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# Assessment of Soil Salinity for Different Plant Groups in Different Habitats

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***Abstract: Soil is the medium for plants to live. It provides nourishment to the plants. Plants growth and development is based on the nutrients which are present in soil. Soil mineral conditions are correlated with soil pH and electrical conductivity. Electrical conductivity reflects the salinity nature of soil. In agriculture, crop cultivation is affected due to salinity. Soil salinity greatly influences the ecological environment. In this present study soil samples were collected from three different plant groups from three different habitats. Soil analyses were done by standard methods. pH, electrical conductivity, TDS and salinity of different plant groups soils were measured. Sodium, potassium, calcium and lithium were also tested for different soil samples. The present study clearly showed that, nature of soils in different habitats. The concentration of sodium, potassium, calcium and lithium are higher, below the optimum level, very low and above the normal level respectively.***
***Keywords: Soil, pH, electrical conductivity, TDS, salinity***

## I.INTRODUCTION

Soil salinity is the impact of climate change. Periodical checking of electrical conductivity is necessary for sustainable management of soil salinity. Soil salinity leads to socio economic and environmental impacts. Soil is a non - renewable source and its formation takes long time. Soil becomes saline after land degradation and soil erosion. Soil salinity is the major reason for declines in agricultural yield.

Everyday 2000 ha of arable lands are converted into saline soil and lost their production ability due to salinization. It decreases 10-25% yield in many crops. Severe salinization is the cause of desertification. Food security and avoidance of desertification is achieved by improved soil, water and crop management practices [Shabbir A.et al., 2018].

Soil vegetation type impacts soil ph. Soil pH play a vital role in plant growth. pH is an excellent indicator of a soil suitability for plant growth.

The solubility of minerals or nutrients is mainly depends on soil ph. Most of the minerals are highly soluble in acidic soil. So, in acidic soil most of the minerals are present compared with neutral or alkali soil. Plant nutrients are readily available at a pH range of approximately 6 to 7. Soil pH affects the activity of beneficial microorganisms in soil. In strong acidic soils decomposition of organic matter by bacteria's are hindered. Soil becomes more acidic due to the action of strong organic and inorganic acids, and also leaching of basic ions due to rainwater. Usually lime is added to increase the pH in soil.

Soil salinity is the concentration of major dissolved ions. Evaporation and plant transpiration utilise pure water and leaves salts in the soil. Fertilization practices are also a major source for soil salinity. Ions in soil decrease the permeability of water and deleterious effects on plants and it impairs the nutritional balance of plants [Fernando Visconti and José Miguel de Paz, 2016].

Environmental conditions and nutrient supply are closely associated with plant physiology, growth and development [Savvas D, et al., 2008, Signore A, 2016]. Higher or lower concentration of nutrient solution or imbalanced ion composition is either toxic or nutrient deficiency for plants and inhibits plant growth [Grattan SR, Grieve CM (1999].

Ions which are available in the root zone of the plants are related with electrical conductivity of the nutrient solution [Nemali KS, van Iersel MW (2004].

Every crop is specific for EC, and it depends on environmental conditions [Sonneveld C, Voogt W, 2009, Le Bot J, et al., 1998]. Higher EC severely contaminates the environment and result in environmental pollution. Plant growth and yield is affected by lower EC [Signore A, 2016, Samarakoon UC, et al., 2006]. In cultivated soils, productivity loss is mainly due to soil salinization. Soil salinization is intensively increased, especially in irrigated soils.

One-third of the world's food is salt-affected from 45 million hectare of irrigated land [Shrivastava, P. and Kumar, R., 2015]. In European Union, particularly in Mediterranean countries 1 million hectares are salt affected. It leads to desertification. Agricultural potential is reduced in 3 % of the 3.5 million hectares of irrigated land in Spain and 15% is under serious risk condition [Stolte, J. et.al. 2015].

*A. Category Of Soil For Different pH*

| Category of soil | | Range of pH value |
|---|---|---|
| Extremely acid | - | 3.5 – 4.4 |
| Very strongly acid | - | 4.5 – 5.0 |
| Strongly acid | - | 5.1 – 5.5 |
| Moderately acid | - | 5.6 – 6.0 |
| Slightly acid | - | 6.1 – 6.5 |
| Neutral | - | 6.6 – 7.3 |
| Slightly alkaline | - | 7.4 – 7.8 |
| Moderately alkaline | - | 7.9 – 8.4 |
| Strongly alkaline | - | 8.5 – 9.0 |

*B. Category Of Soil For Different Ec Value*

| Range of EC value | | Category of Soil |
|---|---|---|
| <0.8 dS $m^{-1}$ | - | Normal |
| 0.8 – 1.6 dS $m^{-1}$ | - | Critical for salt sensitive crops |
| 1.6 – 2.5 dS $m^{-1}$ | - | Critical to salt tolerant crops |
| >2.5 dS $m^{-1}$ | - | Injurious to most crops |

## II. MATERIALS AND METHODS

Soil samples were collected from three different plant groups from three different habitats like Ooty, agricultural soils in Coimbatore and Bharathiar University campus. The three different plant groups were medicinal plants, agricultural crops and trees. The soil samples were collected by standard methods. All the soil samples were properly labelled and brought to the laboratory for further analysis. The soil samples were air dried and sieved through 2mm sieve for homogeneity. pH of the soil samples were determined by using pH meter. Electrical conductivity, TDS and salinity were analysed with the help of electrical conductivity meter. Sodium, potassium, calcium and lithium were estimated with the help of flame photometer.

*A. Soil Collection In Ooty [Medicinal Plants]*

1) Aloe vera
2) Foeniculum vulgare
3) Acorus calamus
4) Fragaria ananassa
5) Thymus vulgaris
6) Iris florentina

*B. Soil Collection In Agricultural Areas [Agricultural Crops]*

1) Morus alba
2) Musa acuminata
3) Cocos nucifera
4) Zea mays
5) Saccharum officinarum
6) Sorghum bicolor

*C. Soil Collection In Bharathiar University [Trees]*

1) Azadirachta indica
2) Bambusa vulgaris
3) Ziziphus jujuba
4) Eucalyptus globulus
5) Phyllanthus emblica
6) Santalum album

Table 1: pH, EC, TDS, Salinity of medicinal plants soil

| S.no | Sample Name | pH | EC µS/cm | TDS ppm | Salinity ppm |
|---|---|---|---|---|---|
| 1 | Aloe vera | 05.68 | 058.0 | 37.3 | 43.5 |
| 2 | Foeniculum vulgare | 05.70 | 043.5 | 31.4 | 36.6 |
| 3 | Acorus calamus | 05.86 | 037.7 | 25.5 | 29.8 |
| 4 | Fragaria ananassa | 05.87 | 037.0 | 25.7 | 29.0 |
| 5 | Thymus vulgaris | 05.71 | 043.0 | 29.4 | 33.6 |
| 6 | Iris florentina | 05.93 | 033.6 | 22.4 | 26.4 |

Table 2: pH, EC, TDS, Salinity of agricultural crop soils

| S.no | Sample Name | pH | EC µS/cm | TDS ppm | Salinity ppm |
|---|---|---|---|---|---|
| 1 | Morus alba | 06.92 | 131.9 | 88.9 | 98.9 |
| 2 | Musa acuminata | 07.59 | 162.0 | 119.1 | 140.5 |
| 3 | Cocus nucifera | 07.27 | 190.3 | 125.8 | 149.4 |
| 4 | Zea mays | 06.77 | 110.4 | 73.5 | 85.4 |
| 5 | Saccharum officinarum | 06.66 | 176.7 | 122.3 | 146.3 |
| 6 | Sorghum bicolor | 06.60 | 099.0 | 67.1 | 78.6 |

Table 3: pH, EC, TDS, Salinity of tree soils

| S.no | Sample Name | pH | EC µS/cm | TDS ppm | Salinity ppm |
|---|---|---|---|---|---|
| 1 | Azadirachta indica | 07.21 | 111.3 | 073.8 | 086.7 |
| 2 | Bambusa vulgaris | 06.86 | 089.9 | 060.2 | 070.8 |
| 3 | Ziziphus jijuba | 06.67 | 066.2 | 056.0 | 068.8 |
| 4 | Eucalyptus globulus | 06.98 | 075.4 | 052.8 | 062.3 |
| 5 | Phyllanthus emblica | 07.01 | 078.2 | 050.1 | 060.3 |
| 6 | Santalum album | 06.27 | 031.2 | 027.1 | 032.2 |

Table 4: Na, K, Ca, Li concentrations in medicinal plant soils

| S.no | Sample Name | Na (ppm) | K (ppm) | Ca (ppm) | Li (ppm) |
|---|---|---|---|---|---|
| 1 | Aloe vera | 364 | 64 | 83 | 0 |
| 2 | Foeniculum vulgare | 366 | 68 | 83 | 0 |
| 3 | Acorus calamus | 337 | 73 | 87 | 0 |
| 4 | Fragaria ananassa | 368 | 79 | 92 | 0 |
| 5 | Thymus vulgaris | 362 | 51 | 94 | 44 |
| 6 | Iris florentina | 362 | 55 | 99 | 71 |

Table 5: Na, K, Ca, Li concentrations in agricultural crop soils

| S.no | Sample Name | Na (ppm) | K (ppm) | Ca (ppm) | Li (ppm) |
|---|---|---|---|---|---|
| 1 | Morus alba | 362 | 52 | 0 | 86 |
| 2 | Musa acuminata | 362 | 44 | 0 | 94 |
| 3 | Cocus nucifera | 363 | 57 | 0 | 99 |
| 4 | Zea mays | 363 | 64 | 0 | 0 |
| 5 | Saccharum officinarum | 361 | 45 | 69 | 0 |
| 6 | Sorghum bicolor | 361 | 47 | 73 | 0 |

Table 6: Na, K, Ca, Li concentrations in tree soils

| S.no | Sample Name | Na (ppm) | K (ppm) | Ca (ppm) | Li (ppm) |
|---|---|---|---|---|---|
| 1 | Azadirachta indica | 367 | 70 | 78 | 0 |
| 2 | Bambusa vulgaris | 366 | 58 | 67 | 0 |
| 3 | Ziziphus jijuba | 366 | 58 | 58 | 0 |
| 4 | Eucalyptus globulus | 365 | 59 | 59 | 0 |
| 5 | Phyllanthus emblica | 366 | 62 | 62 | 0 |
| 6 | Santalum album | 367 | 65 | 63 | 0 |

## III. RESULTS AND DISCUSSION

All the soil samples of medicinal plants were moderately acid (5.6 – 6.0). The agricultural soil samples were neutral (6.6 – 7.3) and also slightly alkaline (7.4 – 7.8). Tree soil samples were slightly acid (6.1 – 6.5) and neutral (6.6 – 7.3). All the medicinal, agricultural and tree soil samples were normal in electrical conductivity (EC <8 – normal). Total dissolved solids and salinity were normal for all the medicinal, agricultural and tree soil samples.

In plants sodium and potassium are two important ions that induce salt stress in plants. Sodium is a beneficial element but it is non-essential for plants. Calcium is important micronutrient. In excessive concentration both are toxic to plants. They cause damage to crops [Gabrijel Ondrasek et al., 2011]. Plants need very small quantities of sodium. Sodium level is greater than 200 ppm have a toxic effect in soil. At high concentration leaching of sodium can be accelerated by the addition of gypsum.

Large amount of potassium is needed for plant growth. Optimum level of potassium for plant growth is 80 – 250 ppm. It is contributed to raise salt level in soil. Calcium optimum range is 1000 – 4000ppm. An average of 20 – 30 mg/kg lithium was cited in many studies. Lithium concentration 10 – 40 mg/kg was considered as the background concentration of lithium in soil [Laurence Kavanagh et al., 2018]. In medicinal plants soil, sodium level was between 337 – 368 ppm. Potassium level was between 51 – 79 ppm. Calcium concentration was 83 – 99 ppm. Lithium was absent in four soil samples and present in two soil samples 44, 71 ppm respectively. In agricultural soil samples sodium concentration was between 361 – 363 ppm. Potassium was between 44 – 64 ppm. Calcium was absent in four soil samples and present in two soil samples 69, 73 ppm. Lithium level was between 86, 94, 99 ppm in three soil samples and absent in three soil samples.

In tree soil samples sodium level was between 365 – 367 ppm. Potassium concentration was 58 – 70 ppm. Calcium was between 58 – 78 ppm in different tree soil samples. Lithium was absent in all tree soil samples.

## IV. CONCLUSION

Based on the above results, the soil samples are moderately acid to slightly alkaline. Electrical conductivity, total dissolved solids and salinity are normal for all soil samples. In all the soil samples sodium level is higher. Potassium level is below the optimum level in all soil samples. Calcium level is very much low in all soil samples. Lithium is present in two medicinal plants soil and three agricultural plants soils. Lithium is absent in other soil samples. Soil analysis indicated that all the soil samples are under low level of salinity risk.

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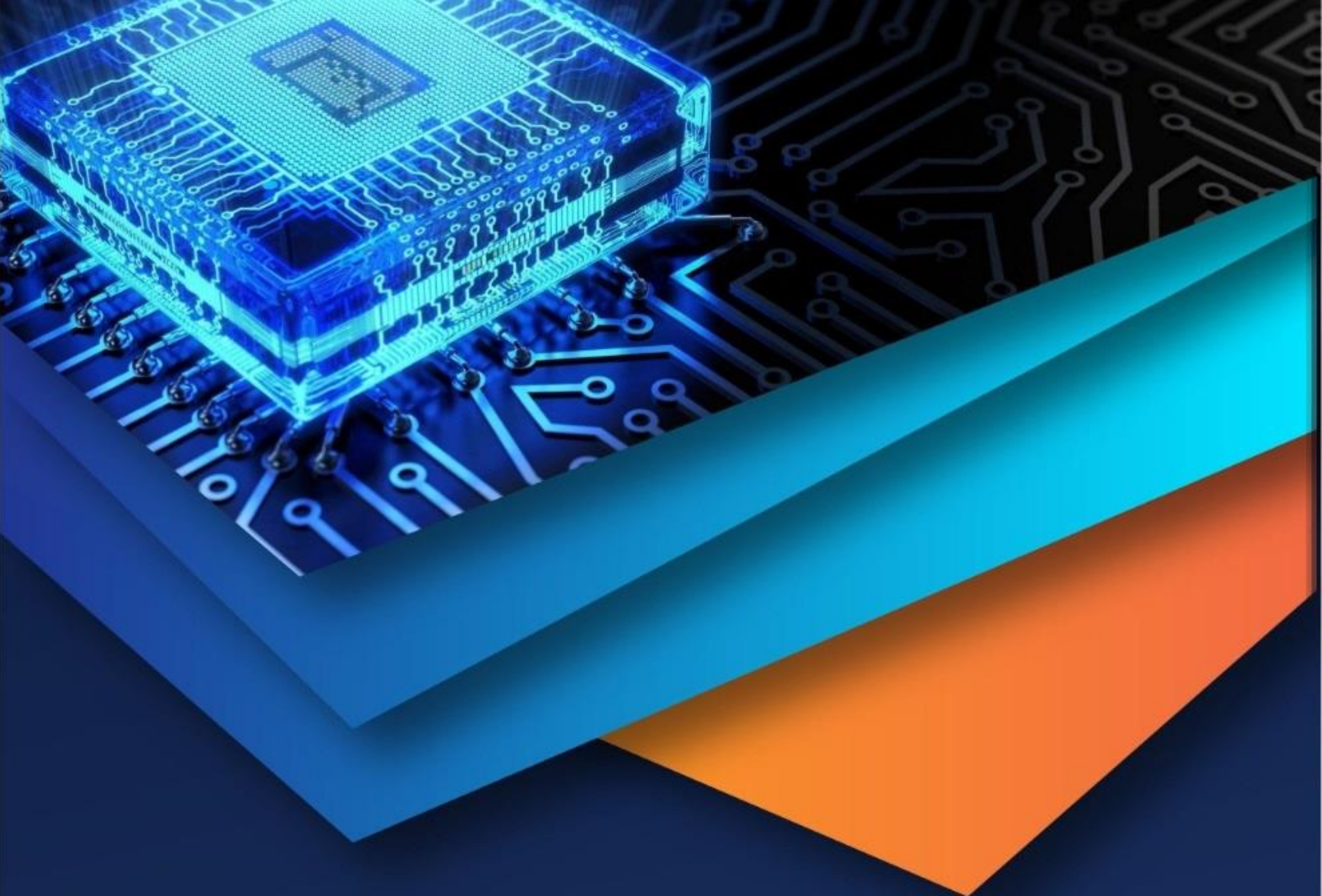


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