Selection and Evaluation Characteristics of Six Candidate Varities of Cucumber (*Cucumis sativus*) in the Dry Season Planting

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Abstract

Cucumber is one of vegetables that are rich in vitamin C. The purpose of this study was to select and to evaluate physical and chemical characteristics of six varieties of cucumber that will be released as new varieties. Planting sited was chosen in plain medium during the dry season in Bandung. The design used was randomized block design with three replicates. Observation was done by determining physical characteristics including length, diameter, weight, texture, and colour of fruit. Chemical characteristics observed were moisture and content of vitamin C. The results showed that two varieties were not significantly different from the characteristics of the control, so both can be recommended to be released as new varieties.

Keywords: characteristics, cucumber, selection, varieties.

Introduction

Cucumber (*Cucumis sativus*) is one type of vegetable widely grown in Indonesia. Cucumber has a fairly broad market both modern and traditional markets. Cucumber production in Indonesia in 2009 reached 583,139 tons per hectare with an area of 56,099 hectares planted. Production mostly in West Java, Central Java and North Sumatra provinces (Anonymous, 2010). Production is still potential for further improved.

Cucumber planted in low, medium, or high plains with optimal rainfall ranges between 200-400 mm/month. Too high rainfall is not suitable for growing vegetables, as it will abort flowers (Sumpena, 2007). Cucumber grow well at the acidity of the soil ranged from 5.5 to 6.5, on alluvial, latosol, and andosol soil type. Cucumber planted in the lowlands can be harvested faster than cucumbers grown in the highlands. Cucumber harvest age ranged from 30 to 50 days after planting (Arief, 2009). Cucumber is one of horticultural commodity easy to handle because it is grown with simple maintenance, inexpensive, and short-lived cycle when it is compared to other vegetables such as tomatoes or peppers. Fluctuations in market prices are low compared to other vegetables, so it would be more profitable for farmers (Sumpena, 2007).

Cucumbers can be consumed directly in fresh as a salad and for pickles. The slicing cucumber are peeled, sliced and served with vinegar or dressing or as an ingredient of salads. In South-East Asia, the young shoots are eaten as raw or steamed (Siemonsma and Piluek, 1994). Cucumber is very important in South East Asia as it is in temperate regions. Breeding work should be aimed to produce improved cultivars resistence to diseases and pests attack in tropical lowland condition (Siemonsma and Piluek, 1994).

The nutrient content per 100 grams of cucumber is water at 96 g, protein at 0.6 g, fat at 0.1 g, carbohydrates at 2.2 g, Calcium at 12 mg, Iron at 0.3 mg, vitamin C at 12 mg. Cucumber fruit consists of 24 mg of P, 45 IU of Vitamin A, 0.03 mg of Vitamin B1, 0.02 mg of Vitamin B2, 0.3 mg of Niacin, and 15 mg at magnesium, respectively (Siemonsma and Piluek, 1994). In addition, cucumber are also rich in fiber. The purpose of this study was to select and to evaluate physical and chemical characteristics of six varieties of cucumber that will be released as new varieties.

Materials and Methods

The research was conducted in plain medium during the dry season at Ciwastra, Bandung 400-700 m above sea level. Chemical analysis was performed at the laboratory of plant physiology at IVEGRI in Lembang, Bandung. Materials used in this experiment were three candidates of new varieties and three varieties of cucumber production of private firms as control.

Each treatment was planted in mulched beds at 9,6 m^2 using a plant distance of 40 x 60 cm. The fertilizer applied was NPK at 125 kg/ha and goat manure at 20 ton/Ha. The remaining dose given as a supplementary fertilizer twice during the plant growth. To control pests of plants (OPT) pesticides were used intensively twice a week, starting at two weeks after planting. Pesticides were adjusted to the type of pests that attacked.

Research was carried out by Randomized Design Group consisted of three replicates. Observation physical parameters included length, diameter, weight, colour, and texture of the fruit. Chemical parameters measured were moisture and vitamin C. Texture observation was done using a QTS 25 Texture Analysis, and colour observations used a chroma meter. Statistical tests were performed with the PKBTSTAT analysis followed by Tukey test at 5% level.

Results and Discussion

There are two types of cucumbers were observed in this study, i.e. green and white cucumbers. Green cucumber fruit is longer than the local cucumbers. Table 1 shows that the varieties of fruit length of variety H1 was not significantly different with the comparison varieties H5. Varieties H2, H3, and H4 were not significant different.

Tabel 1. Analysis variance for length, diameter, weight,colour, texture of cucumber fruit, moisture, and vitamin C of six virieties

Variety	Length (cm)	Diameter (cm)	Weight (g)	Colour (N/mm)	Texture (mm/10sec/50g)	Moisture (%)	Vitamin C (mg/100g)
H1	20.89^{a}	3.37^{b}	121.47^{a}	0.89^{b}	0.12^{ab}	95.30^{b}	19.16^{b}
H2	16.53^{b}	3.87^{a}	146.70^{a}	0.93^{b}	0.12^{ab}	95.68^{a}	17.87^{c}
H3	14.43^{bc}	4.22^{a}	150.44^{a}	1.05^{a}	0.14^{a}	95.14^{b}	19.06^{b}
H4	16.44^{b}	3.93^{a}	144.98^{a}	0.94^{b}	0.14^{a}	95.38^{ab}	17.28^{c}
H5	21.27^{a}	3.27^{b}	140.83^{a}	0.89^{b}	0.10^{b}	94.49^{c}	20.06^{a}
H6	12.66^{c}	3.83^{a}	145.63^{a}	1.05^{a}	0.12^{ab}	95.66^{a}	17.86^{c}
HSD 5%	2.19	0.40	71.08	0.10	0.03	0.31	0.79

Table 1 also shows that the diameter of varieties H1 was not significantly different with H5, meanwhile among varieties H2, H3, and H4 were not significantly different. Diameter would affect the weight of fruit. Type of fertilizer affect the production of cucumber (Sutater and Supriyadi, 1989). Cucumber weight of six varieties were not significantly different at level 5% at Turkey test. Cucumber weight affected the total production of cucumber. Factors planting and type of fertilizer used affected plant growth and produced cucumber (Hilman and Rosliani, 2004). Irigation and composition of the N on the fertilizer also affected the weight of cucumber (Zhan *et al*., 2011).

The colour of varieties H1, H2, H4, and H5 were not significantly different from each other, they were more dominant to the colour of green. Variety H3 was not significantly different compared with variety H6, having the dominant colour of white. Cucumber colour ranges from dark green, green, light green, whitish green to white depending on the type varieties (Sumpena, 2007).

Texture of varieties H1, H2, and H6 were not significantly different among them. Similar results were also found for varieties H3, H4, and H5. Higher texture value indicated softer texture, and conversely lower texture values indicated tougher texture. Texture value difference was also influenced by varieties and fertilization. K elements made harder texture, while the elements of N make the texture softer (Wiranatakusumah *et al,* 1992). Texture of consumer software was not preferred. Storage temperature affected the texture of the cucumber. Storage at low temperature will maintain the texture of the cucumber (Kohyam *et al*, 2009).

The highest moisture content was found in the variety H2, while the lowest was found at variety H5. Variety H1 was not significantly different compared with variety H3. Moisture will affect the shelf life of these products. The presence of water in food is a good medium for the growth of microorganisms. The high moisture is held within the product by osmotic force within cells, mostly as free water, althought a small proportion is chemically bound, therefore, this is more tightly held and more stable (Will, *et al*., 1989). Variety H5 had the highest of Vitamin C content , while variety H4 was the lowest. The vitamin C in vegetables is affected by the type of varieties and types of seasons. In the rainy season Vitamin C content is higher level compared with in the dry season (Hanson *et al*, 2011).

Conclusions

Caracteristic cucumber was effected by the kind of varieties. Varieties H1 and H3 had good caracteristics to be released in public, because they had low moisture and high in the Vitamin C content.

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Blue Light Induced the Stem Growth in Vegetable Water Spinach

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Abstract

A local variety of water spinach in Taiwan was grown under various artificial light conditions to clarify the suitable growth condition in a plant factory. In this experiment, water spinach shoots were grown under various artificial light spectra controlling plant growth. Eight plots with conditions of 8 different light qualities were used to compare the growth of the water spinach plant. Different light qualities were established by combining 3 types of fluorescent light selected from 4 types of light emitted by white, blue, purplish-red, and far-red fluorescent lamps, respectively, and irradiation treatments were performed for 10 days in each plot. The results showed that the plant length and stem diameter increased in the plot in which 1 white and 2 blue fluorescent lamps were set. Increase in plant length and stem diameter were positively correlated with the energy of blue light (400-480 nm), but were negatively correlated with energy of green, red and far-red light (520-780 nm). The size of the stem cavity negatively correlated to the amount of energy of red light (600-660nm) and positively correlated to the amount of energy of blue light (480 nm). The results suggest that blue light promotes and red light inhibits stem growth of the water spinach.

Keywords: artificial light, light quality, plant length, stem diameter, water spinach

Introduction

Water spinach (*Ipomoea aquatica* Forsk.) is a popular vegetable in Japan because of its good texture and high nutrient value. This vegetative has a high content of protein (2.2 g/100 g), calcium (74 mg/100 g) and fiber (3.1 g/100 g) (JATCC, 2009). Moreover, many researchers have evaluated the chemical characteristics of this functional food (Miean and Mohamed, 2001; Prasad *et al*., 2005; Dasgupta and De, 2006). However, the duration of cultivation of this plant is limited to summer because the frost resistance of this plant is low. For obtaining a stable yield throughout the year, water spinach must be cultivated in an artificial environment that provides suitable conditions for its growth. The species can grow easily in hydroponic cultures, and it shows a high nutrient absorption. Therefore, the best growth conditions (light, temperature, nutrition) required for this species must be investigated in detail to maximize the production and sales of this vegetable. In this experiment, the light spectra that controls stem growth were investigated to establish a year-round culture under low energy input condition.

Materials and Methods

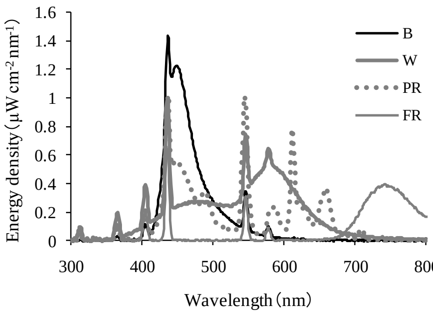
Plant materials

A local variety of water spinach from Taiwan was used in this indoor experiment. The seeds were scarified and soaked in water for 3 days, and the germinated seeds were sown on culture soil in 12 cm poly pot. After sowing, the seedlings were grown under the light of fluorescent lamps (FL40SBR-A, NEC Co. Ltd., Japan) for 7 days. After 7 days, we removed these fluorescent lamps and set other fluorescent lamps producing different light colors, therefore, these seedlings were grown under different light quality conditions by using artificial light.

Treatments and analytical method

Four different fluorescent lamps (white, blue, purplish red and far red) were used in different combinations to provide different lightings in 8 plots (L1-L8). Fig.1 shows the light spectrum of the 4 fluorescent lamps. The spectral distribution of the light in each plot was measured with a spectroradiometer (HSU-100S, Asahi Spectra Co. Ltd., Japan). Table 1 shows the energy distribution in each spectral band (UVA, B, G, R and FR). The air temperature was maintained at 27°C in the room, and all fluorescent lamps were continuously irradiated. The photosynthetic photon flux density (PPFD) was adjusted to 200 µmol m^{-2} s^{-1} at the top of the seedlings in each plot. Ten days after the treatments, the main stem length, stem diameter and cavity size were measured (Figure 2), and the average of all these parameters were calculated from the data of 15 stems.

The correlations between the morphological traits of the stems and the light quality in each plot were obtained. The analytical method of statistics referred to Kasajima *et al*. (2007). The ratio of energy (RE) was defined as the light energy in a specified wavelength width (50 nm) to the total light energy in the whole spectral range (250-1000 nm).



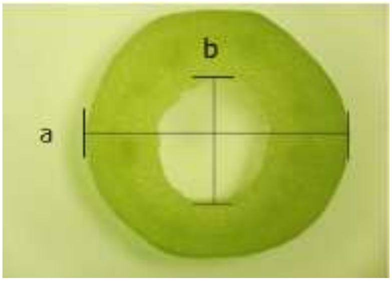
B = Blue (Caribbean Blue, 15W, Sudo Co. Ltd., Japan), W = White (Mellow White, 15W, Toshiba Co. Ltd., Japan), PR = Purplish red (Exotic Rose, 15W, Sudo Co. Ltd., Japan),
FR = Far-red (FL20SFR74, 20W, Toshiba Co. Ltd., Japan)

Figure 1. The emission spectra of four kinds of fluorescent lamps used in the experiment.

Table 1. The light quality in experimental plots (L1-L8)

Plot	Combination of lamps[1)]	RE in each spectral region[2)]				
		UVA	B	G	R	FR
L1	W + W + W	0.018	0.314	0.457	0.182	0.020
L2	W + PR + PR	0.007	0.410	0.351	0.220	0.010
L3	W + B + B	0.007	0.697	0.224	0.051	0.004
L4	W + PR + B	0.007	0.523	0.317	0.132	0.011
L5	W + W + FR	0.010	0.263	0.345	0.146	0.188
L6	W + PR + FR	0.005	0.302	0.307	0.155	0.210
L7	W + B + FR	0.010	0.390	0.265	0.090	0.204
L8	PR + B + FR	0.004	0.491	0.183	0.139	0.170

1) Refer to Figure 1.
2) Ratio of energy in UVA (320-400nm), B(400-500 nm), G(500-600 nm), R(600-700 nm) and FR (700-800nm) range to that in whole spectral range (250-1000 nm).



a, Stem diameter, b, Cavity size

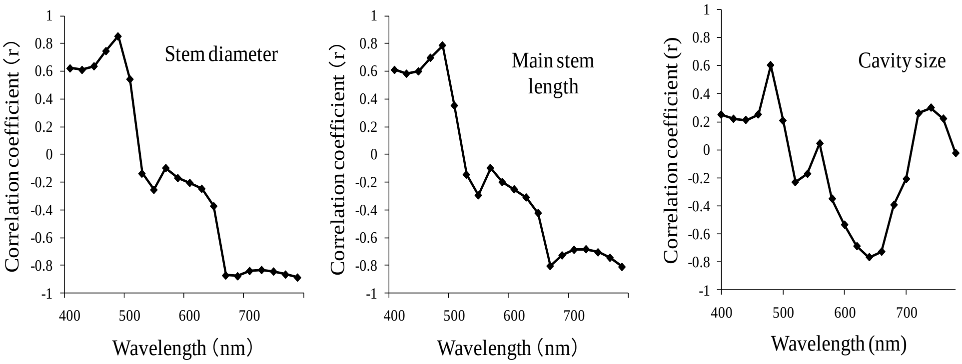
Figure 2. Stem-cross section in water spinach.

Results and Discussion

The plant length and stem diameter of water spinach increased in the plot in which 1 white and 2 blue fluorescent lamps were set (L3 in Table 3). Figure 3 shows the correlation coefficient between REs in various spectral ranges and the morphological traits of stems. Plant length and stem diameter were positively correlated with the energy of blue light (400-480 nm), however, they had negative correlation with the energies of green, red and far-red lights (520-780 nm). In particular, stem diameter was significantly correlated with the energies of light at wavelengths of 480 nm and 660 nm. The size of the stem cavity was negatively correlated to the amount of energy of red light (600-660nm) and positively correlated to the amount of energy of blue light (480 nm).

These results showed that the stem diameter, stem length and cavity size growth were promoted by blue light and inhibited by red light. Blue light had a positive effect on the stem growth of water spinach cultivated under artificial light conditions. However, some studies showed different results. Minanizawa and Kitta (1977) reported that greenish blue light of 450-550 nm suppressed the growth of mulberry (*Morus alba* L.). In morning glory (*Ipomoea nil* L), the elongation of plant length decreased under the blue light compared with that under green or red lights (Yamazaki *et al*., 2003). Kasajima *et al*., (2008) reported that red and green light play an important role in regulating hypocotyl elongation in common buckwheat (*Fagopyrum esculentum* Moench) and Tartary buckwheat (*Fagopyrum tataricum* Gaertn.). In petunia (*Petunia* × *hybrid* Vilm.), blue light had no effect on the plant height (Fukuda *et al*., 2002). These reports suggested that the light response systems of some plants differed from those of water spinach.

On the other hand, stem elongation of eggplant (*Solanum melongena* L.) and sunflower (*Helianthus annuus* L.) were promoted under blue light (Hirai et al., 2006). Goto (2003) summarized the findings of previous studies in order to evaluate the significant effects of the quality of artificial light on plant growth and reported that blue light had various effects on plant growth. Therefore, these reports and our results suggest that the effects of light quality on stem growth differed among plant types and species. In future, these factors should be studied in detail for controlling the plant growth under artificial light.



Significant level: |r| > 0.83 (p < 0.01)

Figure 3. Correlation coefficient between RE in various spectral ranges and morphological traits of stem.

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