A Preliminary Study on the Best pH Value of Water to Increase the Quality of *Echinodorus Bleheri*

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Introduction

The Aquatic plant export industry of Sri Lanka has been developing rapidly. This industry requires a continuous supply of high quality plants. *Echinodorus bleheri* is one of the highest demanded aquatic plants in export market. Aquatic plants have adapted to life in water with a specific pH, Temperature, Electrical conductivity and may suffer from even a slight change. High quality plants can be supplied with in a short time period by finding the best pH value of water. In the world of plants each plant species is perfectly adapted to a certain pH range of the soil or water. Aquatic plant hobbyists are usually familiar with the different pH requirements of various plants and regulate the pH of water appropriately. Hydroponics is proved to have several advantages over soil gardening. The growth rate on a hydroponic plant is 30-50 percent faster than a soil plant. A nutrient solution for hydroponic systems is an aqueous solution containing mainly inorganic ions from soluble salts of essential elements for higher plants. Eventually, some organic compounds such as iron chelates may be present (Steiner, 1968). Changing the pH of a nutrient solution affects its composition, elemental speciation and bioavailability. An important feature of the nutrient solutions is that they must contain the ions in solution and in chemical forms that can be absorbed by plants, so in hydroponic systems the plant productivity is closely related with to nutrient uptake and the pH regulation (Marschner, 1995). Each nutrient shows differential responses to changes in pH of the nutrient solution. The proper pH values of nutrient solution for the development of crops, lies between 5.5 and 6.5. Plants need the right combination of nutrients to live, grow and reproduce. When plants suffer from malnutrition, they show symptoms of being unhealthy. Too little or too much of any one nutrient can cause problems. The main objective of the present study is to find out the best pH value of water to increase the quality of *Echinodorus bleheri.*

Methodology

This experiment was conducted under green house condition with 80% shade at Ruvini Aqua plants Lanka (pvt) Ltd, Koralawella, Moratuwa. Hundred and eighty *Echinodorus bleheri* plant pots(containing four plants in each pot) were used for the experiment. Experimental design was Complete Randomized Design. Fifteen Styrofoam boxes (46 cm×39.5 cm×19.5 cm) were used to plant them. HANNA (HI98107) portable digital pH meter was used to measure pH and HANNA portable digital EC meter (HI 98303) was used to measure Electrical Conductivity of water. Two months aged 180 *Echinodorus bleheri* plant pots were randomly selected and uprooted from culture tanks. Plant pots were washed thoroughly after removing sand and other objects. Randomly selected 12 plant pots were assigned in to a tank and measure the wet weight of 12 plant pots. Plant pots were planted in 15 Styrofoam boxes. Bottoms of the Styrofoam boxes were covered by black polythene sheets to prevent the algal growth. Placement of Styrofoam boxes were decided by lottery method. Five different pH solutions were used for the experiment as 6.0, 6.5, 7.0 (control), 7.5 and 8.0. Six grams of Albert solution was dissolved in 7 l of water and filtered the solution using a muslin cloth. pH of the solution was measured. NaOH or HCl was added drop wise until required pH value achieved and maintained the electrical conductivity 1000-1500 µs level. Prepared pH solutions were kept for 1 hour to see

the fluctuations. pH solutions were poured in to tanks. After 2 days pH solutions of each tank were removed using manual squeeze water changer pump and filled the solutions again. Styrofoam boxes were covered by white polythene sheets up to 2 weeks for acclimatization. Data were collected once a week up to 8 weeks. At the end of the 8 th week, plant pots were uprooted from Styrofoam boxes and measured the wet weight of each replicate (12 plant pots). Total lengths of plants were measured using a tape weekly. Number of leaves was counted weekly. Wet weight of each replicate (12 plant pots) was measured before starting the experiment and at the end of the experiment. Data obtained from the experiment were analyzed by Microsoft Word. Treatment significances and significance among individual treatment levels were analyzed using one way analysis of variance (ANOVA).

Results and Discussion

Effect of pH on total length of the plants is shown in Table 1. As indicated by the Table 1. The best height difference was observed in pH value 6.5throughout the experimental period ($p<0.05$).

Table 1. Effect of pH on total length of plants.

Treatment (pH)	Height difference (cm)							
	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week
6.0	0.8bc	0.8a	0.5b	0.8ab	0.3b	0.4cd	0.5bc	0.5b
6.5	1.8a	1.3a	0.8a	1.1a	1.1a	1.0a	1.2a	1.2a
7.0	0.6c	0.5a	0.5b	0.6b	0.2b	0.3d	0.4c	0.4b
7.5	1.4ab	0.8a	0.7ab	0.7ab	0.5b	0.5bc	0.6b	0.6b
8.0	1.0bc	0.7a	0.5b	0.7ab	0.3b	0.6b	0.5bc	0.5b

The means that do not share the same letter in a column are statistically different)

Table 2. Effect of pH on number of leaves.

Treatment (pH)	Number of leaves increment							
	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week
6.0	6.6a	5.4b	4.3b	4.4b	2.6b	3.1b	2.9b	3.4b
6.5	6.5a	8.9a	8.4a	7.8a	8.1a	7.9a	7.6a	7.5a
7.0	4.7a	4.5b	4.4b	4.6b	3.3b	3.7b	4.8b	3.4b
7.5	4.1a	5.3b	4.8b	4.8b	3.0b	3.1b	3.6b	4.4b
8.0	6.1a	4.4b	5.4b	4.0b	3.4b	3.3b	2.8b	3.6b

The means that do not share the same letter in a column are statistically different)

Effect of pH on increment of number of leaves is shown in Table 2. The pH value 6.5 again showed that it is the best pH for increase of leaves.

A significant difference in both factors was observed in 6.5 pH value. Nutrient uptake is relatively high in acidic pH. Absorption of some elements is higher when pH is lower than 7 and also nutrient availability for plant uptake at pH above 7 may be restricted due to

precipitation of Fe^{2+}, Mn^{2+}, $PO_4^{-3,}$ Ca^{2+} and Mg^{2+} to insoluble and unavailable salts (Resh, 2004).This may have caused the low uptake of nutrients and caused low increment in number of leaves in the plant.

pH regulation in nutrient solution is not more costly or a difficult task. The results showed that the plant quality can be significantly enhanced when plants were grown in pH 6.5. Each plant has a specific pH range for the best growth performance and plant quality can be improved by finding its specific pH value. It will reduce the production cost and generate more income within short period of time.

Conclusion

pH of nutrient solution is a very important in hydroponic technique. It can be concluded that the water having pH 6.5 is more suitable for culturing *Echinodorus bleheri* when grown hydroponically with EC maintained 1500 ± 200 µs level.

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