EFFECT OF SALT-SALINIZATION IN SEEDLING EMERGENCE OF CICER ARITINUM L

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ABSTRACT

Soil is the savor of foods but the scourge of agriculture, forestry, pastures, horticultures, etc; and in excess, it kills growing plants. However, it does not imply that plants are incompatible to salts but most of the plants do not grow in saline soils. Soluble salt contamination of soil has caused problems for all and history is witness. Effect of salt-salinizati of soil on emergence, growth, physiological attributes and nitrogen accumulation in seedlings of Cicer arietinum L (Leguminaceae) were studied. Sodium Chloride (NaCl) was added to the soil and salinity was maintained.

Keywords: Salinization of soil, Cicer arietinum, seedling emergency, seedling growth, salt tolerance

INTRODUCTION

Salinization of soil is a world-wide problem, however it is of common occurrence in arid and semi-arid regions. It has been reported that high concentrations of salts have detrimental effects on plant growth (Bernstein, 1961, Kramer 1983, Garg & Gupta 1997, Mere et al, 2000) and excessive concentrations kill growing plants (Donahue et al. 1983). Many investigations have reported retardation of germination and growth of seedlings at high salinity (Ayers and Hayward, 1948, Bernstein 1962, Garg & Gupta 1997). However plant species differ in their sensitivity or tolerance to salts (Troech and Thompson, 1993, Brady and Weil 1996). There are many different types of salts and almost and equally diverse set of mechanisms of avoidance or tolerance. It is found that shoot growth is often suppressed more than the root growth by soil salinity (Ramoliya and Pandey, 2002, Maas and Hoffman, 1997). Eventually, response of roots and shoots of plants to soil salinity should be understood especially under wet and dry soil conditions.

Cicer arietinum L (Leguminoceae) is one of the dominant crops in Saurashtra region of Gujarat state in India. This region is subjected to desertification (Pandey et al. 1999) and in many areas, soil salinity has increased. Hence, an understanding of effects of soil salinity on growth performance of Cicer arietinum L (Leguminoceae) would be of significant importance

The present study was carried out at Rajkot (22^0 17' N, 23^0, 00' E) in Saurashtra region of Gujarat state, India. This region are tropical monsoonic and can be ecoclimatically classified

as arid and semi-arid type, respectively. Total annual rainfall is about 554mm at central of Saurashtra and @98% rainfall occurs during rainy season.

METHODOLOGY

For the emergence of growth of seedlings, the top 10 cm soil was collected from an agricultural land. This soil is known as black cotton soil, containing 20.3% sand, 17.2% silt and 62.5% clay. The field capacity soil was 38%. Total organic carbon content was 0.8% and pH was 7.6. The EC of soil was 0.3dSM^{-1}. Soil fertility was poor with respect to Nitrogen (0.07%) and Phosphorus (0.003%). Ref. Table-1.

Surface soil was passed through a 2 mm mesh screen. Five lots of soil of 100 kg each were spread separately over thick plastic sheets. Sodium Chloride in proportions of 200gm, 500gm, 700gm and 900gm was thoroughly mixed in four lots respectively to give conductivity of 2.1, 4.2, 6.2 and 8.1 dSM^{-1} leaving 5th lot is maintained as control soil having conductivity of 0.3dSM^{-1}.

For the measurements of EC, soil suspension in distilled water was prepared in 1:2 ratio by weight and EC was measured by conductivity meter. Tap water was added to the soils to field capacity and soils and then allowed to dry for 6 days. Polyethylene bags filled these salts were kept in greenhouse of the Botanical gardens of Saurashtra University, Rajkot. Ten seeds were sown in each bags at a dept of @8-12mm. Immediately after sowing, soils were watered, followed by alternate day re-watering. Emergence of seedlings was recorded every day over a period of forty days. A linear model was fitted to cumulative proportion of seed germination and increasing soil salinity using the expression $Sin^{-1}\sqrt{P}=ß_0 + ß_1X_1$, where $Sin^{-1}\sqrt{P}$ is cumulative proportion of seed germination, X is soil salinity and $ß_0$ and $ß_1$are constants.

RESULTS & DISCUSSION

Seedlings began to emerge 6 days after sowing and 98% seed germination was obtained over a period of 20 days, under control (0.3dSM^{-1}) salinity condition (Fig 1). Seedlings emergence was recorded on 8th, 9th, 10th and 11th day after sowing. Emergency occupied a period of 19, 18, 20 & 17 days in soil with salinities of 2.1, 4.2, 6.2 and 8.1 dSM^{-1} respectively and percentage germination was 75%, 32%, 33%, and 28% respectively. Seedlings did not emergence from soil with further increase in salinity. A negative relationship between percentage seed germination and concentrations of salt was obtained according to the following expression : $Y=78.732-7.085X$, ($R^2=0.804$, $p<0.01$), where Y is $Sin^{-1}\sqrt{P}$ of proportion of cumulative seed germination and X is salt concentration.

Increasing salt concentration reduced seed germination and salt concentration exceeding 8.0 dSm-1 were detrimental to seed germination. Results can be attributed to decreasing osmotic potential of soil solution with increasing concentration of salt. It was observed that seeds began to shrink within a few days in soil with high salt concentration and later became unviable. Although effects of high salt content on metabolic process are yet to be fully elucidable, it is reported that salinity reduces protein hydration (Kramer, 1983) and induces changes in the activities of many enzymes (Dubey and Rani, 1990,Garg et al 1993) in germinating seeds.

Table 1: Physical and chemical properties of black cotton soil collected from 0-15 cm depth

Physical properties	**Values**
Sand %	20.3
Silt %	17.2
Clay %	62.5
Field capacity	38.9
Water holding capacity	69.5
Chemical properties	
Ph	7.6
Electrical conductivity ($dsm^{-1)}$	0.3
Total nitrogen %	0.07
Organic carbon %	0.8
Available phosphorus %	.003

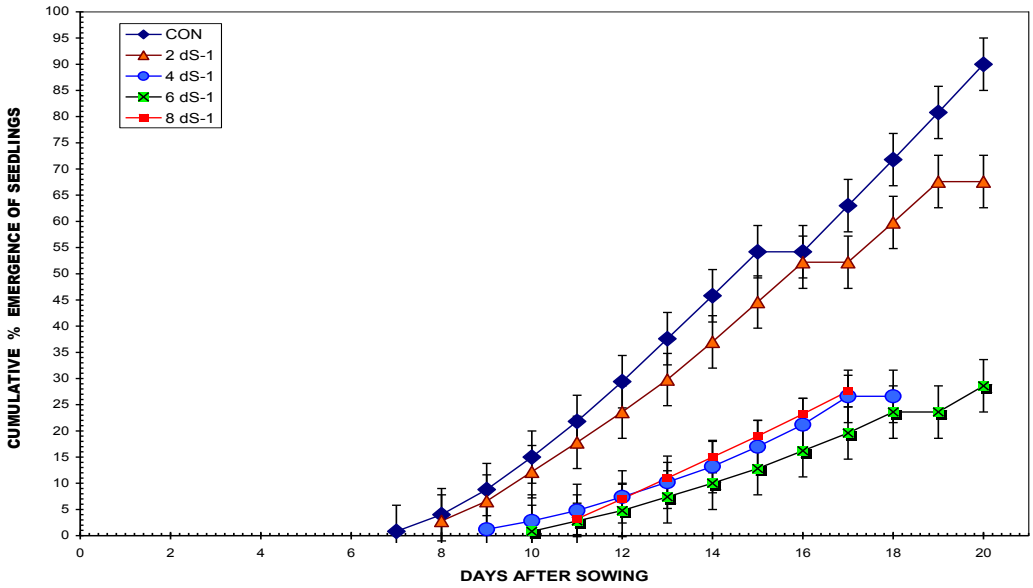

Fig 1. Cumulative emergence of seedlings

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