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Evaluation of the Morphology, Yield and Content of Beta-carotene Sweet Potato (*Ipomoea batatas* L.) Orange Flesh Results of Beta-2 Female Broodstock Assembly

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Abstract

Sweet potato (*Ipomoea batatas* L.) is a functional food commodity that has the potential to support food diversification because it has a high content of beta-carotene as a provitamin A and a natural antioxidant. This study aimed to evaluate the morphological character, yieldability, and content of beta-carotene, dry matter, and sugar content in orange fleshy sweet potato clones assembled by female broodstock Beta-2. The study used a single-factor Group Random Design (RAK) with six clones, namely BOP 36, BOP 42, BOP 73, BOP 77, Beta-2, and *Sari*, which was repeated four times so that 24 experimental units were obtained. The data was analyzed using *Analysis of Variance* (ANOVA) followed by a BNT test of 5%. The results showed that there were significant differences in morphological characteristics, productivity, beta-carotene content, dry matter, and sugar content between clones. The BOP 73 clone produced the highest productivity with an average tuber weight of 234.37 g/plant, followed by BOP 36 of 205.87 g/plant. The two clones also have a higher content of beta-carotene, dry matter, and sugar content than the Beta-2 and *Sari* comparison clones. The BOP 36 clone which has a deep orange tuber has the potential to be developed as a new superior clone that supports food diversification, improving the quality of community nutrition, and strengthening food security through the provision of productive and provitamin A-rich local food.

Keywords: Beta-2; beta-carotene; orange fleshy sweet potato; food security; productivity.

INTRODUCTION

Sweet potato (*Ipomoea batatas* L.) is a tuber plant that has an important role in national food diversification as well as a source of carbohydrates and bioactive compounds. One type of sweet potato that is currently receiving special attention is orange-fleshed sweet potato due to its high content of beta-carotene, which serves as a provitamin A and natural antioxidant. Lampung Province as one of the central sweet potato production centers in Indonesia has great potential for the development of orange sweet potatoes, both in terms of land, agroclimate, and support for research and breeding of local varieties. Dewi *et., al*., (2025). According to Amagloh et al (2021) stated that the nutritional content contained in sweet potatoes includes: manganese, copper, potassium, iron, B complex vitamins, vitamin C, vitamin E, and pro vitamin A (especially carotenoids in yellow and orange fleshy varieties). In addition, sweet potatoes contain many antioxidants, vitamins, minerals, carbohydrates, and dietary fiber (Mohanraj, 2014). Beta-carotene is a component that produces vitamin A, and is one of the abundant nutrients in orange sweet potatoes compared to staple foods such as rice, corn, and cassava. The carotenoids (*beta-carotene*) found in sweet potatoes can act as antioxidants that prevent cancer and inhibit cell damage due to free radicals. Indonesia's sweet potato production can be said to be still low. One of the problems faced in the development of orange sweet potatoes is the limited choice of sweet potatoes that are orange flesh, high dry ingredients, and full lifespan. In Indonesia, there are only 3 national superior varieties with orange flesh, namely Beta-1, Beta-2, and Beta-3. Therefore, a solution is needed to carry out free crosses (*open pollination*) or assembly to produce sweet potatoes that are orange flesh, contain *beta-carotene*, high dry matter, have a good lifespan and high yield.

Efforts to assemble superior varieties of orange sweet potatoes through plant breeding have been carried out in Lampung Province, one of which is through *open-pollination* using Beta-2 female broodstock. Clone assemblies of Beta-2 broodstock produce offspring with high genetic diversity, including in terms of tuber flesh color and yield potential. One of the challenges of the 94m orange sweet potato development is the limited selection of orange sweet potatoes. Therefore, to produce sweet potatoes with orange flesh color, solutions such as free cross-breeding or open pollination with broodstock of various genotypes are needed. The Lampung State Polytechnic has conducted free crosses between Beta-2 female parents and male elders of various genotypes. Based on the results of the study (Rahma, 2019), there are sweet potato clones that have orange flesh color as a result of free crossbreeding with Beta-2 female mothers, namely BOP 36, BOP 42, BOP 73, and BOP 77 clones. Sweet potato germplasm with multicolored tuber flesh (white, purple, yellow, orange) was developed from the local Lampung, including genotypes found at the Lampung State Polytechnic (Dewi, 2022). Sweet potato germplasm that has been introduced genotype and genotype superior in national

According to Dewi *et al*. (2019), The quantitative character of sweet potato germplasm shows a fairly high genetic and phenotypic diversity, accompanied by various heritability values in each character. This high diversity provides great opportunities in selection activities because characters with high heritability are more influenced by genetic factors than environmental factors. In addition, the existence of correlations between quantitative characters can be used as a basis for determining selection criteria to obtain superior genotypes with better productivity

Plant breeding to produce high-quality sweet potato genotypes, resulting in high yield potential, begins with crop crosses to increase genetic diversity, followed by crop selection and yield evaluation (Rini *et al*, 2018). Dewi *et al* (2023) reported that from open crosses of sweet potatoes between Beta-2 female elders (mothers) and male elders, 79 clones were produced with white, beige, yellow, orange, purple and purple white flesh colors. Of the 79 clones produced, there were 32 clones with yellow to orange bulbs. Furthermore, the results from Dewi (2025), stated that of the 32 clones assembled by Beta-2 female broodstock with seven male elders, there were clones that had high yields, including BOP 36, BOP 42, BOP 73 and BOP 77

The test study was conducted on orange-fleshed sweet potatoes that contain beta-carotene, sweetness, dry ingredients and high shelf life. According to Basuki (1991) in the sweet potato breeding procedure there are four stages of selection, namely selection based on a single plant, selection based on a single map, testing based on repeated plots at one testing location and testing in various locations. Evaluation is the final stage in plant breeding activities, which aims to see the stability and adaptability of prospective varieties in various locations with different agroecological conditions. Based on the description above, it is necessary to carry out adaptation tests from the results of Beta-2 female broodstock assemblies with Beta-2 and national superior pollen comparisons. It is expected that sweet potato clones consisted of BOP 36, BOP 42, BOP 73, BOP 77 which have *beta-carotene* content and high yield potential and the best combination in the Tulang Bawang regency area, Lampung Province.

MATERIALS AND METHODS

Place and Time

This research was conducted 10 November 2025-05 March 2026 on agricultural cultivation land located in Bawang Sakti Jaya village, Banjar Baru District, Tulang Bawang Regency, Lampung Province

Materials and Tools

The ingredients used in this study consisted of sweet potato cuttings of the Beta-2 variety, the National Superior (Sari) variety, as well as clones of BOP 36, BOP 42, BOP 73, and BOP 77. In addition, manure and NPK Mutiara fertilizer are also used as a source of plant nutrition. For the control of plant pest organisms, Klocyper insecticide, Dursban 200 EC insecticide, and Dithane fungicide are used. The tools used in this study include roll meters, hoes, corers, sprayers, cuttings, stakes, stakes, machetes, buckets, sacks, and sprinklers or hoses for field activities and cultivation. Meanwhile, for laboratory measurement and analysis purposes, scales, calipers, ovens, porcelain cups, trays, analytical scales, rulers, HPLC-PDA (High Performance Liquid Chromatography with Photodiode Array detectors) are used as tools used to measure the level or concentration of Standard Solutes (Beta-carotene) with the Manual Method (SMM) and stationery as a tool to record the results of research activities as well as RHS colour charts to determine skin color tubers and the color of the tuber flesh.

Methods and Research Design

The experimental design of the orange sweet potato research was carried out using the RAK (Group Random Design) method of single factor, the factor used was a clone of sweet potato plants consisting of 6 clones (BOP 36, BOP 42, BOP 73, BOP 77, Beta-2 and *Unggul Nasional* (Sari) as a comparison with 4 replicas so that there were 24 experimental units. The quantitative observation variables observed were tendril length (cm), book segment length (cm), leaf length (cm), leaf width (cm), petiole length (cm), stem diameter (mm), trimmed weight (gram). The qualitative observation parameters observed were the weight of large tubers of the plant, the weight of the small tubers of the planting and the total weight of the tubers of the plant, the weight of the large tubers of the tubers, the weight of the small tubers of the tubers and the total weight of the tubers of the tubers, the dry matter content of the tubers, the sugar content of the tubers, the content of beta-carotene and the color of the tubers' skin, the color of the tuber flesh and the shape of the tubers. The implementation of research with soil tillage, preparation of sweet potato cuttings, planting and maintenance which includes embroidery, irrigation, weeding, fertilization, pest and disease control, saturation, vine reversal and observation of the morphological characteristics of each clone

Data Analysis

All quantitative data obtained from the assessment of morphology, yield power, and chemical content were statistically analyzed to determine genotype-related variability among sweet potato clones. Analysis of Variance (ANOVA) was performed using Group Random Design (RAK) with a clone as a fixed factor and four replicates. Statistical significance was evaluated. at $p \leq 0.05$. If significant effects are detected, an average post-hoc comparison is performed using the Smallest Significant Difference (LSD) test at a probability level of 5% to identify paired differences between genotypes. Chemical content data were analyzed descriptively and interpreted in relation to the nutritional and functional quality of the genotype. Results were tabulated and graphically illustrated to facilitate interpretation and discussion, and statistically analyzed using standard analytical procedures appropriate for agricultural field experiments

RESULTS AND DISCUSSION

Vegetative Morphological Characteristics

In table 1. Based on the analysis of the observations, it shows that the Sari variety records the highest tendril length and is statistically significant compared to other treatments, such as BOP 36 and Beta-2. Physiologically, the very extreme elongation of the tendrils in Sari shows a very strong apical dominance phenomenon. According to Taiz & Zeiger (2010) in the book Plant Physiology, this elongated growth is regulated by a high concentration of auxin hormones in the apical meristem, which spurs the expansion of the cell wall. However, in agronomic studies, excessive *vine length* growth does not always correlate positively with good vigor. Ravi *et al.* (2009) in Advances in Agronomy stated that in creeping bulb plants, disproportionate elongation of tendrils is often a form of competition for light or carbon allocation that is too centered on the growth of the stem end (shoot apex), thus sacrificing the growth of other organs. Inversely proportional to the length of the tendrils, the stem diameter data shows that Sari has the smallest stem, while Beta-2 and BOP 36 have the largest diameter

This difference proves that although *Sari* is very long, its secondary growth rate (vascular cambium activity) is very slow. Salisbury & Ross (1995) assert that the diameter of the trunk represents the extent of the transport vessel network (xylem and phloem). The thick stems of Beta-2 and BOP 36 indicate a much more efficient and robust capacity for water, nutrients, and assimilation (photosynthesis). In the journal Crop Science, Behera *et al*. (2006) stated that long but very thin stems indicate a weak plant structure and are susceptible to mechanical damage, and have limitations in supplying photosynthates optimally to the reservoir organs (bulbs).

In the length parameters of the book segment, the Beta-2 variety recorded the longest segment distance, which was significantly different from Sari and BOP 36. The distance between these nodes is greatly influenced by the activity of the hormone gibberelline. Gardner *et al*. (1991) in Physiology of Crop Plants explains that the architecture of the crown is largely determined by the length of the book segment. The fairly long book section in Beta-2, which is offset by a thick rod (0.64 mm), is an indication of an ideal canopy architecture. This configuration allows for a more dispersed leaf distribution (good leaf spatial arrangement) so that sunlight penetration can enter the lower leaf layer without mutual shading, which ultimately optimizes the rate of photosynthesis

The weight parameter of the spruce (fresh canopy biomass) became the estuary of all previous vegetative activity. The data shows that Beta-2 has the highest weight, while Sari actually occupies the lowest position. This provides comprehensive physiological proof: the high biomass in Beta-2 is the result of a combination of thick stem diameter and optimal leaf architecture (long book), resulting in maximum photosynthesis and abundant accumulation of carbon compounds. On the other hand, the low weight of the Sari, even though the tendrils are the longest, proves the phenomenon of partial etiolation or spindly growth. According to Bhagsari & Ashley (1990) in the Journal of the American Society for Horticultural Science, the allocation of assimilates in elongated lean plants is very wasteful for the maintenance respiration of new cells in the shoots, so that the accumulation of dry matter or fresh weight becomes very low and inefficient.

Table 1. Average Vegetative Morphological Characteristics of Sweet Potato Clones Orange Fleshed Varieties Derived from the Beta-2 Female Parent.

Treatment	Observation parameters			
	Tendril length (cm)	Rod diameter (mm)	Length of section between books (cm)	Trimmed weight (g)
BOP 36	176.94 b	0.64 a	4.04 b	711.00
BOP 42	174.25 b	0.53 b	3.81 b	676.06
BOP 73	170.75 b	0.51 b	3.50 b	628.94
BOP 77	167.25 b	0.51 b	3.40 b	580.31
Beta-2	170.75 b	0.64 a	5.47 a	774.31
Sari	262.75 a	0.39 c	3.04 b	468.19
BNT 5%	34.15	0.11	1.14	-

Based on the analysis of observations, it shows that the Beta-2 variety has the highest average leaf length which is statistically not statistically different from BOP 36, but it is very noticeable from *Sari* which has the shortest leaves (table 2). Physiologically, leaf length is a representation of the longitudinal expansion of the lamina (leaf strands) driven by the process of cell division and elongation in the meristematic area of the leaf. According to Pérez-Harguindeguy *et al.* (2013) in the journal New Phytologist, the elongated dimensions of leaf strands are highly regulated by the optimal availability of nutrients (especially Nitrogen) and water during the early vegetative phase. Longer leaves in Beta-2 indicate maximum cell proliferation activity. Adequate leaf length is an important component in forming a high Leaf Area Index (LAI), which has direct implications for increasing the capacity of photosynthetically active radiation (PAR) for photosynthesis

In line with leaf length, leaf width parameters show a similar trend. Beta-2 and some BOP clones (such as BOP 36, 42, and 73) occupy the highest class, while *Sari* again recorded the smallest size along with BOP 77. In the physiology of cultivated plants, the interaction between leaf length and width will result in a total leaf area. Kays (1985) in a physiological study of tuber plant results explained that wide leaf strands are positively correlated with high stomata density and chloroplast volume in mesophyll tissue. The leaf width reaching almost 10 cm in Beta-2 proves that this variety has a vast and massive photosynthetic "factory". The wider the cross-section of a leaf, the greater the volume of carbohydrates (photosynthes**is**) that can be produced by the source organ to then be translocated to the sink organ (such as tubers or storage roots)

Petiole length data showed dominance in almost all treatments (Beta-2 and all BOP clones), except for Sari which had the shortest stalk. Petioles have very vital mechanical and photomorphological functions. Taiz & Zeiger (2010) stated that the main function of petiole elongation is to project the leaf blade away from the main stem axis. This is a spatial response to find the best sunlight position within the plant canopy structure. According to Ravi *et al.* (2009) in Advances in Agronomy, the ideal length of the petiole facilitates a good distribution of leaf angles to prevent overlapping of leaves between the branches (mutual shading). The long, sturdy petioles of Beta-2 allow the leaf arrangement to spread optimally, so that the leaves in the lower layer still receive sufficient light transmission to photosynthesize.

Table 2. Average Vegetative Morphological Characteristics of Sweet Potato Clones Orange Fleshed Varieties Derived from the Beta-2 Female Parent.

Treatment	Observation Parameters		
	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)
BOP 36	9.71 a	9.77 a	15.31 a
BOP 42	9.41 ab	9.76 a	15.28 a
BOP 73	8.90 bc	9.73 a	14.31 a
BOP 77	8.66 bc	8.38 b	13.81 a
Beta-2	9.95 a	9.94 a	15.53 a
Sari	8.36 c	7.89 b	11.19 b
BNT 5%	0.76	0.88	2.29

Potential Harvest Yield

Table 3. shows that as a result of the observations that have been made, this study found a very interesting agronomic pattern: the fertility of leaves and stems above the ground does not always guarantee the high yield of bulbs. In the growth phase, the Sari variety is recorded to grow very elongated and the Beta-2 variety grows very lush. But ironically, the total yield of tubers of these two varieties was actually recorded as the lowest. This condition is in line with the recent findings of Villordon *et al.* (2020) in the reputable journal Frontiers in Plant Science. In their research, they suggested that bulb plants that are too "extravagant" to spend their energy lengthening the stems or thickening the leaves will experience what is called a source-sink imbalance. In this situation, the food reserves (carbohydrates) of photosynthesis are used up only to maintain the top of the ground, so that the supply of food delivered to the roots becomes very minimal and results in the bulbs growing stunted

On the other hand, the maximum yield of tubers was actually obtained in clones. If you look back, these two clones actually only have medium tendril length and leaf lushness. This phenomenon confirms the latest scientific study from Priyanto et al. (2023) in the Journal of Agronomy, which proves that the key to the high productivity of creeping tuber plants lies in the efficiency of food translocation (delivery), not in the length of the tendrils. Clones of BOP 73 and BOP 36 have been shown to be able to hold the growth rate of their leaves from being excessive, and focus their energy directly into the soil for bulb enlargement. These findings provide strong empirical evidence that in order to get a bountiful harvest, the balance of plant architecture is much more decisive than just the lush foliage or the length of tendrils.

Table 3. Average weight of large tubers of plants, weight of small tubers of planting and weight of tubers of planting

Treatment	Observation Parameters		
	Large tuber weight per plant (grams)	Small tuber weightper plant (grams)	Total bulb weight per plant (grams)
BOP 36	186.31 a	19.56	205.87 a
BOP 42	85.50 c	16.81	102.31 c
BOP 73	213.50 a	20.88	234.37 a
BOP 77	149.56 abc	14.31	163.87 abc
Beta-2	100.82 c	15.56	116.37 c
Sari	113.88 c	10.38	124.25 b
BNT 5%	78.48	-	84.48

In table 4. Showing that the results of the observations that have been carried out, this study found a very interesting agronomic pattern: vegetative fertility on the ground is not always directly proportional to the high yield of tubers in the soil. At the beginning of growth, the Sari variety grows the most dominant with the longest tendrils. But ironically, this variety actually produces a low total weight of bulbs. A similar phenomenon is also seen in Beta-2 which grows very lush with a pruning weight of 774.31 grams, but the yield of the tubers is actually the lowest (116.37 grams per plant). This condition shows an imbalance in the distribution of plant energy or known as the source-sink relationship. As explained by Lal *et al*. (2022) in the journal Frontiers in Plant Science, plants that are too "wasteful" spend their energy to lengthen tendrils or form very dense foliage will experience an energy deficit to be sent to the roots, so that the formation of bulbs becomes inhibited.

On the other hand, the most optimal yield was recorded by BOP 73 clones (234.37 grams per plant or 1,969.75 grams per gulud) and BOP 36 (205.87 grams per plant or 2,242.75 grams per gulud). If we look back at the growth data, these two clones have a more proportional architecture: the tendrils are not very long, but the stems are sturdy (0.51–0.64 mm in diameter). These findings are in line with the research of Villordon *et al*. (2020) published in Frontiers in Plant Science, which asserts that root architecture and nutrient translocation efficiency are much more determinative of yield potential than excessive crown vigor. the BOP 73 and BOP 36 clones have been shown to be more "intelligent" at managing photosyntheses; They do not waste energy on wasted vegetative growth, but rather focus direct carbon allocation on tuber enlargement. This is also reinforced by Ngailo *et al*. (2019) in the Journal of Crop Improvement, which emphasizes that in the breeding strategy of bulb crops, the selection criteria should be prioritized on the efficiency of the yield component rather than just the physical appearance of the lush plant

Table 4. Average weight of large tubers per gulud, weight of small tubers per gulud and weight of tubers per gulud

Treatment	Observation Parameters		
	Large tuber weight per gulud (gram)	Weight of small bulbs per gulud (grams)	Total tuber weight per gulud (gram)
BOP 36	1831.25	409.00	2242.75
BOP 42	467.00	215.75	665.25
BOP 73	1628.00	341.75	1969.75
BOP 77	937.25	254.00	1191.25
Beta-2	1032.25	450.00	1482.25
Sari	1084.00	228.50	1312.50
BNT 5%	-	-	-

Qualitative Characteristics of Tubers

Table 5. Classification of tuber characteristics: tuber skin color, tuber flesh color and tuber shape

<table>
<tr><th rowspan="2">Clone</th><th colspan="3">Observation Parameters</th></tr>
<tr><th>Color of the skin of the bulbs</th><th>Color of tuber meat</th><th>Tuber shape</th></tr>
<tr><td>BOP 36</td><td>Greyed-Purple Group N186
Dark Purplish Red (D)</td><td>Orange
Group 26
Light Orange (C)</td><td>Wide oval at the base of the tuber</td></tr>
<tr><td>BOP 42</td><td>Red-Purple Group 59
Deep Purplish Red (B)</td><td>Orange Group 24
Light Orange Yellow (C)</td><td>Long oblong</td></tr>
<tr><td>BOP 73</td><td>Yellow Orange Group 18
Light Yellow (B)</td><td>Orange Group 24
Light Orange Yellow (C)</td><td>Long oblong</td></tr>
</table>

BOP 77	 Purple Group N79 Dark Purplish Red (B)	 Orange Group 28 Light Orange (C)	Oblong
Beta-2	 Red-Purple Group 61 Deep Purplish Red (A)	 Yellow Group 10 Light Yellow (C)	Oblong
Sari	 Greyed-Purple Group 186 Moderate Purplish Red (B)	 Yellow Group 5 Light Greenish Yellow (D)	Oblong

Beta-carotene content

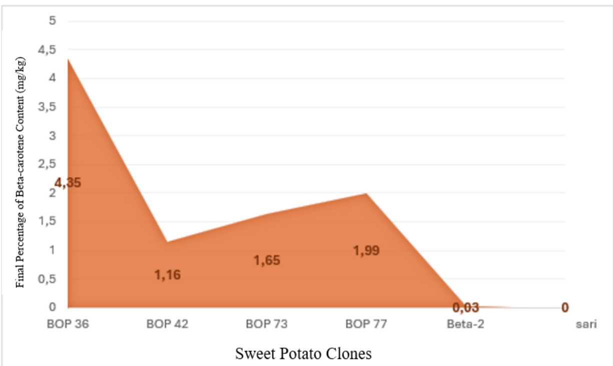

Figure 1. Graph Average Beta-carotene content of Sweet Potato Clones Orange Fleshed Varieties Derived from the Beta-2 Female Parent

In figure 1. Based on the results of observation parameters in the fingerprint analysis and the 5% BNT test, it was shown that the content of beta-carotene was significantly different between clones. The BOP 36 clone produced the highest beta-carotene content and was markedly different from all other treatments. In the BOP 77 clones, BOP 73 and BOP 42 showed noticeable differences, while the Beta-2 and Sari clones did not differ significantly from each other and produced the lowest beta-carotene content. This shows that genetic factors play an important role in determining the content of beta-carotene in sweet potatoes, so that BOP 36 clones have greater potential as a source of provitamin A compared to other clones. In general, beta-carotene is part of the carotenoids that function as a natural pigment as well as provitamin A which is important for the quality of food.

According to Lismawati *et al.* (2021), beta-carotene is one of the carotenoid compounds that functions as a provitamin A and has high antioxidant activity, so it is very important in food quality. The content of beta-carotene in a material is greatly influenced by the type of material, environmental conditions, and treatment during the cultivation or processing process. In addition, research by Fendri *et al.* (2024) shows that differences in the type or treatment of ingredients can lead to significant variations in beta-carotene levels, especially if there are differences in the composition or physiological conditions of the ingredients. However, in this study, the possibility of differences in treatment is not large enough that it does not produce a real difference.

Furthermore, research by Hurria (2024) explains that the content of beta-carotene can differ significantly if there are differences in material characteristics such as color, texture, and level of maturity. In addition, Syahar (2024) stated that beta-carotene as a natural pigment is also influenced by processing conditions such as fresh or dry and the extraction method used. Thus, the results of this study show that environmental factors and material characteristics may be more dominant than the treatment given, so that all treatments produce beta-carotene content that is not significantly different.

Sugar Content

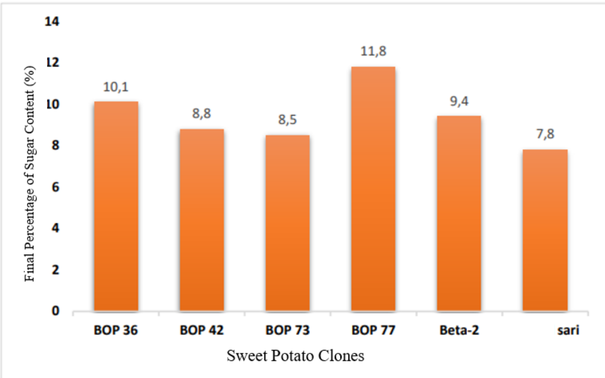

Figure 2. Graph Average sugar tuber content of Sweet Potato Clones Orange Fleshed Varieties Derived from the Beta-2 Female Parent.

Figure 2 shows the sugar content in the six sweet potato clones was found to vary quite noticeably, ranging from 7.8% to 11.8% Brix. Based on the standards of the Bionutrient Association Food (2016), clones BOP 36 and BOP 77 are included in the high to very high category, while Beta-2, BOP 42, and BOP 73 are in the medium to high category, and the *Sari* variety is classified as medium. Physiologically, this diversity is influenced by genetic factors as well as the dynamics of carbohydrate composition, where starch is hydrolyzed into simple sugars during storage or as a result of the post-harvest heating process.

This mapping of total sugar content is crucial for product standardization, nutrition labeling, and the development of food formulations that are in line with market preferences. Clones with high sugar content such as BOP 77 and BOP 36 have superior prospects as raw materials with natural sweetness that consumers are interested in today. Meanwhile, genotypes with moderate sugar levels remain relevant to be developed in support of the provision of healthy foods that take into account glycemic index control.

Tuber Dry Matter Rate

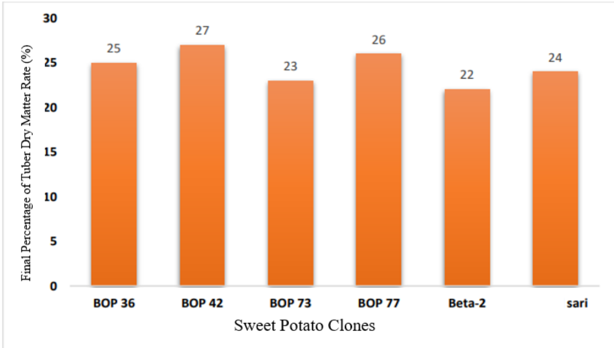

Figure 3. Graph Average Dry Matter Rate of Tubers of Sweet Potato Clones Orange Fleshed Varieties Derived from the Beta-2 Female Parent.

Figure 3 shows that the dry matter content in the six sweet potato clones studied ranges from 22% to 27%, which according to Samhana and Indrasti (2024) is still within the normal range of fresh sweet potatoes which generally have a moisture content of around 78%. In detail, BOP 42 clones had the highest levels (27%), followed by BOP 77 (26%), BOP 36 (25%), *Sari* (24%), BOP 73 (23%), and Beta-2 (22%). Based on the latest criteria, clones with dry matter content of ≥25% (BOP 42, BOP 77, and BOP 36) are categorized as high-quality raw materials because they have large total solids. Ramdan and Fitriah (2023) emphasized that this dry ingredient component greatly determines the quality of processed yields such as flour or noodles because it is directly related to their carbohydrate content.

The difference in dry matter content in this study was mainly influenced by genetic factors (clones) because all samples were grown in the same season, location, and cultivation technique. Although Vimala and Hariprakash (2011) state that these commodities are generally also influenced by environmental, climatic, and soil type factors, clones with high yields tend to have lower dry material weights. From the aspect of utilization, Sari *et al.* (2019) explains that this parameter is crucial in maintaining product stability and resisting water loss during processing; so high-grade clones are ideal for solid-textured industrial efficiency, while low-grade clones are more suitable for direct consumption as they produce a softer texture.

CONCLUSION

Based on testing of several genotypes of sweet potatoes assembled by female Beta-2 mothers, significant diversity was identified in various quantitative and qualitative results, where each clone showed vegetative morphological advantages influenced by its own genetic factors. BOP 36 clones generally show better vegetative growth, especially in the parameters of stem diameter, pruning weight, as well as the size of petiole length, leaf width and leaf length side by side with other clones such as *Sari*, BOP 77, and BOP 42 which have specific advantages in the size of tendrils, book segments, and petioles.

In terms of yield potential, observations of the quantity and weight of the bulbs showed that the BOP 73 clone was the best genotype with the highest achievement of bulb weight of 234.37 grams per plant. However, the production value of this BOP 73 clone is statistically not statistically different from the achievement of the BOP 36 clone which is able to produce a tuber weight of 205.87 grams per plant, so these two genotypes have great potential to be developed as superior clone candidates

In terms of quality, all clones tested uniformly met the criteria for high dry matter of tubers, reaching more than 24% with significant nutritional variation between genotypes. The Beta-2 parent maintained the advantage in the highest beta-carotene content and the BOP 77 clone had the best level of sweetness, but these two quality parameters were apparently not significantly different from the BOP 36 clone, which at the same time confirmed that the BOP 36 clone had a well-packaged stability of advantages ranging from vegetative growth, yield potential, to nutritional quality.

Competing Interests: The authors declare no conflict of interest.

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