DETERMINE THE EFFECT OF CALCIUM ON NUTRIENT ACCUMULATION OF PROSOPIS SPECIGERA LINN. IN DESERT SOIL**Seema V. Joshi¹ Dr. Jigna Tank² Dr. Hitesh Solanki³**¹PhD, Saurashtra University, Rajkot 360005, India²Asst. Prof. Dept of biosciences, Saurashtra University, Rajkot 360005, India.³Prof. Dept. of Botany, Gujarat University, Ahmedabad India.**Corresponding Email:** drseemajoshi11@gmail.com**ABSTRACT**

Introduction: Greenhouse experiments were conducted to assess the effects of supplemental calcium (CaSO₄) in salinized soil on the response of germination and seedling growth of *Prosopis specigera* Linn. Desert soil was collected from Little Rann of Kachchh (LRK) and made seven concentrations for the plant growth of green house experiment.

Material & methods: The present study is carried out in a greenhouse of the botanical garden of Saurashtra University, Rajkot, Gujarat.

Result: CaSO₄ was added to desert soil in a different amount that is 25, 45, 65, 85, 105 and 125 grams and control without adding calcium. Total Water content for plant tissue found 1218.15% (leaf was 23.15%, stem 225%, tap root 243.3% and lateral root 515.7%). Vegetational growth and water content do not show specific trends with the increasing CaSO₄.

Conclusion: It is concluded that application of specific amount of CaSO₄ is beneficial for plant growth and reduce detrimental effects of salinity and sodicity in desert area.

Keywords: LRK, calcium sulphate, seed germination, salinity, leaf area, water content.

INTRODUCTION

The Indian arid zone like other arid regions of the world is characterized by scarce of water resources. The rainfall is low and erratic and ground water is deep seated and often brackish or saline. Terrestrial higher plants encounter high concentrations of salts close to the seashore and estuaries where sea water and fresh water mix or

replace each other with the tides under natural conditions. In arid region of Gujarat, large areas of natural salt affected lands along the sea coast and ingress of sea due to human activity is the cause salinization. Salinity can impair plant function, growth and developmental processes. It can reduce survival of plant in the extreme condition.

Gypsum has been the most common amendment applied to sodic soil for reclamation and revegetation, as it supplies the more favourable calcium for exchange with sodium. In recent years, successful efforts have been made to reclaim sodic soils by application of gypsum for production of crops like rice, wheat, etc. (Abrol et al., 1973; Abrol and humbla, 1980). Only a few efforts have been made in the past to raise forest plantation on such a soils. Yadav (1980) reviewed the available literature and stressed the immediate need of generating more information on the performance of selected salt tolerant tree species. Recently, some 176

systemic research efforts were made to establish tree on highly sodic soils. (Abrol and Sandhu, 1985; Grewal and Abrol, 1986; Singh et al. 1987a; Gill and Abrol, 1987.

The objectives of the study are to check the effects of CaSO_4 propagule germination, determine plant growth and water content of *P. specigera* on highly sodic soil of desert.

MATERIALS AND METHODS:

The present study is carried out in a greenhouse of the botanical garden of Saurashtra University, Rajkot (22°18' N Latitude, 70°56' E Longitude) in Gujarat.

CASO₄ CONTENT:

For the experiment natural saline soil was collected from Little Rann of Kachchh (LRK). After air dried and passes through 2mm mesh screen, the soil was prepared in seven lots; each of containing 5 kg was separately spread and filled in polyethylene sheets above 50mm thick. CaSO_4 was added in a quantity of 25 g, 45 g, 65 g, 85 g, 105 g and 125 g was separately mixed with soil of six lots to give concentrations 1,2,3,4,5 and 6 respectively. In seventh concentration of soil there was no addition of calcium sulphate that served as control. The electrical conductivity of control is 4.0 ds/m. Measurement of electrical conductivity of soil followed by (Ramoliya et al. 2004).

Mineral analyses of plant material

Mineral analyses were performed on leaves, stems, tap roots and lateral root tissues of different concentrations of $\text{CaSO}_4 \cdot 2/7 \text{ H}_2\text{O}$. Components of plants were pooled separately and ground using mortar and pestle. Plant samples were analyzed in triplicate. Concentrations of sodium and potassium were determined by systronics Flame photometer. Organic carbon were determined by ash method and nitrogen were determined by Micro Kjeldahl method. Phosphorus was determined by Vanado-Molybdo Phosphoric acid method.

Plant sample elemental analysis done at Food Testing Lab. Dept. of Biotechnology JAU, Junagadh.

Data were analyzed by t-test and one-way ANOVA.

FIG- GROWING PLANTS

RESULTS

Greenhouse experiment was carried out to know the effect of calcium on growth and water status of *Prosopis specigera* Linn. in the garden of Biosciences department. The average temperature in the greenhouse was 32°C in the month of August, 35°C in September and 35°C in October. Soil used for experiment was collected from Little Rann of Kachchh which is highly saline and sodic. Following results were found during the study.

The value of pH ranges from 6.37 to 6.72 and EC from 4.0 to 7.2 of different con. of soil (Fig 1.1). Water holding capacity 19.789% and field capacity 35.233% were found of soil.

TABLE 1. NUTRIENT CONTENT OF TISSUES (LEAF, STEM, TAP ROOT AND LATERAL ROOT) OF *P.SPECIGERA* AS INDICATED BY MEAN $\pm$ SEM.

NUTRIENT	CONTROL	CON.1	CON.2	CON.3	CON.4	CON.5	CON.6
OC	31.43 $\pm$ 0.1	27.29 $\pm$ 0.1	32.89 $\pm$ 0.1	31.01 $\pm$ 0.1	34.48 $\pm$ 0.1	33.46 $\pm$ 0.1	32.09 $\pm$ 0.1
N	0.44 $\pm$ 0.1	0.63 $\pm$ 0.1	1.03 $\pm$ 0.1	1.6 $\pm$ 0.1	0.28 $\pm$ 0.1	2.59 $\pm$ 0.1	1.43 $\pm$ 0.1
K	0.54 $\pm$ 0.1	0.49 $\pm$ 0.1	0.55 $\pm$ 0.1	0.47 $\pm$ 0.1	0.60 $\pm$ 0.1	0.64 $\pm$ 0.1	0.67 $\pm$ 0.1
P	0.13 $\pm$ 0.1	0.12 $\pm$ 0.1	0.12 $\pm$ 0.1	0.10 $\pm$ 0.1	0.23 $\pm$ 0.1	0.21 $\pm$ 0.1	0.22 $\pm$ 0.1
Na	0.36 $\pm$ 0.1	0.46 $\pm$ 0.1	0.43 $\pm$ 0.1	0.34 $\pm$ 0.1	0.65 $\pm$ 0.1	0.52 $\pm$ 0.1	0.53 $\pm$ 0.1
Ca	2.99 $\pm$ 0.1	0.81 $\pm$ 0.1	1.20 $\pm$ 0.1	2.47 $\pm$ 0.1	2.39 $\pm$ 0.1	2.07 $\pm$ 0.1	2.18 $\pm$ 0.1

THE EFFECTS OF SALINITY ON NUTRIENT ACCUMULATION

Concentration of organic carbon in control, con 1, con2 con3, con4, con5, con6 is 31.43, 27.29, 32.89, 31.01, 34.48, 33.46 and 32.09 respectively. The OC value was found to be maximum in con4 (34.48) and minimum in con1(27.29). (Fig 1.5a)

Nitrogen in control, con 1, con2 con3, con4, con5, con6 is 0.44, 0.63, 1.03, 1.60, 0.28, 2.59, and 1.43 respectively. Nitrogen content is found to be maximum in con5 (2.59). Whereas its found to be minimum in con 4 (0.28). Nitrogen content showed an increasing trend from control(0.44) to con3 (1.60) ,then it decreased in con4. The Nitrogen content increased in con5(2.59) and decreased again in con6(1.43) (Fig 1.5b)

Potassium content (%) in control is, con 1, con2 con3, con4, con5, con6 is 0.54, 0.49, 0.55, 0.47, 0.60, 0.64 and 0.67 respectively.

The Potassium content is found to be maximum in con6 (0.67). Whereas its found to be minimum in con 1(0.47) and con3 (0.47). Potassium content showed an increasing trend from control(0.54) to con6 (0.67) ,except in con2(0.49) and con4 (0.47). (Fig 1.5c)

Phosphorus content (%) in control is, con 1, con2 con3, con4, con5, con6 is 0.13, 0.12, 0.12, 0.10, 0.23, 0.21 and 0.22 respectively. The Phosphorus content is found to be maximum in con4 (0.23), and minimum in con3 (0.10). Phosphorus content showed an decreasing trend from control (0.12) to con 3 (0.10) , increased in con 4(0.23), again decreased in con5. (0.21) and con6 (0.22). (Fig 1.5d)

Sodium content (%) in control is, con 1, con2 con3, con4, con5, con6 is 0.36 , 0.46, 0.43, 0.34, 0.65, 0.52, and 0.53 respectively. The Sodium content is found to be maximum in con4 (0.65). Whereas its found to be minimum in con3(0.34). (Fig 1.5e)

Calcium content (%) in control is, con 1, con2 con3, con4, con5, con6 is 2.99, 0.81, 1.20, 2.47 ,2.39, 2.07 and 2.18 respectively. The calcium content is found to be maximum in con6 (2.02). Whereas its found to be minimum in control(2.99) , while the calcium value is minimum in con1 is (0.81). (Table 1.3) (Fig 1.5f)

DISCUSSION

Earlier work (Ramoliya et al. 2004) indicated that seedling emergence for the salt-tolerant legume tree *acacia catechu* was reduced to 50 % (SG50) in soil with salinity

of 6.0 ds/m, but for *Salvadora oleoides* SG50 was obtained at 6.9 ds/m (Hardikar et al. 2011). In some plant species, salt tolerance is associated with accumulation of organic solutes in cytoplasm to balance the osmotic pressure of ions in the vacuoles.

The morphological development of plants was negatively affected by salinity. Plant height, root length and leaf area were changed with increasing stress level. Altered morphology and reduced growth rate are known to occur under salinity in many crops causing economic reductions in the yield. Cramer *et al.* 1987 reported that salinity can alter Ca^{2+} uptake and transport leading to Ca^{2+} deficiency in plants. It is evidenced that Ca^{2+} causes closure of non selective cation channels and restrict Na^{+} uptake (Rus *et al.* 2001).

The detrimental effect of NaCl salinity on germination is associated with an accumulation of toxic ions (Uhvits 1946), a decrease of available water to the seed (Bernstein and Hayward 1958) or both. In some plant species, salt tolerance is associated with accumulation of organic solutes in cytoplasm to balance the osmotic pressure of ions in the vacuoles. The compounds that accumulate most commonly are proline and high glycine betaine,

although other molecules can accumulate to concentration in certain species (Hasegawa et al. 2000). The morphological development of plants was affected by salinity. Plant height, root length and area of individual leaves were changed with increasing stress level. Altered morphology and reduced growth rate are known to occur under salinity in many crops causing economic reductions in the yield.

In present study CaSO_4 show positive effect on *P. specigera* and found maximum seed germination and shoot height and root height at concentration 3. While lower concentration and higher concentration of CaSO_4 may not reduce detrimental effects of NaCl present in desert soil. A positive response to Ca^{+2} application on germination rate under saline conditions has also been reported in *Phaseolus vulgaris* (Cachorro et al.1994) in Wimmera 92 ryegrass (Marcar 1986), in barley (Bliss et al. 1986), *Salvadora Oleoides* (Vaghela et al.2009).

In increase in the level of gypsum increased Ca concentration in all parts of mesquite, which is attributed to improved Ca status of the soil (Singh et al. 1988). Earlier studies (Bernstein and Pearson, 1956; Poonia et al. 1972; Singh et al., 1981 Singh and Abrol,

1985) have also reported a decreased in the uptake of Ca in different crops with an increase in the exchangeable sodium concentration in the soil solution.

CONCLUSION

Effect of CaSO₄ was determined in green house experiment for 90 days on *Prosopis specigera* Linn. species using highly saline and sodic soil of desert area of LRK. Seed propagule 58%, shoot height and root length were found maximum at pH 6.8 and EC 5.3 dsm-1 in concentration 3 in which 65gm CaSO₄ was added in 5kg of soil. Control and other concentration of soil are not suitable for seed germination and plant growth.

It is concluded that application of specific amount of CaSO₄ is beneficial for plant growth and reduce detrimental effects of salinity and sodicity in desert area

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