Environment and Ecology 39 (1A) : 188—191, January—March 2021
ISSN 0970-0420

Effect of Different EC (dS m^{-1}) Levels on Yield of Tomato

G. Sridevi

Received 29 August 2020, Accepted 2 December 2020, Published on 9 January 2021

ABSTRACT

Soil and water salinity is one of the major problems in the world for agricultural production. Tomato is one of the ten most important fruit and vegetables consumed in the world, with approximately one hundred million tonnes of fresh tomato fruit being produced worldwide every year. This research was conducted to determine the different evels of EC dS m^{-1} in irrigation water collected from Central Farm well water and Bore well water of Agricultural College and Research Institute, Madurai and Periyar Vaigai Command water in the year 2018 were evaluated based on their growth and yield of tomato (PKM 1). The results indicated that there was consistent decrease in yield with increase in salt concentration in saline irrigation water and yield and it was found that the maximum salinity tolerance is 2 dS m^{-1}.

Keywords: Tomato, Salinity, Irrigation water, Potassium chloride, Sodium chloride.

Dr. G. Sridevi
Assistant Professor (SS & AC)
Department of Soil Science and Agricultural Chemsitry,
Tamil Nadu Agricultural University, Coimbatore 641003, India
Email: smathareddy @ gmail.com

INTRODUCTION

Seventy percent of the earth surface is covered with water, which amounts to 1400 million cubic kilometers (m km^3). However, 97.5% of this water being sea water, it is salty. Fresh water availability is only 35 m km^3. Out of the total fresh water, 68.7% is frozen in ice caps, 30% is stored underground and only 0.3% water is available on the surface of the earth. Out of the surface water, 87% is stored in lakes, 11% in swamp and 2% in rivers. As all the sweet water is not extractable, only 1% of the total water can be used by human beings.

As water was available in plenty, it was considered as a free resource since generations. However, with growing demand for water and depletion of the available water, assured supply of good quality water is becoming a growing concern. As the water resources are not evenly distributed, across different continents, some countries have surplus water while many other countries are facing scarcity of water. Likewise, there is skewed growth of population in different continents, resulting in a wide mis-match between the existing population and water availability. Among various continents, Asia has 36% of the available fresh water reserves, with over 60% of the world population where water is a scarce commodity.

Salt stress affects some major processes such as germination, speed of germination, root/shoot dry weight and Na^+/K^+ ratio in root and shoot (Huang *et al.* 2012). Salinity tolerance is critical during the life cycle of any species. The maximum soil salinity tolerated by tomato, with basis on electrical conductivity of the saturation extract is 2.5 dS m-^{1}.

However, in general the effect of increase in salinity on the tomato will be harmful, since, it reduces the yield and increasing the incidence of blossom - end rot, even though there is increase in quality. As mentioned earlier, fresh water being a scarce resource use of low quality water for irrigation is gaining importance nowadays. However, the use of low quality water for irrigation to food crops immediately raises concerns in consumers and authorities administering food quality and health. Hence by considering the above points, the present project is proposed to determine the salinity level of irrigation water as well as its effect on the yield of tomato and also optimize the EC level and improve the tomato yield and quality under salinity stress condition.

MATERIALS AND METHODS

Three salts were taken to create artificial EC levels of (1 dS/m, 2 dS/m and 3.0 dS/m) with different irrigation water source were used for this study . Pot culture experiment was conducted to study the effect of different salinity and levels (1, 2 and 3 dS m^{-1}) with the tomato as the test crop . Treatment structure adopted was as fallows.

Treatments

T_1-1 dS m^{-1} (Potassium Chloride), T_2-1 dS m^{-1} ($MgSO_4$), T_3-1 dS m^{-1} (Sodium Chloride), T_4-2 d S m^{-1} (Potassium Chloride),T_5-2 dS m^{-1} ($MgSO_4$),T_6-dS m^{-1} (Sodium Chloride),T_7-3 dS m^{-1} (Potassium Chloride), T_8 3 dS m^{-1} ($MgSO_4$), T_9- dS m^{-1} (Sodium Chloride), T_{10}- Control.

Table 1. Initial soil physico-chemical properties.

Parameter	Unit	Value	Interpretation
pH	-	7.12	Neutral
EC	dSm^{-1}	0.10	Normal
Available Nitrogen	kg ha^{-1}	242	Low
Available Phosphorus	kg ha^{-1}	50	High
Available Potassium	kg ha^{-1}	524	High
Organic Carbon	g kg^{-1}	12.0	High
Available Iron	ppm	0.77	Deficient
Available Manganese	ppm	0.54	Deficient
Available Zinc	ppm	0.02	Deficient
Available Copper	ppm	0.15	Deficient

RESULTS AND DISCUSSION

Pot culture experiment soil samples were collected from Central farm (A block), Agricultural College and Research Institute, Madurai. The initial soil properties of A block were analyzed.The pH of the A block soil samples is neutral in reaction (7.12), Electrical conductivity is in normal range (0.10 dSm^{-1}).The available nitrogen is low in nutrient status (242 kg ha^{-1}), phosphorus and Potassium is in high (50 and 524 kg ha^{-1}). Similarly micronutrients are in deficient condition (Table 1).

Effect of different EC levels on growth parameters

From the experiment results observed tt harvest stage

Table 2. Influence of salinity levels on plant growth parameters at harvest stage of tomato (PKM 1).

Salt added (g)	Height of plants (cm)	Girth of plants (mm)	Number of Branches	Number of lateral branches
T_1-1 dS m^{-1} (Potassium chloride)	11.5	2.41	9	5.5
T_2-1 dS m^{-1} ($MgSO_4$)	10.5	2.86	8	4.6
T_3-1 dS m^{-1} (Sodium Chloride)	9.4	2.56	8	5.0
T_4-2 dS m^{-1}(Potassium Chloride)	9.2	2.21	9	4.5
T_5-2 dS m^{-1} ($MgSO_4$)	8.5	1.85	6	4.0
T_6- 2 dS m^{-1} (Sodium Chloride)	8.3	1.96	6	4.2
T_7- 3 dS m^{-1} (Potassium Chloride)	7.0	1.92	5	4.0
T_8 - 3 dS m^{-1} ($MgSO_4$)	6.8	1.78	5	3.5
T_9- 3 dS m^{-1} (Sodium Chloride)	6.5	1.89	4	3.0
T_{10}-Control	12.0	2.00	10	9.0
SEd	0.89	NS	0.11	0.23
CD (p=0.05)	1.82		0.29	0.47

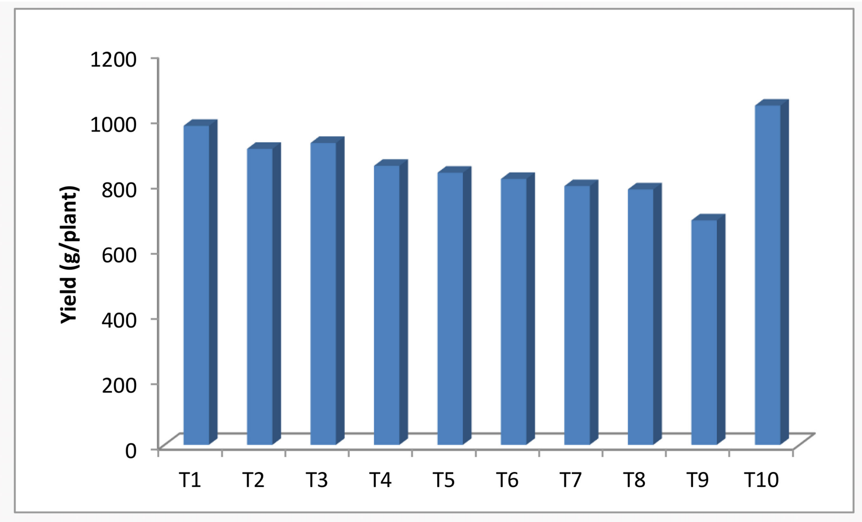

Fig. 1. Influence of salinity levels on yield of tomato.

(Table 2) the plant height wash highest in the treatment T_{10}- Control (12 cm) when compared to other treatment and the lowest plant height was recorded in treatment T_9 (3 dS m^{-1} + Sodium Chloride) (6.5 cm). The reason might be due to higher concentrations of electrolytes released in the soi. High salinity of more than 1 dS m^{-1} would be determinal to sensitive crop of tomato. Unfavorable salinity levels might affect water transport, nutrient absorption and results in reduced plant height.

Table 3. Influence of salinity levels on dry matter yield at critical stages of tomato (g $plant^{-1}$).

Salt added (g)	Dry matter of plant shoot (haulms) (g $plant^{-1}$) Vegetative stage	Flowering stage	Hervest stage
T_1-1 dS m^{-1} (Potassium Chloride)	5.6	26.5	51.6
T_2-1 dS m^{-1}($MgSO_4$)	5.5	24.3	50.5
T_3-1 dS m^{-1} (Sodium Chloride)	4.8	23.8	49.5
T_4-2 dS m^{-1} (Potassium Chloride)	4.7	22.5	45.3
T_5-2 dS m^{-1} ($MgSO_4$)	4.6	21.7	44.4
T_6- 2 dS m^{-1} (Sodium Chloride)	3.9	21.5	39.3
T_7-3 dS m^{-1} (Potassium Chloride)	3.7	21.6	35.6
T_8 -3 dS m^{-1} ($MgSO_4$)	3.6	21.3	29.8
T_9- 3 dS m^{-1} (Sodium Chloride)	3.1	24.8	27.5
T_{10}-Control	6.5	29.5	53.3
SEd	0.08	0.85	1.93
CD (p=0.05)	0.17	1.72	3.88

Similar trend was observed in girth of the plants and number of branches and lateral branches of tomato.

Influence of salinity levels on yield of tomato

The results revealed that different salinity levels, had significantly influenced the growth and yield attributes of tomato (Fig.1). Salinity significantly impedes plant growth, leading to a decrease in crop yield and quality. This occurs due to two mechanisms: Osmotic stress and ion toxicity. Osmotic stress occurs because saline soils have high osmotic potential, so plants which grow in saline soils have difficulty taking up water, resulting in low cell turgor and slow shoot growth (Zhai *et al.* 2015, Bustomi Rosadi *et al.* 2014). Ion toxicity occurs because saline water moves up the transpiration stream, causing Na+ and Cl- to accumulate in leaf tissue. Soil salinity imposes ion toxicity, osmotic stress, nutrient (N, Ca, K, P, Fe, Zn) deficiency and oxidative stress on plants and thus limits water uptake from soil. Soil salinity significantly reduces plant phosphorus (P) uptake because phosphate ions precipitate with Ca ions.

Some elements, such as sodium, chlorine and boron, have specific toxic effects on plants. Excessive accumulation of sodium in cell walls can rapidly lead to osmotic stress and cell death. Plants sensitive to these elements may be affected at relatively low salt concentrations if the soil contains enough of the toxic element. Because many salts are also plant nutrients, high salt levels in the soil can upset the nutrient balance in the plant or interfere with the uptake of some nutrients. Salinity also affects photosynthesis mainly through a reduction in leaf area, chlorophyll content and stomatal conductance and to a lesser extent through a decrease in photosystem II efficiency (Etissa *et al*. 2014). With respect to this experiment also, it was evident and had impacted the growth and yield of tomato.

Dry matter yield at critical stages of tomato (g plant^{-1})

From the results it was observed that there was significant influence of salinity levels in dry matter production per plant (Table 3) at vegetative stage, flowering stage and harvest stage. At harvest stage, DMP ranged from 27.5 g plant^{-1} to 53.3 g plant^{-1}. It was also evident the dry matter production showed declining trend in Higher EC levels (T_9- 3 dS m^{-1}+ Sodium Chloride) when compared to control.

CONCLUSION

The following conclusions may be drawn from the research various salinity levels were tested along with the Periyar Vaigai command water and its effect on crop growth and yield of tomato crop. The results showed that salinity levels significantly influence the tomato growth and yield and it was found that the maximum salinity tolerance is 2 dS m^{-1}.

REFERENCES

Bustomi Rosadi R, Masateru Senge A, Diding Suhandy, Ahmad us (2014) The effect of EC levels of nutrient solution on the growth, yield and quality of tomatoes *(Solanum lycopersicum*) under the hydroponic system. J Agric Engg. Biotechnol 2 (1) : 7—12.

Etissa E, Dechassa N, Alamirew T, Alemayehu Y, Dessalegne L (2014) Response of fruit quality of tomato grown under varying inorganic N and P fertilizer rates under furrow irrigated and rain fed production conditions. I*nt J Develop Sustain* 3 : 371—387.

Huang CH, Zong L, Buonanno M, Xue X, Wang T (2012) Impact of saline water irrigation on yield and quality of melon (Cucumis melo cv Huanghemi) in Northwest China. Europ J Agron 43: 68—76.

Zhai Y, Yang Q, Hou M (2015) The Effects of Saline Water Drip Irrigation on Tomato Yield, Quality and Blossom-End Rot Incidence-A 3a Case Study in the South of China. *PLoS ONE* 10: 1-17.