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IDENTIFICATION OF SUITABLE MEDIA BASED ON HYDROPONIC CULTURE FOR PRODUCTION OF ZUCCHINI SQUASH

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Abstract

An experiment was conducted to identify the hydroponic culture based suitable media for the production of Zucchini Squash in the Biochemistry Laboratory, Patuakhali Science and Technology University, Dumki, Patuakhali, Bangladesh during 2014. Zucchini plant (*Cucurbita pepo* L.) were grown in closed soilless systems to determine the effect of four different hydroponics media on plant growth, yield and nutrient contents (fruit moisture content, ascorbic acid content on fruit, fruit protein content, protein content in leaves). Three types of substrates (coconut husk, jute, cotton) along with Hoagland solution were used in this experiment. Result revealed that media using Jute fiber showed significant effect on plant growth and nutritional values than the other media (media of cotton with Hoagland solution, coconut husk with Hoagland solution and only Hoagland solution). The plant grown using jute media showed the highest plant height (60.33 cm), number of leaves (17.33), yield (1.5 kg plant^{-1}), fruit moisture content (97.33%), Ascorbic acid content in fruit (28.73 mg 100g^{-1}), protein percentage in fruit (1.406%) and percentage (1.326%) in leaves than the other media. Therefore, with the controlled nutrient supply, less expense, less labor, no use of pesticides or fertilizer with controlled environment the use of jute fiber as a substrate with Hoagland solution can be an effective one.

Keywords: Hydroponics, Protein, Squash, Substrate, Vitamin C

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Introduction

Cultivation of plant without soil allows good control over environment, plant growth and development and currently practiced all over the world (VanOs and Benoit, 1999; VanOs *et al.*, 2002). The soilless culture technique allows the achievement of high yields and less use of pesticides (Savvas, 2002). Different research activities and field trials showed that hydroponics is an economic, profitable and ecofriendly than the traditional agricultural cultivation. Through soilless cultivation crops grown two times faster and have better nutritive value and it helps to element the soil borne pests, diseases, troublesome weeds and also reduction of health risks associated with pest management and soil care (Munoz, 2010). Among various soilless culture practices, the use of substrate with nutrient solution is an effective one. A number of substrates are used in hydroponics cultivation like saw dust, coconut fiber, oasis cubes, sphagnum peat moss, rice hulls, polyurethane, grow slabs, clay bricks, lava rocks, LECA etc. A good substrate should have the character of maintaining moisture, which are not decomposed easily and not containing nutritive mineral elements. Substrate should free from microorganism harmful to man or plants should be ecofriendly, which can prevent root rot disease with neutral pH and reservoir of nutrient in root zone (Yeager *et al.*, 2007). Squash is an important vegetable as its fruit, flower, leaves all are the edible part and a good source of nutrient including vitamin C, vitamin A, vitamin B complex, dietary fiber including pectin, iron and copper. In the Mediterranean region, zucchini squash (*Cucurbita pepo)* is an important crop for open-field and protective cultivation. However, over the last 20 years, growing zucchini squash in soilless culture have become popular. Starting from the above consideration, our aim was to find out a low cost ecofriendly media based hydroponic culture technique to investigate the production of squash, identify the nutrient content of squash, and maintain the media based hydroponics at household spaces.

Materials and Methods

The experiment was conducted to determine the effect of different media based hydroponics culture on plant growth and nutritional values at Biochemistry laboratory, Patuakhali Science and Technology University (PSTU), Dumki, Patuakhali, Bangladesh (22°37'N latitude and 89°10'E longitude). The hybrid squash seed (South Korea) were surface sterilized by 95% ethanol and imbibed in deionized distilled water overnight. Seedbed was prepared using 50% sand, 25% ash and 25% topsoil (the outmost layer of soil, usually the top 2-8 inches). On 10 November 2014, the seed was sown 1 inch depth in seed bed. At the two true leaf stage zucchini plant were transplanted into nutrient media. Non-reactive plastic pot (3.0 litters' capacity) was used for nutrient media preparation. All substrate treatments were supplied with same nutrient composition. The study includes 3 types of treatments that is Hoagland solution with no substrate, Hoagland solution with jute fiber, Hoagland solution with coir, Hoagland solution with cotton, respectively symbolized as T0, T1, T2, T3. Plants were grown in open place with direct sunlight (11 ± 1 hour's photoperiod) and 21 ± 2°C temperature. Constant volume of the nutrient solution was maintained by adding deionized distilled water every day. Nutrient level was maintained by adding fresh nutrient solution by every 3 days. Air pump was used for water oxygenation. In all nutrient containers, EC was maintained within the range of 1.8-2.4 ds m^{-1} by adding concentrated nutrient solution (Pardossi *et al.*, 2002). The nutrient solution was prepared according to the method described by Hoagland and Arnon (1950) with modification necessitated to the experiment. Ascorbic acid was determined according to the dye method by Ranganna (1977).

Kjeldahl (1883) method was used to determine the nitrogen content and used the conversion factor to determine the protein content from nitrogen content. All data were statistically analyzed by ANOVA using the SPSS software package (SPSS 10 for windows). Duncan's multiple range test was performed at p=0.05 on each of the significant variables measured.

Results and Discussion

Figure 1 to 3 indicate effect of different treatments on squash vegetative and productive character. Comparison of means showed that yield had significant difference between treatments (Fig. 3). The highest amount of fruit yield related to T1 (Hoagland + jute fiber) treatments had significant difference with other treatments. The yield from T1 treatment was close to the value reported by Graifenberg *et al.* (1996) for zucchini squash (1.6 kg $plant^{-1}$).

Number of leaves (Fig. 2) had significant differences among the treatments. Maximum number of leaves was found related to T1 treatment. The significant plant height was obtained in T0 and T1 treatments, which were 62.66 and 60.33 cm, respectively.

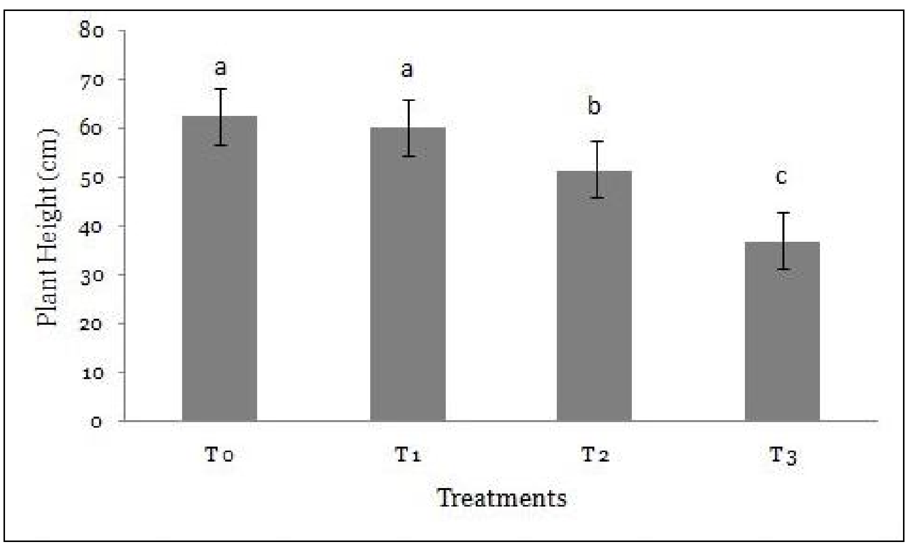

Fig. 1. Variation in plant height in different treatments. Values are the means of three replicates.

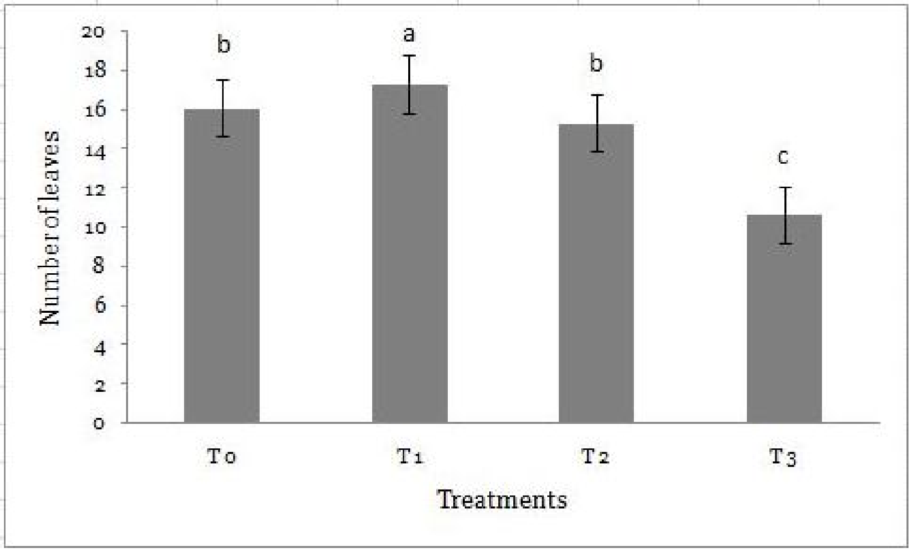

Fig. 2. Variation in leaf numbers of plant in different treatments. Values are the means of three replicates.

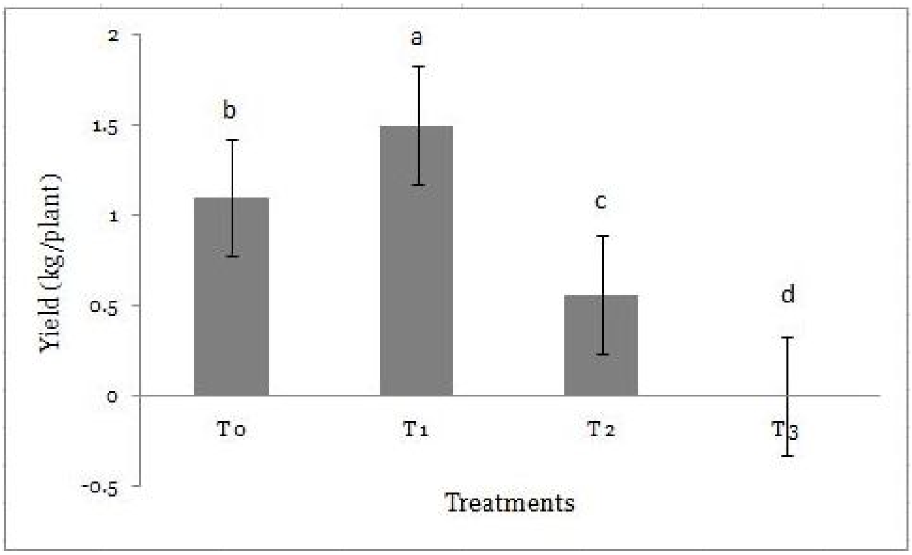

Fig. 3. Variation on yield per plant in different treatments. Values are the means of three replicates.

Table 1. Effect of different treatments on nutritional values of Zuccini squash.

Treatments	Moisture content of fruit (%)	Vitamin C in fruit (mg 100 g^{-1})	Protein content in fruit (%)	Protein content in leaves (%)
T0	94.90b	19.80b	1.006c	0.90bc
T1	97.13a	28.73a	1.46a	1.30a
T2	95.10b	22.90b	1.10ab	1.00b
T3	*	*	*	0.70c

**no fruit setting*

Values are the means of three replicate samples. Means in each column by similar letter are not significantly different at 5% level and values in the same column followed by different letters are significantly different by Duncan's multiple range test (0.05).

Table 1 indicates fruit moisture percentage, ascorbic acid content, protein percent and leaves protein percent. The highest amount of fruit ascorbic acid content was related to plant under jute media (28.73 mg 100g^{-1}) when the lowest amount of ascorbic acid recorded from the media using only nutrient solution, which was significantly different from others treatments and there was no significant difference between T0 and T2 treatment where we used only Hoagland solution and coconut fiber with Hoagland solution, respectively. The highest quantities of protein percent in fruit were found in Jute fiber treatment and significantly different from other. The highest moisture percent of fruit also related to jute fiber treatments and most protein percent (1.32%) in leaves was found in jute fiber treatment and lowest percent in cotton treatment. In this study, comparison of means showed that plant height, number of leaves, yield, and fruit ascorbic acid content, fruit protein percentage and protein percentage of leaves were significantly different between treatments. The highest amount of mentioned properties were observed in T1 treatment where jute fiber was used as substrate with Hoagland solution. The lowest amount of properties was found in T3 treatments where cotton was used as substrate with Hoagland solution. There was no fruit setting on cotton treatment. This may be due to the physical and chemical properties of substrate. To summarize, we can conclude, that the growth and nutritional value was much more satisfactory of plant growing under media using jute fiber, than the other media. The result also indicates that the jute fiber may provide adequate oxygen to root than that of cotton and coconut husk. On the other hand, the response of plant to media using coconut husk was good after the medium with jute fiber. In case of cotton media, the response of plant was not good because of coloring and toxic chemicals of cotton which changed the character of Hoagland solution and inhibited the nutrient uptake by the plants.

Conclusion

On these types of media based closed container hydroponic technique the loss of nutrient solution is less and this technique does not require pesticide or fertilizer as there was no chance of damage due to soil borne diseases or pests. In addition, the supply of balance nutrient maintained sudden nutrient scarcity. Over all it is an eco-friendly technique for agriculture. Therefore, with the controlled nutrient supply, less expense, less labor, no use of pesticides or fertilizer with controlled environment the use of jute fiber with Hoagland solution can be an effective one for growing squash.

References

Graifenberg, A., Botrini, L., Giustiniani, L. and Lipucci Di Paola, M. 1996. Yield, growth and element content of Zucchini squash grown under saline-sodic conditions. *J. Hort. Sci.* 71(2): 305–311.

Hoagland, D.R. and Arnon, D.I. 1950.The water-culture method for growing plants without soil. *California Agril. Expt. Stn.* 347: 1-32.

Kjeldahl, J. 1883. Neue Methode zur Bestimmung des Stickstoffs in organischen Körpern. (New method for the determination of nitrogen in organic substances). *Zeitschrift für Analytische Chemie*. 22(1): 366-383.

Munoz, H. 2010. Hydroponics Manual, Home-Based Vegetable Production System. Guyana. pp. 3-10.

Pardossi, A., Malorgio, F., Campiotti, C. and Tognoni, F. 2002. A comparison between two methods to control nutrient delivery to green house melons grown in recirculating nutrient solution culture. *Sci. Hort.* 92: 82-95.

Ranganna, S. 1977. Manual of Analysis of Fruit and Vegetable Products. 1st Edn., Tata McGraw-Hill, New Delhi, India. 634 p.

Savvas, D. 2002. General Introduction. *In:* Savvas, D., Passam, H.C. (Eds.), Hydroponic Production of Vegetables and Ornamentals. Embryo Publications, Athens, Greece. pp. 15–23.

VanOs, E.A. and Benoit, F. 1999. State of art of the Dutch and Belgian greenhouse horticulture and hydroponics. *Acta Hort.* 481: 765–767.

VanOs, E.A., Gieling, Th.H., Ruijs, M.N.A. 2002. Equipment for hydroponic installations. *In:* Savvas, D.,Passam, H.C. (Eds.), Hydroponic Production of Vegetables and Ornamentals. Embryo Publications, Athens, Greece. pp. 103–141.

Yeager, T.H., Fare, D., Lea-Cox, J., Ruter, J., Bilderback, T.E., Gilliam, C.H., Niemiera, A.X., Warren, S.L., Whitwell, T.E., Wright, R.D. and Tilt, K.M. 2007. Best management practices: guide for producing container-grown plants. 2nd edn. Southern Nurserymen's Association, Maretta, GA. 69p.