Original Research Article

Effect of Saline Water Irrigation on Tomato Yield, Quality and Growth in Andhra Pradesh: A Comparative Study

ABSTRACT

Tomato (*Lycopersicon esculentum*) belonging to the family Solanaceae, is one of the most important, popular, nutritious, and palatable vegetables grown in Andhra Pradesh. It plays a vital role in providing a remarkable quantity of vitamin-A and vitamin-C in human diet. Tomato is cultivated all over Andhra Pradesh due to its adaptability to wide range of soil and climate. Saline water resources are abundant in the most areas of India. Most of these resources still have not been effectively utilized. The present investigation was conducted on the effects of saline water irrigation on tomato yield, quality and growth at the Research Farm, Department of Agricultural Engineering, Aditya Engineering College, Surampalem, East Godavari district, Andhra Pradesh. Saline water differing in Electrical Conductivity (EC) 6ds/m and 4ds/m was supplied to the plant after the seedling establishment. The objective of this work is to compare the effect of tomato crop under drip irrigation by three different treatments. First treatment is of fresh water under drip irrigation. Second treatment is of Nacl+water with an EC of 6ds/m under controlled irrigation in the ratio 2.5:7.5. Third treatment is of Nacl+water with an EC of 4ds/m under controlled irrigation in the ratio 1.5:8.5 of the tomato variety Pusa F1 hybrid is used for the experiment. Growth of crop includes plant height, number of fruits, number of leaves, fruit length, fruit diameter and fruit weight. The healthy growth that is 69.4cm plant height, 26 leaves per plant, 34 fruits per plant, 7.8 cm fruit length, 5.4 cm diameter of fruit and 89.4 g of average fruit weight and maximum score (4.86 out of 5) in organoleptic test were obtained in (T-1) i. e. drip irrigation. Although salinized tomato fruits were smaller than non-salinized control fruits, they have increased soluble solids, high sugar content, which all are highly requested qualities by the processing tomato industry. Current research concludes that the fresh water irrigation T-1 recorded the high water use efficiency and saline water irrigation treatments (T2&T3) having less water use efficiency may be due to the plants suffering with more soil moisture stress due to osmotic pressure build up by the saline water irrigation.

Key words: saline, Nacl, tomato, drip irrigation, EC and pH, treatments, organoleptic etc.

Introduction

Tomato (*lycopersicon esculenthummill*) is one of the most important vegetable plants in the world. It is originated in western South America and domestication is thought to have occurred in Central America. Because of its importance as food, tomato has been adopted to improve productivity, fruit quality, and resistance to biotic and abiotic stresses. Tomato has been widely used not only as food, but also as research material. It occupies an area of about 4.73 million hectares with a production of 163.96 million tonnes in the world. The total global area under tomato is 46.16 lakh ha and the global production is to the tune of 1279.93 lakh tonnes. It is the world's 3rd largest vegetable crop after potato and onion. The biggest producer of tomatoes in 2016 was china by far with more than 50 million tons harvested, followed by India, USA, Turkey, and Egypt. As it is a relatively short duration crop and gives a high yield, it is economically attractive and the area under cultivation is increasing daily.

Fresh water is a (very) limited resource in the world. Most of the water available for irrigation comes from aquifers and lakes. The total amount of fresh water from these two resources only accounts for less than 1% of the total water supply. So, if saline water can be used as a resource, this can greatly reduce the amount of fresh water used by agriculture and decrease water stress in many areas. If all the world's saline water would be used for irrigation, it could double the amount of available water for agriculture. At the same time, saline agriculture limits the damage caused by salinization by employing sustainable practices for agriculture and water management, and by making use of salt-tolerant crop varieties. If salt-affected soils are put back into production, 70-120 million hectares of new arable land can be saved, along with their natural ecosystem and the associated biodiversity.

Therefore, selection of best method of saline water irrigation is governed by two points:

1. To avoid salt accumulation at the upper layer and to enhance salt leaching to the deep layers.

2.To avoid disturbance of water absorption by roots and to maintain plant water status at acceptable level.

- Soil salinity is a major environmental constraint to crop production, effecting an estimated 45 million ha of irrigated land and is expected to increase due to global climate changes because of many irrigation practices.
- People have long believed that salt-affected land was unusable. But as a result of in-depth research and years of testing, a practical solution was found Saline agriculture.
- If salt-affected soils are put (back) into production, 70-120 million hectares of new arable land can be saved, along with their natural ecosystems and the associated biodiversity.
- As to the tomato crop, consider it as moderately sensitive to the effects of salts.
- Andhra pradesh is one of the major tomato producing state in the country of yield of 20114 kg/ha. A large volume is coming from the Kurnool, Chittoor and Prakasam districts.

Objectives

1. To find the effect of different levels of EC and pH of saline water on growth of tomato crop.

2. To compare the yield with normal irrigation water to saline water of tomato crop- under drip system.

MATERIALS AND METHODS

Experimental site

The experiment was conducted in the Department of Agricultural Engineering, Aditya Engineering College, Surampalem, East Godavari, Andhra Pradesh, India.

Experimental Details

Name of the crop: Tomato

Botanical name: *lycopersicon Esculentummill*

Family: Nightshade

Crop Variety: Pusa hybrid

Number of treatments: 3

Dimensional area of each plot: 9 m×4.5m

Row to Row & plant to plant spacing: 0.6×0.6m

Design of Experimental Field

The total area selected for experimental field is 121.5 m^2 and divided into three plots i.e.

T1-drip with Fresh Water

T2 -drip with Saline Water (EC 4ds/m)

T3 -drip with Saline Water (EC 6ds/m).

Methods

The field was thoroughly ploughed and divided into plots of 9m×4.5m. As per the requirement of the research, two tanks were installed in the field nearer to experimental plots at the head of 5m and connected to the separate sub lines to maintain two salinity levels. Laterals with 16 mm diameter are provided with the online emitters at a spacing of 60cm directly joined to the mainline having size of 50 mm through lateral take-off.

RESULTS

Plant height: The height was measured after 15 days from transplanting and followed with that interval

Chart 1 : Measurement of plant height

NO. OF DAYS	PLANT HEIGHT (in cm)		
	Treatment-1	Treatment-2	Treatment-3
After 15 days	10	6	8
After 30 days	20.5	13.2	16.5
After 45 days	38	26	30
After 60 days	49.2	35	41
After 75 days	56	42	48
After 90 days	69.4	50.8	56

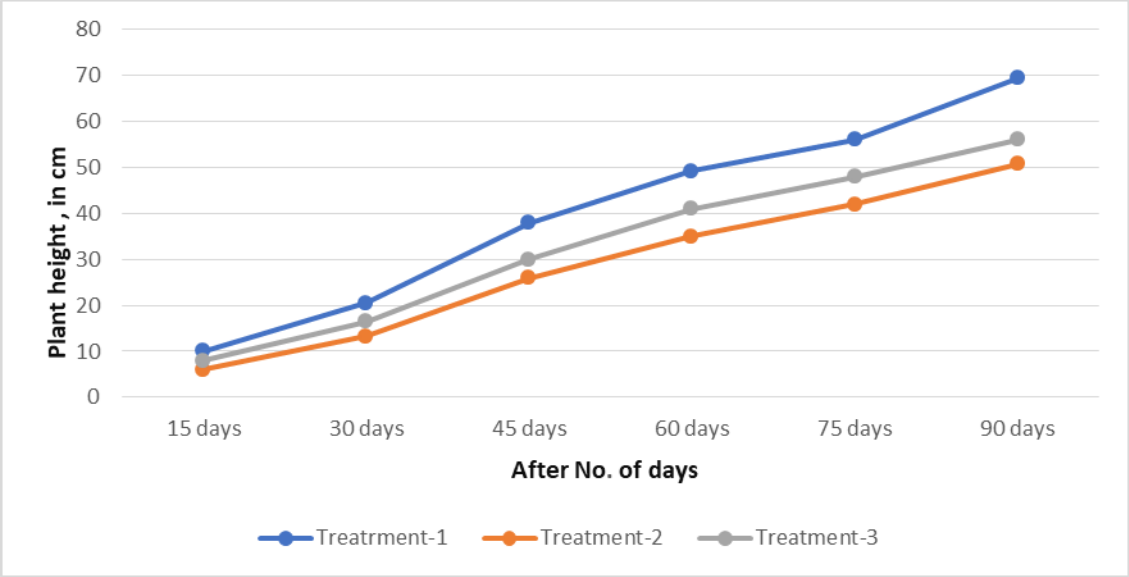


Fig 1: plant height (cm) of tomato as influenced by three different growing media.

Table 1.: The number of leaves per plant in two treatments at 15 days interval

NO. OF DAYS	NO. OF LEAVES PER PLANT		
	Treatment-1	Treatment-2	Treatment-3
After 15 days	4	3	4
After 30 days	7	5	6
After 45 days	12	10	12
After 60 days	15	13	14
After 75 days	20	16	18
After90 days	26	22	24

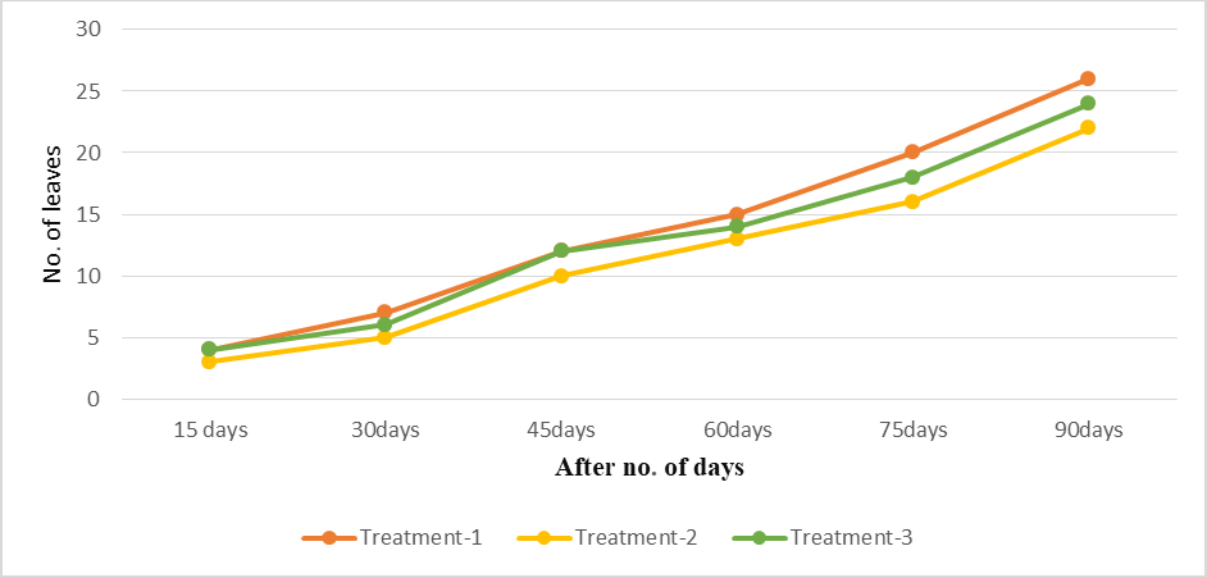


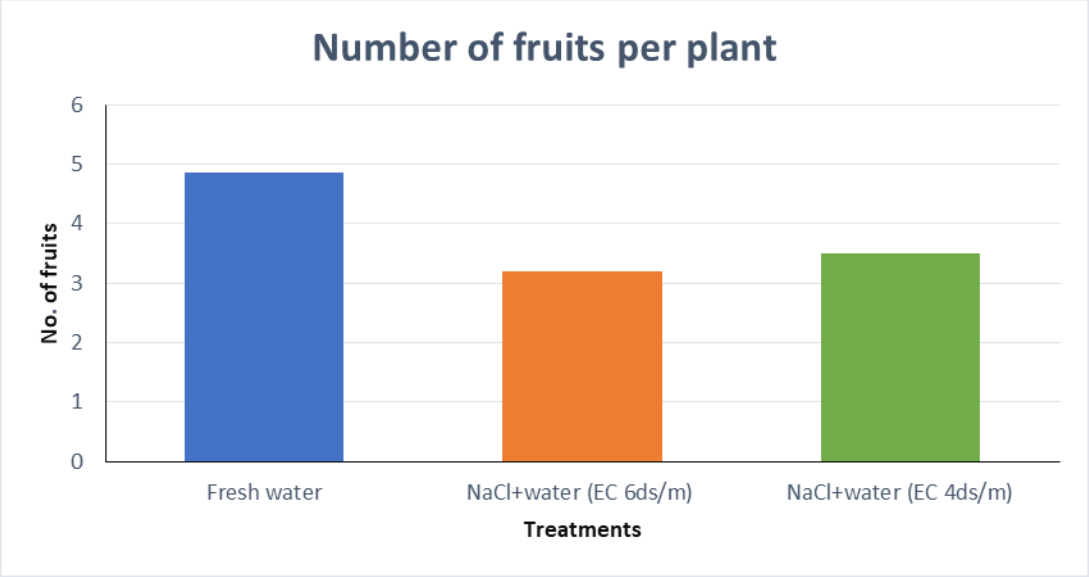
Fig: No 2. of leaves per plant as influenced by three different growing media.

Chart 2 : Observations of Fruit length (cm), Fruit diameter (cm), No. of Fruit per plant and Average fruit weight (g).

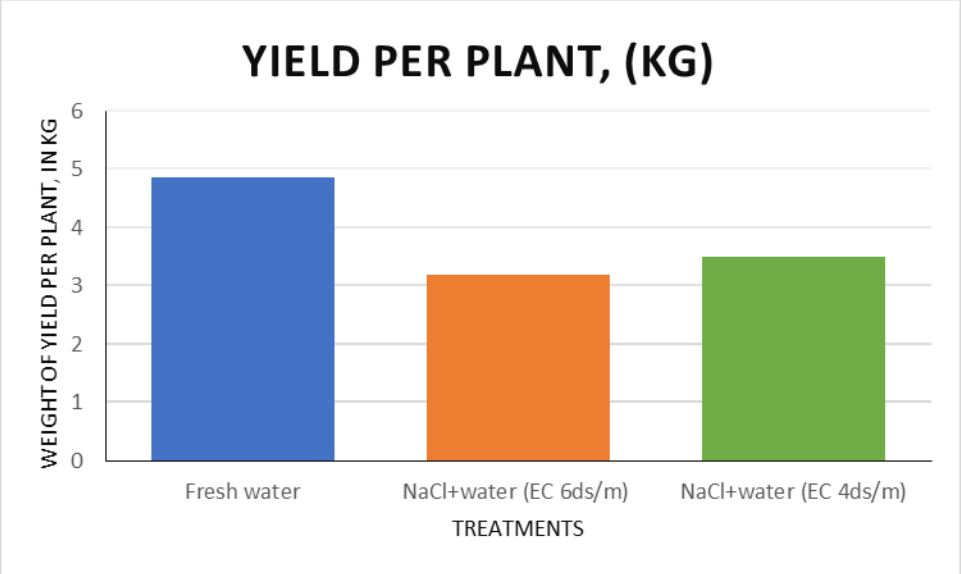
parameters	T1	T2	T3
Fruit length (cm)	7.8	5.9	6.4
Fruit diameter(cm)	5.4	3.7	4.2
*Average fruit weight (g)	89.4	48.2	67.5

Table 2: Observations recorded for number of fruits per plant, Yield per plant (kg)

Treatments	No. of fruits per plant	Yield per plant (kg)
Fresh water (T1)	32	3.78
Nacl+water (T2) (EC 6ds/m)	13	0.68
Nacl+ water (T3) (EC 4ds/m)	24	2.12



Picture 1 : Bar graph showing yield of fruits per plant with various treatments



Picture 2 : Bar graph showing yield per plant with various treatments

CONCLUSIONS

- Current research concludes that the fresh water irrigation T1 recorded the high water use efficiency and the saline water irrigation treatments (T2&T3) having less water use efficiency may be due to the plants suffering with more soil moisture stress due to osmotic pressure build up by the saline water irrigation.

REFERENCES

- Gawad G. A., Arslan A., Gaihbe A., & Kadouri, F. (2005). The effects of saline irrigation water management and salt tolerant tomato varieties on sustainable production of tomato in Syria. *Agricultural Water Management, 78(1-2), 39-53.*

- Maggio, A., De Pascale, S., Angelino, G., Ruggiero, C., & Barbieri, G. (2017). Physiological response of tomato to saline irrigation in long-term salinized soils. *European Journal of Agronomy, 21(2), 149-159.*

PHOTOS RELATED TO RESEARCH

Fig 3. T1

Fig 4 . T2

Fig 5. T3

Fig. 3-5. Field experiment