ANALYSIS OF GROWTH OF TOMATO SAPLINGS FOR TREATMENT WITH DIFFERENT TYPES OF WATER

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ABSTRACT *A study was conducted on how the Tomato (Solanum lycopersicum) Saplings would respond to the treatment with different types of water like highly aerated water, moderately aerated water and non-aerated water. For the study, the tomato saplings were considered in four different Agricultural Trays/Plastic Trays; three trays contained black soil and one tray contained black soil with 20% sand. The study showed us that, the saplings treated with highly aerated water had a better performance when compared to the other saplings in terms of root length, wet/fresh weight and dry weight. In order to aerate the water a low cost, low power aerator or aquarium bubble generator/air pump was used. The aeration for 30 minutes gave rise to an increased Dissolved Oxygen (DO) in water of about 16.1 mg/L which we here consider as highly aerated water, aeration of 10 minutes gave us an increased Dissolved Oxygen (DO) of 12.4 mg/L which is here considered as moderately aerated water, while the normal water used for the treatment for other saplings had a DO of about 9 mg/L.*

Keywords: *Dissolved Oxygen, surface aeration, subsurface aeration.*

Introduction

Aeration of water is the process of increasing or maintaining the oxygen saturation of water in both natural and artificial environments. Aeration of water is usually required because the water bodies suffer from hypoxic or anoxic conditions which is mainly caused by the human activities like sewage discharge, agricultural run-off etc. One of the important parameter which contributes towards the quality of water is the Dissolved oxygen (DO). Dissolved Oxygen is a very much important element which is not only required by fishes, other aquatic animals but is also a prime element that aerobic bacteria need. When oxygen concentrations in water bodies become low, anoxic conditions may develop which can decrease the ability of the water body to support life. We see that the aeration is an in-line point-of-entry process that helps in reducing the concentration of volatile organic compounds present in the water also the process aids in removing several gases from the water such as methane, hydrogen sulfide, radon etc. The process of aeration involves sending a huge amount of air through the water and then letting it out; the sent air then causes the dissolved volatile compounds and gases to come out from the water. The aeration devices are available in several types ranging from a simple, open holding tank which allows the dissolved gases to diffuse into the atmosphere to a complex aeration system that has a tower or column filled with packing material; so that whenever the water passes through the packing material, the gases are released. In home usage there are basically three main types of aeration devices viz. packed tower aerators, multi-stage diffused bubble aerators and spray aerators. In this experiment, we use a type of diffused bubble aerator which is a coarse bubble generator which can generate bubbles in millimeter to centimeter range.

There are several ways to aerate the water; as any of the method by which oxygen could be added to water can be considered as a method of water aeration. These methods of aeration fall into two broad categories such as surface aeration and subsurface aeration. Surface Aerators propel the water up in the air and as this water falls down it mixes air and water and thus causing as increase in the DO of the water. Some of the examples of surface aerators are Paddlewheel aerators, Low speed surface aerators, Floating surface aerators, Fountains etc. The subsurface aerators deploy a line of bubbles from the bottom of the water body and allow these bubbles to rise to the surface of the water by the force of buoyancy and thus help us in improving the value of the DO. The examples of subsurface aerators are Fine bubble aerators, Jet aerators, Coarse bubble aerators etc [1] [2] [3] [4].

Method and Materials

Here in this experiment, in order to generate the bubbles or to aerate the water a simple bubble generator was used which was able to produce bubbles in range of few millimeters to centimeter. Since we wanted to have a water sample with higher values of Dissolved Oxygen (DO) the aeration was carried out for 30 minutes which gave us a water sample with a DO value of 16.1 mg/L (the DO of the water was tested using Winkler's Method); then the water sample was fed to a tray and the growth of the saplings treated

with this water was observed. The aeration of 10 minutes gave us a water sample which had a DO value of about 12.4 mg/L and this sample was then supplied to a agriculture tray and the growth of the particular saplings were noted. Furthermore, the DO value of the normal water which was used to treat the other two trays was found to be about 9 mg/L. This water was fed to one tray in which the soil sample was a mixture of black soil and sand; where the sand was of about 20%, while the second tray had only black soil; the observations were made on the saplings grown in these two trays and noted. The tomato saplings were grown in an Agricultural Tray/Plastic Tray with 30 seeds sowed in each tray. Unfortunately, only about an average of 12 sprouting were seen in all the four agriculture trays. Five main test parameters were considered for carrying out the experiment viz. Shoot Length, Root Length, Number of Leaves, Wet/Fresh Weight and Dry Weight. These parameters were measured or tested at an interval of every five days over a period of 15 days. The saplings were extracted carefully from the agricultural tray and the required parameters were measured; where the wet weight and dry weight of the saplings were measured on a weighing machine which had a sensitivity of 10 mg. In order to measure the dry weight, the saplings were left to dry in sun for about 4 days, so that the water content present in the extracted saplings dries off and the weight of the plant without water content could be measured [5].

Fig. 1 Air Bubble Generator

Fig. 2 Air Bubble Generator with Bubble Generation

Experimental Outcomes

The noted values of the parameters for all the samples are mentioned as follows:

Highly Aerated Water Treated Saplings:

PARAMETERS	DAY 15 (5th Oct)	DAY 20 (10thOct)	DAY 25 (15th Oct)	DAY 30 (20th Oct)
SHOOT LENGTH (cm.)	4.85	3.65	5	6.05
ROOT LENGTH (cm.)	3.55	6.85	13.25	7.95
NO. OF LEAVES	4	5	6.5	6
WET/FRESH WEIGHT (g.)	0.105	0.095	0.245	0.25
DRY WEIGHT (g.)	0.02	0.03	0.05	0.05

TABLE I Observed values of different parameters for Highly Aerated Water Treated Saplings

Fig. 3 Clockwise view of the Tomato Saplings on DAY 15, DAY 20, DAY 25, DAY 30

Fig. 4 Shoot Length and Wet/Fresh Weight Measurement of Saplings Treated with Highly Aerated Water on Day 15

Moderately Aerated Water Treated Saplings:

PARAMETERS	DAY 15 (5th Oct)	DAY 20 (10th Oct)	DAY 25 (15th Oct)	DAY 30 (20th Oct)
SHOOT LENGTH (cm.)	4.3	3.4	4.1	5.5
ROOT LENGTH (cm.)	3.4	6.55	8.5	7.35
NO. OF LEAVES	4	5	6.5	8
WET/FRESH WEIGHT (g.)	0.075	0.12	0.175	0.245
DRY WEIGHT (g.)	0.01	0.02	0.04	0.04

TABLE II Observed values of different parameters for Moderately Aerated Water Treated Saplings

Non – Aerated Water Treated Saplings with Sandy Soil:

Parameters	DAY 15 (5th Oct)	DAY 20 (10th Oct)	DAY 25 (15th Oct)	DAY 30 (20th Oct)
SHOOT LENGTH (cm.)	3.95	4.3	5.1	7
ROOT LENGTH (cm.)	5.2	5.2	8.4	8.25
NO. OF LEAVES	4	4.5	8	8
WET/FRESH WEIGHT (g.)	0.085	0.11	0.21	0.34
DRY WEIGHT (g.)	0.01	0.03	0.04	0.06

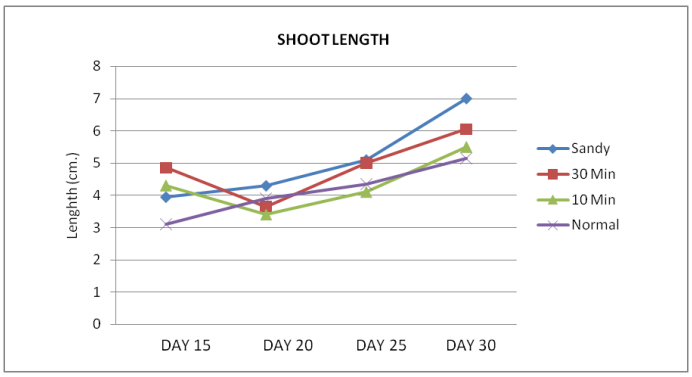
TABLE III Observed values of different parameters for Non - Aerated Water Treated Saplings with Sandy Soil

Non - Aerated Water Treated Saplings:

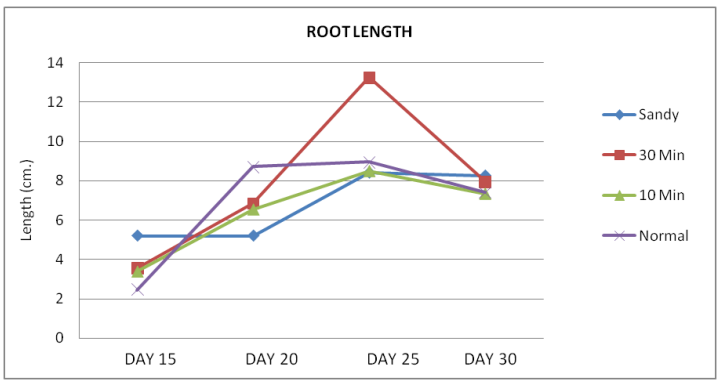
PARAMETERS	DAY 15 (5th Oct)	DAY 20 (10th Oct)	DAY 25 (15th Oct)	DAY 30 (20th Oct)
SHOOT LENGTH (cm.)	3.1	3.9	4.35	5.15
ROOT LENGTH (cm.)	2.45	8.7	8.95	7.4
NO. OF LEAVES	4	5	6.5	6.5
WET/FRESH WEIGHT (g.)	0.04	0.10	0.15	0.23
DRY WEIGHT (g.)	0	0.03	0.03	0.03

TABLE IV. Observed values of different parameters for Non - Aerated Water Treated Saplings

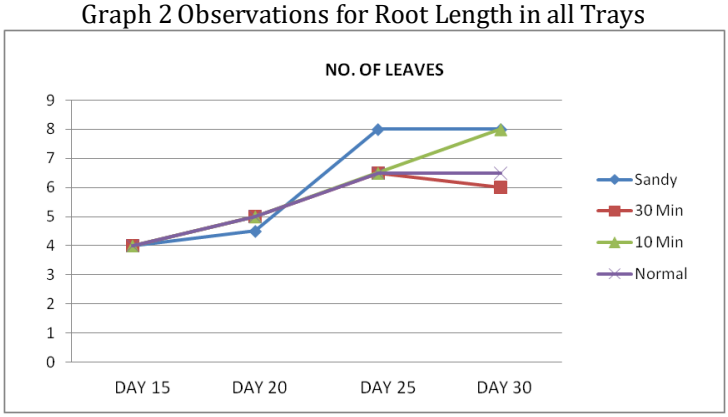
The graphs were plotted to analyze the observed data for each of the parameter. The graphs obtained show that the growth of the saplings is better in the highly aerated water in terms of root length, wet/fresh weight and dry weight. The following graphs show us the growth of saplings in all the agriculture trays.



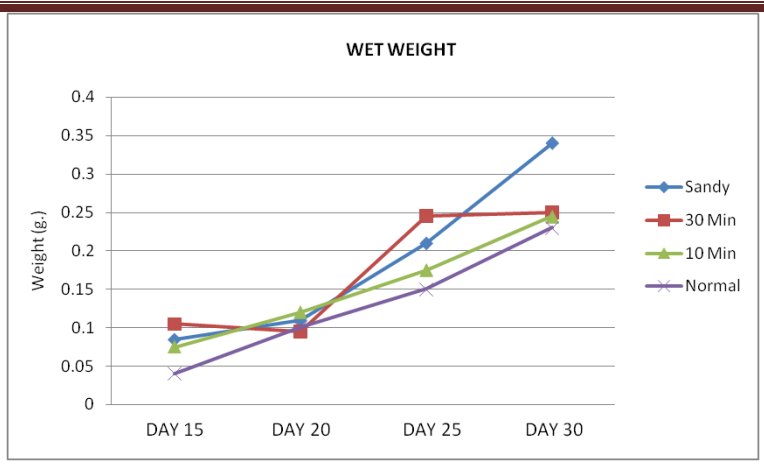
Graph 1 Observations for Shoot Length in all Trays



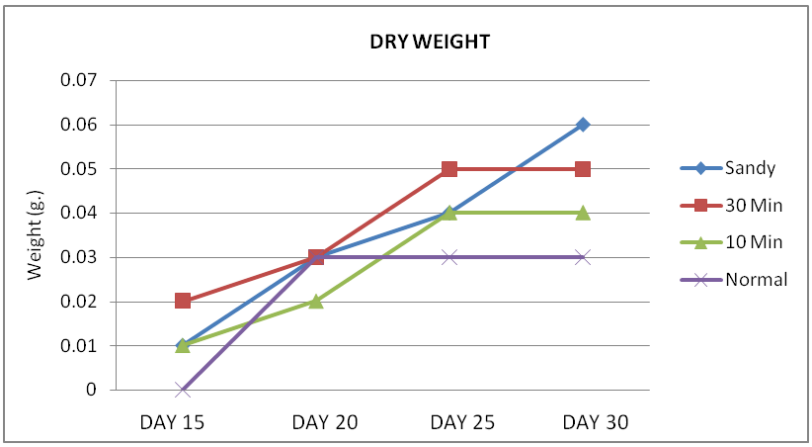
Graph 2 Observations for Root Length in all Trays



Graph 3 Observations for Number of Leaves in all Trays



Graph 4 Observations for Wet/Fresh Weight in all Trays



Graph 5 Observations for Dry Weight in all Trays

Conclusion

The experiment showed that the saplings treated with Aerated Water perform/grow better when compared to the saplings treated with normal water; particularly the saplings treated with Highly Aerated water (30 minute aerated water) have an enhanced growth in terms of root length, wet/fresh weight and dry weight which can be comprehended by observing the graphs. Finally we can say that if Aerated Water is used for irrigation purposes in the fields then it would help us in raising the yield to a greater degree and also help us in having a rapid growth of the crops when compared to the crops grown/treated with normal water. Thus the method of aeration stands to become a promising one in having better yield of the crops.

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