Effect of Various Concentrations of Sodium Salt (Na_2SO_4) On *Trianthema portulacastrum* L

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Abstract*: The most important land problems caused by means of the soil salinity. This are the serious problem which caused by accumulation of different salt by soils. Todays in India and other major countries faces these new problem and hard against these problem. The different activities of humans and urbanization is the main reasoned to increase these salt wastages. The survival of halophytic plant species in nature depends upon its ability to reproduce under salt stressed condition. There are not any locations in the world where plants are without environmental stress. The significance of discovering mechanisms of adaptation is great. Result from research on the physiology of plants under stress have important ramification for all fields related to crops or agriculture. Tolerance occurs when a plant under stress is able to maintain high metabolic activity similar to that attained under optimum natural condition. Spread across the landscape in relatively small patches is region with unusually high soil salt content. In these saline patches, the diversity of plants and productivity of communities are reduced compared with similar ecosystem that has lower concentration of salt in the soil. As a result of the reduced productivity in these sites and the salinization of agricultural soils, scientists have been studying the impacts of salinity on plants for many decades. The ions involved in creating saline condition can be diverse i.e. Sodium, Calcium, Potassium, Sulphate, Chloride etc. and may contain toxic levels of boron or selenium. The combined effect of these specific ions can reduce synergistic or antagonistic responses in plants. Salt stress is one of the major abiotic stresses limiting crop production especially in arid and semi-arid regions. It is reported that about 7 % of the total earths land and 20 % of the total arable area are affected by high salt contents. Reclamation of salt affected soils is necessary as the salt is engulfing the cultivable land day by day. In this paper, we have focused on the causes and effects of salinity on crop plants and possible mechanisms of salt tolerance including the possible use of *Trianthema* in conferring salt tolerance.

***Keywords*: *Trianthema portulacastrum* L, Salinity, Sodium salt Halophytes, Tolerance**

INTRODUCTION

The salt concentration enhances in soils that because of heavy irrigation and poor percolation, particularly in arid regions. Agricultural management plans that involve repeated cycles of water use and lying fallow in the summer further accumulates soil salinity. Although these programs result in increased salinity and dramatically reduce crop productivity and yield (Ashraf 1994), they are necessary due to the marginal nature of the land in use. The countries most affected by agronomic salinization are often those that have a critical need for agricultural products and a relatively small proportion of arable land. The development of new cultivars or the selection of new species with salt tolerance is important for solving this problem. Therefore, understanding the mechanism by which native plants have adapted to saline environments, discovering the genes that determines those mechanisms, and transferring the genetic traits into agricultural crops are goals of many research labs around the world. Baramati with 1, 38,248 hectors total area is located on Eastern region of Pune district. Out of this total area, nearly 70% area is used for the agricultural practices. River water is the main source of agricultural practices as this tehsil comes under rain shadow areas. Neera is the river on which "Veer dam" is constructed. The water from dam is used by different areas of Baramati through canal irrigation system which support the crop rotation.Agricultural Land of Neera River becomes salt affected because of growing monotype cropping system and use of harmful chemicals factors i.e. chemical fertilizer and irrigation water. Salinity reduces seed germination percentage, reduce development and decrease plant growth and finally yield of plants (Greenway and Munns 1980). Germination is important physiological process because of no germination then no establishment of any seed producing plant. The halophytic plant seeds have potential to germinate under salt stress condition. The ability of halophytic seeds to germinate at high salt concentration is important for survival and preservation of species. Plants growing in arid and semi-arid regions are facing salinity stress which severely reduce growth and yield (Shannon 1988).

About study plant:

The common name of *Trianthema portulacastrum* L. is horse purslane, black pigweed, and giant pigweed. It is native to areas of several continents, including Africa and north and south America, and present as an introduced species in many other areas. It grows in wide variety of habitats types and it can easily take hold in disturbed areas and cultivated land as a weed. Desert horse purslane is a weed found throughout the tropical and subtropical countries. It occurs in wastelands, roadsides, lawns, gardens cultivated crops, and in paddy fields if the water supply is low. It is green to red in colour, hairless except for small lines of hairs near the leaves, and fleshy. The leaves have small round or oval blades up to 4 centimetres long borne on short petioles. Solitary flowers occur in leaf axils. The flowers lack petals but has purple, petal like sepals. The fruit is curved, cylindrical capsule emerging from the stem. It is up to half a centimetre long and has two erect, pointed wings on top, where the capsule open.***Trianthema portulacastrum*** is a species of flowering plant in the ice plant family known by the common names **desert horse purslane**, **black pigweed**, and **giant pigweed**. It is native to areas of several continents, including Africa and North and South America, and present

as an introduced species in many other areas. It grows in a wide variety of habitat types and it can easily take hold in disturbed areas and cultivated land as a weed. It is an annual herb forming a prostrate mat or clump with stems up to a meter long. It is green to red in color, hairless except for small lines of hairs near the leaves, and fleshy. The leaves have small round or oval blades up to 4 centimeters long borne on short petioles. Solitary flowers occur in leaf axils. The flower lacks petals but has purple, petal like sepals. The fruit is a curved, cylindrical capsule emerging from the stem. It is up to half a centimeter long and has two erect, pointed wings on top, where the capsule opens. Seed dispersal occurs in a number of ways. One seed may be carried on the detached cap of the fruit, which floats on water. Other seeds may fall out of the remaining part of the fruit or remain on the plant after it dies and withers, reporting the following season. The present study was under taken to investigate the effect of sulphate salt on the internal parameters like Protein, Proline, Carbohydrates, **and** macronutrient analysis of *Trianthema portulacastrum* L. growing at Baramati, and nearer **villages** in Baramati Taluka (**M. S** India **).**

External Appearance of Plant (Photograph: Baramati area)

MATERIALS AND METHODS

Plant material

Healthy plantlets of *Trianthema portulacastrum* L. Collected from college campus were potted and raised in pots under controlled greenhouse conditions at Kavivarya Moropant Botanical Garden of Post Graduate Research Centre of Department of Botany, Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati for 17 days.

Stress Treatment

The plants were treated with Control (tap water), 0.5% and 1% concentrations of Na_2SO_4 salt for 17 days. Treatment was given continuously each day and accordingly by checking the accumulation of salt in the pots it was given by alternate days. The loss of water from the pots was also checked. After 17days of treatment the plants were uprooted from the pots and taken for further analysis.

Treatment of to Na_2SO_4 to *Trianthema portulacastrum* L. plant

Weighing of biomass: The biomass i.e. fresh weight and dry weight was calculated accordingly of plants used as Control, 0.5% treated plants and 1% treated plants. The plants were dried and powdered form was used for analysis of organic and inorganic compounds.

Estimation of proteins:

The plants were raised in 0.5% and 1% concentrations of Na_2SO_4 salt for 17 days and collected and the seedlings were dried and powder form of *Trianthema portulacastrum* L. were used for estimation of proteins separated and compared with control. The proteins present in the *Trianthema portulacastrum* L. was estimated by Lowery's method (1951) of protein estimation. The plant powder was weigh 0.5gm, homogenized with mortar and pestle in 10ml phosphate buffer. Further it was centrifuged and collected supernatant was stored in ice bath. Standard proteins of 0.1ml, 0.2ml, 0.3ml, 0.4ml and 0.5ml in different test tubes and 0.1ml of plant powdered material in separate test tubes was taken. Final volume was adjusted (i.e. 1ml) with the distilled water. Blank was prepared with 1ml distilled water. 50 ml reagent C (i.e. reagent A 49ml with reagent B 1ml) was added including blank and allowed to stand for 10min. Then, 0.5ml Folin- Ciocalteou reagent D was added and shakes. Kept for incubation for 10 min. Read absorbance at 660 nm spectrophotometrically.

Estimation of Carbohydrates:

The plants were raised in 0.5% and 1% concentrations of Na_2SO_4 salt for 17 days and collected and the seedlings were dried and powder form of *Trianthema portulacastrum* L. were used for estimation of carbohydrates separated and compared with control. 0.5gm plant powder used was hydrolyzed by keeping it in boiling water bath for 3hrs with 5ml of 2.5N HCl and cooled at room temperature. It was neutralized with solid Sodium Carbonate ($NaCO_3$) until effervescences observed. 100ml in 2.5N HCl volume was made and centrifuged. Supernatant was collected and 0.1ml of aliquant was analyzed. 0.1ml, 0.2ml, 0.3ml, 0.4ml and 0.5ml of standard glucose was pipetted out in the test tubes according to series. 1ml of final volume was made using distilled water. 4ml of Anthrone reagent in each test tube was added. Heated for 8min in boiling water bath and cooled rapidly. Read absorbance at 630nm. Calculated amount of total carbohydrates were present in the sample solution.

Estimation of Total Free Amino Acids:

The plants were raised in 0.5% and 1% concentrations of sa Na_2SO_4lt for 17 days and collected and the seedlings were dried and powder form of *Trianthema portulacastrum* L. were used for estimation of total free amino acids separated and compared with control. Total free amino acids have been estimated by method of Moore and Stein (1948). 0.5gm of powdered plant material was homogenized in 10ml of 80% ethanol with the help of mortar and pestle and was centrifuged at 15000rpm for 15min. The residue was re- extracted with 10ml of 80% ethanol and centrifuged. Supernatant was collected and used for quantitative estimation of total free amino acids. 0.1ml, 0.2ml, 0.3ml, 0.4ml and 0.5ml of working standard proline were pipetted out in the test tubes according to series. 1ml of Ninhydrine reagent was added. 2ml final volume was made with distilled water. Tubes were heated in boiling water bath for 20min. 5ml diluents solvent (equal vol. of water and n-propanol) was added in each test tube. Added contents were mixed well and after 15min purple colour was developed. Absorbance was read at 570nm. Total free amino acids were calculated present in the sample.

Estimation of Mg^{2+} and Ca^{2+}:

The plants were raised in 0.5% and 1% concentrations of Na_2SO_4 salt for 17 days and collected and the seedlings were dried and powder form of *Trianthema portulacastrum*L. were used for estimation of Mg^{2+} and Ca^{2-}separated and compared with control. The estimation of Mg^{2+} and $Ca^{2-}$by Double acid digestion followed by quantitative analysis with the help of AAS (Atomic Absorption Spectrometer)

Estimation of Na^+ and K^+:

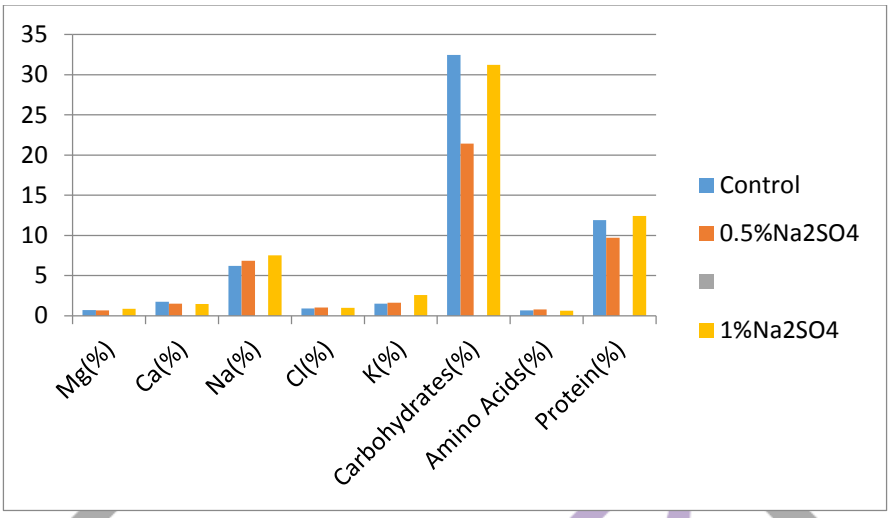
The plants were raised in 0.5% and 1% concentrations of Na_2SO_4 salt for 17 days and collected and the seedlings were dried and powder form of *Trianthema portulacastrum*L. were used for estimation of Na^+ and K^+ separated and compared with control. The estimation of Na^+ and K^+ by Double acid digestion was followed by quantitative analysis with the help of Flame photometric method.

Estimation of Cl^- :

The plants were raised in control, 0.5% and 1% concentrations o Na_2SO_4 salt for 17 days and collected and the seedlings were dried and powder form of *Trianthema portulacastrum* L. were used for estimation of Cl^- separated and compared with control. Estimation of Cl^- by Mohr's carried out by Titration method.

Sample	Mg (%)	Ca (%)	Na (%)	Cl (%)	K (%)	Carbohydrates (%)	Amino Acids (%)	Protein(%)
Control	0.71	1.72	6.20	0.89	1.52	32.45	0.67	11.89
0.5%Na2SO4	0.67	1.52	6.84	1.04	1.64	21.43	0.78	9.71
1%Na2SO4	0.87	1.47	7.52	0.97	2.58	31.22	0.61	12.44

Table: *Trianthema* spp- Plant Analysis Report



Graphical Representation Of *Trianthema* Plant Analysis Report.

RESULT AND DISCUSSION

Effect of salt stress on growth of plant is the fundamental key for characterization. The effect of salt on growth and development of *Trianthema portulacastrum* L. is given in Table 1. It is interesting to note observations recorded for fresh weight, dry weight, dry matter percentage, moisture percentage of plants grown in control and Na_2SO_4 are presented in Table 1.

Fresh weight:

The data of fresh weight in *Trianthema portulacastrum* L. showed that the fresh weight of plants grown in non-saline and saline conditions varied between 7.5 to 13.36gm. It was furthermore noticed that fresh weight of plants decreases in response to Na_2SO_4 concentrations however, fresh weight was greater in plants raised in non-saline conditions. Thus, the fresh weight was adversely affected in high concentration of. Na_2SO_4

Dry weight:

The data of dry weight in *Trianthema portulacastrum* L. observed that the dry weight of plants grown in non-saline and saline conditions varied between 3.7 to 4.4gm. It was furthermore noticed that dry weight of plants decreases in response to c Na_2SO_4 concentrations however, dry weight was greater in plants raised in non- saline conditions. Thus, the dry weight was adversely affected in high concentration of. Na_2SO_4

Dry matter percentage:

The data of dry matter percentage in *Trianthema portulacastrum* L. observed that the dry matter percentage of plants grown in non-saline and saline conditions varied between 49.33 to 32.93 percentage. It was furthermore noticed that dry matter percentage of plants increases in response to Na_2SO_4 concentrations however, dry matter percentage was less in plants raised in control conditions than those plants raised in saline conditions.

Moisture percentage:

The data of moisture percentage in *Trianthema portulacastrum* L. observed that the moisture percentage of plants grown in non-saline and saline conditions varied between 50.66 to 67.06 percentage. It was furthermore noticed that moisture percentage of plants decreases with increase in Na_2SO_4 concentrations however, moisture percentage was greater in plants raised in non-saline conditions than those plants raised in saline conditions.

Organic compounds:

Carbohydrates:

The data of carbohydrates content in *Trianthema portulacastrum* L. shown in Fig. 1 through which it was observed that the carbohydrates content of plants grown in non-saline and saline conditions varied between 32.45 to 21.43 percentage. It was furthermore noticed that the carbohydrates content of plants increases in response to concentration however, carbohydrates accumulation was less in plants grown in non-saline conditions than those plants grown in saline conditions. Thus, the carbohydrates accumulation showed positive response to salinity conditions.

Proteins:

The data of carbohydrates content in *Trianthema portulacastrum* L. shown in table through which it was observed that the proteins content of plants grown in non-saline and saline conditions varied between 9.71 to 9.81 percentage. It was furthermore noticed that the proteins content of plants increases in response to Na_2SO_4 concentration however, proteins accumulation was less in plants grown in non-saline conditions than those plants grown in saline conditions. Thus, the proteins accumulation showed positive response to salinity conditions.

Amino acids:

The data of amino acids content in *Trianthema portulacastrum* L. shown in Fig. 2 through which it was observed that amino acids content of plants grown in non-saline and saline conditions varied between 0.78 to 0.61%. It was furthermore noticed that the amino acids content of plants increases in 0.5% Na_2SO_4 concentration and decreased in 1% Na_2SO_4 concentration.

Inorganic osmolytes :

Observations recorded for Ca^{2+}, Mg^{2+}, Na^+, K^+ and Cl^- percentage of plants grown in control and Na_2SO_4 are presented as follows:

Calcium (Ca^{2+}):

The data of Ca^{2+} accumulation in *Trianthema portulacastrum* L. shown in table through which it was observed that Ca^{2+} percentage of plants grown in non-saline and saline conditions increases in response to Na_2SO_4 concentration however, Ca^{2+} percentage was less in plants grown in non-saline conditions than those plants raised in saline conditions.

Magnesium (Mg^{2+}):

The data of Mg^{2+} in *Trianthema portulacastrum* L. shown in table through which it was observed that Mg^{2+} percentage of plants grown in non-saline and saline conditions decreases in response to Na_2SO_4 concentration however, Mg^{2+} percentage was increased in 0.5% Na_2SO_4 concentration and decreases in 1% c Na_2SO_4 oncentration.

Sodium (Na^+):

The data of Na^+ in *Trianthema portulacastrum* L. shown in table through which it was observed that Na^+ percentage of plants grown in non-saline and saline conditions increases in response to Na_2SO_4 concentration however, Na^+ percentage was less in plants grown in non-saline conditions than those plants raised in saline conditions.

Potassium (K^+):

The data of K^+ in *Trianthema portulacastrum* L shown in table through which it was observed that K^+ percentage of plants grown in non-saline and saline conditions increased in 0.5% Na_2SO_4 concentration and decreased in 1% Na_2SO_4 concentration.

Chloride (Cl^-):

The data of Cl^- in *Trianthema portulacastrum* L. shown in table through which it was observed that K^+ percentage of plants grown in non-saline and saline conditions increases with increase in Na_2SO_4 concentration. Thus, there was a positive response to saline conditions.

Summary and Conclusions

Trianthema portulacastrum L. are sensitive to salinity. Species distribution and survival of plant species in nature depend on the seed ability to complete germination under high salt concentration. Sulphide salts especially Na2SO4 are more inhibitory than sulphate salts. *Trianthema portulacastrum* do not show more effect of salt during exposure to high concentration of salts and they survive at high salt stress. Halophytes have also been utilized practically for managing the stressful environment and shown to be involved in increasing the economy of developing countries. The human population of the world continuing grow, the question is even more relevant today. We are likely to need all our resources if we are to maintain food supply over the coming years, salt loving plants will play an important role as models for generating tolerance in their own right for landscapes with saline conditions. Salt tolerant plants may also be useful as a means to enhance the tolerance of conventional crops.It is aslo helpful to reclamation of saline soil.

Output of project

1. Added the knowledge about *Trianthema* for act as halophyte.
2. Using plants,biological reclamation of different soils.
3. The results of this study are the first reported results for *Trianthema portulacastrum* L. growing at Baramati Tehsil of India.
4. Findings of this research study on first responded the result of effect of various concentrations of sulphate salts on *Trianthema portulacastrum* L.

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