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Curtailment of Salinization by using different strategies to maintain Balance between Nature and Human Life

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Abstract

Salinization of soil is a globe ultimatum to mankind .It is a burning issue across the globe which is challenging our food security . Salinization is one of the biggest threat to mother nature ,. It is serious effect on the environment , Bio-diversity, ecosystem , agriculture and on the economy of any country. More that 60 million ha of land is salt –effected making the land unfit for agriculture which requires immediate action as 70% of the people are dependent on agriculture for their living , agriculture as an occupation is not developed in India . Soil health card , neem coated area , promoting organic culture , resolving the problem of groundwater problem and working towards the interest of farmer. India is experiencing the worst water crisis in the world and a major problem of groundwater , where we see 70% of the groundwater is used for irrigation purpose .India needs to come up with new measures and invention that will help to solve or reduce salinization We need to make the use of nanotechnology and geo-textile technology in soil management , skill development project on soil culture , Introduction digital soil card with soil nutrient parameter Index and soil testing centres with the use of machine learning .

Keywords : Salinization, Technology , Digital soil card, food security , agriculture , organic farming , groundwater, salt-effected .

Introduction

Salinization can be delineated as the intensification of salt content in the soil caused by dissolved salt in the water supply .This water supply is precipitation by floods, rising of sea level and climate change. Composition of soil may differ from place to place depending upon the temperature, climate, shape of land etc. Even the composition of soil of a certain place may change continually as time passes due to natural incidents like storm, earthquake etc. and human activity. Salinization is also a transformation of components of the land which denotes the increase of concentration of the inorganic salts like Sodium Sulphate, Calcium Sulphate, Magnesium Sulphate etc. in the soil beyond the optimum level. It badly affects the fertility of soil which may result desertification of land resources and thereby threatens the sustainability of agriculture. Salinization is a burning issue across the globe which occurs more often in arid and semi arid parts of the world, it is also a product of poor irrigation structure .Salinization of soil is one of main causes of land degradation that reduces soil fertility and further results in desertification . It is estimated that soil salinization effect 60 million hectares of land because of poor irrigation practices

worldwide. We see can increase in the rate of salinization taking place in India, Pakistan , China and Central Asia .There are various types of salinization : Primary Salinization which occurs in arid and semi arid areas , it is a nature salinization process , and then we have secondary salinization which is a product of Human Activity ,Soil salinity is an outcome of an amalgamation of evaporation surpass cloudburst and decomposition , salt transport and icon exchange.

Poor irrigation water supply for agriculture purpose is one of factor for soil salinity in India . It is connected with agriculture land , which is one of the most devastating environmental issue across the globe which can result in the death of crops and effect the food security , changing the picture of farmland and landscape industry. Soil salinity is also associated with sodic soil , saline salt , unsaturated area, climate zones .It is a global threat to food production , coastal areas are more affected by the presences of salt in the sea water and Mediterranean countries where irrigation farming is main and at times the salinization make the land unfit for farmers to grow crops . It is a major ultimatum to our life.

Research Methodology:

For the purpose of this exploration , I have used a amalgamation of two of the archetypical social sciences research tools application –as they are authentic and brilliant method to assemble statistics from multiple appellant in an methodical and convenient way . Question were asked to the parents and their children , survey , interviews –consisting of several interrogation which were dispersed among representative of each contender group.

Objective of the Research

The main area of exploration in this paper includes

1.What is Salinization and its types.

2.How salinizaion is becoming a threat to globe food security

3.Causes behind salinization In the world

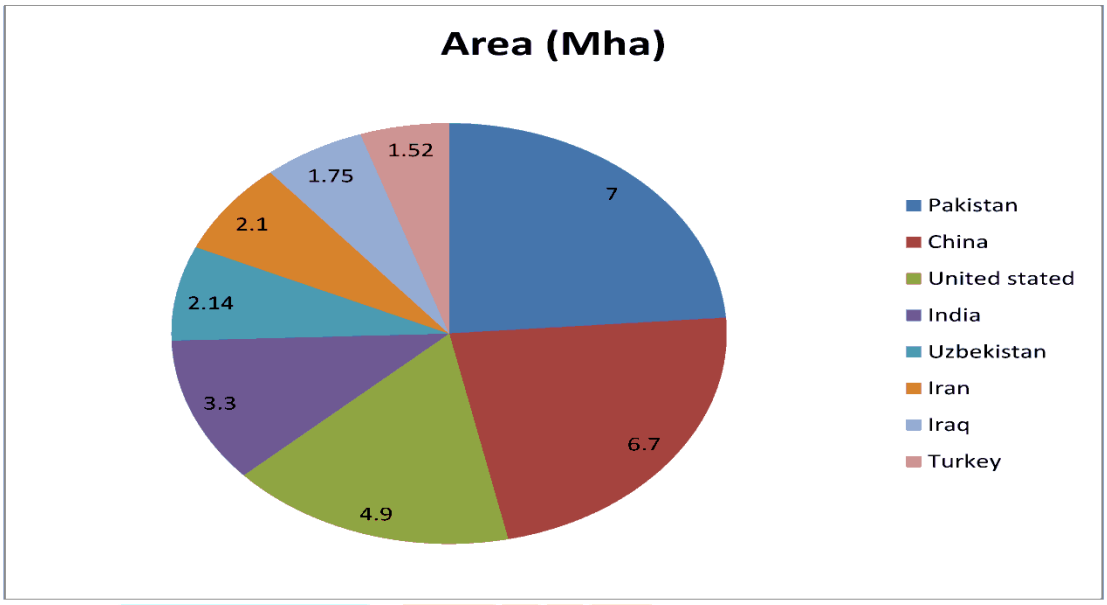
4.What are the measure taken by the Government of India to end the problem of salinization in India.

5.What can we do to overcome the problem of salinization

Literature Review

90% of the farmers all around the whole face the problem of salinization are forced to live in poverty or , As the population increases demand for food also increases , but the land left suitable for agriculture is reducing every second because of salinization Salinization in India is approx 6.727 million ha in India which covers 2.1% of the land out of which 2.956 million is saline and 3.771 million ha is Sodic. Canal irrigation project without proper drainage system has also resulted in salinization in India. Salinization has resulted in low agricultural production , less economic , has forced famers to change their occupation for survival and has socio economic factors , loss of biodiversity .In India lack of water tables due to irrigation in canal irrigated areas made the salts percolate into the subsoil and in areas with good drainage system the salts are wasted away by flowing water the paces where the drainage system is proper the water with high salt concentration becomes stagnant and leaves the salt on the topsoil layer .As the content of salt increases in the soil it becomes difficult for plants to absorb water from the soil , Sodium Chloride is the most common salt found in soil , high concentration of salt and excess use of fertilizers , poor groundwater facilities and drainage system result in soil salinity , these high salt concentration makes the plant toxic and effect the seed germination process and causes root injury which contributes to less production. High concentration of salt in soil solution creates osmotic pressure which measures the uptake and growth of plants which are sources of wilting of plants and nutrient deficiency in them . Presences of salt of more than 0.1% is injurious to plant growth. Salinization occurs on the soil surface when soluble salts such as

calcium , magnesium and sodium are present, there is highevaporation and high water tables and less rainfall , There are many signs which indicates the level of salinization present in the soil firstly when soil equipment no more support because of soil being wet in semi arid regions , slat tolerant weed , irregular growth pattern of crop growth and no plant vigor , white spots and streaks in the soil are also indicators of soil salinity and white crushing on the surface.



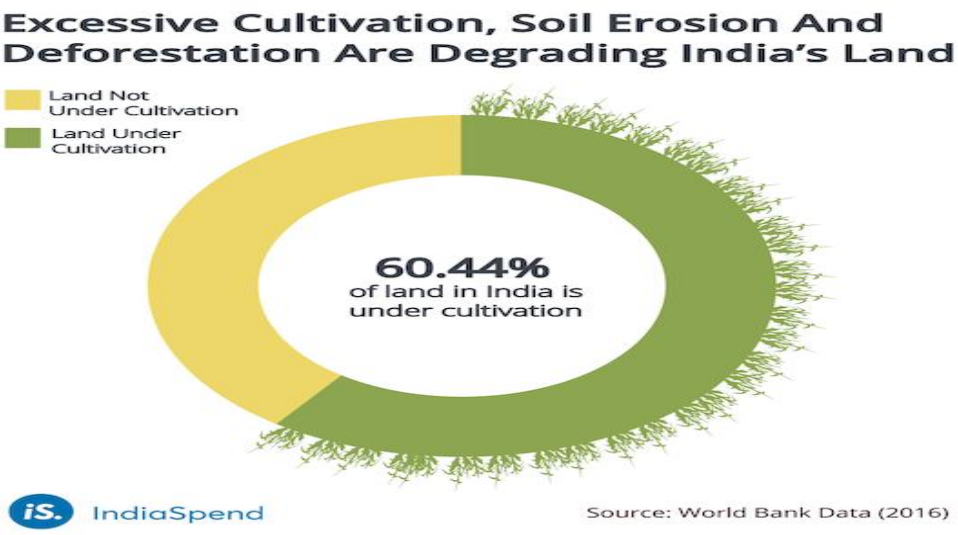
Salinization also has an bad effect on groundwater they make the groundwater shallow and hampers water resources such as ponds, well etc. Soil salinity can also be measured by electrical conductivity of soil solution. India has the worst water scarcity problem in the world , groundwater is one of major problem in India , 70% of the water is sued for irrigation purpose in India , as we see groundwater depletion is rising with 54 % of India population has no access to groundwater , increasing demand of groundwater has resulted in increase salinization in India. Over exploitation of fresh drinking water resources is resulting in decline of water levels and encroachment of saline water into agriculture . The origin of salinity falls into three main categories which are as follows (a)marine origin –they are consanguine or infringe and found in the coastal areas.(b) Terrestrial origin-this occurs due to poor irrigation , evaporation , improve groundwater , dissolution and Anthropogenic (c) Mixed origin which is a combination of the above two category. Salinization of soil may differ depending on the geographical location and other factors like climate , irrigation , farming patterns.

Findings

Salinization is a product of number of factors which are as follows

1.Irrigation**:** The irrigation potential of India has been increasing from 22.6 million hector in 1951 to 92 million hector in 1985 which is also proposed to be increasing more in order to meet the demand of food for the growing population. Approximately 42 million hector land are irrigated by ground water and the surveys indicate that 32-84% groundwater used for irrigation is of poor quality. Basically, groundwater is used for irrigation purpose in arid and semi-arid region where river water is not available and rate of annual rainfall is low. That is why, the concentration of ionic compounds in soil and inland water bodies are very high resulted in highly saline groundwater which is largely used for irrigation purpose in farming activities causing high salinity of agricultural land.

2.Fertilization **:**Chemical fertilizers and pesticides are widely used in agricultural activities in order to increase the productivity of crops. Sodium, Phosphate and Potassium are the main components of chemical fertilizers which are chemically reacted with the inorganic minerals of soil to form salt. In this way, the concentration of salts in the soil has been increasing leading to the salinization of land.



3.Industrial waste**:** The wastes from industries are thrown in water bodies in large number leading to the mixture of toxic ionic compounds with water which when used in agricultural land for irrigation and other purposes react with the ionic minerals of soil to form stable inorganic salts resulted in salinization.

4.Upward migration of shallow groundwater**:** Sometimes saline groundwater has been migrated in upward direction through the roots of plants and increases salinity of the soil.

A saline soil is defined as one in which the electrical conductivity (EC) of saturation extract in the root zone exceeds 40 mM of Sodium Chloride content at 25^0C and has an exchangeable sodium of 15%. The yield of most crop plants generally decreases in this concentration due to degradation of the physicochemical quality of soil. It restricts photosynthesis, protein synthesis, reproduction process and nutrient uptake capacity of plants which resulted in the reduction in growth of plants. In 100- 175 mM concentration of sodium chloride in soil, delayed emergence of spikes followed by the significant reduction in number of spikelet per spike of wheat plants has been observed which also restricts the regular growth of plants .The impacts of salinization incorporates Death of plant cells- Excessive accumulation of sodium, chloride and borate ion in plant cells due to salinization leads to the osmotic stress in the cell. Hence, water comes out through the semipermeable cell wall of plant cell leading to the premature death of cells.

Precipitation of phosphate ion present in plant cells:Phosphate ion is an essential component of plant cells which also helps in plant growth. The calcium ion of salts form a stable complex calcium phosphate by combining with phosphate ion within the plant cells which resulted in the reduction of phosphate ion concentration within the cell.

Restriction in photosynthesis of plants: The increase in salt concentration leads to the reduction in leaf area, chlorophyll content and stomatal conductance of plant leaves which affects the photosynthesis process of plants.

Restriction in protein synthesis of plants -Due to salinization the concentration of sodium ion in plant cells increases significantly which causes the decrease in the concentration of potassium ion in cells. In this way, availability of potassium ion for binding tRNA with ribosome of cell has been restricted which ultimately hampers protein synthesis of plant. In this way, the expression and activity of cyclin and cyclin dependent kinase proteins have been arrested in plant cells that finally resulted in the irregularity of plant growth.

Impact on reproduction of plants:The increase in concentration of toxic ions due to soil salinity hampers micro sporogenesis and elongation of stem filament which restricts the process of flowering in plants. It also catalyses the process of ovule abortion which negatively affects the germination of plant seeds.

The government has taken many initiatives to resolve this problem like the introduction of soil heath cards which will help the farmers know the nutrient level present in the soil and the amount required , this will not result in over use of fertilizers and maintain a balance between the use of fertilizers and nutrient level , this resulting in better productivity and enhance income for farmers.

Neem coated Urea ,another method adopted by the government of India , a bio-chemical method which will improve the soil quality and crop productivity and reduce the use of fertilisers .

The Parampargat Krishi VikasYoijan introduced by the government to promote organic farming which will resolve the problem of poor irrigation method which is one of the main contributors of salinization in India and across the globe , it will also help improve soil health and organic matter content.

The New National Crop Insurance Scheme which aims to take into consideration the interest of the farmers and crop looses and other disaster that will effect the farmers and soil healthy.

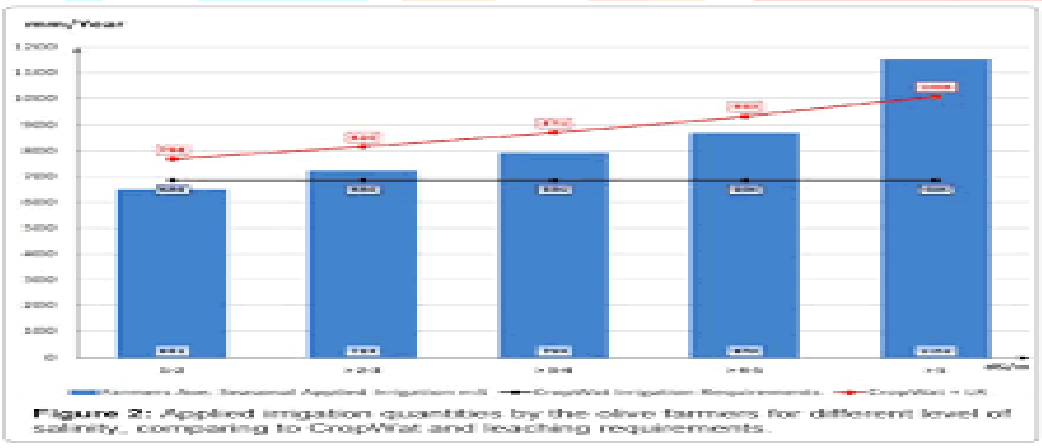


Figure 2: Applied irrigation quantities by the olive farmers for different level of salinity, comparing to CropWat and leaching requirements.

Suggestions

1.Adoption of better irrigation process**,** As salts responsible for salinization are soluble in water, the adoption of irrigation processes like partial root drying methodology and drip or micro- jet irrigation process will be able to optimize the quantity of water in agricultural land. In this way, the concentration of sodium, calcium and other toxic ions can be reduced.

2.Plantation of deep rooted perennial plants**,**The deep rooted perennial plants are able to prevent the rise of groundwater tables and movement of salt to the soil surface leading to the decrease in soil salinity.

3.Modification of farming practises:Incorporation of perennial plants in rotation with annual crops (phase farming), in mixed farming (alley farming) or in site-specific planting (precision farming)can improve the salt stress in the farming land.

4.Application of chemical amendments, Use of gypsum ($CaSO_4.2H_2O$: Calcium Sulphate Dihydrate) followed by pyrites containing at least 5-6% sulphur depending upon the exchangeable sodium percentage (ESP), tolerance of crops to be grown, texture and minerology of soil before initiation of farming is very effective for reducing the concentration of salts in soil and creating suitable environment for plant growth.

5. Development of proper drainage system, Eco-friendly drainage system needs to be developed for removing excess water from the agricultural land in order to avoid excessive accumulation of ionic compounds dissolved in water. Development of sub-surface drainage technology by Central Soil Salinity Research Institute, India is one of the remarkable step in this regard. However, this technology is only applicable in waterlogged saline soils of alluvial region where underground water is of good quality. Similar kind of development is highly recommended in arid and semi-arid regions where the quality of groundwater is poor.

6.Soil Digital card for farmers and soil nutrient parameter Index (Mineral Quality).

7.Soil Testing centres through artificial Intelligence and machine learning.

8.Digital Awareness Programme for salinization "उपजाऊ भूमि, विकसित भारत " (Fertile land , Developed India)project for crop production Management.

9.Research and development centre for soil.

10.Introduction of Bio-Technology Scientific Advancement and innovation for better salinization control.

11. Soil bank and digital data n – soil portal.

12. Skill development project on soil culture , maintenance and advancement.

13. Geology impact on soil measuring Index .

14.Several Bio-processing unit needs to be engaged with scientific Intervention to maximize the soil quality.

15.Using of nano-technology and geo-technology in soil management and reduction of salinization.

16Using of Bio-fibre technology with textile technology (Plant Natural Fibre) for soil maintenance and reduce soil erosion.

17.Employing soil researcher as soil collecting officer by forming state soil directors and opening up District soil research centre .

18.Application of genetic engineering- Central Soil Salinity Research Institution, India has produced several salt-tolerant strain of crops which can be cultivated in arid and semi-arid region where the soil salinity is high. CSR 10, CSR 11, CSR 13, CSR 27 strain and CST 7-1, CSR 4, CSR 6 strain of rice are designed for inland and coastal regions respectively. Apart from that, wheat (KRL 1-4) and mustard (CS-52 and CS-330) strains are also available. Some genetically modified grasses like *Vetiveriazizaioides, Cymbopogan martini* and *Cymbopoganflexuosus*can retain high proportion of salinity in the root of plants. Thus, the cultivation of these kind of grasses are highly recommended.

19.Reduce excess water from incursion into the soil in recharge areas of seeps by transferring the surface water into downslope ponds.

20.Use cropping and plow land fallow soil will provide sufficient incursion and penetrability . This incorporates building organic matter and soil conglomeration.

21.Monitor groundwater quality and recharge the groundwater making pure and fresh to be used for irrigation.

Conclusion

Salinization is a burning issue, it is causing threat to food security across the world and farmland, Approximately 835 million hectares land resources have been found to be affected by salinization globally and 1.5 million hectares of land are becoming unsuitable for agricultural production due to high salinity level. Ions present in salt is a necessary component of plant's nutrient. But, excess salinity in soil is a threat to the food security of human civilization. As, we are determined to achieve the goal of zero hunger by 2030 in order to promote sustainable development in society it is the high time to take necessary steps in order to combat with this emerging issue which is one of the reason of degradation of fertility in land resulting in the shortage in crop production leading to the stress in the supply of staple food at reasonable cost. It also causes huge loss of the people involving in primary sector leading to the increasing number of suicides among small and marginal farmers of the society and stress in the daily financial management of common people. Introduction of soil health cards and promoting organic farming and recharge groundwater for improving soil health and productivity quality are some of the few steps taking by the government of India to make the situation better for farmers , 70 % of the people live in rural area and are depended on agricultural for their living . Salinization of soil is making most of the land unfit for going crops which reduces the use of technology and other scientific inventions , artificial intelligence and machine learning to be used for agriculture development , with organising awareness campaigns aiming to reduce salinization in soil . it mostly takes place in arid and semi arid regions of the world, Land degradation , irrigation , waste water , poor irrigation and agricultural practices , no skill and vocational training are all product of salinization which needs to be challenged and green methods should be adopted which can solve these problems and provide enough food for everyone .

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