Level of Uniformity of Five F1 Melon (*Cucumis melo* L.) Lines According to Agronomic and Morphological Characters

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ABSTRACT
Melon is favored by the people of Indonesia so the consumption of melon is increasing. The decrease in melon production is one of the problems in complying with this consumption. One of the ways to overcome this is to use melon seeds that have high production potential such as the F1 melon seeds in this study. This study aimed to determine the uniformity in each line of F1 melon based on agronomic and morphological characters and to determine the differences in the five F1 melon lines based on some agronomic and morphological characters. This research was carried out at the Greenhouse located in Pendem Village, Batu City in April-July 2022 using the single-row method. Observation characters include agronomic and morphological characters which are divided into quantitative and qualitative characters. Quantitative data were analyzed using the coefficient of variation, while qualitative data were analyzed using descriptors from PPVT and the RHS color chart. Independent Sample T-Test analysis was also performed to determine differences in characters between lines. The results showed that five F1 melon lines based on agronomic and morphological characters had high and quite high uniformity. AH with BH lines had significant differences in eight agronomic-morphological quantitative characters.

Keywords: *Agronomic, F1 Melon, Morphological, Qualitative, Quantitative.*

1. INTRODUCTION

Melon (Cucumis melo L.) is one of the leading fruits in Indonesia. The sweet taste and crunchy flesh of the fruits are one of the reasons why melons are in great demand by the people of Indonesia. According to data from the Dirjen Hortikultura Kementerian Pertanian [1], it was noted that in 2012, 2014 and 2017 consumption of melons increased sequentially, namely 0.2 kg, 0.4 kg, and 0.5 kg/capita/year. However, the increase in consumption of melons was not matched by an increase in production. According to the Badan Pusat Statistik [2], in 2014, 2015, 2016, 2017, and 2018 there was a decrease in melon production sequentially, namely 150,356 tons, 137,877 tons, 117,344 tons, 92,434 tons, and 118,708 tons. The decline in melon production has forced Indonesia to import it to meet the domestic demand for melons. According to the Dirjen Hortikultura Kementerian Pertanian [2], total import data recorded in 2016, 2017, and 2018 were 95.84 tons, 33 tons, and 28.47 tons.

One of the ways to increase melon production is to use melon seeds that have high production potential, such as seeds from F1 melons. F1 melons are expected to be used to increase melon fruit production because hybrid seeds have advantages such as vigor and high yield [3]. The superiority of hybrid melons is determined by high fruit uniformity (both quality and shape), fast-growing ability to enable the desired combination of characters to be obtained in a plant [4].

The seeds of the F1 melon line in this study were obtained from crosses using some melon parents [5]. Then the results of these crosses were selfed until the third generation produced inbred lines. Then selection and crosses were carried out on third-generation inbred lines to produce F1 melon lines [6]. The results of the F1 melon seeds required uniformity testing to determine the ability of the F1 melon seeds to show uniformity. Evaluation of the appearance of melon plants was carried out on several agronomic and morphological characters. Agronomic characters are characters that play a role in determining the yield potential of a plant [7].

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Evaluation of agronomic characters can be an indication of the potential of a line in the production sector. Observation of agronomic and morphological characters can be a guide in obtaining data on lines based on evaluating the phenotype of a plant [8]. So if the agronomic and morphological characters of the F1 melons have high uniformity, it can indicate the yield potential of the five F1 melon lines. Therefore, it is necessary to test the uniformity of five F1 melon lines based on agronomic and morphological characters to see the yield potential of F1 melon.

2. MATERIALS AND METHODS

This research was carried out at the Greenhouse located on Jalan Tegalgondo, Mojorejo Hamlet, Pendem Village, Junrejo District, Batu City, East Java from April to July 2022. The materials used were five lines of F1 melon such as the F1 AH, F1 BH, F1 DB, F1 DC, and F1 EC. This research was carried out using the single-row method, in which each F1 melon line was planted in one row with a total of 15 plants/row. Planting melons in polybags uses 1 plant per planting hole with a spacing of 70 x 40 cm. The number of plants in each F1 melon line was 15 plants with a total of 5 F1 melon lines so the total of all is 75 plants.

The characters observed were the agronomic and morphological characteristics of melon plants based on guidelines from the Pusat Perlindungan Varietas Tanaman (PPVT) [9] which were divided into quantitative and qualitative characters. Quantitative characters were (i) leaf blade: size, length of terminal lobe (ii) petiole: length (iii) fruit: ratio length/diameter, length of peduncle, the thickness of peduncle, maximum width of flesh in cross-section, and maximum width outer layer of flesh in cross-section. Qualitative characters are (i) young fruit: density of dots (ii) fruit: density of patches, shape of base, shape of apex, size of pistil scar, grooves, creasing of surface, cork formation, the thickness of cork layer, pattern of cork formation, the density of pattern of cork formation, and main color of flesh.

Quantitative data were analyzed using the coefficient of variation, while qualitative data were analyzed using descriptors from PPVT and the RHS color chart. an independent sample t-test analysis was carried out to determine differences in quantitative characters between lines. The formula for the coefficient of variation, is consist of:

$$\text{coefficient of variation} = \frac{\sigma}{\mu} \times 100\%$$

Information:
σ = standard deviation
μ = population mean

There are four categories of values for the coefficient of diversity [11], consist of:
Low = 0-25% (high uniformity)
Moderate = 25-50% (quite high uniformity)
Quite high = 50-75% (moderate uniformity)
High = 75-100% (low uniformity)

3. RESULTS

Uniformity of Agronomic and Morphological Character in Each Line

1. Quantitative characters

Based on the results of the coefficient of variation (CV) for agronomic and morphological characters, it is known that some characters have high uniformity and quite high uniformity (Table 1). In characters of leaf blade: size of the five F1 melon lines had different coefficients of variation, namely the AH line 5.93%, the BH line 10.15%, the DB line 7.64%, the DC line 7.20%, and the EC line 10.64%.

Tabel 1 *Coefficient of Variation Value of Five Melon F1 Lines on Quantitative Characters*

Character	Coefficient of Variation Value (%)				
	AH	BH	DB	DC	EC
Leaf blade: Size	5.93*	10.15*	7.64*	7.20*	10.64*
Leaf blade: Length of terminal lobe	14.90*	12.70*	13.40*	24.92*	12.05*
Petiole: Length	8.98*	10.72*	7.55*	11.53*	10.27*
Fruit: Ratio length/Diameter	7.59*	4.99*	9.30*	9.24*	6.68*
Fruit: Length of peduncle	32.91 tn	32.49 tn	36.11 tn	25.96 tn	20.45*

Fruit: Thickness of Peduncle	9.84*	9.60*	10.45*	10.02*	12.30*
Fruit: Maximum width of flesh in cross section	18.84*	9.19*	10.60*	17.67*	12.15*
Fruit: Maximum width outer layer of flesh in cross section	23.38*	20.38*	29.22tn	31.05 tn	31.61 tn

Description: L (low) = 0-25%, M (moderate) = 25-50%, QH (quite high) = 50-75%, H (high) = 75-100%; tn = quite high, medium, and low uniformity (KK values in categories M, QH, and H), * = high uniformity (KK values in category L)

On the leaf blade: length of terminal lobe of the five F1 melon lines, the CV value of the AH line was 14.90%, the BH line was 12.70%, the DB line was 13.40%, the DC line was 24.92%, and the EC line was 12.05%. Petiole: Length of five F1 melon lines obtained CV values of AH line 8.98%, BH line 10.72%, DB line 7.55%, DC line 11.53%, and EC line 10.27%. Fruit: Ratio length/diameter of the five F1 melon lines obtained the AH line 7.59%, BH line 4.99%, DB line 9.30%, DC line 9.24%, and EC line 6.68%.

On characters of fruit: length of peduncle of five F1 melon lines, the AH line 32.91%, BH line 32.49%, DB line 36.11%, DC line 25.96%, and EC line 20.45%. Fruit: thickness of peduncle of five F1 melon lines obtained the KK values of the AH line of 9.84%, the BH line of 9.60%, the DB line of 10.45%, the DC line of 10.02%, and the EC line of 12.30%. Fruit: maximum width of flesh in cross section of five F1 melon lines obtained KK values of AH line 18.84%, BH line 9.19%, DB line 10.60%, DC line 17.67%, and EC line 12.15%. Fruit: maximum width outer layer of flesh in cross section of five F1 melon lines obtained KK values AH line of 23.38%, BH line 20.38%, DB line 29.22%, DC line 31.05%, and EC line 31.61%.

2. Qualitative characters

Based on the results of observations on the qualitative characters based on PPVT descriptors [10] it is known that almost all the characters in the five strains of F1 melon have high uniformity (Table 2). Observation results of five F1 melon lines on young fruit: density of dots (Figure 1) showed that the AH, BH, and DC lines had the sparse criteria. While the DB and EC lines have medium criteria.

Table 2. *Results of Observation Five F1 Melon Lines on Qualitative Characters*

Character	AH	BH	DB	DC	EC
Young Fruit: Density of dots	Sparse	Sparse	Medium	Sparse	Medium
Fruit: Density of patches	Sparse	Sparse	Sparse	Sparse	Sparse
Fruit: Shape of base	Rounded	Rounded	Rounded	Rounded	Rounded
Fruit: Shape of apex	Rounded	Rounded	Rounded	Rounded	Rounded
Fruit: Size of pistil scar	Medium	Small	Medium	Medium	Medium
Fruit : Grooves	Absent	Absent	Absent	Absent	Absent
Fruit: Creasing of surface	Absent	Absent	Absent	Absent	Absent
Fruit: Cork formation	Present	Present	Present	Present	Present
Fruit : Thickness of cork layer	Thick	Thick	Thick	Thick	Thick
Fruit: Pattern of cork formation	Netted	Netted	Netted	Netted	Netted
Fruit: Density of pattern of cork formation	Dense	Dense	Dense	Dense	Dense
Fruit: Main color of flesh	Orange 29B (60%) Green 154D (40%)	Orange 29B (46.67%) Green 154D (53.33%)	Orange 29B (86.67%) Green 154D (13.33%)	Green 154D (100%)	Orange 29B (53.33%) Green 154D (46.67%)

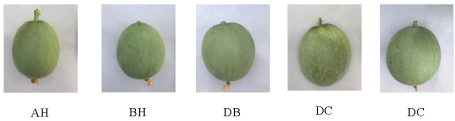

Figure 1. Young Fruit: Density of dots

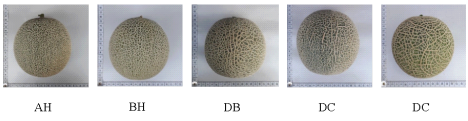

Figure 2. Melon Fruits

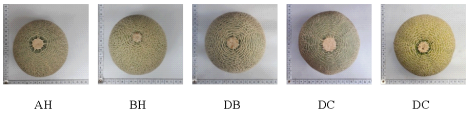

Figure 3. Fruit: Size of pistil scar

On fruit: density of patches of five F1 melon lines had sparse criteria (Figure 2). Fruit: shape of base of the fruit and shape of apex of five F1 melon lines had rounded criteria (Figure 2). Fruit: size of pistil scar in AH, DB, DC, and EC lines has medium criteria (Figure 3). While the BH line has small criteria. Fruit: grooves and creasing of surface of five F1 melon lines had absent criteria (Figure 2). Fruit: cork formation of five F1 melon lines had present criteria (Figure 2). Fruit: thickness of cork layer of five F1 melon lines had thick criteria (Figure 2). Fruit: pattern of cork formation of five F1 melon lines had netted criteria (Figure 2). Fruit: density of pattern of cork formation of five F1 melon lines had dense criteria (Figure 2). Fruit: main color of flesh of the DC line was uniform with the main color of the flesh being green (Figure 4). While AH, BH, DB, and EC have variations in the main color of the fruit flesh, namely orange and green.

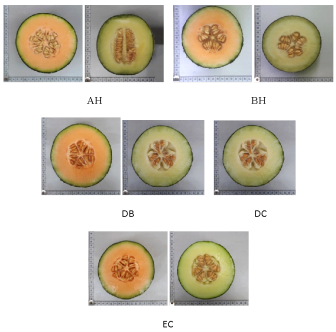

Figure 1. Fruit: Main color of flesh

Differences in Some Agronomic and Morphological Characters between Lines

The results of the normality and homogeneity tests indicated that the five F1 melon lines for the eight quantitative characters were normally distributed and homogenous. Based on the independent sample t-test results showed that AH with BH lines had significant differences in the characters of (i) leaf blade: size, length of terminal lobe (ii) fruit: thickness of peduncle, maximum width of flesh in cross-section, and maximum width outer layer of flesh in cross-section due to significance <0.05 (Table 3). AH with BH lines had significant differences in the following characters (i) leaf blade: size, length of terminal lobe (ii) fruit: ratio, thickness of peduncle, maximum width of flesh in cross section, and maximum width outer layer of flesh in cross-section due to significance < 0.05 (Table 3).

The AH with DC lines had significant differences in the following characters (i) leaf blade: size, length of terminal lobe, (ii) petiole: length (iii) fruit: ratio, length of peduncle, thickness of peduncle, maximum width of flesh in cross-section, and maximum width outer layer of flesh in cross-section due to significance <0.05 (Table 3). AH with EC lines had significant differences in the characters of: (i) leaf blade: size (ii) fruit: ratio, length of peduncle, thickness of peduncle, maximum width of flesh in cross-section, and maximum width outer layer of flesh in cross-section due to significance < 0.05 (Table 3).

The BH with DB lines had significant differences in fruit: length of peduncle and maximum width outer layer of flesh in cross-section because of significance < 0.05 (Table 3). BH with DC lines had significant differences in the following characters: (i) leaf blade: size, (ii) petiole: length, (iii) fruit: ratio, length of peduncle, maximum width of flesh in cross-section, and maximum width outer layer of flesh in cross-section because of significance <0.05 (Table 3). The BH with EC lines had significant differences in the following characters (i) fruit: ratio, maximum width of flesh in cross-section, and maximum width outer layer of flesh in cross-section due to significance <0.05 (Table 3).

The DB with DC lines had significant differences in the characters of (i) leaf blade: size, (ii) petiole: length (iii) fruit: length of peduncle, and maximum width outer layer of flesh in cross-section because of significance < 0.05 (Table 3). The DB with EC lines had significant differences in the characters (i) fruit: ratio and length of peduncle because the significance was <0.05 (Table 3). The DC with EC lines had significant differences in the following characters (i) petiole: length, (ii) fruit: ratio, length of peduncle, and maximum width outer layer of flesh in cross-section because of significance < 0.05 (Table 3).

Tabel 3. Independent Sample T Test of Agronomic and Morphological Characters

Lines	Leaf blade: Size	Leaf blade: Length of terminal lobe	Petiole: Length	Fruit: Ratio length/Diameter	Fruit: Length of peduncle	Fruit: Thickness of Peduncle	Fruit: Maximum width of flesh in cross section	Fruit: Maximum width outer layer of flesh in cross section
	T-test for Equality of Means (Sig. (2-tailed))							
AH with BH	0.001*	0.019*	0.823tn	0.061tn	0.025*	0.001*	0.031*	0.039*
AH with DB	0.001*	0.034*	0.393tn	0.021*	0.640tn	0.001*	0.002*	0.001*
AH with DC	0.001*	0.030*	0.001*	0.001*	0.001*	0.001*	0.001*	0.001*
AH with EC	0.001*	0.325tn	0.717tn	0.001*	0.049*	0.001*	0.001*	0.001*
BH with DB	0.394tn	0.816tn	0.320tn	0.290tn	0.011*	0.160tn	0.123tn	0.040*
BH with DC	0.005*	0.600tn	0.001*	0.020*	0.008*	0.137tn	0.009*	0.001*
BH with EC	0.992tn	0.095tn	0.902tn	0.001*	0.381tn	0.942tn	0.003*	0.049*
DB with DC	0.001*	0.501tn	0.001*	0.287tn	0.001*	0.956tn	0.100tn	0.007*
DB with EC	0.403tn	0.161tn	0.246tn	0.001*	0.018*	0.244tn	0.099tn	1.000tn
DC with EC	0.007*	0.104tn	0.001*	0.013*	0.001*	0.219tn	0.706tn	0.010*

Description: tn = not significant (sig. > 0.05) means to have similar quantitative characters, * = significant (sig. < 0.05) means to have different quantitative characters

4. DISCUSSION

Uniformity of Agronomic and Morphological Character in Each Line

1. Quantitative characters

The CV value of each line on leaf blade: size, leaf blade: length of terminal lobe, petiole: length, fruit: ratio length/diameter, fruit: thickness of peduncle, and fruit: maximum width of flesh in cross-section shows the low category. The lower the KK value, the more uniform a character will be [11]. The research was conducted on each F1 melon line consisting of 15 individual plants. This shows that the uniformity of each strain among individual plants has the same character. The uniformity of F1 melon lines is the ability of a plant to maintain its phenotypic characters so that they remain the same as individuals of their kind [12].

The high uniformity of each F1 melon line on the six characters above also shows that the F1 melon lines have an advantage in character uniformity. The F1 melon strain is known to have some advantages, one of which is the uniformity of its characters. The character uniformity test of melon plants resulting from crosses (F1) shows that several quantitative characters are generally uniform [13].

The AH, BH, DB, and DC lines on fruit: length of peduncle had moderate CV values which indicated that there were differences in the response of individual plants due to powdery mildew attack. The different responses of the individual plants within the lines caused each of these lines to have a moderate CV value. The high value of CV produced on the observed character of a plant attacked by powdery mildew indicates a large difference in response within the same line [14]. Based on the previous statement, the EC lines that had low CV values indicated that the individual plants in the lines had the same response to powdery mildew attack. Likewise, the DB, DC, and EC lines which had moderate CV values indicated that during the process of forming the fruit protective layer, the individual plants in these lines had a different response due to the attack of fruit fly pests.

2. Qualitative characters

The results of qualitative character observations in each F1 melon line showed high uniformity. Qualitative characters are characters that are influenced by the most dominant genes and the least influenced by environmental conditions. Qualitative characters are characters that are influenced by the most dominant gene [15].

Based on observations of fruit: the main color of flesh in the AH, BH, DB, and EC lines had a variation of the orange and green main color of flesh. The variation in the main color of flesh in the four F1 melon lines could occur due to a recessive dominant expression on the allele that governs these characters. Qualitative characters are expressions of dominant and recessive genes whose offspring experience segregation, leading to comparisons between dominant phenotypic characters and recessive phenotypic characters [16]. Following the results of another research, the 8 strains of melon observed, 3 lines showed variations in fruit skin color and fruit flesh color due to a recessive dominant expression by alleles that govern these characters [17]. The main color character of the meat in the AH, DB, and EC lines shows that the orange color is more dominant, while the BH line shows that the green color is more dominant.

3. Differences in Some Agronomic and Morphological Characters between Lines

A comparison between AH with DC lines showed that there were differences in all quantitative characters. The existence of differences in quantitative characters indicates that these lines have quite a lot of genetic differences. In case the character differences are greater, the genetic differences between lines will also be further apart. Following the previous statement, the BH and DB and DB and EC lines had the most quantitative character similarities, indicating that the lines had genetic similarities.

5. CONCLUSION

Based on the research that has been done, the following conclusions are obtained:

Based on agronomic and morphological characters, five F1 melon lines had high and quite high uniformity. The characters included in the high uniformity were (i) leaf blade: size, length of terminal lobe (ii) petiole: length, (iii) young fruit: density of dots, (iv) Fruit: ratio, thickness of peduncle, maximum width of flesh in cross-section, density of patches, shape of base, shape of apex, size of pistil scar, grooves, creasing of surface, cork formation, thickness of cork layer, pattern of cork formation, and density of pattern of cork formation. While the characters included in the uniformity were quite high, namely the fruit: length of peduncle, the maximum width outer layer of flesh in cross-section, and the main color of flesh.

AH with BH lines have significant differences in eight agronomic-morphological quantitative characters. These characters include (i) leaf blade: size, length of terminal lobe (ii) petiole: length (iii) fruit: ratio, length of peduncle, thickness of peduncle, maximum width of flesh in cross-section, and maximum width outer layer of flesh in cross-section. While the BH with DB lines and DB with EC had significant differences in only two agronomic-morphological quantitative characters. These characters were fruit: length of peduncle and maximum width outer layer of flesh in cross-section on BH with DB lines and fruit: ratio and length of peduncle on DB with EC lines.

AUTHORS' CONTRIBUTIONS

- Mochammad Roviq as person in charge of the method of observing physiological and morphological characters
- Dela Kylyfe is person in charge as data observer and researcher in the field
- Noer Rahmi Ardiarini is the person in charge of data analysis
- Afifuddin Latif Adiredjo as a research coordinator and person in charge of the sponsorship proposal

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REFERENCES

[1] Dirjen Hortikultura Kementrian Pertanian, Statistika Produksi Hortikultura, 2020, http://hortikultura.pertanian.go.id/ accessed on 5 May 2021.

[2] Badan Pusat Statistik, Produksi Tanaman Buah-Buahan, 2021, //www.bps.go.id/indicator/55/62/3/produksi-tanaman-buah-buahan.html accessed on 5 May 2021.

[3] BBPADI, Apa yang Dimaksud dengan Hibrida Balitbangtan Kementerian Pertanian, 2015, http://bbpadi.litbang.pertanian.go.id/index.php/info-berita/tahukah-anda/apa-yang-dimaksud-dengan-hibrida accessed on 5 May 2021.

[4] Isnaini, Sobir, and W.B. Suwarno, Evaluasi Karakteristik Hortikultura Melon (*Cucumis melo* L.) Introduksi dan Hasil Rakitan PKBT IPB, Pros. Semin. Nas. Pekanbaru, 2013, pp 128–135.

[5] Leorentina, A.B, Hibridisasi Beberapa Varietas Melon (*Cucumis melo* L.) dengan Perlakuan Waktu Penyerbukan dan Proporsi Bunga Berdasarkan Rancangan Tersarang, Fakultas Pertanian, Universitas Brawijaya, 2019.

[6] Handayani, D.R., Pendugaan Daya Gabung Beberapa Karakter Hasil dan Komponen Hasil pada Persilangan Dialel Penuh Sepuluh Galur Melon (*Cucumis melo* L.), Fakultas Pertanian. Universitas Brawijaya, 2022.

[7] Aisyah, S., M.S. Poerwoko, and B. Trisusilowati, Pencandraan Sifat Agronomis Delapan Genotipe Kedelai Tahan dan Agak Tahan Patogen Karat Daun, Berkala Ilmiah Pertanian, 1(1), 2014, pp 1–5.

[8] Sudré, C.P., L.S.A. Gonçalves, R. Rodrigues, A.T.D.A. Junior, E.M. Rivasouza, and C.D.S. Bento, Genetic Variability in Domesticated *Capsicum spp* as Assessed by Morphological and Agronomic Data in Mixed Statistical Analysis, Genetic Molecular Res. 9(1), 2010, pp 283–294. doi: 10.4238/vol9-1gmr698.

[9] PPVT, Panduan Pengujian Individual Kebaruan, Keunikan, Keseragaman, dan Kestabilan Melon (*Cucumis melo* L), Kementrian Pertanian. Pusat Perlindungan Varietas Tanaman, 2006.

[10] Sulisetijono, S., Statistika Deskriptif, Biologi FMIPA, Universitas Negeri Malang, 2016.

[11] Susanto, N., Respatijarti, and A.N. Sugiharto, Uji Keunikan dan Keseragaman Beberapa Galur Inbrida Jagung Manis (*Zea mays* L. Saccharata Sturt) Distinctness And Homogeneity Test on Inbreed Lines of Sweet Corn (*Zea mays* L. Saccharata Sturt), Plantropica J. Agric. Sci., 1(2), 2016, pp 49–54.

[12] Hidzroh, F., and B.S. Daryono, Keseragaman dan Kestabilan Karakter Tanaman Melon (*Cucumis melo* L. 'Tapaca Gold') berdasarkan Karakter Fenotipe dan Inter-Simple Squence Repeat. Biospecies, 14(2), 2021, pp 11–19.

[13] Khumaero, W.W., D. Efendi, W.B. Suwarno, dan Sobir, Evaluasi Karakteristik Hortikultura Empat Genotipe Melon (*Cucumis melo* L.) Pusat Kajian Hortikultura Tropika IPB, J. Hortikultura Indonesia, 5(1), 2015, pp 56-63, doi: 10.29244/jhi.5.1.56-63.

[14] Gepts, P., and J. Hancock, The Future of Plant Breeding, Crop Sci. Soc. 46, 2006, pp 1630–1634, doi: 10.2135/cropsci2005-12-0497op.

[15] Daryono, B.S., S.D. Hayuningtyas, dan S.D. Maryanto, Perakitan Melon (*Cucumis melo* L.) Kultivar Melodi Gama 3 dalam Rangka Penguatan Industri Pertanian Nasional. Pros. Semin. Nas., 2012, pp 245–256.

[16] Makful, M., H. Hendri, S. Sahlan, S. Sunyoto, dan K. Kuswandi, Karakter Buah Galur Melon Generasi S6 dan S7, Bul. Plasma Nutfah 23(1), 2018, pp 1-12, doi: 10.21082/blpn.v23n1.2017, , p1-12.

[17] Salamah, U., H. Eka, dan W. Herman, Karakterisasi Buah Dua Puluh Enam Genotipe Melon pada Media Pasir Sistem Hidroponik, 5(2), 2021, pp 195–203.