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Adaptation Test of Several Promising Varieties of Cucumber (*Cucumis sativus* L.) in Lowlands

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ABSTRACT

Cucumber plants exhibit a remarkable capacity for adaptation to varying altitudes. The objective of this study is to identify the cucumber hybrid candidates that demonstrate the highest adaptability in lowland environments, based on the diversity of both qualitative and quantitative growth characteristics exhibited by each hybrid of *Cucumis sativus* L. The research was conducted in Sumbersari Hamlet, Kencong Village, Kepung District, Kediri Regency, East Java Province. A completely randomized block design (CRBD) was employed, incorporating six treatments of cucumber varieties, which included five hybrid varieties and one control variety. The experiment was organized into four groups. The materials utilized in this study comprised cucumber seeds from the Cu12, Cu13, Cu14, Cu15, Cu16 varieties, along with the Top Tavi F1 variety as a control. Fertilizers used included NPK and Urea. Observations of qualitative characteristics were conducted in accordance with the test implementation guidelines (PPU), with color variables assessed using the RHS color chart. The qualitative analysis revealed that the cucumber leaves exhibited a green hue (greyish olive green), the flowers were yellow (brilliant yellow), the fruit skin displayed green and yellowish green tones (moderate olive green and strong yellow green), and the shape of the fruit base and slices was characterized as round and obtuse. In terms of quantitative characteristics, the Cu12 variety demonstrated the shortest harvest age, while the Cu16 variety exhibited the longest. Among the varieties tested, the Cu13 variety emerged as the most adaptive, possessing characteristics and traits that surpassed those of the control variety (Top Tavi F1).

Keywords: Adaptation, Cucumber, Lowland, Morphology, Variety

1. INTRODUCTION

Cucumbers (*Cucumis sativus*) belong to the Cucurbitaceae family and are believed to have originated in North Asia. These plants are a significant horticultural commodity and are cultivated extensively across various regions globally (Afrendi et al., 2024). In Indonesia, cucumber cultivation occurs predominantly in lowland areas and extends to altitudes of up to 1,000 meters above sea level. The growth of cucumber plants necessitates a dry climate, adequate sunlight, and temperatures ranging from 18 to 30 degrees Celsius. Additionally, microclimatic factors play a crucial role in the growth and development of cucumber plants (Ashish et al., 2023). Several hybrid cucumber varieties that have been introduced are typically cultivated in highland regions, specifically between 1,000 and 1,200 meters above sea level.

Several factors contribute to the low productivity of cucumber plants in Indonesia, including the utilization of inferior cucumber varieties, environmental incompatibility, and the limited adaptability of certain cucumber varieties. Cucumber plant breeding is conducted through the development of new varieties as a strategy to enhance yields and satisfy the evolving preferences of consumers. It is essential to characterize each existing variety to generate a comprehensive description that aids in the creation of superior new varieties. Key variables such as the number of fruits, weight per fruit, fruit length, fruit diameter, and the relationship between fruit length and weight are critical parameters for assessing the superiority of a variety (Taufik et al., 2017).

The findings of the research conducted by Sumpena and Bakrie (2010) indicated significant differences in fruit color, fruit weight per plant, and cucumber crop yield per hectare. In the advancement of plant breeding aimed at developing new hybrid varieties, cross-breeding is essential, accompanied by a rigorous selection process, evaluation, testing, and subsequent release of the new variety.

Fruits exhibit a wide range of morphological characteristics, including variations in size, shape, wax properties, thorns, warts, and flesh thickness. These morphological differences are influenced by genetic factors that contribute to significant diversity. Specific genes have been identified that impact the formation of floral organs, cell division and regulation of the cell cycle, biosynthesis of hormones, sugar transport, trichome development, as well as the biosynthesis of cutin, wax, and pigments, all of which play a role in determining cucumber fruit morphology. The identification of genetic factors that govern these traits can enhance plant breeding efforts aimed at developing cucumber varieties with high productivity and improved quality that meets consumer preferences (Grumet et al., 2023).

During the testing phase prior to the release of a new variety, it is essential to conduct field tests that involve evaluating candidate varieties alongside established comparison varieties. This process is necessary to assess the interaction of the plants with their environment and to identify the advantages and characteristics of the candidate hybrid variety, including traits such as leaf color, fruit skin color, leaf terminal shape, cross-sectional fruit shape, and fruit base shape. Measuring the characteristics of cucumber plants intended for development into hybrid varieties provides critical information regarding their advantages before they are officially released as hybrid varieties (Ardian, 2017).

Therefore, to find out the characteristics and advantages of several candidate hybrid genotypes, it is best to carry out tests first, such as adaptation tests at various different altitudes.

2. MATERIAL AND METHODS

The research was conducted in Dusun Sumbersari, Kencong Village, Kepung District, Kediri Regency, East Java Province at an altitude of 169 meters above sea level and temperatures between 23 - 29 0C. coordinate point -7.82490,112.31177 in March to April 2023.

The instruments employed in this study comprised meters, hand tractors, stationery, watering cans, trays, black silver plastic mulch (MPHP), stakes, mulch holes (plong), gawar, digital scales, alpaboard, scissors, rulers, and cameras. The materials utilized included cocopeat, water, and pesticides containing active ingredients of pyrethroids, alongside various cucumber varieties: Cu12, Cu13, Cu14, Cu15, Cu16, and Top Tavi F1, which served as a comparative reference.

The research was conducted using a Randomized Block Design (RAK) featuring six treatments of cucumber varieties, which included five hybrids from the collection of CV. Borneo Seed Indonesia and one comparative variety, with four replications. Each plot consisted of 24 plants, resulting in a total plant population of 576. Four samples were taken from each plot, yielding a total of 96 samples for observation.

The parameters for observation encompassed both quantitative and qualitative characteristics. Quantitative characteristics included leaf color, flower crown color, fruit skin, leaf terminal tip shape, transverse fruit slice shape, and fruit base shape. Qualitative characteristics comprised leaf length, leaf width, harvest age, number of fruits per plant, fruit weight per plant, fruit weight per plot, and crop yield per hectare..

Qualitative character analysis was conducted based on the test implementation guidelines (PPU) and color variable references on the RHS color chart. Quantitative character analysis used analysis of variance at the 5% level with SPSS version 24 to determine the effect of differences in the genotypes tested. If the treatment showed a significant difference, further testing was carried out using the Duncan Multiple Range Test (DMRT) 5%.

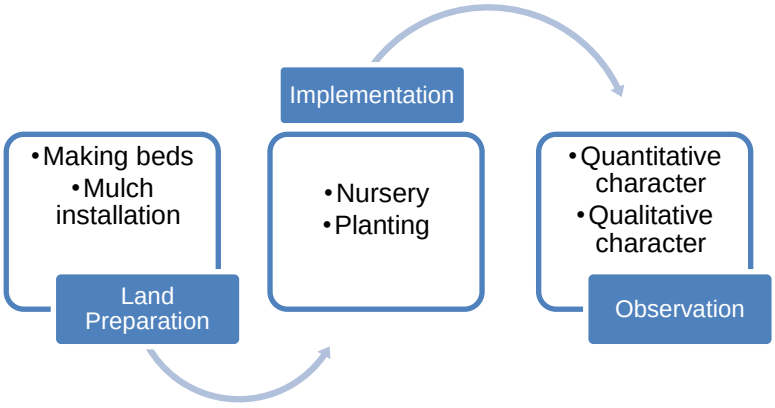

Figure 1. Research flow diagram

3. RESULTS AND DISCUSSION

3.1 Qualitative Character

Based on the results of observations with the RHS Color Chart, it shows that the leaf color of all varieties is green (Greyish Olive Green). The observation results show that the greenest leaf colour is found in varieties Cu14, Cu15, and Cu16 with colour (Greyish Olive Green) 137 A, then the slightly green leaf colour is found in variety Cu13 with colour (Greyish Olive Green) 137 B, and the less green colour is found in varieties Cu12 and toptavi with colour (Greyish Olive Green) 137 C (Figure 2). The greener the leaf colour indicates that the chlorophyll content is higher (Istri & Dharmadewi, 2020) so that

the ability to carry out the photosynthesis process is also higher.

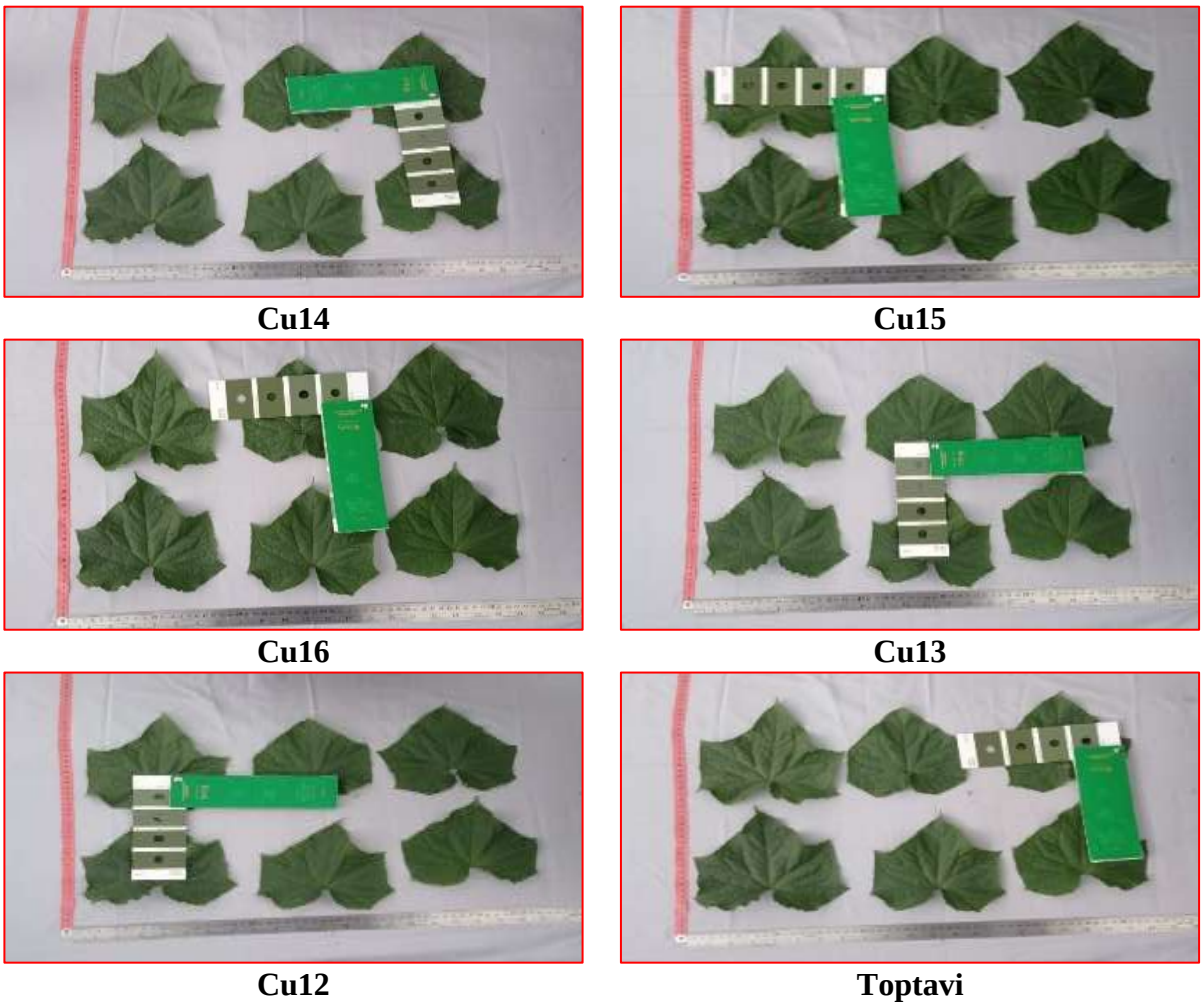

Figure 2. Leaf color of each variety tested

3.2 Flower Crown Color

The color of the flower crown for all varieties is yellow (Brilliant Yellow) (Figure 3). The color of the fruit skin has a dark green and yellowish green color (Moderate Olive Green and Strong Yellow Green) (Figure 4). The difference in fruit skin color can create its own appeal for consumers.

The morphology of the leaf terminal tip exhibits various forms across different varieties. Specifically, the Cu16 variety is characterized by a rounded leaf terminal tip, while the Cu14 and Toptavi varieties display an obtuse shape. In contrast, the Cu12, Cu13, and Cu15 varieties possess serrated and acute terminal tips (see Figure 5). Regarding the transverse fruit slice, it is predominantly rounded, and the fruit base is described as obtuse. The observed differences among the tested varieties can be attributed to genetic factors that influence trait inheritance and phenotypic expression, as well as environmental factors that pertain to the specific conditions in which the plants are cultivated.

Transverse slices of fruit were examined during the initial harvest. The observations indicated that all tested varieties exhibited a rounded shape, with no discernible differences noted (see Figure 6).

The observation results for all tested varieties have a blunt fruit base shape (obtuse) (Figure 7). This shows that there is no difference in the shape of the fruit in each variety.

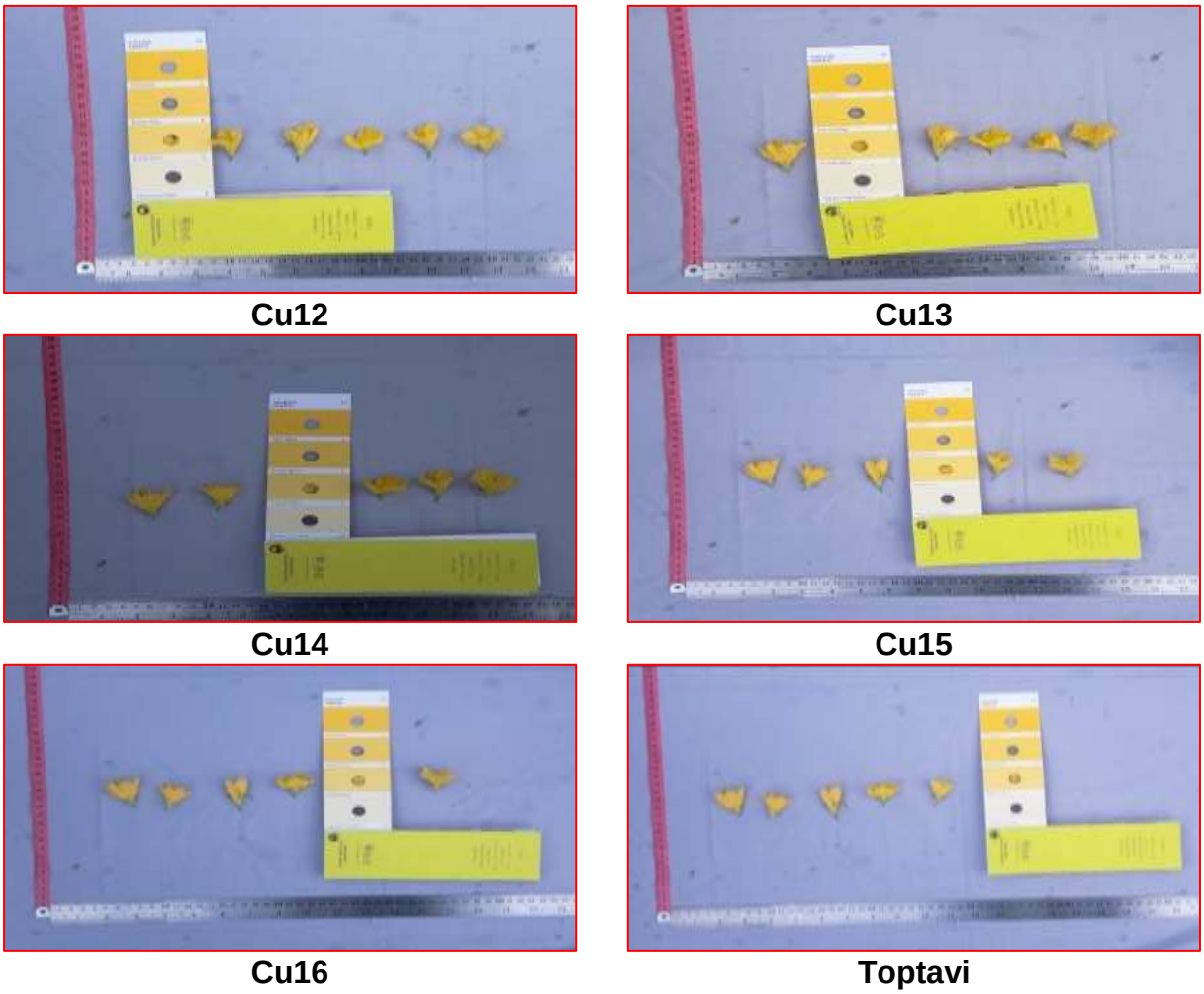

Figure 3. The color of the flower crown of each variety tested

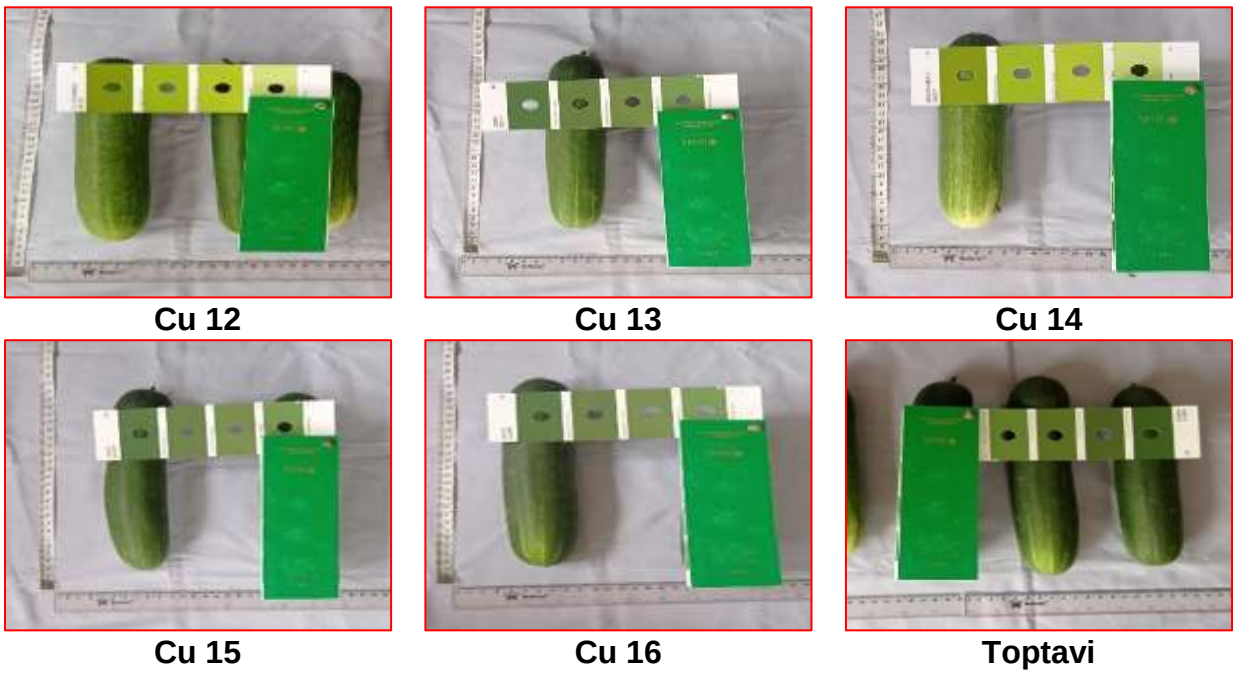

Figure 4. Fruit skin color of all tested varieties.

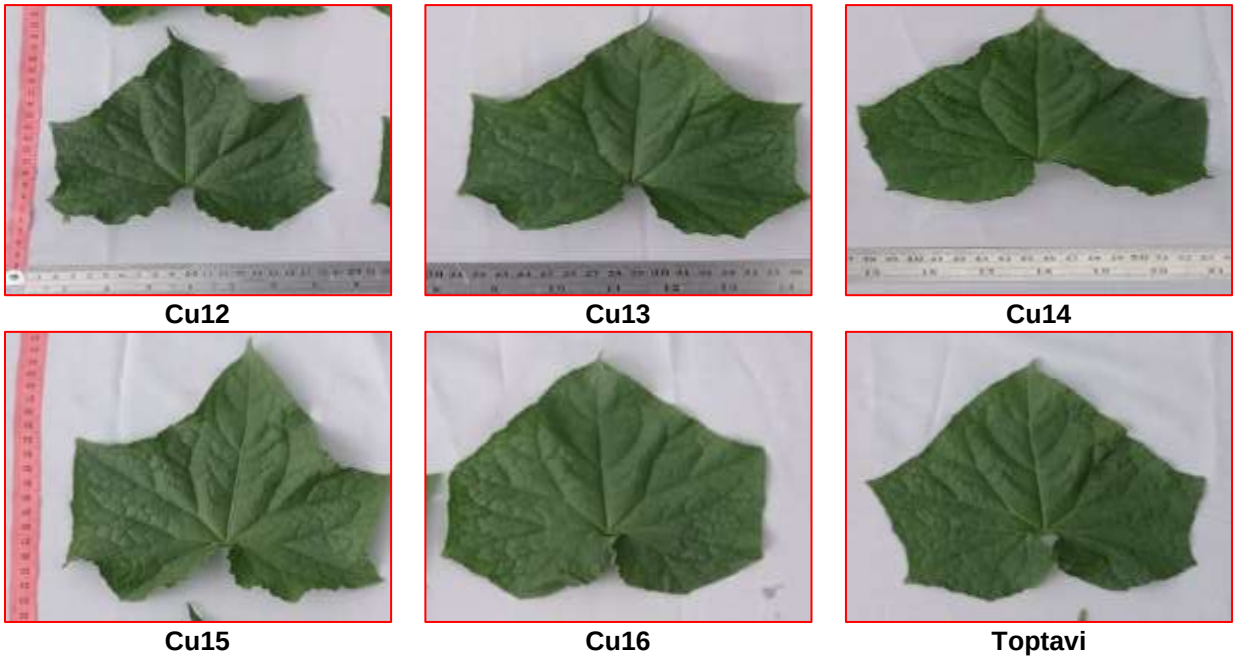

Figure 5. Terminal leaf tip shape of tested varieties

Figure 6. Transverse fruit slice shape

Figure 7. Form of fruit base: Cu 12, Cu 13, Cu 14, Cu 15, Cu 16 and Toptavi varieties

The qualitative character observations regarding color variables, conducted in accordance with the Royal Horticultural Society (RHS) standards, indicate that the predominant color of cucumber leaves is green, specifically classified as Greyish Olive Green. A correlation exists between the intensity of leaf greenness and chlorophyll content; increased chlorophyll levels enhance the rate of photosynthesis, thereby facilitating accelerated plant development and growth (Setiadi et al., 2021). The flower crowns of all examined varieties exhibit a yellow hue, identified as Brilliant Yellow. The fruit skin displays a spectrum of colors, including dark green and yellowish green, categorized as Moderate Olive Green and Strong Yellow Green, respectively. This variation in fruit skin

color may enhance consumer appeal. In terms of leaf morphology, the terminal tip shapes vary among the varieties: the Cu16 variety features a rounded terminal tip, while the Cu14 and Toptavi varieties possess obtuse terminal tips. Conversely, the Cu12, Cu13, and Cu15 varieties exhibit serrated and sharp terminal tips. The transverse fruit slice is characterized by a rounded shape, and the base of the fruit is obtuse. The observed differences among the tested varieties can be attributed to genetic factors influencing trait inheritance and phenotypic expression, as well as environmental factors that pertain to the specific conditions in which the plants are cultivated.

Table 1. Harvest age, number of fruits per plant and fruit weight per plant of several varieties

Varieties	Parameter		
	Harvest Age (HST)	Number of Fruits per Sample Plant (g)	Fruit Weight per Plant Sample (g)
Cu 12	38,8b±0,96	28,8 a±3,3	432,09 a±85.87
Cu 13	39,8 ab±0,5	32,3 a±8,81	529,89 a±157,7
Cu 14	39,0 b±0,82	24,3 a±3,3	380,45 a±39.50
Cu 15	41,3 ab±3,3	26,3 a±5,44	406,38 a±83,71
Cu 16	42,3 a±1,5	30,0 a±3,46	465,18 a±74,78
Toptavi	41,5 ab±1,7	27,5 a±5,2	443,00 a±58,69
Average	40,4	28,2	442,83

Note: The average number followed by the same letter in the same column shows no significant difference at the 5% level.

The Cu13 variety exhibits a leaf length of 20.8 cm and a leaf width of 19.3 cm (see Table 2), indicating that its leaves are broader and consequently produce a greater amount of photosynthate compared to other varieties. This observation is supported by research conducted by Vidianto et al. (2006), which posits that the capacity of leaves to generate photosynthate is contingent upon leaf area. The presence of wider leaves is likely to enhance overall yield. Furthermore, findings from Nwofia et al. (2015) suggest that cucumber varieties that are well-adapted to specific land conditions tend to exhibit higher production levels. Additionally, Diouf et al. (2023) highlight a correlation between morphological and phenological differences and yield variations among cucumber varieties.

Quantitative characters of each variety showed significant differences in the parameters of harvest age, fruit weight per plot, yield per hectare, leaf length and width. The number of fruits and fruit weight in the sample plants did not show any significant difference.

Table 2. Leaf length and leaf width

Varietals	Leaf length (cm)	leaf width (cm)
Cu 12	19,1 bc±1,03	18,0 b±0,87
Cu 13	20,8 a±0,70	19,3 a±0,36
Cu 14	18,9 cd±0,36	17,9 b±0,67
Cu 15	20,0 ab±0,31	18,8 a±20,23
Cu 16	18,8 cd±0,32	17,5 bc±0,63
Toptavi	18,1 d±0,94	17,1 c±0,46
Average	19,3	18,1

Note: The average number followed by the same letter in the same column shows no significant difference at the 5% level.

Table 3. Fruit weight per ha, yield per ha

Varieties	Fruit Weight per Field (kg)	Yield per ha (ton)
Cu 12	32,1 ab±1,08	6,9 ab±1,16
Cu 13	38,6 a±1,36	8,32 a±1,49
Cu 14	32,3 ab±0,85	6,7 ab±1,16
Cu 15	29,0 b±0,85	6,23 b±0,35
Cu 16	31,2 b±1,05	6,7 ab±1,13
Toptavi	31,0 b±0,80	6,7 ab±0,87
Average	32,4	6,92

Note: The average number followed by the same letter in the same column shows no significant difference at the 5% level.

4. CONCLUSION

4.1 Qualitative characteristics

Varieties Cu14, Cu15, and Cu16 have a darker leaf colour than varieties Cu12, and Toptavi, while variety Cu13 has a slightly green leaf colour. Variety Cu16 has a rounded leaf terminal tip shape, varieties Cu12, Cu13, and Cu15 have a serrated leaf terminal tip shape and for varieties Cu14 and Toptavi the leaf terminal tip shape is blunt. Varieties Cu12, Cu13, Cu14, Cu15, Cu16, and Toptavi have a yellow flower crown colour. Varieties Cu15, Cu16, Cu13, and Toptavi have green fruit skin colour while varieties Cu12 and Cu14 have yellowish green fruit skin colour.

4.2 Quantitative characters

The shortest harvest age is for variety Cu12 and the longest is for variety Cu16. Variety Cu13 has the highest production per ha compared to Cu12, Cu14, Cu15, Cu16, and Toptavi.

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REFERENCES

Afrendi, J., Hariyati Adam, D., & Hartati Yusida Saragih, S. (2024). Response to applying vegetable liquid organic fertilizer (POC) on cucumber plants (*Cucumis sativus* L.) growth and production. *Jurnal Agronomi Tanaman Tropika (Juatika)*, 6(2), 588–596. https://doi.org/10.36378/juatika.v6i2.3644

Ardian. (2017). Evaluasi kinerja mentimun (*Cucumis sativus*) hibrida resiprokal melalui pengukuran nilai heterosis dan cluster analysis. *Prosiding Seminar Nasional Agroinovasi Spesifik Lokasi untuk Ketahanan Pangan pada Era Masyarakat Ekonomi ASEAN*, 796–803.

Ashish, Topno, S. E., & Kerketta, A. (2023). Performance of different varieties of cucumber (*Cucumis sativus*) under Prayagraj agro-climatic condition. *International Journal of Environment and Climate Change*, 13(10), 902–911. https://doi.org/10.9734/ijecc/2023/v13i102735

Diouf, S., Sambou, A., & Cisse, A. (2023). Agro-morphological characterization of four varieties of cucumber from *Cucumis sativus* L. and *Cucumis metuliferus* E. Mey. ex Naudin in Senegal. *Journal of Horticulture and Postharvest Research*, 6(2), 131–144. https://doi.org/10.22077/jhpr.2023.5822.1300

Grumet, R., Lin, Y. C., Rett-Cadman, S., & Malik, A. (2023). Morphological and genetic diversity of cucumber (*Cucumis sativus* L.) fruit development. *Plants*, 12(1), 1–21. https://doi.org/10.3390/plants12010023

Istri, A. A., & Dharmadewi, M. (2020). Analisis kandungan klorofil pada beberapa jenis sayuran hijau

sebagai alternatif bahan dasar food supplement. *Jurnal Emasains: Jurnal Edukasi Matematika dan Sains*, 9(2), 171–176.

Nwofia, G. E., Amajuoyi, A. N., & Mbah, E. U. (2015). Response of three cucumber varieties (*Cucumis sativus* L.) to planting season and NPK fertilizer rates in lowland humid tropics: Sex expression, yield, and inter-relationships between yield and associated traits. *International Journal of Agriculture and Forestry*, 5(1), 30–37. https://doi.org/10.5923/j.ijaf.20150501.05

Setiadi, A., Dermiyati, & C. Ginting, Y. (2021). Pengaruh jenis bakteri pelarut fosfat (BPF) terhadap pertumbuhan dan produksi tanaman mentimun (*Cucumis sativus* L.). *Jurnal Agrotek Tropika*, 9(3), 443–451.

Sumpena, U., & Bakrie, A. H. (2010). Daya hasil galur-galur hibrida mentimun (*Cucumis sativus* L.) di Bandung, Blitar, Bogor, Garut, dan Subang. *Jurnal Agrotropika*, 15(2), 60–67.

Taufik, T., Fahrurrozi, F., & Sari, O. (2017). Karakteristik dan identifikasi sepuluh genotipe mentimun (*Cucumis sativus* L.) pada tanah ultisol. *Research Gate*, January 2017, 415–424. https://www.researchgate.net/publication/341540120

Vidianto, D. Z., Fatimah, S., & Wasonowati, C. (2006). Penerapan panjang talang dan jarak tanam dengan sistem hidroponik NFT (Nutrient Film Technique) pada tanaman kailan (*Brassica oleracea* var. *alboglabra*). *Agrogivor*, 6(2), 128–135.