Quality evaluation for chili hybrid variety candidate cultivated on highland

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Abstract. Chili is one of potential vegetable due to its high demand and as an important source of nutrition. Hybrid chili has several advantages so it is beneficial to be cultivated. The purpose of this study is to examine the quality of several prospective varieties of large chili hybrids which will be released as new varieties. This research was conducted in Indonesian Vegetable Research Institute in 2019 at the Post Harvest Physiology Laboratory, West Bandung Regency, West Java. The materials used in the study were 3 chili variety candidates and 2 existing varieties that harvested in Lembang during rainy season. The study used randomized block design with 5 treatments and 5 replications. Physical parameters observed were weight, diameter, length, and texture. Chemical parameters include water content (gravimetric method), Total Soluble Solid (TSS), vitamin C (titration method), and ash content. Organoleptic test was carried out by 15 untrained panelists using scale from 1 (like extremely) to 5 (dislike extremely) in order to determine consumer acceptance of the freshness of chillies. The organoleptic tests were conducted on days 0, 4, and 7. The results showed Genotype number. 4 had weight, diameter and vitamin C close to the comparative varieties. Genotypes number 2 and 3 have quality parameters (color, shape, size, appearance, and freshness) preferred by consumers during storage until the 7th day at room temperature in Lembang area of West Java.

1. Introduction
Chilli is an indispensable food ingredient in many cuisines worldwide. Chili, which is rich in vitamins A, C and E, often being used as spice, condiment, vegetable, culinary supplement, medicine and as ornamental plant. Chilli plants have variety of names with reference to place and type. Improvements in chilli cultivation practices, availability of improved quality of crop varieties, and improvement in irrigation infrastructure are some of the reasons for the recently observed improvement in chilli productivity in Indonesia.

Selecting a hybrid cultivar for a diverse or specific chilli growing area requires growers consider stability of performance in addition to an overall average or maximum performance in a single location [1]. Quality of hybrids and lineages of sweet peppers, reporting loss in mass, soluble solids, titratable acidity, pH and reducing sugars. Different hybrids and harvests influenced physicochemical and biochemical traits. The unripe sweet pepper presents low acidity and soluble solids content, independently of genotype. However, all nutraceutical properties present in fruits and vegetables are largely influenced by genotypes, environmental conditions and production system [2]. Scientific evidences are rapidly accumulating that show the beneficial effects of wide variety of food components on human health. fruits and vegetables are immensely valued not only for their nutritional value but also
for their potential health functionality against various degenerative diseases such as cancer, cardiovascular, cataract, diabetes [3].

Two chilli genotypes gave different embryogenic response to seasonal effects [4]. Kekova cultivar gave the highest embryogenic yield in summer season while this was occurred in winter season for Sera Demre 8 cultivar. The effect of donor plant age was also an important factor in anther culture of chilli. Since 4-month-old plants gave the highest embryo yield in both cultivars in each seasons, it is possible to say that anthers collected from old plants have sufficient embryogenic response when the optimum developmental stage is selected. The collection featured phenotypic variability for all the studied traits, which were influenced by the location, except for the yield. The greater part of the variance was accounted for traits such as fruit weight, pericarp thickness and fruit shape and color. The molecular analysis suggested a high level of genetic diversity within the collection and the presence of specific alleles, which were not previously detected in other Spanish pepper landraces [5]. The objective of the research is to examine the quality of several prospective varieties of large chili hybrids which will be released as new varieties.

2. Materials and methods

The study was conducted in July-August 2019 at the Post Harvest Physiology Laboratory, Vegetable Crops Research Institute, Lembang, West Bandung Regency, West Java Province. The material used in this study were 3 chilli genotypes and 2 varieties harvested in Lembang during the rainy season planting which were harvested at full red maturity.

The procedure for carrying out this research was: The harvested chilli was transported to the laboratory. Only relatively uniform size, free from damage, and free from disease symptoms chilli was collected as samples. The study used a randomized block design with 5 treatments and four replications. Physical parameters observed were weight, diameter, length, and texture. Chemical parameters include water content (gravimetric method), Total Soluble Solids (TSS), vitamin C content (titration method), and ash content. Organoleptic tests were carried out by 15 untrained panellist using hedonic scale from score 1 (extremely like) to score 5 (extremely dislike) to determine consumer acceptance of the freshness of chillies which were conducted on days 0, 4, and 7.

3. Results and discussion

Table 1. Physical and chemical parameters of several hybrid big chili genotypes.

| Genotype | Weight (g) | Length (cm) | Diameter (mm) | Texture (mm/g/dtk) | TSS (°Brix) | Vitamin C (mg/100g) | Water (%) | Ash content (%) |
|----------|------------|-------------|---------------|--------------------|-------------|---------------------|-----------|----------------|
| 1        | 10.95 ab   | 12.12 c     | 14.9 a        | 4.26 a             | 8.10 b      | 139.49 b            | 80.64 b   | 0.38 b         |
| 2        | 9.7 bc     | 13.95 ab    | 11.84 b       | 4.27 a             | 8.09 b      | 140.21 b            | 81.13 ab  | 0.43 b         |
| 3        | 7.25 c     | 11.53 c     | 10.42 c       | 4.44 a             | 8.77 b      | 136.59 b            | 79.81 b   | 0.42 b         |
| 4        | 12.9 a     | 15.60 a     | 12.43 b       | 4.02 a             | 8.17 b      | 156.11 ab           | 80.87 b   | 0.79 a         |
| 5        | 11.05 ab   | 12.26 bc    | 12.85 b       | 3.69 a             | 6.18 a      | 209.60 a            | 85.80 a   | 0.24 b         |

Table 1 illustrates the physical and chemical parameters of the 5 chilli genotypes. There was a positive correlation between the weight and length of the chilli. Genotype No. 4 has the largest size and length and is significantly different from the other genotypes, even exceeding the two comparisons, No. 1 and 5. Most Thai chilli landraces have elongate fruit with various lengths (1–12 cm) and colors (greenish white to dark green for green fruit or yellow to red for ripe fruit). Some Thai chilli landraces have potential to be developed for commercial cultivars serving demands from both fresh consumption and food industry through selection and breeding [6]. The heterocyst effect to create F1 hybrid could be expected on the 4 genotypes of F1. Positive heterocyst for plant height range from 1.84 to 25.41% with heterobeltiosis range from 1.63 to 20.78%. For flowering date, negative heterobeltiosis occurred with
value ranging from -9.18 to -0.19%. Fruit weight and fruit number per plant heterosis occurred successively 2.27 to 93.40 % and 6.32 to 22.84 %, respectively [7]. Significant differences among cultivars, environments, and cultivar-by-environment interactions for all characteristics were observed. A large proportion of variation on fruit number (80.1%), dry fruit yield (78.1%) and capsaicinoid yield (67.7%) [8]. The level of hardness of chili generally has almost the same texture ranging from 3.69 mm / g / sec-4.44 mm / g / sec. The content of TSS (Total Soluble Solids) in genotype no 2, 3, and 4 were not significantly different from comparison number 1. TSS and firmness were found to be good indicator of sweet pepper fruit maturity. It was shown that prediction of fruit growth stage was possible from measurement of lineargrowth (diameter and length) to determine fruit fresh weight [9].

The highest vitamin C content in genotype no 4 was not significantly different from comparison number 5. Other research reporting vitamin C increase with the advance in ripening in all hybrids included in this study. The highest value of 3689.4 ± 39.50 µg/g FW was recorded in Fire Flame hybrid [10]. da Silveira Agostini-Costa et al., reported that Red jalapeño peppers grown in the field (in summer) showed higher zeaxanthin, b-cryptoxanthin, provitamin A and ascorbic acid than peppers grown in the greenhouse [11].

The water content in the five genotypes tested showed values ranging from 79.81-85.80% where comparator no. 5 had the highest value of 85.80%, while genotype no. 3 had the lowest content which was 79.81%. Ash content in genotype no 4 has the lowest value. Whereas ash content no. 2 and 3 were not significantly different from the comparison of no. 1 and 5. Significant differences among cultivars, environments, and cultivar-by-environment interactions for all characteristics studied. A large proportion of variation on fruit number (80.1%), dry fruit yield (78.1%) and capsaicinoid yield (67.7%) was contributed from environment while variations due to genotype were 42.4% for capsaicinoid content trait [8].

Table 2. Results of consumer preference tests on the 0 day chili.

| Genotype | Color | Shape | Size | Texture | Features | Freshness | Average |
|----------|-------|-------|------|---------|----------|-----------|---------|
| 1        | 2.93  | 2.60  | 2.53 | 2.71    | 2.80     | 2.53      | 2.44    |
| 2        | 3.20  | 3.00  | 2.87 | 2.80    | 2.73     | 2.07      | 2.67    |
| 3        | 2.47  | 2.20  | 2.27 | 2.53    | 2.40     | 2.53      | 2.49    |
| 4        | 2.87  | 2.93  | 2.87 | 2.93    | 2.87     | 3.20      | 3.10    |
| 5        | 1.47  | 1.27  | 1.53 | 1.80    | 1.47     | 1.00      | 1.93    |

Notes: score 1 (extremely like), 2 (like), 3 (normal), 4 (dislike), 5 (extremely dislike)

On the harvesting day chilli was judged by consumers, the comparison number 5 has a value that consumers prefer. whereas genotypes No. 2, 3, and 4 has a value that is favoured by consumers

Table 3. Results of consumer preference test on 4th day chili.

| Genotype | Color | Shape | Size | Texture | Features | Freshness | Average |
|----------|-------|-------|------|---------|----------|-----------|---------|
| 1        | 2.40  | 2.27  | 2.27 | 2.80    | 2.47     | 2.20      | 2.20    |
| 2        | 2.73  | 2.87  | 2.53 | 2.80    | 2.93     | 3.07      | 2.70    |
| 3        | 2.33  | 2.40  | 2.60 | 2.73    | 2.93     | 2.33      | 2.62    |
| 4        | 3.40  | 3.40  | 2.73 | 3.33    | 3.33     | 3.40      | 3.37    |
| 5        | 2.27  | 2.00  | 2.00 | 1.87    | 1.67     | 1.53      | 2.33    |

Notes: score 1 (extremely like), 2 (like), 3 (normal), 4 (dislike), 5 (very dislike)

As storage period, the preferred level of the five chilli genotypes decreases. On day 4, the average consumer preference of 5 chili genotypes showed that comparison no. 1 and 5 had a value that consumers preferred while genotype no. 4 had values that began to be less liked by consumers. Genotypes no. 2 and 3 are still preferred by consumers. Ascorbic acid in tomato fruit increased slowly reaching a maximum of 94.9 mg/100 g at 74 days and then declined slowly. The decrease in ascorbic acid coincided
with the initiation of ripening, as indicated by color change, and with an increase in the activity of ascorbate oxidase. There was more putrescine in bell pepper than in tomato fruit. No major changes were observed in spermine and spermidine in bell pepper and in spermidine in tomato fruits [12].

### Table 4. Results of consumer preference test on the 7th day chili.

| Genotype | Color | Shape | Size | Texture | Features | Freshness | Average |
|----------|-------|-------|------|---------|----------|-----------|---------|
| 1        | 2.53  | 2.60  | 2.67 | 2.67    | 2.87     | 2.93      | 2.47    |
| 2        | 3.13  | 3.00  | 2.80 | 2.80    | 3.13     | 3.33      | 2.89    |
| 3        | 2.93  | 2.87  | 2.60 | 2.60    | 3.07     | 2.80      | 2.84    |
| 4        | 3.27  | 3.53  | 2.87 | 2.87    | 3.60     | 4.00      | 3.45    |
| 5        | 2.47  | 2.27  | 2.07 | 2.07    | 2.13     | 2.53      | 2.65    |

Notes: score 1 (really like), 2 (like), 3 (normal), 4 (dislike), 5 (very dislike)

![Figure 1](image1.png)

**Figure 1.** The weight loss of five genotypes on seven days.

Until the 7th day the average consumer preference showed that comparison no. 1 and 5 had a value that consumers preferred while genotype no. 4 had a value that consumers disliked, and the freshness parameter had begun to dislike the consumer. Genotypes no. 2 and 3 are still preferred by consumers on 7th day storage. Shrinkage weight of the chili tested continued to increase during 7 days of storage. The weight loss ranges from 20.91% -23.84% on the 7th day of storage. Genotype No.4 has the highest tendency to decrease weight during storage. While genotypes no. 2 and 3 tend to approach the same as the comparison.

### 4. Conclusion

Genotype number 4 has a weight and diameter measurement and vitamin C content close to the comparative variety. Genotypes number 2 and 3 have quality parameters (color, shape, size, appearance, and freshness) during storage that are still preferred by consumers to room temperature storage on the 7th day in Lembang, West Java.

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