Many traditional and wild food species grow naturally without cultivation, demonstrating ecological resilience and potential as sustainable food sources (Thattantavide and Kumar 2022). These edible plants—classified as alternative foods, vegetables, fruits, and spices (Silalahi et al. 2021)—remain underutilized in modern food systems due to their low energy yields and limited large-scale cultivation. Yet, their ability to thrive under harsh conditions makes them essential for improving nutrition in rural and low-income communities (Kumar and Bhalothia 2020). Promoting neglected and underutilized species can thus enhance dietary diversity, strengthen climate resilience, and advance sustainable agriculture (Li et al. 2020).

Food crops play a vital role in local cultures and global biodiversity. Different regions have cultivated various edible plants as the foundation of traditional diets and

culinary practices, shaping both nutrition and identity (Chivenge et al. 2015; Bisai et al. 2023). Beyond their nutritional value, these plants serve as cultural symbols, strengthening the connection between people, their history, and the environment (Ghosh et al. 2023). This connection is further reinforced through sustainable cultivation practices, which not only preserve biodiversity but also reflect a harmonious relationship between communities and their ecosystems. Moreover, in many traditions, agricultural knowledge and consumption practices are passed down through generations, ensuring both cultural continuity and long-term food security (Patel et al. 2020).

In traditional markets, beyond serving as hubs for trading various food crops from local agriculture, they also play a crucial role in preserving cultural traditions and social values within communities (Britwum and Demont 2022). Traditional markets see buying and selling transactions conducted directly between sellers and buyers, using bargaining as a characteristic (Ahearne et al. 2022). In this bargaining, the social relationship between traders and buyers becomes active (Alfian et al. 2020). Although their role has diminished in the modern era, traditional markets remain important socio-economic spaces and historical

entities within a city, highlighting their importance in sustaining the socio-economic and cultural sustainability of a region (Agboola et al. 2018). Even in the absence of historic buildings, traditional markets continue to hold significant value as intangible cultural assets of a region (Zandieh and Seifpour 2020).

Traditional markets are central to Wonosobo's agricultural trade in Central Java, functioning as key distribution hubs for locally grown food and horticultural crops. The region's high rainfall supports the cultivation of diverse crops such as corn, tubers, onions, chilies, beans, and fruits (Ariefin and Cahyono 2016). Although previous studies have explored plant diversity for food, vegetables, fruits, spices, and traditional medicines (Iskandar et al. 2020; Alfian et al. 2020), little is known about edible plant diversity in Wonosobo's traditional markets—particularly regarding species identification, food categories, availability, suppliers, and socio-cultural values. This study hypothesizes that market plant diversity reflects both local agricultural productivity and cultural food preferences. Using an ethnobotanical approach, it links market inventories to social indicators such as Use Value and Cultural Importance Index to reveal connections between trade, local knowledge, and agrobiodiversity. The research focuses on recording and identifying edible plant varieties and analyzing price variations in Kertek and Wonosobo Central Markets, aiming to inform local food security policies.

MATERIALS AND METHODS

Study area

This research was conducted in Wonosobo District, Central Java Province, Indonesia. Geographically, Wonosobo District is situated between 7°11'-7°36' S latitude and 109°43'-110°04' E longitude (Figure 1). It lies approximately

120 km from Semarang, the provincial capital of Central Java Province, and about 520 km from Jakarta, the capital of Indonesia. The region is characterized by a mountainous landscape with elevations ranging from 275 m to 2,250 m asl. (Statistics Indonesia 2023). The study focused on two sub-districts within Wonosobo District, i.e.: Kertek and Wonosobo Sub-districts. The specific research locations are Kertek Market, located at Street of Kertek No. 1, Kertek Sub-district (7°23'22.7"S 109°57'48.3"E), and Wonosobo Central Market, located at Street of Pasar Induk Wonosobo No. 1, Wonosobo Sub-district (7°21'44.4"S 109°54'06.1"E). These markets were selected due to their significant role in local food crop trading. Both Kertek Market and Wonosobo Central Market operate daily, including on Sundays, providing consistent opportunities for observing market activities (Metananda et al. 2023).

Data collection

Data collection in this study was conducted through direct observations and interviews with traders at the selected markets—Kertek Market and Wonosobo Central Market—during October 2024. The interview process employed purposive sampling, as respondents were selected based on criteria relevant to the research objectives, targeting traders who sold edible plants, including those dealing in staple food crops, substitute food crops, fruits, vegetables, and spices. A total of 102 traders were interviewed, consisting of 51 respondents from Kertek Market and 51 from Wonosobo Central Market. Respondents were selected using purposive sampling, focusing on traders who regularly sell edible plants and are considered knowledgeable about the types and sources of the plants they trade. All respondents provided informed consent prior to participation, in accordance with institutional research ethics.

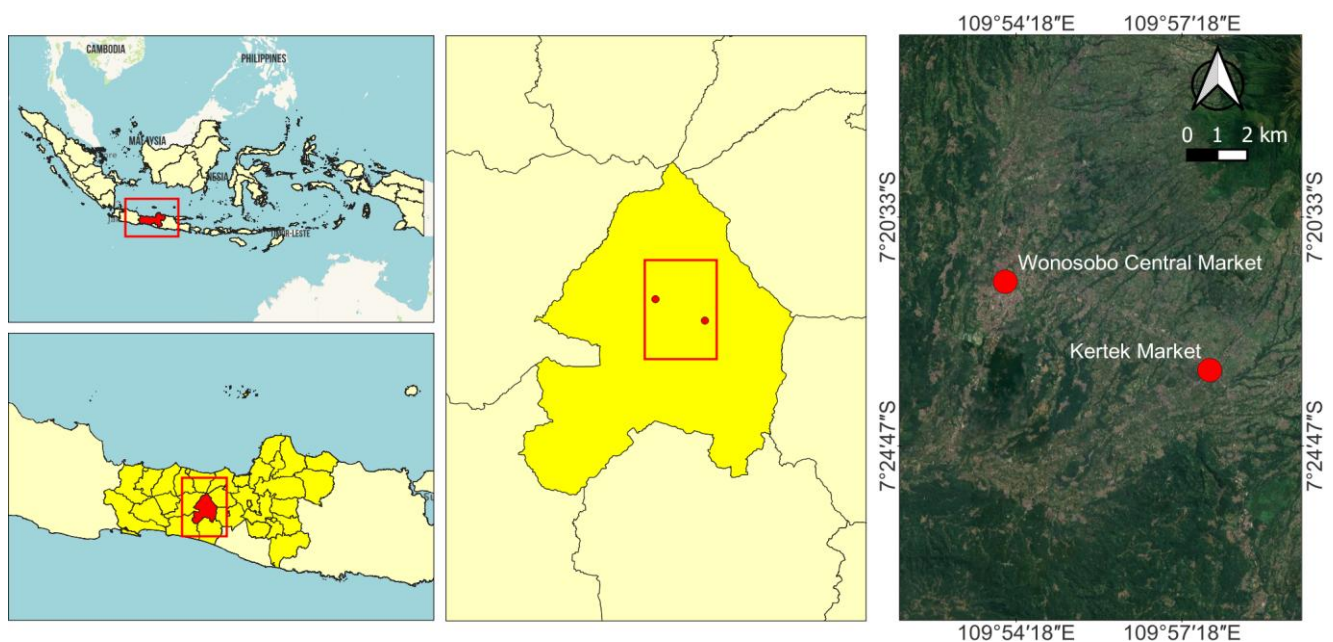


Figure 1. Map of the study area (Kertek Market and Wonosobo Central Market) in Wonosobo District, Central Java, Indonesia

The collected data included plant family, habitat, category, seasonality, availability, supplier, and price. Interviews provided additional insights into edible plant diversity, consumption patterns, and associated cultural values. Species were identified in the markets based on morphological traits and local names, as all were cultivated and commonly known food crops. Scientific names were verified through the Plants of the World Online (POWO) and Global Biodiversity Information Facility (GBIF) databases to ensure taxonomic accuracy. Voucher specimens were not collected because all species were cultivated and easily recognized in the field.

The identification of local varieties (landraces) in this study combined both morphological and vernacular criteria. Varietal distinction was based on observable morphological traits such as color, size, shape, texture, and organoleptic characteristics, together with vernacular naming used by traders and consumers to differentiate forms of the same species. Additional distinctions were made when traders indicated specific geographic origins (e.g., *kentang Dieng*) or described different uses for particular forms, such as culinary versus ritual purposes. A plant form was considered a distinct local variety only when at least one morphological difference and one consistent vernacular or functional distinction were confirmed independently by a minimum of three respondents.

Data analysis

Data analysis in this research used a combined qualitative and quantitative descriptive approach to understand the diversity of local edible plant varieties and the social, economic, and cultural implications of trading practices in Kertek Market and Wonosobo Central Market.

Quantitative analysis employed three commonly used ethnobotanical indices: the Sørensen Similarity Index (SSI), Use Value (UV), and Cultural Importance Index (CII). These indices were calculated using the following formulas.

Sørensen Similarity Index (SSI)

The SSI was applied to measure the similarity of edible plant species and varieties between the two markets (Santhyami et al. 2024).

$$SSI = \frac{2C}{A + B} \times 100$$

Where:

A: Number of edible plant species recorded in Kertek Market;

B: Number of edible plant species recorded in Wonosobo Central Market;

C: Number of edible plant species common to both markets.

SSI values greater than 50% indicate that the two markets share similar species composition, while values below 50% denote greater dissimilarity (Poedjirahajoe et al. 2019).

Use Value (UV)

The Use Value was used to estimate the relative importance of each species based on its frequency of mention or sale (Phillips and Gentry 1993; Hoffman and Gallaher 2007).

$$UV = \frac{\sum U_i}{N}$$

Where:

U_i: Number of different uses or mentions reported for species *i* by all respondents;

N: Total number of respondents.

A higher UV indicates that a species is more frequently traded or culturally valued within the community.

Cultural Importance Index (CII)

The CII was used to represent both the spread (number of respondents) and frequency (number of uses) of each species across all categories (Tardío and Pardo-de-Santayana 2008).

$$CII = \sum_{u=1}^{NC} \frac{UR_{iu}}{N}$$

Where:

UR_{iu}: Number of respondents who cited use *u* for species *i*;

N: Total number of respondents;

NC: Total number of use categories.

This index integrates both the diversity of uses and their distribution among traders, giving a broader picture of cultural significance.

Descriptive statistics were also used to summarize species richness by family and by category (staple food, substitute food, vegetables, fruits, and spices). The results of these analyses were presented in the form of tables and graphical visualizations (bar charts, pie charts, and histograms) to facilitate the interpretation of patterns related to dominant plant families, use categories, and inter-market composition differences.

Qualitative interpretation combined field observations and trader interviews with secondary literature to contextualize the findings within the socio-cultural systems of Wonosobo. Secondary data were employed to strengthen the discussion on how edible plant diversity in both markets reflects local traditions, dietary practices, and agrobiodiversity conservation values (Swiderska 2020).

RESULTS AND DISCUSSION

Profil of Kertek Market and Wonosobo Central Market

Kertek Traditional Market and Wonosobo Central Market play complementary roles in shaping the local food economy and trading networks of Wonosobo District. Both markets function not only as economic centers but also as social spaces that reflect local cultural values and consumption patterns. Kertek Traditional Market, located

in Kertek Sub-district, is known as a trading center for local agricultural commodities such as vegetables and fruits. Despite being situated along the Wonosobo-Temanggung strategic route, the market often appears poorly maintained, with scattered garbage and insufficient waste management facilities, such as adequate trash bins. This condition reflects the limited infrastructure investment typically found in rural markets, which can affect hygiene and visitor comfort.

On the other hand, the main attraction of this market lies in its vibrant bargaining atmosphere, where communications between buyers and traders are direct, intimate, and personal. Such interactions create a strong sense of social cohesion and community trust, representing an important dimension of market-based cultural exchange. This direct interaction creates a closer social value compared to the Central Market. Meanwhile, Wonosobo Central Market is the largest market in the city, with a modern and more organized building. The market offers a cleaner and tidier environment, having recently been renovated. Almost every shop is equipped with a wastebasket, which helps keep the market clean. The distribution of stalls is more organized, as there are dividers between sellers based on product class, making it easier for shoppers to find the items they want. These structural improvements not only enhance consumer convenience but also illustrate an ongoing modernization of traditional market systems in urban Wonosobo. This market is also increasingly complete in its function, not only selling edible plants but also various household necessities. Together, both markets represent two interconnected nodes in the region's agrobiodiversity trade system—Kertek Market emphasizing locally grown produce and Wonosobo Central Market serving as a hub for regional distribution and diversified goods.

Characteristics of respondents

This study involved 102 respondents who were traders operating in Kertek Market and Wonosobo Central Market, with each market representing 50% of the total respondents. This balanced sampling design ensures a fair representation of both rural and urban trading environments in Wonosobo. Table 1 shows that most traders (67.65%) are between 40 and 64 years old. This age group is considered economically productive, possessing sufficient trading experience and financial stability (Toossi and Torpey 2017). Additionally, a notable proportion of respondents (15.69%) aged 65 to 90 remain actively engaged in trading, reflecting the persistence of elderly participation in the informal economy. This continued involvement among older individuals highlights the social resilience of traditional market actors, where trading activities also serve as a means of maintaining social interaction and livelihood security beyond retirement age.

However, the participation of younger traders aged 20 to 39 is relatively low (16.66%), indicating a generational shift in employment preferences. The limited engagement of youth suggests declining interest in traditional trading careers, which could threaten the long-term continuity of market-based agrobiodiversity systems. According to the

Pew Research Center (2020), younger generations tend to seek jobs offering flexibility, career advancement, and technological integration—features rarely available in the traditional market sector. This trend may eventually influence the transmission of local knowledge about plant diversity and trade practices, as traditional skills are not being passed down to younger generations.

Gender differences in the traditional markets of Kertek and Wonosobo Central Market highlight a marked gender disparity, with 83.33% of traders being women. This finding aligns with Arwemi et al. (2022), who reported that approximately 85% of traders in Indonesian traditional markets are women. The predominance of women is largely attributed to the flexible working hours and minimal formal requirements, allowing them to combine household responsibilities with income-generating activities. This pattern also emphasizes the vital role of women in maintaining household food security and preserving the circulation of local food biodiversity through daily trading activities.

Despite these advantages, women traders continue to face barriers in accessing formal economic sectors and government support programs, primarily due to patriarchal structures that limit women's access to capital and policy participation. According to Tyagi (2021), patriarchal culture often results in women being undervalued and underrepresented, perpetuating gender inequities in work, education, and economic participation. Such conditions underscore the need for gender-sensitive policies that recognize women's contribution to sustaining traditional markets as biodiversity and food-security hubs.

The educational backgrounds of traders in both markets are relatively diverse: approximately 33.3% have completed elementary school, 27.47% junior high school, and 27.47% senior high school. A small proportion of traders (8.81%) have no formal education, while only 2.93% hold tertiary qualifications. These findings indicate that the traditional trade sector remains accessible to individuals from a wide range of educational backgrounds.

Table 1. Characteristics of respondents in Wonosobo Traditional Market, Central Java, Indonesia (N = 102)

| Information | Quantity | Percentage |
|--------------------|----------|------------|
| Respondent | | |
| Kertek Market | 51 | 50% |
| Central Market | 51 | 50% |
| Age | | |
| 20-39 years old | 17 | 16.66% |
| 40-64 years old | 69 | 67.65% |
| 65-90 years old | 16 | 15.69% |
| Gender | | |
| Female | 85 | 83.33% |
| Male | 17 | 16.67% |
| Education | | |
| Collage | 3 | 2.93% |
| Senior High School | 28 | 27.47% |
| Junior High School | 28 | 27.47% |
| Elementary | 34 | 33.32% |
| Not Graduated | 9 | 8.81% |

However, the dominance of low to moderate educational attainment also implies limited opportunities for business development and innovation, particularly in adapting to digital marketing or modern supply-chain systems. This educational profile suggests that most traders rely more on experiential knowledge and intergenerational learning rather than formal training, which can be both a strength in maintaining traditional trade values and a challenge for modernization.

Diversity of edible plants

In Wonosobo traditional markets, edible plants are categorized into five groups—staple food, substitute food, herb-spice seasoning, vegetables, and fruits (Figure 2). A total of 104 species and 161 varieties belonging to 49 families were recorded Table 2, reflecting the rich agrobiodiversity and dynamic food economy of Wonosobo. This high diversity indicates a well-established local trading system and reflects the region's fertile agricultural landscape.

A comparative analysis of the two major markets reveals both shared and distinct plant varieties. Wonosobo Central Market offered 96 species with 152 varieties, including several exclusive species such as *Vitis vinifera* L., *Garcinia xanthochymus* Hook.fil. ex J.Anderson, *Amaranthus tricolor* L., *Cucumis melo* L., *Capsicum frutescens* L., *Limnocharis flava* (L.) Buchenau, *Brassica oleracea* L., *Mangifera indica* L., *Gnetum gnemon* L., *Luffa acutangula* (L.) Roxb., *Pilea melastomoides* (Poir.) Wedd., *Salacca zalacca* (Gaertn.) Voss, *Ocimum basilicum* L., and *Syzygium aqueum* (Burm.fil.) Alston. Additionally, *Capsicum annum* L. appears in seven varieties, while *Musa paradisiaca* L. occurs in seven .

Observations in Kertek Market show slightly lower but still significant diversity, with 95 species and 137 varieties. Unique to this market are *Psophocarpus tetragonolobus* (L.) DC., *Etilingera elatior* (Jack) R.M.Sm., *Spondias purpurea* L., *Pangium edule* Reinw., *Phoenix dactylifera* L., *Swietenia mahagoni* (L.) Jacq., *Diplazium esculentum* (Retz.) Sw., *Pandanus amaryllifolius* Roxb. ex Lindl., and *Xanthosoma sagittifolium* (L.) Schott. Despite their unique offerings, both markets share 86 species and 128 varieties (Figure 3), indicating considerable overlap in food crop

availability. This overlap suggests shared consumer preferences and common staple foods that underpin the dietary habits of the Wonosobo population.

The Sorensen Similarity Index (SSI) shows a high degree of similarity between the two markets: 88.54% for species and 88.58% for local varieties. Such high values (Figure 3) indicate that both markets exhibit similar species composition, likely driven by shared supplier networks and overlapping consumer demands. Several factors may explain this pattern, including market size, customer demographics, and supply chain logistics (Zhu et al. 2022). The SSI is valuable for assessing the similarity of edible plant inventories across local markets (Poedjirahajoe et al. 2019). The following discussion interprets these results in the context of agrobiodiversity, cultural food preferences, and local trade systems.

The composition of edible plant categories in Wonosobo traditional markets is dominated by fruit (32%) and vegetables (26%), followed by herbs-spices-seasonings, mixed foods, staple foods, and substitute foods (Figure 4). A comparison between the two markets shows only minor differences in the number of edible plant species and local varieties traded, with both exhibiting nearly equal diversity levels (Figure 5).

Dominant plant families and their functional importance

The dominant families identified in both markets were Solanaceae (18 varieties), Fabaceae (14 varieties), Poaceae (13 species), and Brassicaceae (10 varieties) as presented in Figure 6. These four families represent the ecological and nutritional backbone of Wonosobo's food system.

Within Solanaceae, local varieties include *C. annum* (*cabai hijau besar*, *cabai merah besar*, *cabe hijau keriting*, *cabe merah keriting*, *paprika hijau*, *paprika kuning*, *paprika merah*), *C. frutescens* (*cabai rawit hijau*, *merah*, *putih*), *Solanum tuberosum* L. (*kentang*), *S. melongena* L. (*terong hijau*, *ungu*, *lalap*), *S. nigrum* L. (*leunca*), and *Lycopersicon esculentum* Mill. (*tomat varieties*). The dominance of Solanaceae reflects the community's dependence on high-value horticultural crops used daily in household cooking, both for flavor and nutritional enrichment.

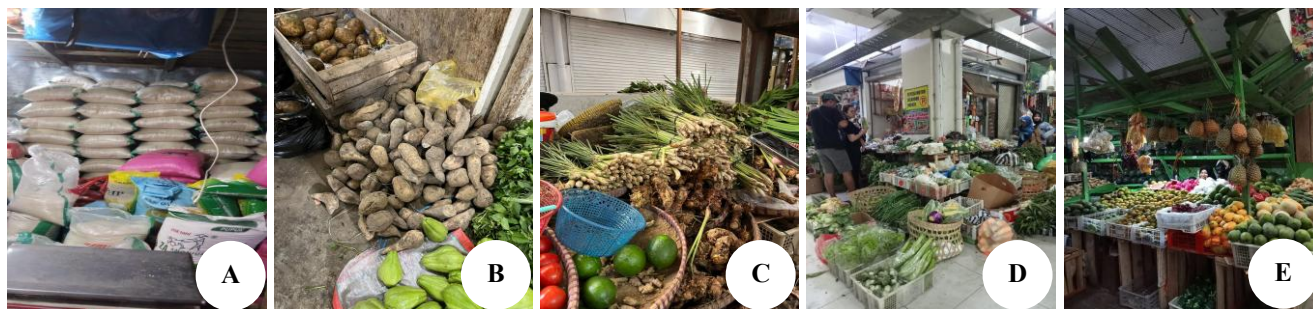


Figure 2. Food crop categories in Wonosobo Traditional Market, Central Java, Indonesia. A. Staple food, B. Substitute food, C. Herb-Spice seasoning, D. Vegetables, E. Fruits

Table 2. Edible plant diversity in traditional markets of Wonosobo, Central Java, Indonesia

| Family | Species | Local varieties | Place | | Edible part | Categories | CS | Season | Available | Supplier | Price (IDR) |
|---------------|---|---------------------------|-------|----|-------------|------------|-----|--------|------------|------------|--------------|
| | | | KM | IM | | | | | | | |
| Actinidiaceae | <i>Actinidia deliciosa</i> (A.Chev.) C.F.Liang & A.R.Ferguson | <i>Kiwi hijau</i> | ● | ● | F | F | C | Sea | + | Impor | 50,000/kg |
| Alismataceae | <i>Limnocharis flava</i> (L.) Buchenau | <i>Daun genjer</i> | - | ● | L | V | W | All | + | Wonosobo | 2,000/bundle |
| Alliaceae | <i>Allium cepa</i> L. | <i>Bawang bombay</i> | ● | ● | B | HSS, V | C | Sea | + | Brebes | 30,000/kg |
| | | <i>Bawang merah</i> | ● | ● | B | HSS, V | C | Sea | + | Brebes | 20,000/kg |
| | <i>Allium sativum</i> L. | <i>Bawang putih</i> | ● | ● | B | HSS, V | C | Sea | - | Temanggung | 37,000/kg |
| | | <i>Bawang tunggal</i> | ● | ● | B | HSS, V | C | Sea | - | Temanggung | 200,000/kg |
| | <i>Allium fistulosum</i> L. | <i>Daun bawang</i> | ● | ● | L | HSS, V | C | All | + | Wonosobo | 7,000/kg |
| | <i>Allium schoenoprasum</i> L. | <i>Kucaai</i> | ● | ● | L | V | W | Sea | + | Wonosobo | 2,000/bundle |
| Amaranthaceae | <i>Amaranthus hybridus</i> L. | <i>Bayam hijau</i> | ● | ● | L | V | C | All | + | Wonosobo | 2,500/bundle |
| | <i>Amaranthus tricolor</i> L. | <i>Bayam merah</i> | - | ● | L | V | C | All | + | Wonosobo | 5,000/bundle |
| | <i>Spondias purpurea</i> L. | <i>Kedondong</i> | ● | - | F | F | W | All | - | Jepara | 12,000/kg |
| Anacardiaceae | <i>Mangifera indica</i> L. | <i>Mangga harum manis</i> | ● | ● | F | F | C | Sea | + | Yogyakarta | 16,000/kg |
| | | <i>Mangga indramayu</i> | ● | ● | F | F | C | Sea | + | Yogyakarta | 30,000/kg |
| | <i>Mangga manalagi</i> | - | ● | F | F | C | Sea | + | Yogyakarta | 15,000/kg | |
| | <i>Annona muricata</i> L. | <i>Sirsak</i> | ● | ● | F | F | C | All | + | Wonosobo | 7,000/kg |
| Annonaceae | <i>Foeniculum vulgare</i> Mill. | <i>Adas</i> | ● | ● | S, L | HSS | SC | All | - | Yogyakarta | 8,000/bundle |
| | | <i>Seledri</i> | ● | ● | L | V | C | All | + | Wonosobo | 5,000/kg |
| | | <i>Ketumbar</i> | ● | ● | F | HSS | C | All | + | Kaliwiro | 40,000/kg |
| Asteraceae | <i>Cosmos caudatus</i> Kunth | <i>Kenikir</i> | ● | ● | L | V | C | All | - | Wonosobo | 2,500/bundle |
| Arecaceae | <i>Cocos nucifera</i> L. | <i>Kelapa</i> | ● | ● | F | HSS | C | All | + | Kendal | 5,000/pcs |
| | | <i>Kolang kaling</i> | ● | ● | F | F | C | Sea | + | Wonosobo | 16,000/kg |
| | <i>Phoenix dactylifera</i> L. | <i>Kurma</i> | ● | - | F | F | C | Sea | + | Impor | 40,000/kg |
| | <i>Salacca zalacca</i> (Gaertn.) Voss | <i>Salak</i> | - | ● | F | F | C | Sea | + | Wonosobo | 10,000/kg |
| | | <i>Pondoh</i> | ● | ● | F | F | C | All | + | Wonosobo | 12,000/kg |
| Averrhoaceae | <i>Averrhoa carambola</i> L. | <i>Belimbing</i> | ● | ● | F | F | C | All | + | Wonosobo | 12,000/kg |
| Brassicaceae | <i>Brassica oleracea</i> L. | <i>Kol putih</i> | ● | ● | L | V | C | Sea | + | Wonosobo | 4,000/pcs |
| | | <i>Kol ungu</i> | - | ● | L | V | C | All | + | Wonosobo | 20,000/pcs |
| | | <i>Kubis</i> | ● | ● | L | V | C | Sea | + | Wonosobo | 4,000/kg |
| | | <i>Kembang kol</i> | ● | ● | FL | V | C | All | - | Wonosobo | 20,000/kg |
| | | <i>Kembang kol</i> | ● | ● | L | V | C | All | - | Wonosobo | 20,000/kg |

| | | | | | | | | | | | |
|----------------|---|--|---|---|------|--------|----|-----|---|------------|--------------|
| | <i>Raphanus raphanistrum</i> subsp. <i>sativus</i> (L.) Domin | <i>kol hijau</i> <i>Lobak putih</i> | • | • | T | V | C | All | + | Wonosobo | 12,000/kg |
| | <i>Brassica rapa</i> subsp. <i>chinensis</i> (L.) Hanelt Czern. | <i>Pakcoy</i> | • | • | L | V | C | All | + | Wonosobo | 2,000/kg |
| | <i>Brassica juncea</i> (L.) Czern. | <i>Sawi hijau</i> | • | • | L | V | C | All | + | Wonosobo | 7,000/kg |
| | <i>Nasturtium officinale</i> R.Br. | <i>Sawi putih</i> <i>Selada air</i> | • | • | L | V | C | All | + | Wonosobo | 2,500/pcs |
| | <i>Nasturtium officinale</i> R.Br. | <i>Selada air</i> | • | • | L | V | C | All | + | Wonosobo | 2,000/bundle |
| Bromeliaceae | <i>Ananas comosus</i> (L.) Merr. | <i>Nanas</i> | • | • | F | F | C | All | + | Wonosobo | 12,000/kg |
| Cactaceae | <i>Hylocereus lemairei</i> (Hook.) Britton & Rose | <i>Buah naga</i> | • | • | F | F | C | All | + | Yogyakarta | 10,000/kg |
| Caricaceae | <i>Carica papaya</i> L. | <i>Pepaya</i> | • | • | F, L | F, V | SC | All | + | Wonosobo | 14,000/fruit |
| | | <i>Pepaya</i> <i>California</i> | • | • | F | F | C | All | + | Wonosobo | 25,000/fruit |
| Chenopodiaceae | <i>Beta vulgaris</i> L. | <i>Bit</i> | • | • | T | V | C | Sea | - | Wonosobo | 23,000/kg |
| Clusiaceae | <i>Garcinia xanthochymus</i> Hook.fil. ex J.Anderson | <i>Asam kandis</i> | - | • | F | F | C | All | - | Sumatera | 35,000/kg |
| Compositae | <i>Lactuca sativa</i> L. | <i>Selada</i> <i>lalapan</i> | • | • | L | V | C | All | + | Wonosobo | 30,000/kg |
| Convolvulaceae | <i>Ipomoea aquatica</i> Forsk. | <i>Kangkung</i> | • | • | L | V | SC | All | + | Wonosobo | 3,500/bundle |
| | <i>Ipomoea batatas</i> (L.) Lam. | <i>Ubi kuning</i> | • | • | T | SUF | C | All | + | Wonosobo | 4,000/kg |
| Cucurbitaceae | <i>Cucumis melo</i> L. | <i>Blewah</i> | • | • | F | V | C | All | + | Wonosobo | 16,000/kg |
| | | <i>Melon</i> | - | • | F | F | C | Sea | - | Wonosobo | 25,000/kg |
| | | <i>Timun suri</i> | • | • | F | F | C | All | + | Wonosobo | 8,000/kg |
| | <i>Cucumis sativus</i> L. | <i>Mentimun</i> | • | • | F | V | C | All | + | Wonosobo | 3,000/pcs |
| | <i>Luffa acutangula</i> (L.) Roxb | <i>Oyong</i> | - | • | F | F | C | All | + | Wonosobo | 16,000/kg |
| | <i>Momordica charantia</i> L. | <i>Pare</i> | • | • | F | V | C | All | + | Wonosobo | 15,000/kg |
| | <i>Sechium edule</i> (Jacq.) Sw. | <i>Labu siam</i> | • | • | F | V | C | All | + | Wonosobo | 4,000/kg |
| | <i>Citrullus lanatus</i> (Thunb) Matsum. & Nakai | <i>Semangka</i> | • | • | F | F | C | All | + | Wonosobo | 8,000/kg |
| Euphorbiaceae | <i>Aleurites moluccanus</i> (L.) Willd. | <i>Kemiri</i> | • | • | F | HSS | C | All | + | Banyuwangi | 62,000/kg |
| Fabaceae | <i>Manihot esculenta</i> Crantz | <i>Singkong</i> | • | • | T, L | SUF, V | C | All | + | Wonosobo | 4,000/kg |
| | <i>Tamarindus indica</i> L. | <i>Asam jawa</i> | • | • | F | F | C | All | + | Ngawi | 15,000/kg |
| | <i>Phaseolus vulgaris</i> L. | <i>Kacang</i> <i>merah</i> | • | • | S | V | C | All | - | Yogyakarta | 30,000/kg |
| | | <i>Buncis</i> | • | • | F | V | C | All | + | Wonosobo | 6,000/kg |
| | <i>Archidendron pauciflorum</i> (Benth) I.C.Nielsen | <i>Jengkol</i> | • | • | F | V | C | Sea | - | Wonosobo | 40,000/kg |
| | <i>Vigna radiata</i> (L.) R.Wilczek | <i>Kacang</i> <i>hijau</i> | • | • | S | V | C | All | - | Wonosobo | 8,000/kg |
| | | <i>Kecambah</i> | • | • | S, R | V | C | All | + | Wonosobo | 35,000/kg |
| | <i>Vigna unguiculata</i> (L.) Walp. | <i>Kacang</i> <i>panjang</i> | • | • | F | V | C | All | + | Wonosobo | 9,000/kg |
| | | <i>Kacang tolo</i> | • | • | S | V | C | All | + | Yogyakarta | 27,000/kg |

| | | | | | | | | | | | |
|----------------|--|------------------------|---|---|------|--------|----|-----|---|-------------|---------------|
| | <i>Pisum sativum</i> L. | <i>Kacang kapri</i> | ● | ● | F | V | C | All | - | Wonosobo | 20,000/kg |
| | <i>Glycine max</i> (L.) Merr. | <i>Kacang kedelai</i> | ● | ● | S | V | C | All | + | Wonosobo | 18,000/kg |
| | <i>Arachis hypogaea</i> L. | <i>Kacang tanah</i> | ● | ● | S | HSS, V | C | Sea | + | Yogyakarta | 22,000/kg |
| | <i>Caesalpinia sappan</i> L. | <i>Kayu secang</i> | ● | ● | ST | HSS | SC | All | + | Magelang | 60,000/kg |
| | <i>Psophocarpus tetragonolobus</i> (L.) DC. | <i>Kecipir</i> | ● | - | F | V | SC | All | + | Wonosobo | 22,000/kg |
| Flacourtiaceae | <i>Parkia speciosa</i> Hassk. | <i>Pete</i> | ● | ● | F | V | SC | All | + | Wonosobo | 10,000/bundle |
| | <i>Pangium edule</i> Reinw. | <i>Kluwek</i> | ● | - | F | HSS | W | All | - | Yogyakarta | 2,000/pcs |
| Gnetaceae | <i>Gnetum gnemon</i> L. | <i>Melinjo</i> | - | - | F, L | V | SC | All | + | Yogyakarta | 20,000/kg |
| Lamiaceae | <i>Ocimum basilicum</i> L. | <i>Kemangi</i> | ● | ● | F, L | V | W | All | + | Wonosobo | 4,000/pcs |
| | | <i>Selasih</i> | - | ● | S | F | C | All | + | Wonosobo | 2,000/pack |
| Lauraceae | <i>Cinnamomum burmannii</i> (Nees & T. Nees) Blume | <i>Kayu manis</i> | ● | ● | ST | HSS | C | All | + | Magelang | 100,000/kg |
| | <i>Persea americana</i> Mill. | <i>Alpukat mentega</i> | ● | ● | F | F | C | Sea | + | Wonosobo | 22,000/kg |
| Leguminosae | <i>Pachyrhizus erosus</i> (L.) Urb. | <i>Bengkoang</i> | ● | ● | F | F | C | All | + | Wonosobo | 9,000/kg |
| Meliaceae | <i>Swietenia mahagoni</i> (L.) Jacq. | <i>Mahoni</i> | ● | - | S | HSS | W | All | + | Probolinggo | 50,000/kg |
| Moraceae | <i>Artocarpus heterophyllus</i> Lam. | <i>Nangka</i> | ● | ● | F | F | C | All | + | Wonosobo | 4,000/kg |
| Musaceae | <i>Musa paradisiaca</i> L. | <i>Pisang ambon</i> | ● | ● | F | F | C | All | + | Kaliwiro | 20,000/bundle |
| | | <i>Pisang kepok</i> | ● | ● | F | F | C | All | + | Kaliwiro | 20,000/bundle |
| | | <i>Pisang lampung</i> | - | ● | F | F | C | All | + | Kaliwiro | 15,000/bundle |
| | | <i>Pisang nangka</i> | - | ● | F | F | C | All | + | Kaliwiro | 25,000/bundle |
| | | <i>Pisang raja</i> | ● | ● | F | F | C | All | + | Kaliwiro | 20,000/bundle |
| | | <i>Pisang tanduk</i> | ● | ● | F | F | C | All | + | Kaliwiro | 5,000/pcs |
| | | <i>Pisang uli</i> | - | ● | F | F | C | All | + | Kaliwiro | 18,000/bundle |
| | <i>Musa balbisiana</i> Colla | <i>Pisang barangan</i> | - | ● | F | F | C | All | + | Kaliwiro | 30,000/bundle |
| | <i>Musa acuminata</i> Colla | <i>Pisang mas</i> | ● | ● | F | F | C | All | + | Kaliwiro | 10,000/bundle |
| Myristicaceae | <i>Myristica fragrans</i> Houtt. | <i>Pala</i> | ● | ● | S | HSS | C | All | + | Yogyakarta | 120,000/kg |
| Myrtaceae | <i>Syzygium aromaticum</i> (L.) Merr. & LM.Perry | <i>Cengkeh</i> | ● | ● | FL | HSS | C | All | + | Wonosobo | 180,000/kg |
| | <i>Syzygium polyanthum</i> (Wight) Walp. | <i>Daun salam</i> | ● | ● | L | HSS | SC | All | + | Wonosobo | 40,000/ons |
| | <i>Syzygium aqueum</i> (Burm. f.) Alston | <i>Jambu air</i> | - | ● | L | HSS | SC | All | + | Wonosobo | 10,000/kg |
| | | <i>Jambu citra</i> | - | ● | F | F | C | Sea | - | Demak | 10,000/kg |
| | <i>Psidium guajava</i> L. | <i>Jambu biji</i> | ● | ● | F | F | C | All | - | Wonosobo | 10,000/kg |

| | | | | | | | | | | | |
|----------------|--|--------------------------------|---|---|---|-----|----|-----|---|--------------|--------------|
| | | <i>merah</i> | • | • | F | F | C | All | - | Wonosobo | 20,000/kg |
| | | <i>Jambu kristal</i> | • | • | F | F | C | All | - | Wonosobo | 20,000/kg |
| Pandanaceae | <i>Pandanus amaryllifolius</i> Roxb. ex Lindl. | <i>Pandan wangi</i> | • | - | L | HSS | SC | All | + | Wonosobo | 33,000/kg |
| Passifloraceae | <i>Passiflora edulis</i> Sims | <i>Markisa</i> | - | • | F | F | C | Sea | - | Wonosobo | 15,000/kg |
| Phyllanthaceae | <i>Sauropus androgynus</i> (L.) Merr. | <i>Daun katuk</i> | • | • | L | V | W | All | - | Wonosobo | 2,000/bundle |
| Piperaceae | <i>Piper betle</i> L. | <i>Daun sirih</i> | • | • | L | HSS | SC | All | + | Wonosobo | 5,000/bundle |
| | <i>Piper nigrum</i> L. | <i>Lada</i> | • | • | S | HSS | C | All | + | Wonosobo | 200,000/kg |
| Poaceae | <i>Cymbopogon nardus</i> (L.) Rendle | <i>Serai</i> | • | • | L | HSS | W | All | + | Wonosobo | 5,000/kg |
| | <i>Oryza sativa</i> L. | <i>Beras bengawan</i> | • | • | S | SF | C | Sea | + | Klaten | 14,000/kg |
| | | <i>Beras kepala biasa (R2)</i> | • | • | S | SF | C | Sea | + | Purworejo | 13,000/kg |
| | | <i>Beras kepala super (R1)</i> | • | • | S | SF | C | Sea | + | Purworejo | 16,000/kg |
| | | <i>Beras ketan hitam</i> | • | • | S | SUF | C | Sea | + | West Java | 25,000/kg |
| | | <i>Beras ketan merah</i> | • | • | S | SUF | C | Sea | + | West Java | 30,000/kg |
| | | <i>Beras ketan putih</i> | • | • | S | SUF | C | Sea | + | West Java | 22,000/kg |
| | | <i>Beras rojolele</i> | • | • | S | SF | C | Sea | + | Klaten | 15,000/kg |
| | | <i>Beras pandan wangi</i> | • | • | S | SF | C | Sea | + | Banjarnegara | 16,000/kg |
| | | <i>Beras ramos</i> | • | • | S | SF | C | Sea | + | Klaten | 13,000/kg |
| | | <i>Beras merah</i> | • | • | S | SF | C | Sea | + | Yogyakarta | 14,000/kg |
| | <i>Zea mays</i> L. | <i>Jagung manis</i> | • | • | F | SUF | C | Sea | + | Wonosobo | 7,000/kg |
| | | <i>Jagung muda</i> | • | • | F | V | C | Sea | + | Temanggung | 4,000/pcs |
| Pteridaceae | <i>Diplazium esculentum</i> (Retz.) Sw. | <i>Pakis</i> | • | - | F | HSS | W | All | + | Yogyakarta | 33,000/kg |
| Ranunculaceae | <i>Nigella sativa</i> L. | <i>Jinten</i> | • | • | S | HSS | C | All | + | Wonosobo | 150,000/kg |
| Rosaceae | <i>Malus domestica</i> (Suckow) Borkh. | <i>Apel fuji</i> | • | • | F | F | C | Sea | + | Wonosobo | 50,000/kg |
| | | <i>Apel malang</i> | • | • | F | F | C | All | + | Wonosobo | 18,000/kg |
| | | <i>Apel merah</i> | - | • | F | F | C | All | + | Wonosobo | 25,000/kg |
| | <i>Pyrus communis</i> L. | <i>Pir</i> | • | • | F | F | C | Sea | - | Kaliwiro | 20,000/kg |
| | <i>Fragaria ×ananassa</i> (Weston) Rozier | <i>Stroberi</i> | • | • | F | F | C | Sea | + | Wonosobo | 80,000/kg |
| Rutaceae | <i>Citrus</i> L. | <i>Jeruk berastaji</i> | • | • | F | F | SC | All | + | Wonosobo | 20,000/kg |

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|----------------|---|----------------------------|---|---|------|--------|----|-----|---|------------|------------|
| | | <i>Jeruk lemon</i> | ● | ● | F | HSS | SC | All | - | Wonosobo | 15,000/kg |
| | | <i>Jeruk mandarin</i> | ● | ● | F | F | SC | All | + | Temanggung | 10,000/kg |
| | | <i>Jeruk nipis</i> | ● | ● | F | F | SC | All | - | Temanggung | 25,000/kg |
| | | <i>Jeruk peras</i> | ● | ● | F | F | C | All | - | Temanggung | 12,000/kg |
| | | <i>Jeruk purut</i> | ● | ● | F, L | F | SC | All | + | Wonosobo | 40,000/kg |
| | | <i>Jeruk Daun</i> | ● | ● | L | V | SC | All | - | Wonosobo | 10,000/kg |
| | <i>Colocasia esculenta</i> (L.) Schott | <i>Talas</i> | ● | ● | T | SUF | C | All | + | Wonosobo | 18,000/kg |
| | <i>Xanthosoma sagittifolium</i> (L.) Schott | <i>Talas kimpul</i> | ● | - | T | SUF | C | All | + | Wonosobo | 5,000/kg |
| Sapindaceae | <i>Dimocarpus longan</i> Lour. | <i>Kelengkeng</i> | ● | ● | F | F | C | Sea | + | Magelang | 45,000/kg |
| Sapotaceae | <i>Manilkara zapota</i> (L.) P.Royen | <i>Sawo</i> | ● | ● | F | F | C | Sea | + | Tasik | 12,500/kg |
| Schisandraceae | <i>Illicium verum</i> Hook.fil. | <i>Pekak</i> | ● | ● | F | HSS | SC | All | + | Wonosobo | 9,000/kg |
| Solanaceae | <i>Capsicum annuum</i> L. | <i>Cabai hijau besar</i> | ● | ● | F | HSS, V | C | All | + | Wonosobo | 20,000/kg |
| | | <i>Cabai merah besar</i> | ● | ● | F | HSS, V | C | All | + | Wonosobo | 15,000/kg |
| | | <i>Cabe hijau keriting</i> | ● | ● | F | HSS, V | C | All | + | Wonosobo | 15,000/kg |
| | | <i>Cabe merah keriting</i> | ● | ● | F | HSS, V | C | All | + | Wonosobo | 20,000/kg |
| | | <i>Paprika hijau</i> | - | ● | F | HSS | C | All | + | Wonosobo | 45,000/kg |
| | | <i>Paprika kuning</i> | - | ● | F | HSS | C | All | + | Wonosobo | 55,000/kg |
| | | <i>Paprika merah</i> | - | ● | F | HSS | C | All | + | Wonosobo | 120,000/kg |
| | <i>Capsicum frutescens</i> L. | <i>Cabai rawit hijau</i> | ● | ● | F | HSS, V | C | All | + | Wonosobo | 30,000/kg |
| | | <i>Cabai rawit merah</i> | ● | ● | F | HSS, V | C | All | + | Wonosobo | 40,000/kg |
| | | <i>Cabai rawit putih</i> | - | ● | F | HSS, V | C | All | + | Wonosobo | 30,000/kg |
| | <i>Solanum tuberosum</i> L. | <i>Kentang</i> | ● | ● | T | SF, V | C | All | - | Wonosobo | 12,000/kg |
| | <i>Solanum torvum</i> | <i>Leunca</i> | ● | ● | F | V | C | All | + | Wonosobo | 30,000/kg |
| | <i>Solanum melongena</i> L. | <i>Terong hijau</i> | ● | ● | F | HSS | C | All | + | Wonosobo | 8,000/kg |
| | | <i>Terong lalap</i> | ● | ● | F | HSS | C | All | + | Wonosobo | 20,000/kg |
| | | <i>Terong ungu</i> | ● | ● | F | HSS | C | All | + | Wonosobo | 7,000/kg |
| | <i>Lycopersicon esculentum</i> Mill. | <i>Tomat cherry</i> | ● | ● | F | F | C | All | + | Wonosobo | 20,000/kg |
| | | <i>Tomat hijau</i> | ● | ● | F | HSS, V | C | All | + | Wonosobo | 14,000/kg |
| | | <i>Tomat merah</i> | ● | ● | F | HSS, V | C | All | + | Wonosobo | 15,000/kg |
| Theaceae | <i>Camellia sinensis</i> (L.) Kuntze | <i>Teh</i> | ● | ● | L | HSS | C | All | + | Wonosobo | 20,000/kg |

| | | | | | | | | | | | |
|---------------|--|-----------------------|---|---|----|--------|----|-----|---|------------|------------|
| Umbelliferae | <i>Daucus carota</i> L. | <i>Wortel</i> | ● | ● | T | V | C | All | + | Wonosobo | 3,000/kg |
| Urticaceae | <i>Pilea melastomoides</i> (Poir.) Wedd. | <i>Pohpohan</i> | - | ● | L | V | SC | All | + | Wonosobo | 9,000/kg |
| Vitaceae | <i>Vitis vinifera</i> L. | <i>Anggur merah-1</i> | - | ● | F | F | C | Sea | + | Wonosobo | 120,000/kg |
| | | <i>Anggur merah-2</i> | ● | ● | F | F | C | Sea | + | Wonosobo | 50,000/kg |
| Zingiberaceae | <i>Zingiber officinale</i> Roscoe | <i>Jahe emprit</i> | ● | ● | R | HSS | C | Sea | + | Temanggung | 40,000/kg |
| | | <i>Jahe gajah</i> | ● | ● | R | HSS | C | All | - | Temanggung | 24,000/kg |
| | | <i>Jahe merah</i> | ● | ● | R | HSS | C | All | - | Temanggung | 38,000/kg |
| | <i>Etilingera elatior</i> (Jack) R.M.Sm. | <i>Kecombrang</i> | ● | - | FL | HSS, V | SC | All | - | Wonosobo | 25,000/kg |
| | <i>Kaempferia galanga</i> L. | <i>Kencur</i> | ● | ● | R | HSS | C | All | + | Wonosobo | 20,000/kg |
| | <i>Curcuma longa</i> L. | <i>Kunyit</i> | ● | ● | R | HSS | C | All | + | Wonosobo | 12,000/kg |
| | <i>Alpinia galanga</i> (L.) Willd. | <i>Lengkuas</i> | ● | ● | R | HSS | C | All | + | Wonosobo | 10,000/kg |
| | <i>Curcuma aeruginosa</i> Roxb. | <i>Temu kunci</i> | ● | ● | R | HSS | C | Sea | + | Wonosobo | 25,000/kg |
| | <i>Curcuma roscoeana</i> Wall. | <i>Temulawak</i> | ● | ● | R | HSS | C | All | + | Wonosobo | 8,000/kg |

Note: KM: Kertek Market, IM: Induk Market ●: Available, -: Not available, F: Fruit, L: Leaves, S: Seed, R: Roots, T: Tuber, B: Bulbs, FL: Flower, ST: Stem, SF: Staple food, SUF: Substitute food, V: Vegetable, HSS: Herb-Spice Seasoning, CS: Cultivation Status, C: Cultivated, SC: Semi cultivated, W: Wild, All: All Season, Sea: Seasonal, +: High, -: Low

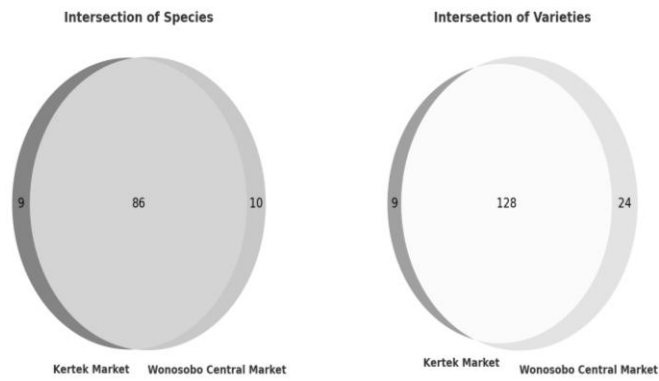


Figure 3. Intersection of species and varieties at Wonosobo Traditional Markets, Indonesia (Sørensen Similarity Index: 88.54% for species; 88.58% for varieties)

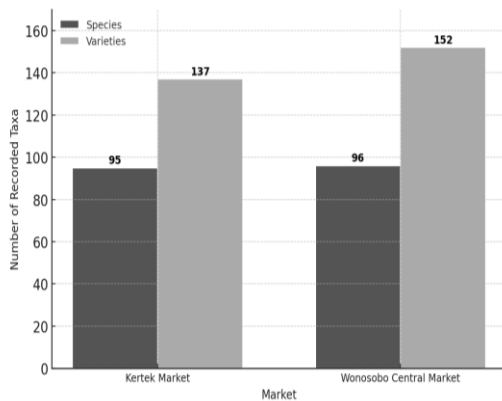


Figure 5. Comparison of edible plant species and local varieties recorded in Kertek Market and Wonosobo Central Market, Indonesia

The Fabaceae family, comprising 14 varieties, includes *Tamarindus indica* L. (*asam jawa*), *Phaseolus vulgaris* L. (*buncis*, *kacang merah*), *Archidendron pauciflorum* (Benth) I.C.Nielsen (*jengkol*), *Vigna radiata* (L.) R.Wilczek (*kacang hijau*, *kecambah*), *Pisum sativum* L. (*kacang kapri*), *Glycine max* (L.) Merr. (*kedelai*), *V. unguiculata* (L.) Walp. (*kacang panjang*, *tolo*), *Arachis hypogaea* L. (*kacang tanah*), *Caesalpinia sappan* L. (*kayu secang*), *P. tetragonolobus* (*kecipir*), and *Parkia speciosa* Hassk. (*pete*). These legumes are key sources of plant-based protein and dietary fiber, reflecting both nutritional significance and agricultural adaptability.

The predominance of Solanaceae and Fabaceae indicates that market diversity is strongly tied to culinary traditions and nutritional needs rather than to ecosystem-level biodiversity. Poaceae, represented by staple cereals such as *Oryza sativa* L. and *Zea mays* L., emphasizes carbohydrate supply stability, while Brassicaceae (including *B. oleracea*, *Raphanus raphanistrum* subsp. *sativus* (L.) Domin, and *Brassica juncea* (L.) Czern.) reflects high consumer preference for leafy vegetables. Such dominance of a few families (Figure 6) suggests that while species diversity is high, market composition is

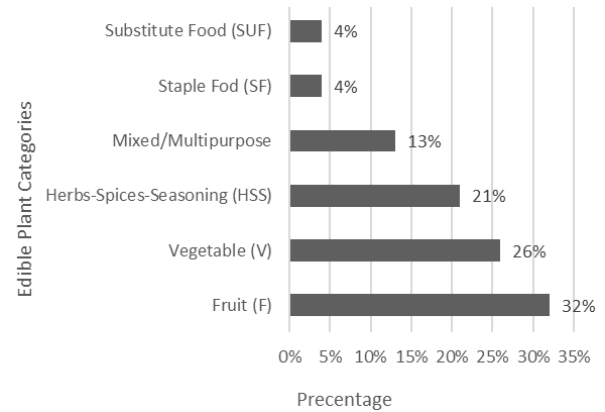


Figure 4. Proportion of edible plant categories traded in Wonosobo Traditional Markets, Indonesia

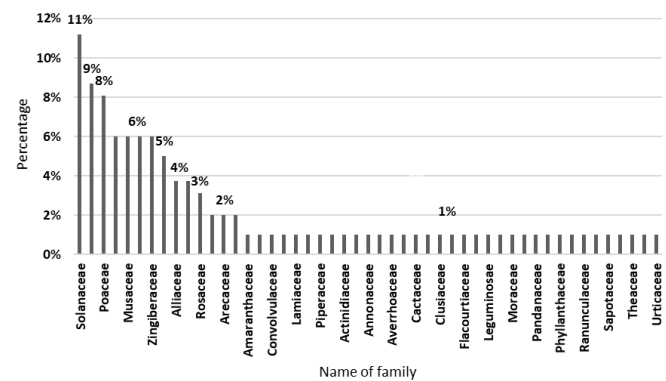


Figure 6. Dominant plant families and number of edible varieties recorded in Wonosobo Traditional Markets, Indonesia

functionally constrained by local diets, climatic suitability, and trade efficiency. These findings suggest that the edible plant composition in Wonosobo markets is not merely a reflection of ecological diversity but rather of socio-economic adaptation—where high-demand food crops dominate market trade due to their nutritional, cultural, and economic importance.

Plant parts used and their dietary implications

The traded edible plants comprise various parts—roots, stems, leaves, flowers, fruits, seeds, and rhizomes (Figure 7). Roots and rhizomes mostly belong to Fabaceae and Zingiberaceae; stems to Fabaceae and Lauraceae; leaves and flowers to Brassicaceae, Amaranthaceae, and Asteraceae; fruits to Solanaceae, Rutaceae, Cucurbitaceae, Rosaceae, and Musaceae; and seeds to Fabaceae and Poaceae.

Based on Figure 7, fruit is the most dominant plant part in trade, comprising 52.8% of all recorded varieties. This dominance reflects strong consumer demand for nutrient-rich, easily consumable products that require minimal preparation. Fruits are preferred for their convenience, vitamin content, and contribution to dietary diversity. Leaf

(15.5%) and seeds (12.4%) are also important components, particularly for vegetable and condiment preparation, whereas roots/rhizome (5%) and tubers (4.3%) serve as alternative carbohydrate sources. Bulbs (2.5%), flowers (1.9%), and stems (1.2%) represent minor categories, yet they contribute to culinary flavor, medicinal value, and dietary balance. In addition, several plant species are utilized in a mixed or multipurpose manner, accounting for 4.3% of the total, indicating their versatility in meeting multiple household and market needs. These findings indicate that market demand prioritizes plant parts with high perishability and nutritional density, suggesting a consumer pattern that values freshness and daily consumption. The prevalence of fruits and leafy vegetables aligns with a growing public awareness of healthy diets, while the limited representation of tubers and grains suggests a lower emphasis on plant-based carbohydrate substitutes.

The detailed distribution of edible plant categories is presented in Figure 4, which shows 32% fruit varieties, 26% vegetables, 21% herb-spice-seasoning (HSS), 13% mixed/multipurpose varieties, 4% staple food, and 4% substitute food. This distribution suggests that local diets are dominated by micronutrient-rich foods but lack diversity in macronutrient sources.

Figure 8 presents the distribution of local varieties by cultivation status, classified as cultivated, semi-cultivated, and wild, and further differentiated into all season and seasonal availability. Cultivated varieties dominate (75.8%), largely available all season (61.6%), indicating intensive cultivation and stable supply. Semi-cultivated varieties account for 16.8%, with a higher proportion of seasonal types, reflecting continued seasonal dependence. Wild varieties represent the smallest share (7.4%) and are predominantly seasonal, indicating limited availability and strong reliance on natural conditions. Overall, the figure underscores the role of cultivation systems in enhancing all season availability of plant varieties and reducing dependence on seasonally available wild resources, as cultivation expands food availability and resiliency in agricultural systems. This pattern supports Cantwell-Jones et al. (2022), who note that dietary resilience relies on crop diversification. The prevalence of fruits and leafy vegetables thus reflects the markets' role in sustaining both nutrition and local agrobiodiversity within the Wonosobo food system

Use Value (UV) and Cultural Importance Indeks (CII)

The qualitative assessment of Use Value (UV) and Cultural Importance Index (CII) highlights the prominence of edible plants in Wonosobo's traditional food system. Species with diverse uses and frequent presence in daily life—such as *O. sativa*, *C. annuum*, *Curcuma longa* L., *Allium cepa* L., and *M. paradisiaca*—showed the highest UV and CII, reflecting their strong integration into household consumption, cuisine, and rituals.

In contrast, species traded infrequently or with limited uses—such as imported fruits (*Malus domestica* (Suckow) Borkh., *V. vinifera*) and minor wild vegetables (*D. esculentum*, *Solanum torvum*)—showed lower UV and CII

values. Five representative species were listed in Table 3 to illustrate those most frequently used and culturally significant. Overall, staple and complementary food plants exhibited higher UV and CII due to their nutritional value, ease of cultivation, and cultural familiarity. The presence of culturally important species across both markets indicates strong traditional knowledge continuity. Maintaining plants with high UV and CII is therefore vital for preserving food diversity and the cultural heritage embedded in Wonosobo's traditional markets.

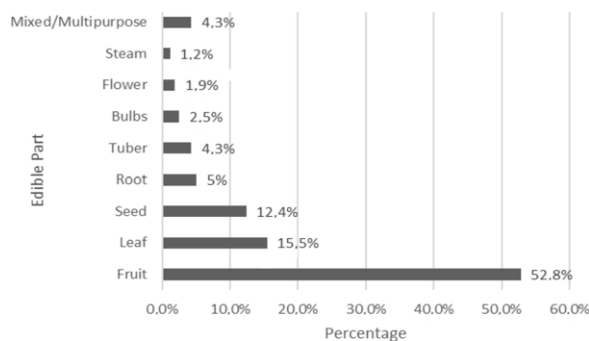


Figure 7. Proportion of plant parts used as food among edible plant species traded in Wonosobo traditional markets, Indonesia

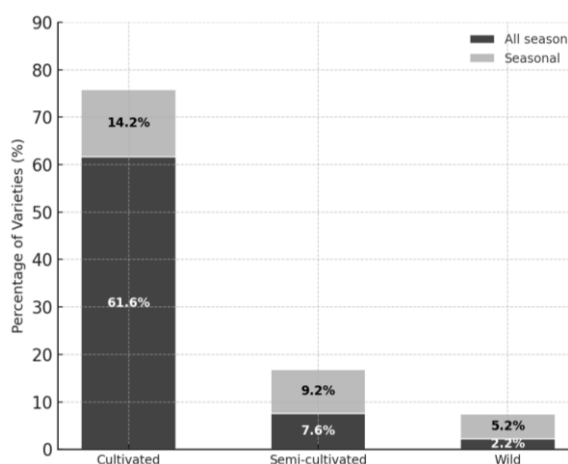


Figure 8. Cultivation status and seasonality of edible plants in Wonosobo traditional markets, Indonesia

Table 3. Representative edible plant species with relative Use Value (UV) and Cultural Importance Index (CII) in Wonosobo traditional markets

| Species | Use category | Relative UV | Relative CII | Remarks |
|-------------------------|-----------------|-------------|--------------|----------------------------|
| <i>Oryza sativa</i> | Staple food | High | High | Core cultural crop |
| <i>Capsicum annuum</i> | Vegetable/spice | High | High | Daily condiment |
| <i>Curcuma longa</i> | Spice/medicinal | High | High | Ritual and health use |
| <i>Allium cepa</i> | Vegetable | Moderate | Moderate | Common household food |
| <i>Musa paradisiaca</i> | Fruit | Moderate | High | Ceremonial and nutritional |

Market trading system and socio-economic significance

Interviews with market traders reveal that Wonosobo's traditional market supply chain involves multiple interconnected actors (Figure 9). The flow of commodities begins with local farmers, who cultivate vegetables and fruits and sell them to distributors. These distributors act as intermediaries responsible for sorting, packaging, and redistributing products to the main trading hubs—Kertek Market and Wonosobo Central Market. Outside suppliers also play a critical role, particularly for non-local commodities such as spices, staple foods, and food substitutes (e.g., plant-based meat and gluten-free flour) sourced from regions outside Wonosobo.

Wonosobo Central Market functions as the principal distribution hub due to its larger capacity, modern infrastructure, and broader supplier network, enabling it to manage large quantities efficiently and supply smaller markets like Kertek. This system mirrors the role of collectors highlighted by Kaimba et al. (2020), who noted that intermediaries bridge smallholder farmers and large urban markets, improving logistics and market access. In contrast, Kertek Market serves primarily as a local retail center, focusing on products demanded by nearby communities.

The agricultural trade system in Wonosobo thus integrates farmers, traders, distributors, and consumers into a cohesive local economy where cultural practices significantly shape market interactions. Farmers maintain long-standing agrarian traditions emphasizing sustainability and ecological balance, ensuring continuity between agricultural production and food trade. This integration of traditional knowledge with market exchange represents a socio-ecological adaptation sustaining both livelihoods and biodiversity.

Cultural factors strongly influence consumption behavior. According to Abdullah et al. (2023), local food preferences in Central Java often reflect social beliefs and inherited practices. In Wonosobo, buyers select agricultural products not only by price or quality but also by cultural familiarity. Market transactions are often based on long-term relationships and mutual trust between traders and customers, reinforcing community cohesion. As Hur (2020) noted, bargaining in traditional markets is more than a price negotiation—it is a social interaction that strengthens communal identity.

The spatial distribution of suppliers, shown in Figure 10, indicates that 71% of food suppliers originate from Wonosobo District, while the remaining 29% come from neighboring districts such as Ngawi, Probolinggo, Brebes, Klaten, Magelang, and Yogyakarta. This diverse supplier network ensures year-round availability and stabilizes food prices (Jia et al. 2023). Regions like Dieng specialize in cool-climate crops (potatoes, carrots), whereas Brebes contributes shallots, and Magelang provides tropical fruits. This multi-regional integration enhances market resilience, reduces supply shocks, and reflects an increasingly regionalized agri-food system in Wonosobo.

Similarity index and agrobiodiversity interpretation

The high Sorensen Similarity Index (SSI)—88.54% for species and 88.58% for local varieties—demonstrates a substantial overlap in plant composition between Kertek Market and Wonosobo Central Market (Figure 3). This finding indicates not ecological redundancy, but socio-economic integration, where both markets draw from the same supplier networks and serve overlapping consumer bases. High SSI values therefore reflect shared cultural preferences and common dietary staples, rather than ecosystem-level homogeneity.

Several factors contribute to this similarity: (i) shared supply chains dominated by the same distributors and production areas, (ii) consumer convergence in food preferences across rural-urban gradients, and (iii) regional crop specialization that feeds both markets simultaneously. These results are consistent with the observations of Gupta et al. (2020), who found that traditional markets often exhibit similar crop diversity due to overlapping demographic characteristics and demand structures.

However, minor compositional differences between the two markets still reveal subtle expressions of local agrobiodiversity. Kertek Market's unique inclusion of semi-cultivated and wild species such as *P. tetragonolobus*, *D. esculentum*, and *P. amaryllifolius* reflects closer proximity to rural cultivation systems. Meanwhile, Wonosobo Central Market's greater variety of cultivated fruits and vegetables indicates stronger integration into regional trade networks. This dual pattern—one market representing local diversity and the other regional connectivity—demonstrates how traditional markets function as socio-ecological interfaces where biodiversity, economy, and culture intersect. The SSI not only measures compositional similarity but also serves as an indirect indicator of the socio-economic and cultural coherence of Wonosobo's food system. The dominance of cultivated species combined with a smaller number of wild and semi-wild varieties suggests an ongoing transformation from subsistence-based diversity toward market-oriented agrobiodiversity.

Price structure and consumer preference

The price structure of edible plants, summarized in Table 2, reflects the economic accessibility and purchasing behavior of Wonosobo consumers. Prices range from IDR 2,000 to IDR 200,000, depending on category, unit, and market demand. Vegetables such as *Amaranthus hybridus* L. (*bayam*), *P. vulgaris* (*buncis*), *Ipomoea aquatica* Forsk. (*kangkung*), and *O. basilicum* (*kemangi*) are mostly sold at IDR 2,000-20,000 per bundle, while staple foods like *O. sativa* example *beras bengawan*, *beras kepala biasa* (R1), *beras kepala super* (R2), *Beras rojolele*, *Beras pandan wangi*, *beras ramos*, *beras merah* are priced between IDR 13,000-16,000 per kg. Substitute staples—such as *Manihot esculenta* Crantz (*singkong*), *Colocasia esculenta* (L.) Schott (talas), and *O. sativa* (*beras ketan*)—range from IDR 4,000-30,000 per kg, reflecting their role as secondary carbohydrate sources.

In the fruits category, *Persea americana* Mill. (*alpukat*), *V. vinifera* (*anggur merah*),

M. domestica (Suckow) Borkh. (*apel fuji*), and *Hylocereus lemairei* (Hook.) Britton & Rose (*buah naga*) vary from IDR 10,000 to 120,000 per kg, while the most expensive herbs and spices—*Syzygium aromaticum* (L.) Merr. & LM.Perry (*cengkeh*), *Cinnamomum burmannii* (Nees & T. Nees) Blume (*kayu manis*), *Myristica fragrans* Houtt. (*pala*), and *Piper nigrum* L. (*lada*)—reach up to IDR 200,000 per kg. These high-value commodities are traded in smaller volumes, indicating their economic importance despite limited accessibility.

As shown in Table 4, most edible plants (143 price points) fall within the IDR 2,000–40,000 range, revealing that the majority of products in Wonosobo's traditional markets are affordable to local consumers. Only a small fraction of products (10 items) are priced between IDR 40,001–80,000, while fewer than five items exceed IDR 120,000. This skewed distribution toward lower price ranges underscores Wonosobo's market inclusivity, where daily consumption goods remain economically accessible. This pattern is consistent with observations by Hapsari et al. (2020), who found that price stratification in rural markets reflects purchasing power and the predominance of staple consumption behavior among low- to middle-income groups.

The prevalence of low- and medium-priced commodities suggests a consumer base that prioritizes affordability and familiarity over novelty or exotic species. This aligns with local consumption patterns rooted in cultural familiarity and subsistence orientation rather than luxury consumption. Similar findings were reported by Abdullah et al. (2023), indicating that Central Javanese consumers tend to maintain traditional dietary preferences based on availability, affordability, and social attachment to local crops. High-priced commodities—mostly spices and imported fruits—serve niche markets but contribute disproportionately to economic turnover.

From a socio-economic perspective, this pricing structure reveals that traditional markets act as stabilizers of local food security, offering affordable and diverse food options while maintaining cultural continuity. Variations in price across food categories also indicate elastic consumer preferences, where substitution between vegetables, fruits, and condiments helps households adapt to seasonal or economic fluctuations (Jia et al. 2023). Such adaptive purchasing patterns are a hallmark of resilient local food systems (Cantwell-Jones et al. 2022), demonstrating that price diversity supports both livelihood stability and nutritional balance. Together with stable supply networks (Figures 10 and 11), this price resilience reinforces the sustainability of Wonosobo's agrobiodiversity-based market ecosystem.

Table 4. Price interval of edible plants in Wonosobo Traditional Market, Indonesia

| Price interval (IDR) | Quantity |
|----------------------|----------|
| 2,000-40,000 | 143 |
| 40,001-80,000 | 10 |
| 80,001-120,000 | 4 |
| 120,001-160,000 | 1 |
| 160,001-200,000 | 3 |

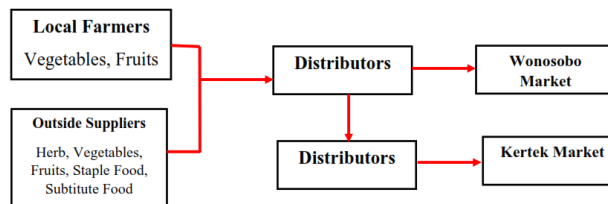


Figure 9. Supply chain system for edible plants in two Wonosobo Traditional Markets, Indonesia

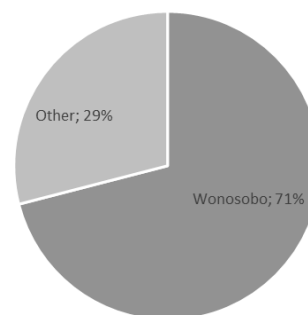


Figure 10. Supplier areas of edible plants in Wonosobo Traditional Market, Central Java, Indonesia

Discussion

The results of this study demonstrate that Wonosobo's traditional markets function not only as centers of agricultural trade but also as living repositories of local agrobiodiversity and cultural identity. Across 104 species and 161 varieties, the high diversity of edible plants underscores the region's strong integration between agricultural production, market demand, and local dietary practices. The observed 88.54% similarity in species composition (Figure 3) between Kertek Market and Wonosobo Central Market confirms that both markets share a unified food system rooted in similar supplier networks, shared cultural food preferences, and regional trade flows. The predominance of vegetables and fruits in market composition (Figure 4) and the relatively balanced representation of edible plant parts (Figure 7) reflect functional diversification within Wonosobo's traditional food system. This pattern indicates not only nutritional diversity but also the maintenance of multiple provisioning and cultural ecosystem services through local agrobiodiversity.

This market-level biodiversity represents a form of managed agrobiodiversity—where species diversity is maintained not by natural ecological processes alone but by continuous human-environment interaction. Farmers, traders, and consumers collectively sustain this diversity through cultivation, exchange, and consumption practices. Such findings are consistent with Swiderska (2020) and Candraningtyas et al. (2025), who highlighted that traditional food systems in Southeast Asia often act as adaptive mechanisms linking biodiversity conservation with cultural resilience. Similar diversity patterns were reported in markets of Bekasi, West Java (Silalahi et al. 2021), suggesting a nationwide trend of high inter-market similarity driven by shared cultural preferences.

The dominance of cultivated crops (Figure 8) and the limited proportion of wild and semi-cultivated species reflect a gradual shift toward market-oriented agriculture. While this shift enhances food availability and economic stability, it also implies a potential reduction in genetic diversity, as wild and landrace varieties become underrepresented in trade (Schmitz et al. 2023). Therefore, strengthening the connection between local cultivation and traditional plant knowledge is essential to sustain long-term resilience.

Socio-economically, traditional markets serve as nodes of social interaction, gender participation, and livelihood security (Geertz 1963; IPES-Food 2024). Women constitute over 80% of traders (Table 1), highlighting their central role in managing household income and local food distribution. This mirrors findings by Arwemi et al. (2022), showing that women's informal economic participation contributes significantly to food system stability (FAO 2011). The gendered structure of Wonosobo markets thus provides an important socio-cultural foundation for local food sovereignty.

Price structure data (Table 2) reveal that the majority of edible plant commodities are accessible to all income levels, suggesting that affordability remains a key driver of consumer choice. The predominance of low- and medium-priced food items ensures equitable access, while the inclusion of premium spices and imported fruits introduces limited but important economic diversity. Such stratification enhances market inclusivity, supporting both daily subsistence and small-scale entrepreneurship (Geertz 1963; IPES-Food 2024).

From a policy perspective, traditional markets represent more than economic infrastructures—they are biodiversity corridors linking rural production with urban consumption (Vitterso et al. 2019). Maintaining species and varietal diversity within these markets could strengthen food security, especially under changing climatic and socio-economic conditions (Gatto et al. 2021). Local governments should prioritize programs that integrate biodiversity conservation, farmer support, and market revitalization to ensure sustainable agri-food systems.

The qualitative pattern of Use Value (UV) and Cultural Importance Index (CII) reinforces the central role of culturally significant crops in sustaining food traditions and biodiversity in Wonosobo. High UV and CII species—such as *O. sativa*, *C. annuum*, *C. longa*, and *A. cepa*—represent key elements of the local food identity, serving as both daily staples and symbolic components in social and ritual contexts. These results are consistent with other ethnobotanical studies indicating that species with multiple uses and deep cultural attachment contribute strongly to community resilience and agrobiodiversity maintenance (Silalahi et al. 2021; Swiderska 2020). The persistence of such species across markets suggests that cultural valuation, rather than purely economic factors, continues to shape plant selection and market diversity in highland Java. The Wonosobo case illustrates that the conservation of edible plant diversity in traditional markets is inseparable from cultural heritage, social equity, and sustainable livelihoods. Enhancing this system requires recognizing

market-based agrobiodiversity as a vital component of regional food resilience and ecological sustainability.

The diversity of edible plants found in the two traditional markets reflects an important foundation for local food security and resilience. The wide variety of cultivated species and local varieties ensures year-round food availability and dietary diversity, allowing households to adapt to seasonal fluctuations and market changes. Many of these plants are grown in homegardens or small farms, providing a steady supply of nutritious food without relying on industrial inputs. By maintaining traditional cultivation and consumption of diverse crops, local communities indirectly contribute to on-farm conservation of agrobiodiversity, supporting both ecological stability and cultural continuity (Negri 2005; FAO 2019). Thus, traditional markets function not only as centers of economic exchange but also as dynamic systems that sustain local biodiversity and strengthen food sovereignty.

In conclusion, this study demonstrates that traditional markets in Wonosobo function as crucial socio-ecological systems that integrate cultural traditions, local economies, and biodiversity conservation. A total of 104 species and 161 varieties belonging to 49 families were recorded, with a high degree of similarity between Kertek and Wonosobo Central Markets (SSI = 88.54%), indicating interconnected supply networks and shared consumer preferences. Dominant families such as Solanaceae and Fabaceae emphasize the nutritional and economic roles of vegetables and legumes in maintaining local diets. The predominance of fruits, vegetables, and spices highlights a community-based food system that supports both dietary diversity and cultural identity. Beyond their economic role, these traditional markets act as in situ conservation hubs where the continuous trade and cultivation of diverse crops sustain local agrobiodiversity. Ensuring the availability and affordability of food commodities (IDR 2,000–40,000) enhances household food access, while the central role of women traders strengthens social cohesion and knowledge transmission across generations. Therefore, policy interventions should focus on empowering women traders, supporting the cultivation of traditional varieties, and integrating market-based biodiversity management into local development programs. Strengthening traditional market networks and encouraging the commercialization of underutilized local crops are key strategies to promote sustainable market practices, food sovereignty, and long-term agrobiodiversity resilience in Wonosobo. The absence of voucher specimens and seasonal replication limits ecological verification. Future studies should include molecular identification, multi-season surveys, and assess how digital trade supports traditional market biodiversity.

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