

# Hydroponic

Alfadil Aboud Alfadil Hassan<sup>1</sup>; Obada Alnoor Abdulmutall<sup>1</sup>; Ibrahim Mustafa Abdalla<sup>1</sup>; Alsharanea Meaoiah Gsmalsed<sup>1</sup>; Anas Mohamad hamad ELneil Abd ELfrag<sup>2</sup>.

<sup>1</sup> College of Agricultural Science and Engineering, Sinner University, Sudan

<sup>2</sup> College of Mechanical Science and Engineering, Sinner University, Sudan

**Abstract:** *In the present situation, Sudan needs food security which entails that each and every people must have physical and economic access to safe and nutritious food to meet dietary needs. Where we have worked on the development of the agricultural system from traditional agriculture to the hydroponic system. With a view to overcoming soil problems that stand for some lands to produce adequately and reduce working hands and provide effort in soil. The experience hydroponic and traditional agriculture has been conducted in Al-Halawi Company for Integrated Solutions in Al Municipal Street in Khartoum. Where plant intensity and the number of leaves we found that the leaves grow more a comparison with traditional agriculture in stages(initial-flower-harvest). Because the Hydroponic system maintains small and large elements in the focus of the solution used. When measuring wet and dry weight of Tomatoes plants with Irrigation time intervals where he recorded a difference from the first month to the sixth month to different irrigation stages. Wet weight was less in the hydroponic system compared with traditional agriculture and achieved the main objective of research which reduces plant water consumption. Where we arrived in the productivity in the hydroponic system found 3000kg/month and 100 a day compared with Traditional agriculture 2000kg/ month and 66 kg/ day.*

**Keywords:** traditional agriculture; Irrigation; Hydroponic

## Introduction

The term (hydroponics) is derived from two Greek words i.e., “Hydro” and “Pones” means water and labor respectively . The first modern use of hydroponics was done by W.F. Gerick from the University of California during the 1930’s. In India, Hydroponics was introduced in year 1946 by an English scientist. He established a laboratory in Kalimpong area, West Bengal and had written a book on Hydroponics, named as ‘Hydroponics- The Bengal System(Bugbee 2019).Most hydroponics systems operate automatically to control the amount of water, nutrients and photoperiod based on the requirements of different plants (David R 2008). Various commercial and special crops can be grown using hydroponics including leafy vegetables, tomato, cucumber, pepper , strawberry and many more. Europe is considered the biggest market for hydroponics in which France, the Netherlands and Spain are the three top producers, followed by the United States of America and Asia-Pacific region(David R 2008). Due to the population explosion ,urbanization and industrialization, the cultivable land area is declining day by day. The conventional methods of crop production are also facing several challenges due to abnormal climatic behaviors (Asao 2012). So that, new and modern methods for growing sufficient food have to be evolved in order to feed the world’s growing population sustainably. Change in growing medium can be an alternative approach for sustainable crop production and conservation of quick depleting land and available water resources(Hussain Shah, Munir, and Hussain Shah 2011).That’s why this ‘hydroponics’ systems is becoming increasingly widespread over the world and according to the most recent report, it is.(Rodríguez-Delfín 2012) Through our preparation and development of this research, we address the expansion of the agricultural system in Sudan into two systems, from the traditional soil system to a modern system known as hydroponics to skip the problems of soil and increase yield. The objectives of this research are Developing the agricultural system in Sudan and overcoming the soil problems that stand on the inability of some lands to produce adequately. Reducing working hands and saving effort in the soil. Improving the quality of productive plants and reducing the spread of pests and insects that reduce production. Provide its appropriate environment for some vegetables that are not available with the properties of soil and produced by hydroponic.

## MATERIALS AND METHODS:

Tomato germination experience was conducted in Umm durman, where the plant was bound for seven days and samples were taken to determine the rate of germination, flowers and harvest to study plant qualities by hydroponics and compared to traditional agriculture Where the nutrient solution is used from A, B, and all of the tools and the following measurement devices.

### 3.1 Experimental site and climatic condition:

Hydroponic experience and Traditional agricultural were conducted in A protected house Area of 9\*40. Al - Halawi Company for Integrated Solutions in Al Municipal Street in Khartoum located Between the latitude 16 degrees north and display 15 degrees south and the length of 21 degrees west and 24 degrees eastward, and its area of 20736 km (12884 mph) is made between the West Bank for the Nile Blue River from two eastern and nine-Nile. At a height of 382 meters (1,253,28 feet) above the sea above the surface flat surface with a slight downturn towards the Nile River. The tropical rain drops, at a rate of more than 155 millimeters (6.1-inch) average, and from December and until February, where the temperature falls relatively. Temperatures fall in the morning

and even afternoon and after sunset. The temperature range during this period between 32 ° C (89.6 ° F) 28 ° C (82.4 Fahrenheit). In all cases, the temperatures in Khartoum landed at large rates at night, down from 15 ° C (59 Fahrenheit) in January and up to 6 ° C (42.8 degrees Fahrenheit) at the passage of an air front.

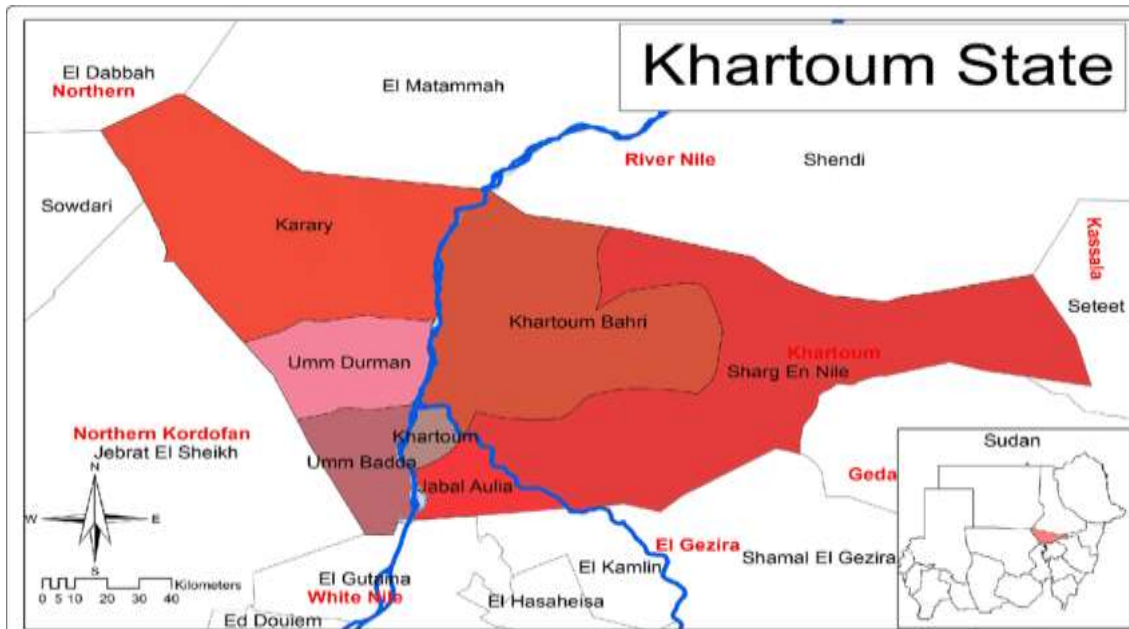


Fig 3.1 Experimental site and climatic condition.

**3.2 Components:**

Pipeline Plastic 6 Inches, Plastic Elbows, Pipe holder, Solution A and B, Tank solution, Water pump, Timer operation pump, Oxygen pump, Cups for Carried Saplings, Central agricultural

**3.3 Measurement devices:**

sensor, Meter, Micrometer

**3.4 prepare the solution:**

Mix the first solution in normal water and then add a B solution on the previous after adding any element mixed well in. the water before adding the other element must switch the tank water in case of unbelievable maximum installation and PH and the estimated duration of all the tank.

Table 3-1Ingredients the solution: -

Solution A	Solution B
Water(10L)	Water(10L)
Magnesium sulphate (MGSO)(400g)	Calcium nitrate (CANO3) (850g)
Potassium nitrate (KNO3) (400g)	EDTA FE (35g)
(12+12+36) NPK+TE (850g)	

**Result.**

Samples have been taken and the measurement of height of plant, the number of leaves, stem diameter, crop duration, wet weight, and then the production account and the water consumption rate at all stages of the plant (initial, flower and harvest). Agriculture leaves by season and classroom no data showed from1: 5 days because the beginning of germination of 7-9 days.

**4.1 Plant Height:**

Observation data of Tomatoes plant height at the age of 9-14 day showed no significant effect by administering Irrigation time interval Compared with traditional agriculture.

This is because the growth of plants or plants is influenced by several factors, namely nutrient ions or mineral salts absorbed by the leaves and photosynthesis

**Flower:** We found that the height of the plant in the flower phase for Hydroponic longer compared to traditional agriculture, this shows that the plant is growing naturally with the addition of small and major elements that led to the growth.

**Harvest:** At the advanced stages of the plant life (harvest) we found that the height of the plant is stable and longer in the hydroponic system compared with traditional agriculture because the plant has skipped soil constraints from the pests and insects that spread as many in Traditional agriculture.

**Table 4.1.** The plant height was found after 9-14 days of germination.

	Initial	Flower	Harvest
<b>Hydroponic</b>	80cm	145cm	357cm
<b>Traditional</b>	60cm	130cm	200cm

#### 4.2 Number of Leaves:

**Initial:** The beginning of plant growth and adoption of the hydroponic system on the focus of the solution used by the Show us results leaves are well go to achieve the search objectives compared with traditional agriculture. Where the results showed us that the number of leaves in the system of the Hydroponic more as many leads to preserving the plant to avoid system problems movement animals that reduce the number of leaves.

**Flower:** With the progress of plant growth and arrival to flowers we found that there is an increase in the number of leaves to the Hydroponic system which Ensures good growth and Maintain from the impact factors that are influencing plant, such as yellowing leaves Compared with traditional agriculture.

**Harvest:** When plant maturity is completed and arrived in the stage of harvest, we found that the plant grows well and gained small and large elements through the focus of the added solution explained that the system of hydroponic keeps the elements and prevents its waste and gives good leaves.

**Table 4.2.** The number of leaves is different with stages of plant growth

	Initial	Flower	Harvest
<b>Hydroponics</b>	25	68	120
<b>Traditional</b>	20	55	95

#### 4.3 Wet weight:

The wet weight of Tomatoes plants with Irrigation time intervals It was different when the samples taken from hydroponic and traditional agriculture where he recorded a difference from the first month to the sixth month to different irrigation stages.

**Initial:** We found the wet weight in aquatic agriculture is less than wet weight in traditional agriculture at stage initial of growth because water consumption in hydroponic is less than traditional agriculture and is considered one of the aims of the study.

**Flower:** After the arrival of the plant to the flower we have taken wet weight for hydroponic system and Traditional agriculture system and is clearly the results hydroponic that keep the quality of the plant of excess moisture that is sometimes considered the danger of the plant by spreading fungi.

**Harvest:** When the plant maturity is completed, we achieve the main target of your hydrotherapy system and is to reduce water consumption and control the irrigation process through the measurement weight which has been found in hydroponic system less than traditional agriculture.

**Table 4.3.** The Wet weight account for hydroponic comparison with the wet weight of traditional agriculture at all stages of growth.

	Initial	Flower	Harvest
<b>Hydroponics</b>	260 (g)	595 (g)	1690 (g)
<b>Traditional</b>	285 (g)	687 (g)	1850 (g)

#### 4.4 Dry Weight:

**Initial:** after taking the Dry weight tomato plant and a dry weight has found that dry weight is less than wet weight because there are factors that increase the weight of the most important weighted moisture and through the comparability of hydroponic and traditional agriculture found that dry weight.

**Flowers:** In the flowers found that the plant maintains a dry weight through a few water and save water consumption compared with traditional agriculture This is considered from a search objectives

**Harvest:** When the maturity of plant and dry weight measurement show us that the water agriculture is less weighing from traditional agriculture and the system skip all the problems that will reduce the yield with the retention of plant on all stages of growth.

**Table 4.4.** Dry weight account for hydroponic comparison with the Dry weight of traditional agriculture at all stages of growth

	Initial	Flower	Harvest
Hydroponics	86 (g)	190 (g)	563 (g)
Traditional	95 (g)	205 (g)	615 (g)

#### 4.5 Stem diameter:

The stem differs in all stages The growth, which affect the factors affecting on germination when plant acquires small and major elements more than vegetable and stem strength in the hydroponic system and traditional agriculture.

**Table 4.5.** Stem diameter account for hydroponic comparison with traditional agriculture.

	Initial	Flower	Harvest
Hydroponics	1cm	1.3cm	2cm
Traditional	1cm	1.5cm	2cm

#### 4.6 Yield:

The yield in Hydroponic was compared with traditional agriculture in production (daily, monthly and total), where he recorded the highest produced in the sixth month as a result of other factors, including the use of agricultural media (volcanic stone) and control of irrigation operations and salts and ph.

**Table 4.6.** Yield in hydroponic Compared with traditional agriculture in. Area 9\*40 for (today; month; total).

	Area	Day	Month	Yield Total
Hydroponics	9*40	100 (kg)	3000 (kg)	21000 (kg)
Traditional	9*40	66 (kg)	2000 (kg)	14000 (kg)

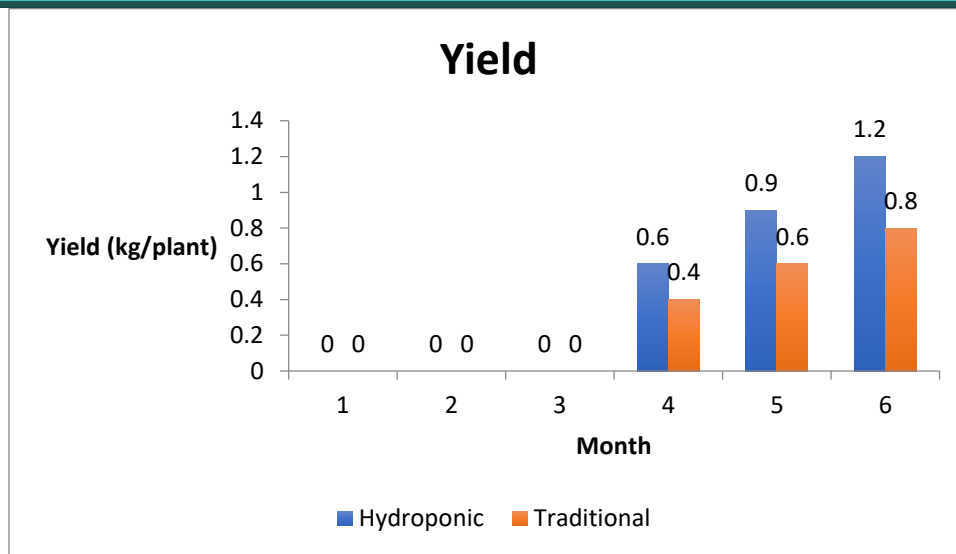


Fig 4.1. yield for plant tomato in hydroponic and traditional agriculture (kg/plant)

#### 4.6 Water Consumption:

The network of irrigation used is a drip irrigation where the Area used is 9 \* 40 in 2000 points in each plant 2 points, where water consumption in hydroponic is compared with traditional agriculture clearly at all stages of growth after water consumption is account It is one of aims of the study.

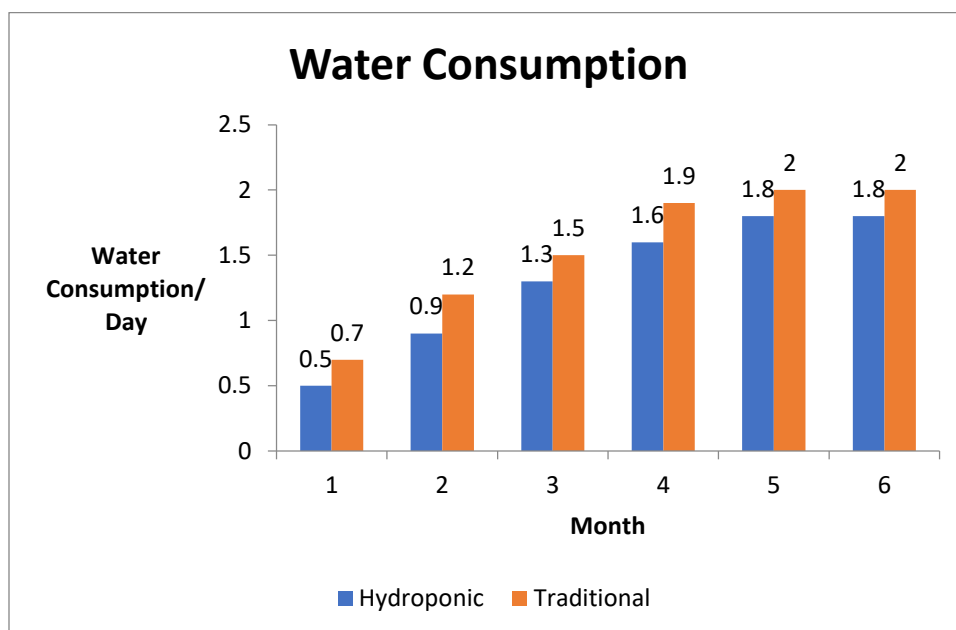


Fig 4.2. Water Consumption for plant tomato in hydroponic and traditional agriculture(L/day).

#### Discussion

As per the experimental setup, the seeds get germinated within one week of planting. Explained (EhsanTavakkoli 2010) hydroponic system helps to increase in the rate of growth of plants compared with the traditional rate of growth of plants in conventional farming This is matched through the results we are in (Table 4.6) and a table that illustrates an increase in the number of papers and plant density compared to traditional agriculture. Through what we have reached from The results of, the hydroponic system provides water consumption (fig.2) compared with traditional agriculture. He expressed (Environmental Science 2014) The

water content used is also reduced up-to 60 percent of the amount of water used in farming, as the system consists of re-circulating water from a fixed tank.

The results from the experiment In terms of producing the hydroponic system in agriculture (today and month) (200kg and 3000kg), respectively in 9 \* 40 area concur with other studies which reported that hydroponic can improve plant growth through access to optimal levels in the concentration of nutritious solution (Malauf and Breese 1977). Other studies have also shown that, increasing water temperature during cold season produced good growth result in the production of vegetables (Bender 2002).

### 6.1 Conclusion:

Through our study of this research our work to expand the system of agriculture in the Sudan from the traditional system to the modern system (Hydroponic) agriculture of tomato plants in the system (hydroponic and traditional agriculture) and to compare the two regimes and the conclusions of the results of each system and efficiency to overcome soil problems and the ability to yield good and acquire full knowledge until we ensure renaissance in agriculture and the creation of agricultural projects operating in hydroponic system. Through this study, the following results were reached: The hydroponic system depends on a total dependence on water recycling Does not lead to water stagnation and increased oxygen ratio and killed most fungi and algae. Maintain water temperatures between 10 to 30 to raise efficiency and avoid the height and low salts, acid and alkali. Water changes each period helps many reduce injuries and increase the efficiency of the solution. The agricultural course in the Hydroponic is very fast without breaks.

### Reference: -

- Bugbee, Bruce. 2019. "284 Towards Efficient Nutrient Management in Recirculating Hydroponic Culture." *HortScience* 34(3): 491C – 491.
- David R, Hershey. 2008. "Soluton Istory Culture Hydroponics: & Inexpensive Equipment." *the American Biology Teacher*, Volume 56, No. 2, February 1944 56(2): 111–18.
- Asao, Toshiki. 2012. *Hydroponics - A Standard Methodology for Plant Biological Researches* Hydroponics - A Standard Methodology for Plant Biological Researches.
- Hussain Shah, Abrar, Shams UL Munir, and Safdar Hussain Shah. 2011. "Evaluation of Two Nutrient Solutions for Growing Tomatoes in a Non-Circulating Hydroponics System." *Sarhad J. Agric* 27(274): 557–67. [http://www.aup.edu.pk/sj\\_pdf/EVALUATION\\_OF\\_TWO\\_NUTRIENT\\_SOLUTIONS\\_FOR\\_GROWING.PDF](http://www.aup.edu.pk/sj_pdf/EVALUATION_OF_TWO_NUTRIENT_SOLUTIONS_FOR_GROWING.PDF).
- Rodríguez-Delfin, A. 2012. "Advances of Hydroponics in Latin America." *Acta Horticulturae* 947: 23–32.
- Tavakkoli, E., Rengasamy, P. and McDonald, G.K., 2010. The response of barley to salinity stress differs between hydroponic and soil systems. *Functional Plant Biology*, 37(7), pp.621-633.
- Malouf, R.E. and Breese, W.P., 1977. Seasonal changes in the effects of temperature and water flow rate on the growth of juvenile Pacific oysters, *Crassostrea gigas* (Thunberg). *Aquaculture*, 12(1), pp.1-13.
- Shepherd, J. and Bender, G., 2002. A history of the avocado industry in California. *Calif Avocado Soc Yearb*, 85, pp.29-50.