HYDROPONIC ROCKMELON CULTURE AS INFLUENCED BY DIFFERENT STRENGTH OF NUTRIENT SOLUTION

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CERTIFICATE

This is to certify that the thesis entitled **"HYDROPONIC ROCKMELON CULTURE AS INFLUNCED BY DIFFERENT STRENGTH OF NUTRIENT SOLUTION"** *submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* **MASTER OF SCIENCE** *in* **HORTICULTURE**, *embodies the result of a research work carried out by* **SABINA YASMIN**, *Registration No.* **18-09312** *under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that any help or source of information, as has been availed of during the course of this investigation has been duly acknowledged.

Dated: December, 2020
Dhaka, Bangladesh

Prof. Dr. Md. Jahedur Rahman
Supervisor

DEDICATED TO MY BELOVED PARENTS

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ABSTRACT

Crop specific nutrient solution is important for higher yield in hydroponic system. Therefore the experiment was conducted at the Hydroponic Farm of the Horticulture farm is Sher-e-Bangla Agricultural University, Dhaka, Bangladesh to identify suitable strength of nutrient solution to get higher yield in Bangladesh. Two factors were used as treatments in this experiment viz, variety and nutrient solution. Three varieties, viz. V_1= Action-434, V_2= Madhurima, V_3= F_1-Hybrid and three nutrient solutions *viz.* S_1=Full strength Rahman and Inden (2012) nutrient solution, S_2 = 3/4 strength Rahman and Inden (2012) nutrient solution, S_3 = Full strength of Hoagland and Arnon (1940) nutrient solution were used in this experiment .The experiment was conducted in a completely randomized block design with three replications. Different strength of nutrient solution and different variety of rockmelon showed significant variation in most of the parameters studied. The highest plant height (7.68, 25.60, 37.78, and 54.11 cm) the maximum number of leaves/plant (9.16, 23.91, 31.10 and 50.12), the maximum number of shoots per plant (4.51, 3.56 and4.39), the maximum number of fruit/plant (4.99), individual fruit weight (1537gm), fruit length (14.78), fruit diameter (52.88cm) and yield per plant (2.48 kg) were found the highest in S_2. And also all the parameters were found the highest in V_2. But all the parameters were drastically reduced when S_1 treatment was applied and also reduced V_1. For combined effects, all the parameters were found the highest in $V_2S_{2.}$ Meanwhile all the parameters were reduced V_1S_1. Therefore, S_2 nutrient solution can be used for rockmelon cv. Madhurima (V_2) in soilless system in Bangladesh.

LIST OF CONTENTS

LIST OF CONTENTS (CONTD.)

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

LIST OF ABBREVIATED TERMS

DAT	= Days after transplanting
DAS	= Days after sowing
SAU	= Sher-e-Bangla Agricultural University
EC	= Electrical conductivity
ANOVA	= Analysis of variance
RGR	= Relative growth rate
NAR	= Net assimilation ratio
df	= Degrees of freedom
AFP	= Air-filled porosity
BCSIR	= Bangladesh Council of Scientific and Industrial Research
CSR	= Charcoal stem rot
dsm-1	= Decisiemens
LSD	= Least significant difference
Nacl	= Sodium chloride
TSS	= Total soluble solids
CEC	= Cation exchange capacity
SE	= Standard error

CHAPTER I

INTRODUCTION

Hydroponic cultivation is an agricultural method where nutrients are efficiently provided as mineral nutrient solutions. This modern agriculture sector provides numerous advantages such as efficient location and space requirements, adequate climate control, water-saving and controlled nutrients usage (Goncalo *et al*., 2019).The hydroponics culture technology is widely used around the world and has a lot of potential in our country. It is very productive, water and land conserving, and environmentally friendly. Even in saline or acidic soils, or non-arable soils with poor structure, which make up a large amount of cultivable land around the world, this approach ensures excellent yields and good quality output. The exact regulation of plant nutrition is another advantage of hydroponics. In addition, the preparation In hydroponics, soil preparation is eliminated, allowing for a longer potential cultivation time, which is an excellent way of improving total yield in greenhouses. The reason for this is that requiring move to hydroponics is becoming increasingly linked to environmental rules. It gives a short-term as well as long-term answer to the problem of a household's incapacity to grow its own fruits in urban environments. In the tropics, where insect infestations are a major concern, hydroponics provides a technique of controlling soil-borne illnesses and pests.

One of the most important aspects of effective hydroponic crop production is the nutrient solution. In commercial hydroponics, the composition of nutrient solutions and nutrition optimization can help to cut fertilizer expenditures. For the majority of horticultural species cultivated in soilless culture, specific formulations of nutrient solution compositions are necessary. Furthermore, in order to achieve high yield and good quality in commercial crops grown hydroponically, the nutrient solution fed to the plants must be tailored to the specific crop, climatic circumstances, or hydroponic system employed, among other factors. In order to increase production and quality, rockmelon cultivated in soilless conditions requires careful management of fertilizer concentrations. As a result, optimizing the nutrient solution concentration is crucial for the farmer. The total nutrient concentration of the fluid used in soilless culture is one of the most critical variables for good fruit production, according to (Pardossi *et al*., 2002). It's also useful for determining crop nutrient requirements in order to avoid potential toxicities from overfertilization, as well as for monitoring crop growth. (Samarakoon *et al.*, 2006). The rock melon (*cucumis melo* L.) is a member of the cucurbitaceae family. It has a sweet and juicy flavor. Rockmelon is related to pumpkin, squash, cantaloupe and other plants that vines on the ground and most of it habitat was found in temperate region of Africa, Central Asia and Mediterranean. Rockmelon which also known as muskmelon is contain with very sweet and juicy tastes. It also enriched with many nutritional values (Norrizah *et al*., 2012). Rockmelon had piqued commercial interest in a number of countries, including Europe, the United States, the Mediterranean, and Asia. The fruit including wild types and diverse variants, could bring economic benefits to the country (Lin et al., 2004). The rock melon is a high-value horticulture crop with exquisite fruits all throughout the world. It is well-known for its orange color, juicy texture, sweetness, vitamins, minerals, Beta carotene, fiber, folate, potassium, and other nutrients. It is a new fruit crop that can be grown commercially in a wide range of climates, including sub-tropical countries like Bangladesh. Rockmelon is commonly consumed on its own, in salads and other dishes, and as a garnish. Rockmelon is popular in meals and as a snack, and it is a staple in several countries diets. Sliced or diced rockmelon can be added to smoothies and tropical cocktails. Rockmelon's popularity has stayed high due to its year-round availability in many regions. In recent years, there has been a push to market not only entire rockmelon, but also pre-cut products, packaged convenience items, and salad bars. To meet market demand for rockmelon, new hybrid cultivars with increased nutrient density, higher sugar content, and other attributes have been produced.

Although there is a lot of research being done on nutrient concentration levels of rockmelon in hydroponic system in the world but, there is very little information on research done on the nutrient solution concentrations in our country. Therefore, the objective of this study was to determine the effect of different concentration of nutrient solution levels in a hydroponic system on growth, yield of rockmelon. Considering the above mentioned facts, the present research work was aimed to study with the following objectives:

- To determine the performance of different cultivars of rockmelon in hydroponic system and

- To identify suitable nutrient solution for producing higher yield and high quality of fruits of rockmelon in Bangladesh.

CHAPTER II

REVIEW OF LITERATURE

Some of the research findings related to the growth and yield of hydroponic rockmelon as influenced by nutrient solution so far have been reviewed here.

Rita *et al*., (2020) reported that the quality-oriented fruit production in well-controlled enclosed hydroponic systems has been greatly enhanced by the technology of modern agriculture. Over-fertilisation has been commonly applied to the traditional hydroponic culture of fruit crops like rockmelon. Adjusting the nutrient formulations depending on crop developmental stages could enable efficient fertilisation to increase yield quality.

Mi *et al*., (2020) reported that the effect of planting density by cultivar on the growth, quality, and yield of melon (*Cucumis melo* L.) in hydroponics using coir substrates. Experiments were conducted using three domestic netted melon cultivars, namely 'Earl's Kingstar', 'Hero', and 'PMR Dalgona'. The plants were transplanted on March 19, 2019 to a venlo-type glass greenhouse. The spacing between the rows was 1.5 m and the planting density was 2.0, 2.7, and 3.3 plants/m^2 (the within-row planting distance was 0.33, 0.25, and 0.20 m, respectively); the plants were grown using slabs of equal sizes (100 × 20 × 10 cm). The electrical conductivity (EC) levels in the supplied nutrient solution were 1.8 and 2.1 dS·m^{-1} after transplanting and fruit setting, respectively. The EC level in the drained solution was less than 1.0 dS·m^{-1} in the early stages of growth; it increased to 3.0 dS·m^{-1} in the middle stages with the increase in irrigation, and in the late stages of growth, it was about 4.0 dS·m^{-1} in all the treatments. The planting density did not have any significant effect on the EC level and pH of the drained solution. An evaluation of the growth of all the three cultivars showed that the lower the planting density, the larger the stem diameter, leaf length, leaf width, and leaf area of the plants. The lengths from 0 to 10th node tended to be small when the planting density was 2.0 plants/m^2, and the node length from 10th to 20th node did not differ among different plant densities. The lower the planting density, the heavier the fruit in all the three cultivars and the higher the soluble solids content. However, the yield increased by 20.8 to 32.6% as the planting density increased from 2.0 to 3.3 plants/m^2. For 'PMR Dalgona', the rate of decline in average fruit weight was the lowest by 19.6% and the rate of yield increase was the highest by 32.6% when increasing the planting density from 2.0 to 3.3 plants/m^2. For ‘Earl’s Kingstar', on the other hand, the rate of average fruit weight decreased the most by 26.8% and the rate of yield increased the least 20.8%. The heavier fruit weight had a large decrease in the average fruit weight by planting density, which showed the sensitivity of planting density depending on cultivars. Therefore, this study suggests that cultivars with a higher planting density with greater production per unit area have an advantage from an economic point of view, whereas the lower planting density is reasonable in terms of fruit quality.

Francisco *et al.,* (2019) discussed that the commercial value of vegetable seeds has increased during the last decades, which has turned seed production into a specialized horticultural activity. Soilless production has been adopted by some seed producers mainly because of sanitary reasons. An additional advantage of soilless culture would be the possibility of managing plant nutrition with the objective of producing more vigorous seeds. However, there is a lack of knowledge about the effects of specific nutritional changes on seed quality attributes, such as vigor or longevity. In the present study, the effect of N supply during growth of the mother plant on quality parameters in lettuce seeds was evaluated. Two experiments in consecutive seasons were established in a greenhouse located under Mediterranean climate conditions in Santiago, Chile. Plants were subjected to N concentrations ranging from 1 to 30 mm. At harvest, seed production (number of seeds per inflorescence and seed weight), seed germination, vigor and longevity were evaluated. Results indicate that seed production is reduced at N concentrations higher than 10 mm, while seed quality start decreasing at N concentrations higher than 5 mm. No differences were observed in seed productivity between 1 and 5 mm, but seed longevity was improved when produced under 5 mm. Seed light requirement for germination decreases with increasing N supply, however this positive effect coupled with a reduction in germination speed and longevity.

Nurul *et al.,* (2019) concluded that the effect of nutrient concentration and inoculation of biological agents (PGPR and AMF) in a hydroponic system of substrate culture on the growth and yield of cherry tomato plants. The greenhouse research was conducted in the Agrotechnopark of the University of Brawijaya at Jatikerto Village, Kromengan Sub-District, Malang Regency. The utilized research method was Completely Randomized Nested Design consisting of two factors. The first factor was the concentration of nutrient solution consisting of 100 % (3.5 dS m-^{1}), 75 % (2.6 dS m-1), and 50 % (1.8 dS m-^{1}) concentrations. The second factor is the inoculation of biological agents consisting of no inoculation of biological agents, PGPR (Plant Growth Promoting Rhizobacteria), AMF (Arbuscular Mycorrhizal Fungi), and PGPR + AMF. The data were analyzed using an analysis of variance and continued with the test of Honest Significant Difference at 5 % level. The results showed that the interaction between the types of biological agents and nutrient concentrations significantly increased the number of flowers, number of fruits, fruit weight, fruit diameter, and sugar content of cherry tomatoes. The AMF application showed the highest fruit weight per plant and fruit diameter, especially at 100 % nutrient concentration. The AMF application also showed a higher sugar content compared to the control and PGPR but not significantly different from the PGPR + AMF treatment at all levels of given nutrient concentration. Fruit weight per plant with treatment of AMF, PGPR + AMF, and PGPR respectively produced 64.47, 48.75 and 29.39 % higher than without application of biological agents.

Garcia *et al.*, (2018) reported that temperature changes, drought, frost, and the presence of pest and diseases place enormous stress on crops, which implies that the potential performance of these crops may be affected. One of the main goals for agronomists, horticulturists, growers, physiologists, soil scientists, geneticists, plant breeders, phytopathologists, and microbiologists is to increase the food production on the same cultivable area and to ensure that they are safe and of high quality. Understanding the biophysical changes in soil will help to manage the crop's ability to cope with biotic and abiotic stress. Optimization is needed in the nutrition of crops, which involves the use of biostimulants to counter oxidative stress and the management of strain bioformulations (bacteria and fungi) that protect and stimulate roots for the acquisition of nutrients. The implementation of these strategies in fertigation programs improves crop yields. This article addresses the importance of the stimulation and the bioprotection of the root as a fundamental pillar in ensuring the high performance of a crop.

Bancha *et al.*, (2017) was conducted that at present, the rockmelon plants are mostly grown under the open soil field condition during weather with frequent heavy rain which caused the loss of nutrients from the soil resulting in low yield and bad fruit quality. The study aimed to assess yield, fruit quality, and growth of four cantaloupe varieties grown in NFT hydroponic system and drip irrigation substrate culture system and drip irrigation soil culture system. The assigned treatments were cantaloupe variety and the planting system. The ten treaments were: Alpha TA209, Emerald Sweet 1225, and Sin Jiang TA212 grown in hydroponic system; Alpha TA209, Emerald Sweet 1225, Sin Jiang TA212, and Golden Lady 1382 grown in drip irrigation substrate culture system; and Alpha TA209, Emerald Sweet 1225, and Sin Jiang TA212 grown in drip irrigation soil culture system. The results showed that the yields of Alpha TA209, Emerald Sweet 1225, Sin Jiang TA212, and Golden Lady 1382 grown in drip irrigation substrate culture system were higher than in NFT hydroponic system and drip irrigation soil culture system, attributable to better fruit weight, flesh thickness, fruit height, and fruit diameter. These fruit qualities were positively associated with yield. Golden Lady 1382 grown in drip irrigation substrate culture system gave the highest yield at 24.14 t ha^{-1} and the heaviest fruit weight at 1.25 kg fruit-1 compared with the rest, while Sin Jiang TA212 grown in drip irrigation soil culture system obtained the lowest yield and fruit weight. Most of the rockmelon varieties had high total soluble solids content (TSSC) observed in the three planting systems, except Emerald Sweet 1225 and Sin Jiang TA212 grown in drip irrigation soil culure system. Plant height was positively associated with fruit diameter, fruit height, flesh thickness, TSSC, fruit weight, and yield. Plant height was the tallest in drip irrigation substrate culture system than in drip irrigation soil culture system and NFT hydroponic system. Therefore, drip irrigation substrate culture system is the best cantaloupe planting system.

Preciado *et al*., (2016) reported that consumption of fruits and vegetables provides natural antioxidants in the human diets that are capable of preventing diseases resulting from the action of free radicals .The aim of the current study was to evaluate the effect of organic nutrient solution on the neutraceutical quality of hydroponic rockmelon produced under greenhouse conditions. The applied organic solutions consisted of compost and vermicompost of test and vermicompost leachate, while steiner nutrient solution was used as a control. Analytical test was run to determine the antioxidant capacity and total phenolic content of the melons fruit. The nutracutical quality of the fruit fertilized with the organic solutions were than the melons fertilized using steiner solutions. Treatment with vermicompost leachate led to the highest antioxidant capacity and phenolic content among all of the treatments.Resuting a 46.1 higher in antioxidand capacity (DPPH+ method) and a 29.3 higher phenolic content compared with inorganically fertilized fruits.

Fatin (2016) reported that fertigation is a method of applying most of the crops nutrition through the irrigation system. plant that practised this method is rockmelon. Rockmelon is belongs to the family of Cucurbitaceae and it is widely cultivated for the commercialization purposes. Fertigated rockmelon cultivar (Cucumis melo L. cv. Glamour) was selected to be studied in two different treatments which are with and without additional application of potassium fertilizer (potassium nitrate). Potassium nitrate is a unique source of potassium and it contributes to the health and yields of plants. In this research, the effect of additional application of potassium nitrate fertilizer on growth and yield of fertigated rockmelon under netted rain shelter were evaluated. Growth and yield parameters data such as number of female flowers, weight, diameter, perimeter, brix meter value and the thickness of the mesocarp of rockmelon fruits were recorded. As a conclusion, fertigated rockmelon with additional of potassium showed better performance compared to rockmelon without additional application of potassium. The research finally showed rockmelon plants were suitable to be planted using additional application of potassium nitrate fertilizer.

Wira and Jamil (2011) reported that coconut coir dust (CD) is a good growth medium in soilless culture for many selected vegetables and fruit. It has a high water holding capacity, excellent drainage, free of weeds and pathogens, high cation exchange capacity (CEC) and electrical conductivity (EC), easier wetting ability and also provides good aeration to root zone. However, there are some problems in using CD such as low pH, high potassium content and salinity. Addition of peat moss to CD in a ratio of 7:3 has proven to be effective in developing crop growth. Instead of peat moss, compost can be used as an additive to CD. An experiment was conducted with the main objective to determine the best medium to be used as an additive in coconut coir dust culture for growing rockmelon var. Waka N.(2011). Five types of composts were used as treatments which consisted of M_1 (70% CD: 30% rice straw compost), M_2 [70% CD: 30% empty fruit bunches (EFB) compost], M_3 (70% CD: 30% peat moss), M_4 (70% CD: 30% burnt rice husk) and M_5 (100% CD as control). M_2, which consisted of a mixture of CD and EFB compost in a ratio of 7:3, was found to be the best medium for growing rockmelon var.Waka Natsu using fertigation system. Overall, plant grown in this medium produced the best growth performance compared to the control (100% CD). Plants grown in M_2 produced the largest fruit diameter (14.15 cm) with highest fruit fresh weight(1482.9g) and total soluble solids (15.33%).

Maria *et al*., (2011) concluded that nitrogen is an important nutrient for melon (*Cucumis melo* L.*)* production. However there is scanty information about the amount necessary to maintain an appropriate balance between growth and yield. Melon vegetative organ must develop sufficiently to intercept light and accumulative water and nutients but it is also important to obtain a large reproductive vegetative dry weight ratio to maximize the fruit yield. We evaluated the influence of different N amounts on the growth, production of dry matter and fruit yield of a melon Piel de sapo type. A three year field experiment was carried out from may to September. Melons were subjected to an irrigation depth of 100 crop evapotranspiration and to 11 N fertilization rates, ranging 11 to 393kgha-1 in the three years. The dry matters production of leaves stems increased as the N amount was increasd above 112,93,9kgha-1 in 200, 2006,and 2007,respectively.The maximum leaf area index(LAI),3.1, was obtained at 393kgha-1 of N. The lowest N supply reduced the fruit yield by 21, while the highest increased vegetative growth .LAI and leaf area duration(LAD), but reduced yield by 24 retrive to the N93 treatment .Excessive applications of N increase vegetative growth at the expense of reproductive growth.For this melon type rates about 90-100 kgha-1 of N are sufficient for adequate plant growth. Development and maximum production. To obtain fruit yield close to the maximum, the leaf N conc. At the end of the crop cycle should be higher than 19.6gkg-1.

Yehia *et al.,* (2010) concluded that the aim of this research is to study some physical and mechanical properties of cantaloupe, as promising fruits, to help the design of handling machines. The physical and mechanical properties are incorporated in the development of the seed-extraction machine as a case study. The main results in this study can be summarized as follows: Physical properties of cantaloupe fruits: diameter = 82.12 – 113.51 mm, height = 82.07 – 119.95 mm, mass = 329.2 – 940.6 g, volume = 380 - 860 cm^3 , projected area = 85.85 – 160.95 cm^2 , real density = 0.69 – 1.08 g/cm^3 , bulk density = 0.51 g/cm^3 , sphericity = 0.88 – 1.07. Mechanical properties: the average of cantaloupe-fruit firmness was 62.5 N/cm^2 , the maximum = 80.4 N/cm^2 and the minimum = 28.6 N/cm^2 . In the design of the cantaloupe-fruit convey tube which affects the physical and mechanical properties are incorporated , holding mechanism and separated mechanism of the designed seed-extraction machine is given also in the paper as a case study.

Singer *et al.*, (2009) cantaloupe plants (*Cucumis melo* L.) 6004 F1 hybrid Galia type, were grown under unheated plastic house at the Arid Land Agricultural Graduate Studies and Research Institute, Ain Shams University, Cairo, Egypt, during both experimental seasons of 2006/2007 and 2007/2008, to evaluate the effect of using different soilless culture systems (aeroponic, nutrient film technique and substrate culture perlite in horizontal bags) in comparison with soil cultivation as a control treatment on growth and productivity of cantaloupe plants in different growing plantations (autumn and spring), in a complete randomized block design with three replicates for each treatment. Growth parameters as plant length, number of leaves/plant, total leaf area, leaf total chlorophyll, leaf mineral contents, number of fruits/plant, average fruit weight and total yield/plant were recorded. The obtained results showed that all the soilless culture systems performed better than the soil cultivation system and NFT system resulted in the best vegetative growth, yield and N, P and K of leaves contents values followed by perlite system comparing with the other treatments. Concerning the plantation season, it seems that spring plantation exhibited faster growth and development compared with autumn plantation. Regarding the interaction effect, significant differences were noticed between different soilless culture and plantation season on all studied characters. Overall, the best values for measured characters were obtained by nutrient film technique in spring plantation followed by perlite system in spring plantation. Whereas, the lowest values were obtained with soil cultivation system even in spring or autumn plantations. Similar trends were obtained in both seasons of study.

Zulkarami *et al*., (2009) reported that effects of soilless coconut media dust (CD) and empty fruit bunch (EFB) and five electric conductivity (EC) levels of fertilizer (0.5, 1.0, 1.5, 2.0 and 2.5 dS/m) on growth, yield and fruit quality of rock melon were investigated under greenhouse conditions. Plant height, number of leaves, total leaf area, chlorophyll content, dry weight of leaf, fruit length, diameter, weight were collected. Medium EFB performed better in comparison to CD in all the parameters studied. Among the different EC levels, 1.5 dS/m was most suitable. However, the highest sweetness of the fruit was with EC 2.0 dS/m. The interaction between media and EC levels was significant. Increasing EC level decreased weight of the fruit or fruit yield and increased dry weight of leaf and stem, chlorophyll content.

Badr *et al*., (2008) concluded that drip irrigation has the greatest advantages over other irrigation methods when saline water is used. In irrigated lands, the production of total and marketable yield depends largely on the quantity and salinity of the irrigation water. The performance of field-grown cantaloupe (*Cucumis melo var. Cantaloupensis*) in 2-years was compared with fresh water applied at crop water requirement, 1.0ETc (as a control) or saline water (3.8 dS/m) applied at amounts equivalent to 1.0ETc, 1.2ETc and 1.4ETc, respectively. The occurrence of maximum soil water content and minimum salinity in the root zone during the growing seasons was noted only for 1.4ETc while irrigation regime at 1.0ETc was found unsuitable under saline conditions. Saline water significantly depressed cantaloupe total yield but the reduction was minimal under 1.4ETc irrigation regime. Salinity reduced average fruit weight while the number of fruit per plant remained almost stable regardless of the irrigation regime. Although the differences in fruit yield were significant, grading for export quality according to suitable fruit size and appearance almost compressed the differences in total yield between fresh and saline water plants. Total yield with saline water was almost 18-32% lower than with fresh water but offered several benefits as the absolute exportable yield was equaled to that of the control but the export rate was 90 versus 72% , respectively. Moreover, saline water contributed markedly to the improvement of fruit quality by increasing total soluble solids and sugar contents.

Tyson *et al.*, (2007) in a study to determine the nitrification rate response in aperlite trickling biofilter (root growth medium) exposed to hydroponic nutrient solution, varying NO_3^- concentrations and two pH levels (6.5 and 8.5), founded that nitrification was significantly impacted by water pH. The increased ammonia oxidation rate (1.75) compared to nitrite oxidation rate (1.3) at pH 8.5 resulted in accumulation of NO_2^- to levels near those harmful to plants (observed peak of 4.2 mg L-1 NO_2^-). The potential for increased levels of un-ionized ammonia, which reduced plant nutrient uptake from micronutrient precipitation are additional problems associated with pH 8.5.

Bergquist *et al.*, (2007) reported that with the exception of carbon (C) and oxygen (O), which are supplied from the atmosphere, the essential elements are obtained from the growth medium. Other elements such as sodium, silicon, vanadium, selenium, cobalt, aluminium and iodine among others, are considered beneficial because some of them can stimulate the growth, or can compensate the toxic effects of other elements, or may replace essential nutrients in a less specific role. The most basic nutrient solutions consider in its composition only nitrogen, phosphorus, potassium, calcium, magnesium and sulphur and they are supplemented with micronutrients. The nutrient composition determines electrical conductivity and osmotic potential of the solution.

Samarakoon *et al.*, (2006) reported that the EC values for hydroponic systems range from 1.5 to 2.5 ds m-1 . Higher EC hinders nutrient uptake by increasing osmotic pressure, whereas lower EC may severely affect plant health and yield.

Fanasca *et al.*, (2006) reported that Iron, copper, zinc, boron, and manganese, become unavailable at pH higher than 6.5 in nutrient solution of hydroponic system.

Dufour and Gueri (2005) reported that when a nutrient solution is applied continuously, plants can uptake ions at very low concentrations. So, it has been reported than a high proportion of the nutrients are not used by plants or their uptake does not impact the production. It was determined that in anthurium of nutrients are lost in the leachate.

Voogt (2002) studied that in closed systems of hydroponic nutrient solution, the loss of nutrients from the root environment is brought to a minimum.

Timmons *et al.,* (2002) reported that iron, copper, zinc, boron, and manganese, become unavailable at pH higher than 6.5 in nutrient solution of hydroponic system.

Serio *et al.,* (2001) found decreasing fresh shoot mass with increasing nutrient solution concentration.

De Rijck and Schrevens (1999) found that each nutrient shows differential responses to changes in pH of the nutrient solution as described below. In the nutrient solution, NH_3 only forms a complex with H^+. For a pH range between and 7, NH_3^+ is completely present as NH_4+. Increasing the pH above 7 the concentration of NH_4^+ decreases, while the concentration of NH_3^+ augments.

Hideo *et al*., (1996) reported that melon plants were grown from spring to summer (crop 1) and summer to autumn (crop 2) by a hydroponic system which was carried below the ground surface so that plants can be grown without management of the nutrient solution.The initial concentration of nutrient solution on the growth of plants, yield and quality of fruits, and absorption of water and minerals were investigated while using this system. The concentrations of the nutrient solution had varied effects on plant growth and fruit yield production of melon, depending on the growing season. The marketable fruits were harvested from plants grown in the higher concentration plots in crop 1 and in all plots in crop 2. The temperature of the root zone was relatively low and fluctuated little even in the summer (crop1), because the growing system, that is solution reservoir was laid below the ground surface. Thus, it was reported that this passive hydroponic system may be an useful and practical production technique for melons. However, more trails need to be conducted to adjust the nutrient solution for practical use.

CHAPTER III

MATERIALS AND MATHODS

The experiment was conducted during the period from September 2018 to August 2019 to study hydroponic rockmelon culture as influenced by different strength of nutrient solution. This chapter includes a brief description of the location of the experimental site, materials used for the experiment, design of the experiment, data collection procedure and procedure of data analysis that were used for conducting the experiment**.**

3.1 Location

The experiment was conducted in the semi greenhouse in Hydroponic farm at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. The experiment was carried out during kharif season. The location of the study site is situated between $23^{0}41^{/}$ N latitude and $90^{o}22^{/}$ E longitude (Anon., 1989). The altitude of the location was 8 m from the sea level (The Meteorological Department of Bangladesh, Agargaon, Dhaka).

3.2 Plant materials and others

Seeds, nutrient solution, compost, cowdung, cocopeat, sawdust and sludge, plastic sheet, plastic pots. Seeds of rockmelon were collected from Siddique Bazar Seed Market, Dhaka.

3.3 Experimental environment

The seeds were sown plastc pots in the prepared by the media mixture of coco peat, brick broken and rice husk at the ratio of 6:2:2 (v/v).Total 27 plastic pots were needed. The pots were filled with the media mixture of coco peat, brick broken and rice husk at the ratio of 6:2:2 (v/v). The pH and EC of 6.0 and 2.5– 3.5 $dS{\cdot}m^{-1}$, respectively are maintaining in the nutrient solution.

3.4 Experimental design and treatments

The experiment has conducted in a completely randomized block design with three replications. Three nutrient solutions and three variety are considered as treatments viz.:

Factors A: Variety	Factors B: Nutrient Solution
V_1= Action-434	S1=Full Strength Rahman and Inden (2012) solution
V_2= Madhurima	S2=3/4 Strength Rahman and Inden (2012) solution
V_3= F1-Hybrid	S3=Full Strength Hoagland and Arnon (1940) solution

The nutrient compositions of Rahman and Inden (2012) solution were NO_3^-, N, P, K, Ca, Mg, and S of 17.05, 7.86, 8.94, 9.95, 6.0 and 6.0 meq·L-1, respectively. The rates of micronutrients were Fe, B, Zn, Cu, Mo and Mn of 3.0, 0.5, 0.1, 0.03, 0.025 and 1.0 mg·L-1 , respectively for the nutrient solutions. All the treatments were started at half strength from the first day of the seedlings. Full strength of the treatments was started from the second week of the experiment.

3.5 Preparation of nutrient solutions

In this experiment Rahman and Inden (2012) solution was used.3/4 strength Rahman and Inden (2012) was used in this experiment. These nutrient solution are prepared according to their composition. $MgSO_4$, $NH_4H_2PO_4$, KNO_3, $Ca(NO_3)_2$ were prepared as macro-nutrient solution and a micro-nutrient stock solution was prepared two nutrient solutions at different concentration were used.

3.6 Growing media preparation for seedling rising

The mixture of coco peat, broken bricks (khoa) and ash at the ratio of 50:30:20% (v/v). Coco peat was soaked in a big bowl for 24 hours. It was washed well with water and spread in a polythene sheet for 3 hours. Then they are mixed with khoa and ash properly. This mixer was placed in a styrofoam sheet box.

Plate 1: Growing media preparation for experiment of rockmelon plant.

3.7 Seed sowing

The seeds were soaked in water for 24 hours and then wrapped with piece of thin cloth. The socked seed were then spreaded over polythene sheet for 2 hours to dry out the surface water. After that seeds were sown in growing substrate and covered newspaper under room temperature for rising.

Plate 2: Seed sowing of rockmelon.

Plate 3: Sprouting stage of rockmelon plant.

Plate 4: Seedling stage of rockmelon plant.

Plate 5 : Flowering stage of rockmelon plant.

Plate 6: Fruiting stage of rockmelon plant.

3.8 Intercultural operations

3.8.1 Weeding

Hand weeding was done in the experiment.

3.8.2 Insect management

Rockmelon leaves were affected by aphids. To control this insect imidacloprid was applied in the experiment.

3.8.3 Diseases management

Leaves were affected by leaf mosaic virus. In this condition, bavistin were applied in the whole affected leaves.

3.9 Harvesting

The crop was harvested after proper maturation of the fruit. Harvesting of the crop was done according to treatment.

3.10 Data collection

Data on the following parameters were recorded from the plants during the experiment. Data were collected from each plant. Each box was regarded as an experimental unit. Data were collected on different growth and yield components. Data is collecting on growth and yield parameters, viz., plant height at different days after transplanting, number of leaves per plant, fruit length, fruit diameter, number of fruit per plant, individual fruit weight, fruit yield per plant. Some of the growth and yield contributing parameters have recorded discussed in the results and discussion section.

3.10.1 Plant height

Plant height was measured in centimetre (cm) by a meter scale at 20, 40, 60 and 80 DAT (days after transplanting) from the point of attachment of growing media up to the tip of the longest leaf.

3.10.2 Number of leaves per plant

Number of leaves per plant were counted at 20, 40, 60 and 80 DAT. All the leaves of each plant were counted separately. Only the smallest young leaves at the growing point of the plant were excluded from the counting and the average number was recorded.

3.10.3 Number of shoots per plant

Number of shoots per plant were counted at 20,40,60 and 80 DAT. All the leaves of each plant were counted separately.

3.10.4 Number of fruits per plant

All the fruits of each plant were counted separately. Only the smallest young fruits at the growing point of the plant were excluded from the counting and the average number was recorded.

3.10.5 Individual fruit weight

The individual fruit weight were measured by electric balance at department of horticulture, Sher-e-Bangla Agricultural University, Dhaka-1207.

3.10.6 Individual fruit length

The individual fruit length was measured during harvesting with the help of a large scale in centimeter unit.

3.10.7 Individual fruit diameter

The individual fruit diameter was measured during harvesting with the help of a large scale in centimeter unit.

3. 10. 8 Yield (kg /plant)

Fruits were harvested at the commercial maturity stage of fruit. In each of harvesting, the weights of harvested fruits were recorded using electric balance in the field. The final data was made at the final harvesting using calculator and Microsoft Excel Software. Average results are used for statistical analysis purpose.

3.10.9 Statistical analysis of data

Data were analyzed by two-way analysis of variance (ANOVA) using SPSS (version-20) software and the differences among means were determined using least significant difference (LSD) test.

CHAPTER IV
RESULTS AND DISCUSSION

The research work was accomplished to identify the effect of different strength of nutrient solutions on growth, yield and quality of rockmelonin soilless culture. Some of the data have been presented and expressed in table(s) and others in figures for case of discussion, comparison and understanding.

4.1 Plant height

Plant heights at different days after planting of rockmelon were significantly affected by different variety. The highest plant heights at 20DAT, 40 DAT, 60 DAT and 80DAT were (8.07, 34.10, 40.60, and 59.58cm respectively) found in the V_2 (Madhurima) variety (Table 1). Meanwhile, the lowest plant heights were(5.87, 19.99, 33.16 and 43.19cm respectively) found in V_1 (Action-434) variety (Table 1). There was significant difference in plant height at 20-80 days after transplanting, among the three different nutrient solution concentrations (Table 2). The longest plant height was recorded at 20-80 days were found in the 3/4 strength of Rahman and Inden (2012) solution (Table 2), while lowest plant height were found in S_1 [Full strength of Rahman and Inden) (2012)] solution. On the other hand, it was showed that the highest plant height in V_2 (Madhurima) and also S_2 [3/4 strength of Rahman and Inden (2012)] solution (Table 3). This might be due to the proportion of nutrient supply in the plants. In case of closed hydroponic system, proper nutrient solution management in the plant is the first consideration for the adoption of the plants. (Castellanos *et al.*, 2011); stated that rockmelon growth was affected by different strength of nutrient solutions. The present finding was consisted with the findings of Sheen and Hsu(1990). In the present study, S_2 can supply proper amount of nutrients to the plant resulting higher plant height.

Table 1. Varietal performance of rockmelon plant height (cm).

Variety	plant height (cm) at different days after transplanting			
	20DAT	40DAT	60DAT	80DAT
V_1	5.87^c	19.99^c	33.16^b	43.19^b
V_2	8.07^a	34.10^a	40.60^a	59.58^a
V_3	7.31^b	22.76^b	33.30^b	48.26^c
LSD	0.2809	0.4655	0.4424	1.86
CV%	3.97	1.82	1.24	3.46

[Means with different letter is significantly different by LSD test. V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid]

Table 2. Effect of nutrient solution on plant height (cm) in rockmelon.

Nutrient solution	plant height (cm) at different days after transplanting			
	20DAT	40DAT	60DAT	80DAT
S_1	6.22^c	25.18^a	34.21^c	50.68^a
S_2	7.68^a	25.60^{ab}	37.58^a	54.11^a
S_3	7.34^b	25.37^b	35.57^b	51.23^b
LSD	0.2809	0.4655	0.4424	1.857
CV%	3.97	1.82	1.24	3.46

[Means with different letter is significantly different by LSD test. S_1=Full strength Rahman and Inden(2012), S_2=3/4 strength Rahman and Inden (2012), S_3= Full Strength Hoagland and Arnon (1940)]

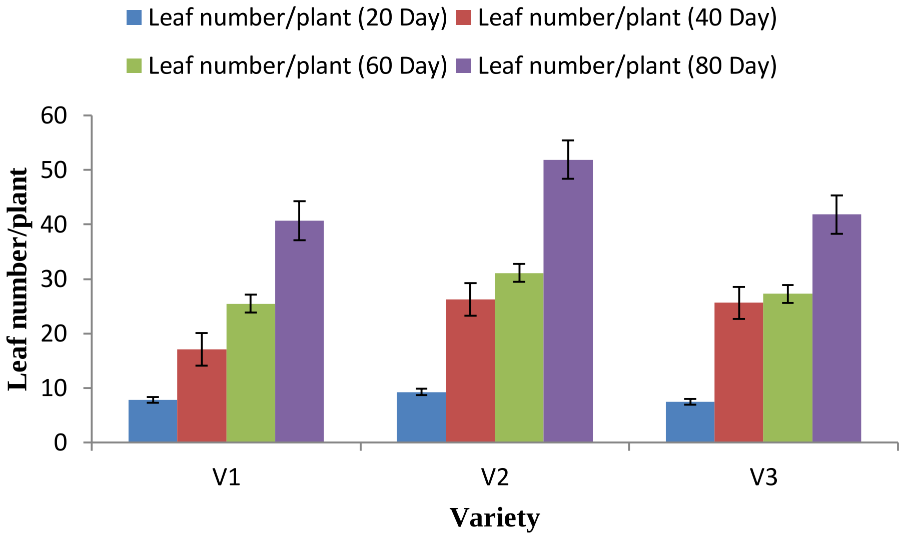
Table 3. Effect of Variety and Nutrient solution on Plant height (cm) in rockmelon.

Variety + Nutrient solution	plant height (cm) at different days after transplanting			
	20DAT	40DAT	60DAT	80DAT
V_1S_1	4.97^{e}	16.43^{g}	28.03^{h}	55.17^{c}
V_1S_2	6.13^{d}	19.27^{f}	34.77^{e}	50.13^{d}
V_1S_3	6.50^{d}	24.27^{d}	37.57^{c}	54.27^{c}
V_2S_1	7.20^{c}	35.67^{a}	39.27^{b}	59.47^{b}
V_2S_2	9.40^{a}	36.27^{a}	46.67^{a}	65.40^{a}
V_2S_3	7.60^{bc}	30.37^{b}	35.87^{d}	53.87^{c}
V_3S_1	6.50^{d}	25.53^{c}	35.33^{de}	52.40^{cd}
V_3S_2	7.50^{bc}	21.27^{e}	31.30^{g}	46.80^{e}
V_3S_3	7.93^{b}	21.47^{e}	33.27^{f}	45.57^{e}
LSD	0.4865	0.8063	0.7663	3.216
CV%	3.97	1.82	1.24	3.46

[Means with different letter is significantly different by LSD test. V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid S_1=Full strength Rahman and Inden(2012), S_2=3/4 strength Rahman and Inden(2012), S_3= Full Strength Hoagland and Arnon (1940)]

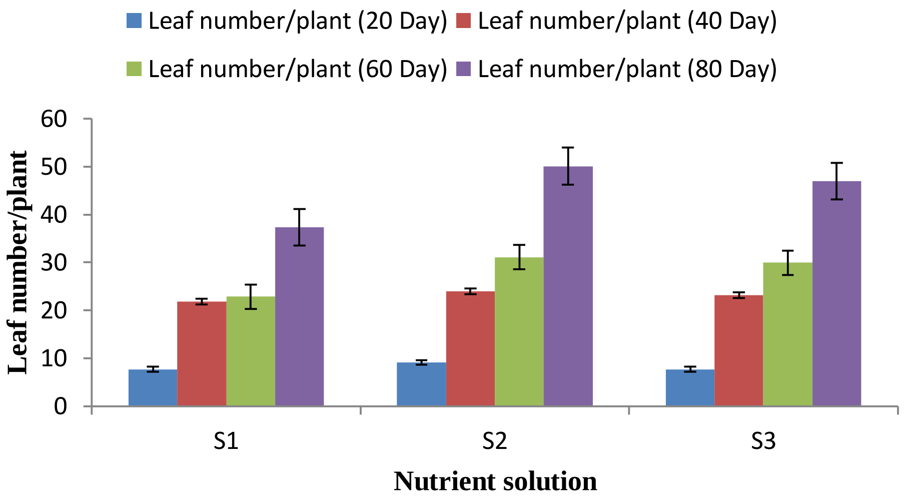
4.2 Number of leaves per plant

Number of leaves per plant at different days after planting of rockmelon were significantly affected by different variety. The highest number of leaves at 20-80 days were(9.27, 26.26, 31.12, and 51.91) found in the V_2 (Madhurima) variety (Figure 1). Meanwhile, the lowest number of leaves were (7.20, 17.11, 25.46 and 40.70) found in V_1 (Action-434) variety. There was significant difference in number of leaves at 20-80 days, among the three different nutrient solution concentrations (Figure 2). The highest number of leaves was recorded at 20-80 days were(9.16, 23.91, 31.10 and 37.33) found in the 3/4 strength of Rahman and Inden (2012) solution (Figure 2), while lowest number of leaves were found in Full strength of Rahman and Inden (2012) solution. This might be due to the proportion of nutrient supply in the plants. In case of closed hydroponic system, proper nutrient solution management in the plant is the first consideration for the adoption of the plants. Yang *et al*. (2019); stated that Rockmelon growth was affected by different strength of nutrient solutions. The present finding was consisted with the findings of Sheen and Hsu(1990). In the present study, S_2 can supply proper amount of nutrients to the plant resulting higher number of leaves.



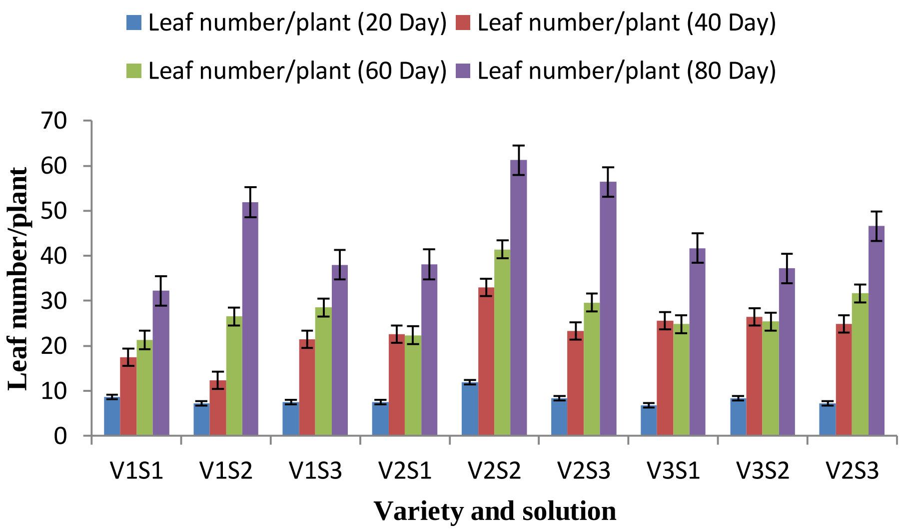
[Vertical bar represent means ± Standard error.V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid]

Figure 1. Effect of variety on number of leaves per plant in rockmelon



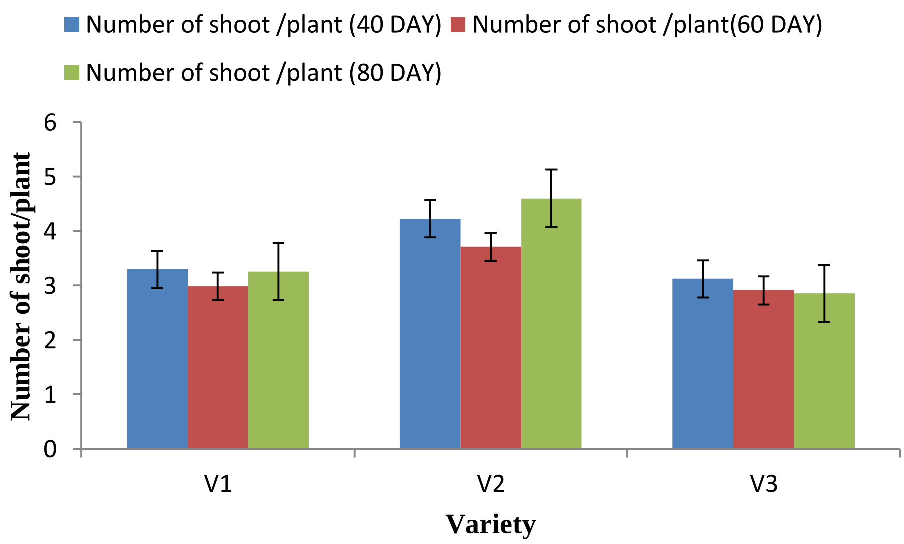
[Vertical bar represent means ± Standard error. S_1=Full strength Rahman and Inden(2012), S_2=3/4 strength Rahman and Inden(2012), S_3= Full Strength Hoagland and Arnon (1940)]

Figure 2. Effect of nutrient solution on number of leaves in rockmelon.



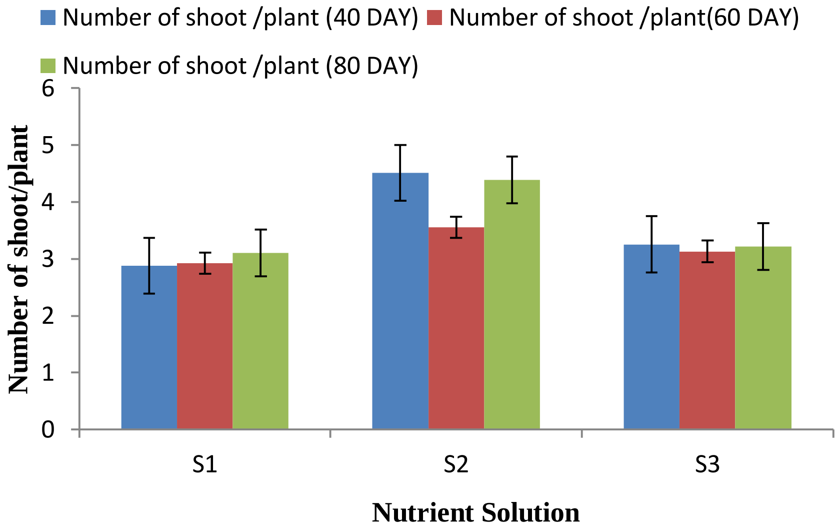
[Vertical bar represent means ± Standard error. V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid S_1=Full strength Rahman and Inden(2012), S_2=3/4 strength Rahman and Inden(2012), S_3= Full Strength Hoagland and Arnon (1940)]

Figure 3. Effect of variety and nutrient solution on number of leaves per plant in rockmelon.



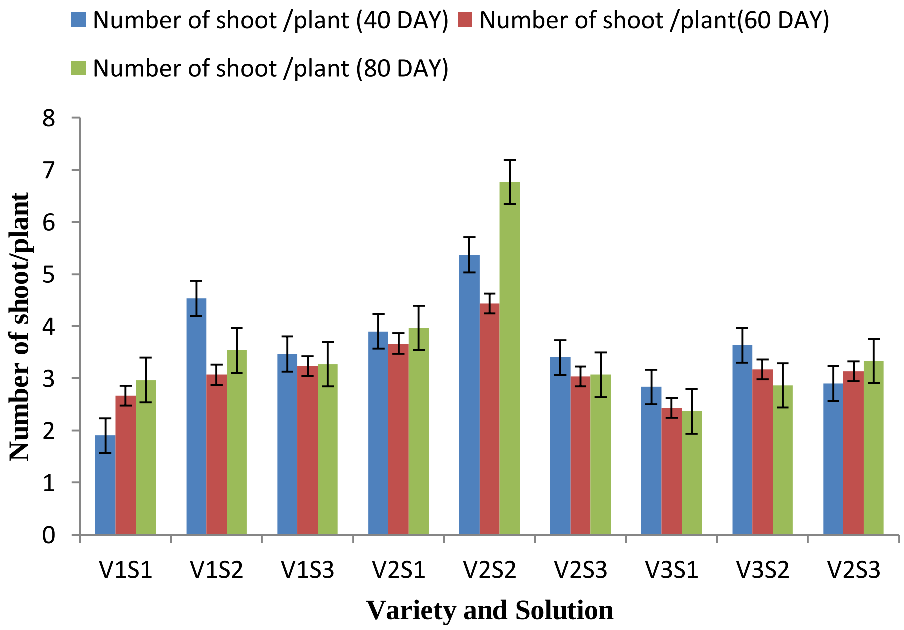
[Vertical bar represents means ± Standard error. V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid]

Figure 4. Effect of variety on number of shoots per plant in rockmelon.



[Vertical bar represent means ± Standard error. S_1=Full strength Rahman and Inden(2012), S_2=3/4 strength Rahman and Inden(2012), S_3= Full Strength Hoagland and Arnon (1940)]

Figure 5. Effect of nutrient solution on number of shoots per plant in rockmelon.



[Vertical bar represents means ± Standard error. V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid S_1=Full strength Rahman and Inden(2012), S_2=3/4 strength Rahman and Inden(2012), S_3= Full Strength Hoagland and Arnon (1940)]

Figure 6. Effect of variety and nutrient solution on number of shoots per plant in rockmelon.

4.3.Number of shoots per plant:

Number of shoots per plant at different days after planting of rockmelon were significantly affected by different variety. The highest number of shoots at 40-80 days were(4.22, 3.71 and 4.60) found in the V_2 (Madhurima) variety (Figure 1). Meanwhile, the lowest number of shoots were (3.3, 2.99 and 3.10) found in V_1(Action-434) variety. There was significant difference in number of shoots at 40-80 days, among the three different nutrient solution concentrations (Figure 4). The highest number of shoots was recorded at 20-80 days were (4.51, 3.56 and 4.39) found in the 3/4 strength of Rahman and Inden (2012) solution (Figure 5), while lowest number of shoots were (2.88, 2.92 and 3.10) found in Full strength of Rahman and Inden (2012) solution. This might be due to the proportion of nutrient supply in the plants. In case of closed hydroponic system, proper nutrient solution management in the plant is the first consideration for the adoption of the plants.(Preciado *et al*. 2019); stated that rockmelon growth was affected by different strength of nutrient solutions. The present finding was consisted with the findings of (Wahocho *et al*., 2017). In the present study, S2 can supply proper amount of nutrients to the plant resulting higher number of shoot.

4.4. Fruit diameter: Fruit diameter of Rockmelon were significantly affected by different variety (Table 4). The highest fruit diameter was found in V_2 (51.48 cm) than other variety.Also were significantly affected by different nutrient solution (Table 5). The highest fruit length was found in S_2 (52.88 cm) other than that of nutrient solution. Meanwhile the combination of variety and nutrient solution (Table 6), were found that highest fruit length between V_2 (Madhurima) and S_2 (3/4 strength of Rahman and Inden)solution was (55.03) than other combination. Similar findings on rockmelon plants were reported by (Asao *et al.*, 2013). On the other hand S_2 [3/4 strength Rahman and Inden(2012)solution] performed the best result of the fruit diameter compare than other nutrient solution.

Table 4 . Effect of variety on fruit diameter in rockmelon.

Variety	Fruit diameter(cm)
V_1	45.74[c]
V_2	51.48[a]
V_3	49.51[b]
LSD	0.1672
CV%	0.34

[Means with different letter is significantly different by LSD test. V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid]

Table 5. Effect of nutrient solution on fruit diameter in rockmelon.

Nutrient solution	Fruit diameter(cm)
S_1	45.62[c]
S_2	52.88[a]
S_3	48.23[b]
LSD	0.1672
CV%	0.34

[Means with different letter is significantly different by LSD test. S_1=Full strength Rahman and Inden(2012), S_2=3/4 strength Rahman and Inden(2012), S_3= Full Strength Hoagland and Arnon (1940)]

Table 6. Effect of variety and nutrient solution on fruit diameter in rockmelon.

Variety + Nutrient solution	Fruit diameter(cm)
V_1S_1	40.59^{i}
V_1S_2	50.48^{e}
V_1S_3	46.15^{g}
V_2S_1	52.03^{c}
V_2S_2	55.03^{a}
V_2S_3	47.39^{f}
V_3S_1	44.24^{h}
V_3S_2	53.12^{b}
V_3S_3	51.17^{d}
LSD	0.2896
CV%	0.34

[Means with different letter is significantly different by LSD test .V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid S_1=Full strength Rahman and Inden(2012), S_2=3/4 strength Rahman and Inden(2012), S_3= Full Strength Hoagland and Arnon (1940)]

4.5. Number of fruit per plant

Significant variation was observed among V_1, V_2, and V_3 variety in terms of number of fruits per plan (Table7).The maximum number of fruit per plant (4.35) was found in V_2 variety, whereas the lowest value (3.31) in V_1 variety. Similarly significant variation was observed among S_1, S_2 and S_3 nutrient solution in terms of number of fruits per plant (Table 8). The maximum number of fruit per plant (4.98) was found in S_2 treatment whereas the lowest value (2.61) was found in S_1 nutrient solution. The plants required optimum nutrient combination for proper growth and development. The highest number of fruit per plant was required in V_2S_2 (5.53) combination which were represented in (Table 9). S_2 treatment provide Ca2+ which decrease % (CSR) on the contrary S_1 treatment contain more Ca2+ than S_2 treatment which causes osmotic stress , resulting higher (%)CSR. Water stress and osmotic stress reduce Ca2+ transport particularly to the distal end region of rockmelon fruit, where CSR develops (H.R. Etebarian *et al*., 2007). Due to lower % (CR) higher number of fruit found in S_2 treatment. On the other hand S_2 [3/4 strength Rahman and Inden(2012)solution] performed the best result of the number of fruit per plant compare than other nutrient solution.

4.6 Fruit length

Fruit length of rockmelon were significantly affected by different variety (Table 7). The highest fruit length was found in V_2 (13.92cm) than other variety.Also were significantly affected by different nutrient solution (Table 8). The highest fruit length was found in S_2 (14.78 cm) other than that of nutrient solution. Meanwhile the combination of variety and nutrient solution (Table 9), were found that highest fruit length between V_2 (Madhurima) and S2 (3/4 strength of Rahman and Inden)solution was (15.79) than other combination. Similar findings on rockmelon plants were reported by (Asao *et al.*, 2013). On the other hand S_2 [$_{3/4}$ strength Rahman and Inden(2012)solution] performed the best result of the number of fruit length compare than other nutrient solution.

4.7. Individual fruit weight

Individual fruit weight of rockmelon varied significantly by different variety and nutrient solution. Result revealed that topmost result (1526 gm) was recorded from V_2 variety (Table 7) and also topmost result (1537 gm) was recorded from S_2 nutrient solution (Table 8) where as S_1 nutrient solution (926.7 gm) was scored as the lowest at final harvest. The highest amount between the combination of variety and nutrient solution, it was required that V_2S_2 (2167 gm) combination was highest than other combination. This might be because of proper supply of nutrient in the plants. Ferrante *et al.* (2008); stated that rockmelon growth was affected by different strength of nutrient solutions. The present finding was consisted with the findings of (Ferrante *et al.*, 2008). In the present study, S_2 can supply proper amount in available forms of nutrients to the plants resulting higher fruit weight. On the other hand S_2 [3/4 strength Rahman and Inden(2012)solution] performed the best result of the individual fruit weight compare than other nutrient solution.

4.8 Yield

Marketable yield was affected by different nutrient solution on different variety of rockmelon(Table 9) The highest yield (2.31 kg/plant) was found in V_2 (Madhurima) variety(Table 7) and S_2 (3/4 strength of Rahman and Inden (2012) treatment (Table 8) while, lowest yield (0.93 kg/plant) was found in V_1 (Action-434) and S_1 (Full strength of Rahman and Inden (2012) treatment. This might be due to higher number of fruit by application of S_2. Furthermore, V_2 variety that might have a positive effect on fruit yield in rockmelon. H.R. Etebarian *et al. (*2007); observed that marketable yield of rockmelon increased, mainly because of decrease in (CSR)-affected fruits. On the other hand S_2 [3/4 strength Rahman and Inden (2012) solution] performed the best result of the yield compare than other nutrient solution.

Table 7. Effect of variety on number of fruit per plant, fruit length (cm), individual fruit weight (gm) and fruit yield (kg/plant) in rockmelon.

Variety	Number of fruit per plant	Fruit length(cm)	Individual Fruit weight(gm)	Fruit yield(kg)
V_1	3.31^b	12.08^c	952.2^c	1.46^b
V_2	4.36^a	13.92^a	1526^a	2.67^a
V_3	3.92^c	13.22^b	1211^b	2.09^a
LSD	0.3031	0.2096	136.7	0.1672
CV%	7.86	1.61	11.12	8.87

[Means with different letter is significantly different by LSD test. V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid]

Table 8. Effect of nutrient solution on number of fruit per plant, fruit length (cm), individual fruit weight (gm) and fruit yield (kg/plant) in rockmelon.

Nutrient solution	Number of fruit per plant	Fruit length(cm)	Individual Fruit weight(gm)	Fruit yield(kg)
S_1	2.61^b	11.54^c	962.7^b	1.76^b
S_2	4.99a	14.78^a	1537^a	2.43^a
S_3	4.59a	12.90^b	1400^a	1.82^b
LSD	0.3031	0.2096	136.7	0.1672
CV%	7.86	1.61	11.12	8.87

[Means with different letter is significantly different by LSD test. S_1=Full strength Rahman and Inden (2012), S_2=3/4 strength Rahman and Inden (2012), S_3= Full Strength Hoagland and Arnon (1940)]

Table 9. Effect of variety and nutrient solution on number of fruit per plant, fruit length (cm), individual fruit weight (gm) and fruit yield (kg/plant) in rockmelon.

Variety + Nutrient solution	Number of fruit per plant	Fruit length(cm)	Individual Fruit weight(gm)	Fruit yield(kg)
V_1S_1	2.43^{e}	10.07^{h}	546.7^{d}	0.9^{a}
V_1S_2	4.20^{c}	13.85^{c}	963.3^{c}	1.700^{b}
V_1S_3	5.10^{ab}	12.32^{e}	1347^{b}	1.73^{b}
V_2S_1	2.80^{e}	11.26^{g}	893.3^{c}	2.15^{a}
V_2S_2	5.53^{a}	15.79^{a}	2167^{a}	2.31^{a}
V_2S_3	4.73^{b}	14.70^{b}	1519^{b}	1.73^{b}
V_3S_1	2.60^{e}	13.29^{d}	1448^{b}	2.20^{a}
V_3S_2	3.43^{d}	14.71^{b}	851.3^{c}	2.07^{a}
V_3S_3	3.93^{cd}	11.66^{f}	1335^{b}	2.00^{ab}
LSD	0.5250	0.3631	236.8	0.2896
CV%	7.86	1.61	11.12	8.87

[Means with different letter is significantly different by LSD test. V_1=Action-434, V_2=Madhurima, V_3=F1-Hybrid S_1=Full strength Rahman and Inden (2012), S_2=3/4 strength Rahman and Inden (2012), S_3= Full Strength Hoagland and Arnon (1940)]

CHAPTER V

SUMMARY AND CONCLUSION

The experiment was conducted at the Horticultural Farm of Sher-e- Bangla Agricultural University (SAU), Dhaka, Bangladesh to determine the hydroponic rockmelon culture as influenced by different strength of nutrient solution under changing climate. Two factors were used in this experiment viz, variety and nutrient solution which are considered as treatments.Three variety viz, V_1= Action-434, V_2= Madhurima, V_3= F1-Hybrid and three nutrient solution *viz*. S_1=Full strength of Rahman and Inden (2012) nutrient solution, S_2 = 3/4 strength Rahman and Inden (2012) nutrient solution, S_3 = Full Strength Hoagland and Arnon (1940) nutrient solution were used in this experiment. The experiment will be conducted as randomized completely block design with three replications. Madhurima variety (V_2) showed significant variation in most of the parameters. The highest plant height (7.7 cm, 25.60 cm, 37.58 cm and 58.11 cm) was observed from S_2 at 20, 40, 60 and 80 DAT. The highest number of leaves (9.16, 23.91, 31.10 and 50.12) was observed from S2 at 20, 40, 60 and 80 DAT. The highest number of shoots (4.51, 3.55 and 4.38) was observed from S_2. The maximum number of fruit per plant (4.9) was observed from S2 whereas minimum (2.6) was recorded S_1, higher individual fruit weight (1537 gm) was recorded from S_2 and lower (962.7 gm) was from S_1, higher fruit length (14.78 cm) was found in S2 and lower (11.54 cm) was in S_1, the maximum fruit diameter (52.88 cm) was observed from S_2, whereas minimum (46.62 cm) was recorded S_1, Maximum yield (2.4 kg/plant) was observed from S_2 whereas minimum (1.7 kg/plant) was recorded S_1. Considering the findings of the experiment, it may be concluded that: V_2 (Madhurima variety) and S_2 (3/4 strength Rahman and Inden (2012)) nutrient solution was very effective for growth and development of rockmelon and cost of production can be minimize.

CONCLUSION

Growth and yield performance of rockmelon grown in pots were influenced by the different strength of nutrient solution. It can be concluded that S_2 [3/4 Strength Rahman and Inden (2012) solution] performed the best for growing rockmelon to obtain high yield.

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APPENDICES

Appendix I. Analysis of variance on plant height of rockmelon

Source of variation	Degree of Freedom(df)	Mean square for plant height (cm)			
		Plant height (20 day)	Plant height (40 day)	Plant height (60 day)	Plant height (80 day)
Replication	2	15.76	12.22	20.43	79.80
Factor A	2	11.25**	503.21**	156.54**	290.02**
Factor B	2	5.23**	0.59*	25.83**	45.73**
AB	4	1.22**	47.81**	74.95**	57.73**
Error	16	0.079	0.217	0.196	3.453

** Significant at the 0.01 level
* Significant at the 0.05 level

Appendix II. Analysis of variance on number of leaves per plant of rockmelon

Source of variation	Degrees of Freedom(df)	Mean square for number of leaves per plant			
		Leaves number (20 day)	Leaves number (40 day)	Leaves number (60 day)	Leaves number (80 day)
Replication	2	8.743	16.31	7.36	16.96
Factor A	2	8.25**	234.69**	75.32**	342.80**
Factor B	2	6.45**	9.72**	179.97**	399.91**
AB	4	6.31**	77.67**	90.83**	209.82**
Error	16	0.141	0.255	0.099	0.214

** Significant at the 0.01 level

Appendix III. Analysis of variance on number of shoots of rockmelon

Source of variation	Degree of Freedom(df)	Mean square for number of shoots per plant		
		Number Shoot /plant (40 day)	Number Shoot /plant (60 day)	Number Shoot /plant (80 day)
Replication	2	3.370	4.011	3.891
Factor A	2	3.138**	1.751**	7.516**
Factor B	2	6.580**	0.936**	4.556**
AB	4	1.204**	0.654**	3.778**
Error	16	0.341	0.206	0.450

** Significant at the 0.01 level

Appendix IV. Analysis of variance on number of fruit per plant, individual fruit weight (gm), fruit length(cm), fruit diameter (cm) and yield (kg/plant) of rockmelon

Source of variation	Degree of Freedom(df)	Mean square for different attributes of Rockmelon				
		Number of fruit per plant	Individual fruit weight (gm)	Fruit length(cm)	Fruit diameter(cm)	Yield(kg/plant)
Replication	2	3.189	105610.70	2.06	0.52	0.28
Factor A	2	2.42**	743654.37 **	7.74**	76.61**	1.16**
Factor B	2	10.67**	494089.48 **	23.86**	121.57**	0.17**
AB	4	1.069**	751791.70 **	5.37**	30.99**	0.37**
Error	16	0.092	18720.620	0.044	0.028	0.028

** Significant at the 0.01 level