Effect of Salinity on Plant Growth

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Abstract: **- Salinity is the accumulation of salt in land and water to a level that impacts on the natural and built environment. Salinity is the saltiness or dissolved salt content of a body of water. Today the spread of salinity impacts farms, irrigation areas, wetlands, rivers, drinking water and infrastructure. The plants that grow naturally, and those we plant, can be affected by changes to the natural salinity of their environment, usually in a detrimental way, especially to more sensitive plants. In this we studied about Salinity and its effect on plant growth.**

Key Words**: Salinization, salt stress, accumulation, soil production, irrigation, arid and semiarid regions.**

I. INTRODUCTION

Salinity in rivers, lakes, and the ocean is conceptually simple, but technically challenging to define and measure precisely. Conceptually the salinity is the quantity of dissolved salt content of the water. There are many chemicals in seawater that make it salty. Most of them get there from rivers carrying chemicals dissolved out of rock and soil. The main one is sodium chloride, often just called salt. The ocean contains a soup of the many different minerals found across the surface of the Earth, all dissolved into the water. These minerals make up about 3.5% of the total volume of the Earth's oceans. Salinity is an ecological factor of considerable importance, influencing the types of organisms that live in a body of water. As well, salinity influences the kinds of plants that will grow either in a water body, or on land fed by a water (or by a groundwater).

II. SALT STRESS

Salts are a natural component in soils and water. The ions responsible for salination are: Na^+, K^+, Ca^{2+}, Mg^{2+} and Cl^-. As the Na^+ (sodium) predominates, soils can become **sodic**. Sodic soils present particular challenges because they tend to have very poor structure which limits or preventswater infiltration and drainage. water stress, as salt stress, causes osmotic imbalances in the plant tissues. However, in the case of salt stress, the presence of excess salts (normally Na+ and Cl-) causes direct nutritional effects and toxic effects.

III. SOIL SALINITY

Soil salinity is the salt content in the soil; the process of increasing the salt content is known as salinization. Saline soils will have a relatively high number of sodium ions compared to healthy soils. Excessive salt not only destroys the soil structure, salt also attracts water and blocks its absorption to plant roots. As a result, plants may exhibit signs of drought even when the soil is wet or waterlogged. Other signs of salt damage may be water pooling on the surface without penetrating. Salinity in drylands can occur when the water table is between two and three metres from the surface of the soil. The salts from the groundwater are raised by capillary action to the surface of the soil.

Mediterranean regions are currently experiencing increasing salt stress problems resulting from seawater intrusion into aquifers and irrigation with brackish water (Rana & Katerji, 2000). While an important cause of salinity in Australian continent is the deposition of oceanic salts carried in wind and rain (R Munns & Tester, 2008).

III. SOIL SALINITY EFFECT

According to 'The basics of Salinity and Sodicity effect on the physical properties of soil ', in the root zone of the plant, excess salt can hinder or prevent the plant from withdrawing water from surrounding soil.

Chemical elements that plants need

Element	Role
Nitrogen	Helps plants to produce new, green growth
Phosphorus	Promotes growth of roots
Potassium	Contributes to overall hardiness, helping plants to resist extreme temperatures, pests, and diseases
Sulfur	Helps plants to produce protein and maintain their dark green color
Calcium	Helps plants to produce protein, promotes growth of roots, and contributes to overall vigor
Magnesium	Helps plants to use light to make food, to absorb other nutrients, and to make seeds
Iron	Helps plants to photosynthesize and to form chlorophyll
Manganese	Helps plants to form chlorophyll and to conduct essential cellular functions
Chloride	Helps plants to metabolize
Boron, cobalt, copper, zinc	Help plants with certain natural processes, such as absorbing nutrients, growing new tissue, metabolizing, and forming chlorophyll

Source: Learn about the effects of salt on plants http://www.salinitymanagement.org/Salinity%20Management%20Guide/le/le_1.html

In natural systems, salt is removed from the soil through proper drainage that brings sodium down away from plants' roots. Agricultural practices, such as logging and irrigation, disrupt the drainage system, causing more sodium to collect at the surface. Mineral weathering also adds to the saline concentration in soil. Increased sodium in agricultural lands is dangerous for crop productivity.

Although that may be one of the effects of salinity in water, plants are able to adapt by producing a quantitative trait loci that increases survivability against salinity. Stretches of DNA are connected and linked to genes that contain the phenotype of being able to survive the salinity. This was tested in Dvorak and Zhang's study in 1992 that showed the difference in

resistance to salinity between Chinese spring wheat and cultivated wheat.

IV. SOIL SALINITY PROBLEMS

Water is the carrier that takes Na to deeper soil levels. Sometimes the deeper soil a foot or more below the surface, may be collecting the sodium and may become sodic at that level. If this happens, the downward movement of water stops at the affected level and begins moving horizontally. It may take a while for the gypsum to affect the deeper soil levels. The change in the level of ground water before the construction had enabled soil erosion, which led to high concentration of salts in the water table.

V. CONCLUSION

To summarize, salt stress is the subject of concern not only for the agriculture sector but has many bad effects on different plants and ecosystems. Plants obtain most of their water from the soil, and when that water increases in salinity it takes the plant more energy to draw it up through its roots and the plant can sometimes dehydrate even when there is water available, because it cannot keep up with the effort required to replenish its water supply.

REFERENCES

[1]. G. Rana, N. Katerji, 2000 Measurement and estimation of actual evapotranspiration in the field under Mediterranean climate: a review. European Journal of Agronomy, 13(2-3), 125 153 .

[2]. from "Soil salinity" in WaterWiki, the on-line Knowledge and Collaboration Tool of the Community of Practice (CoP) on Water- and UNDP-related activities in Central and South-Eastern Europe, Caucasus and Central Asia.

[3]. High Soil Salinity Problems and How to Correct Them http://www.lawn-care-academy.com/soil-salinity.html

[4]. ILRI (1989), Effectiveness and Social/Environmental Impacts of Irrigation Projects: a Review (PDF), In: Annual Report 1988 of the International Institute for Land Reclamation and Improvement (ILRI), Wageningen, The Netherlands, pp. 18–34

[5]. Petronia Carillo, Maria Grazia Annunziata, Giovanni Pontecorvo, Amodio Fuggi and Pasqualina Woodrow (2011). Salinity Stress and Salt Tolerance, Abiotic Stress in Plants - Mechanisms and Adaptations, Prof. Arun Shanker (Ed.), InTech, DOI: 10.5772/22331. Available from: http://www.intechopen.com/books/abiotic-stress-in-plants-mechanisms-and-adaptations/salinity-stress-and-salt-tolerance

[6]. Drainage Manual: A Guide to Integrating Plant, Soil, and Water Relationships for Drainage of Irrigated Lands, Interior Dept., Bureau of Reclamation, 1993, ISBN 0-16-061623-9

[7]. "Free articles and software on drainage of waterlogged land and soil salinity control". Retrieved 2010-07-28.

[8]. How Does Salinity Affect Plant Growth and What Can Be Done? By Anthea Hudson http://earthwiseharmony.com/GARDENS/EH-How-Does-Salinity-Affect-Plant-Growth-and-What-Can-Be-Done.html

[9]. Salt-Affected Soils and their Management, FAO Soils Bulletin 39 (http://www.fao.org/docrep/x5871e/x5871e00.htm)

[10]. R. Munns, M. Tester, 2008 Mechanisms of salinity tolerance. Annual Review of Plant Biology, 59 651 681 .

[11]. Alan D. Blaylock, 1994, Soil Salinity and Salt tolerance of Horticultural and Landscape Plants. University of Wyoming

[12]. The Ocean's Salinity http://www.kidsgeo.com/geography-for-kids/0141-ocean-salinity.php

[13]. Government of Alberta, Salt tolerance of Plants

[14]. R.Brinkman, 1980. Saline and sodic soils. In: Land reclamation and water management, p. 62-68. International Institute for Land Reclamation and Improvement (ILRI), Wageningen, The Netherlands.

[15]. Salinity http://www.environment.nsw.gov.au/salinity/index.htm

[16]. https://www.sciencelearn.org.nz/resources/686-ocean-salinity

[17]. World Ocean Atlas 2009. nodc.noaa.gov

[18]. Learn about the effects of salt on plants http://www.salinitymanagement.org/Salinity%20Management%20Guide/le/le_1.html

[19]. How does salt affect plant growth? https://www.reference.com/home-garden/salt-affect-plant-growth-7c39b72891fd2bbf

[20]. Pawlowicz, R. (2013). "Key Physical Variables in the Ocean: Temperature, Salinity, and Density". Nature Education Knowledge. 4 (4): 13.

[21]. Eilers, J. M.; Sullivan, T. J.; Hurley, K. C. (1990). "The most dilute lake in the world?". Hydrobiologica. 199: 1–6. doi:10.1007/BF00007827.

[22]. Growth and Productivity: Salinity stress influences on plant growth

[23]. Anati, D. A. (1999). "The salinity of hypersaline brines: concepts and misconceptions". Int. J. Salt Lake. Res. 8: 55–70. doi:10.1007/bf02442137.

[24]. IOC, SCOR, and IAPSO (2010). The international thermodynamic equation of seawater – 2010: Calculation and use of thermodynamic properties. Intergovernmental Oceanographic Commission, UNESCO (English). pp. 196pp.

[25]. Wetzel, R. G. (2001). Limnology: Lake and River Ecosystems, 3rd ed. Academic Press. ISBN 978-0-12-744760-5.

[26]. Pawlowicz, R.; Feistel, R. (2012). "Limnological applications of the Thermodynamic Equation of Seawater 2010 (TEOS-10)". Limnology and Oceanography: Methods. 10 (11): 853–867. doi:10.4319/lom.2012.10.853.

[27]. . Kader, M.A. and Lindberg, S. , 2010: Cytosolic calcium and pH signaling in plants under salinity stress.

[28]. Unesco (1981). The Practical Salinity Scale 1978 and the International Equation of State of Seawater 1980. Tech. Pap. Mar. Sci., 36

[29]. Unesco (1981). Background papers and supporting data on the Practical Salinity Scale 1978. Tech. Pap. Mar. Sci., 37

[30]. Millero, F. J. (1993). "What is PSU?". Oceanography. 6 (3): 67.

[31]. Culkin, F.; Smith, N. D. (1980). "Determination of the Concentration of Potassium Chloride Solution Having the Same Electrical Conductivity, at 15C and Infinite Frequency, as Standard Seawater of Salinity 35.0000‰ (Chlorinity 19.37394‰)". IEEE J. Oceanic Eng. OE–5 (1): 22–23. doi:10.1109/JOE.1980.1145443.

[32]. van Niekerk, Harold; Silberbauer, Michael; Maluleke, Mmaphefo (2014). "Geographical differences in the relationship between total dissolved solids and electrical conductivity in South African rivers". Water SA. 40 (1): 133. doi:10.4314/wsa.v40i1.16.

[33]. Bayuelo-Jimenez, J.S., R. Craig and J.P. Lynch, 2002: Salinity tolerance of Phaseolus species during germination and early seedling growth.

[34]. Por, F. D. (1972). "Hydrobiological notes on the high-salinity waters of the Sinai Peninsula". Marine Biology. 14 (2): 111. doi:10.1007/BF00373210.

[35]. E. V. Maas,United states Deparmnet of Agriculture, Springer, volume 27, 2001:Plant growth response to salt stress

[36]. Venice system (1959). The final resolution of the symposium on the classification of brackish waters. Archo Oceanogr. Limnol., 11 (suppl): 243–248.

[37]. Essay UK, Essay: The Effect of Salinity on Bean Plant Growth. Available from: <http://www.essay.uk.com/essays/science/essay-the-effect-of-salinity-on-bean-plant-growth/> [01-02-17].

[38]. Dahl, E. (1956). "Ecological salinity boundaries in poikilohaline waters". Oikos. Oikos. 7 (1): 1–21. doi:10.2307/3564981. JSTOR 3564981.

[39]. Kalcic, Maria, Turowski, Mark; Hall, Callie. "Stennis Space Center Salinity Drifter Project. A Collaborative Project with Hancock High School, Kiln, MS". Stennis Space Center Salinity Drifter Project. NTRS. Retrieved 2011-06-16

[40]. https://en.wikipedia.org/wiki/Soil_salinity

[41]. https://en.wikipedia.org/wiki/Salinity