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A CASE STUDY ON SOIL FERTILITY STATUS OF SALT AFFECTED SOILS OF HIRIYUR TALUK, CENTRAL DRY ZONE OF KARNATAKA,

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Salinity induced land degradation is one of the major obstacles to sustainable agricultural production in many arid and semi-arid regions of the world (Bossio *et al.,* 2007). Increasing soil salinity and sodicity are serious worldwide land degradation issues and may even increase rapidly in the future (Wong *et al.,* 2009). It is estimated that 1.5 billion hectare of lands, all over the world, are salt-affected (Yuan *et al.,* 2010). In India, the area under salt-affected soils is about 6.73 million ha with states of Gujarat (2.23 m ha), Uttar Pradesh (1.37 m ha), Maharashtra (0.61 m ha), West Bengal (0.44 m ha) and Rajasthan (0.38 m ha) together accounting for almost 75% of saline and sodic soils in the country (Sharma and Singh, 2015). Soil salinity problems are encountered in almost all the districts in Karnataka and AP. The area extends to about 0.176 million ha in AP, 0.2 million ha in Karnataka, 0.0427 million ha in TN and about 0.03 million ha in Kerala. (Swarajyalakshmi *et al.,* 2008). Around 50,000 ha of salt affected area are present in Chitradurga district out of which 30,000 ha is present in Hiriyur taluk alone (Chitradurga chapter IV).

All soils contain some amount of soluble salts, which is indeed essential for the healthy growth of plants. If the quantity of soluble salts in a soil exceeds a certain value, the growth and yield of most crops is adversely affected. Such soils, which contain excess soluble salts, adversely affect the plant growth, are called the salt-affected soils. These soils are grouped into two classes depending upon the nature of soluble salts, physico-chemical characteristics, plant response and the management practices required for their reclamation namely, saline and alkali or sodic soils (Anonymous, 2004). Sodicity signifies the predominance of exchangeable sodium (Na^+) in the soil. Sodicity in soils has a strong impact on the soil structure. Dispersion occurs when the clay particles swell strongly and separate from each other on wetting. On drying, the soil becomes dense and hard cloddy and without defined structure form (Sumner *et al*., 1998). Salinity refers to the amount of neutral soluble salt in soil, such as sulphates (SO_4), and chlorides (Cl). Strongly saline soils often exhibit a whitish surface crust when dry. Most saline soils cause yield reduction in crop plants by reducing osmotic potential of soil water. This makes lesser availability of water from soil. Therefore, crops suffer from water stress and result in physiological wilt. In irrigated lands, the major causes for salinity are a combination of poor land management and crude irrigation practices.

The problem of salinization is aggravated by restricted land drainage in most part of the command. This facilitates accumulation of soluble salts over a period of irrigation. Further, semi-arid climate keeps salts in surface layers and adversely affects crop growth. Vani Vilas sagar dam was constructed in Hiriyur taluk of Chitradurga district, Karnataka during 1906, to provide irrigation for parts of Hiriyur and Challakare taluks. Due to alkaline nature of Vani Vilas sagar irrigation water, the soils which are irrigated have gradually become sodic and another reason is inadequate drainage. Hence, a survey study was undertaken to study the effect of tube well irrigation water on soil physico-chemical properties and available nutrients status of central dry zone of Karnataka, Hiriyur taluk, Chitradurga district.

Materials and Methods

Ninety-six soil samples using GPS from 0 - 22.5 cm depth were collected randomly representing Imangala, Hiriyur, Dharmapura and Javagondanahally hoblis of Hiriyur taluk, Chitradurga district, in the cropping period of the peak dry season (January, 2019). Soil samples were first air-dried in shade, then powdered and sieved through 2 mm sieve then stored in clean polyethylene containers. Processed soil samples were analyzed in the laboratory for various physico-chemical parameters (pH and EC), organic carbon and available major (N, P_2O_5 and K_2O) and micronutrients (Fe, Zn, Mn and Cu) status by adopting standard analytical techniques.

The soil pH was measured in 1:2.5 soil water suspension using pH meter and EC(dS m^{-1}) was measured in the supernatant solution of 1:2.5 soil water extract using conductivity bridge (Sparks, 1996). Organic carbon was estimated by Walkley and Black's wet oxidation method (Sparks, 1996). Available nitrogen was estimated by modified alkaline $KMnO_4$ method (Sharawat and Burford, 1982). Available phosphorus was extracted with Olsen's and Bray's reagent depending on their pH and the amount of P in the extract was estimated by chlorostannous reduced phosphomolybdate blue colour method using spectrophotometer at wavelength of 660 nm (Sparks, 1996). Available potassium was extracted with neutral normal ammonium acetate extract and determined by using flame photometer as described by Sparks (1996). The micronutrients were extracted with DTPA extractant and the aliquot was assessed by using Atomic Absorption Spectrophotometer (Lindsay and Norvell, 1978).

Results and discussion

The results of physic-chemcial proeprties and available nutrient status of soils were presented in tables 1 to 4.

Soil pH

The pH of soils (0-22.5 cm) of Aimangala hobli varied from 7.87 to 9.05 with a mean of 8.52. The highest and lowest pH values were observed in Metikurke (9.05) and Mayasandra villages (7.87), respectively.

In Hiriyur hobli, the pH values in soils (0-22.5 cm) ranged between 7.42 and 8.81 with a mean of 8.29. The highest and lowest pH values of 8.81 and 7.42 were recorded in surface soils of M.G. Colony village.

In Dharmapura hobli, the pH values in soils (0-22.5 cm) ranged between 6.88 and 8.82 with a mean of 8.19. The highest and lowest pH values of 8.82 and 6.88 were recorded in surface soils of Chillahalli and Devarakotta villages.

The pH of soils (0-22.5 cm) of Javagondanahally hobli varied from 7.10 to 8.52 with a mean of 8.09. The highest and lowest pH values were observed in Adivala (8.52) and Patrhalli villages (7.10), respectively.

Soil reaction was found to be slightly alkaline to alkaline as the soils studied were under arid to semi-arid region and hence not subjected to leaching losses of cations. Similar values were reported by Binita *et al*. (2009) and Ashok (1996) in black soils of the GLBC area.

Electrical conductivity (EC)

The soils of Aimangala hobli were non-saline to saline in nature with EC values ranging from 0.19 to 2.20 dS m^{-1} with an average of 0.48 dS m^{-1} at the surface. Highest EC value was observed in the surface samples of Mayasandra (2.20 dS m^{-1}) village and the lowest EC value was noticed in Metikurke village (0.19 dS m^{-1}).

The electrical conductivity of Hiriur kasaba hobli varied from 0.21 to

2.00 dS m^{-1} with a mean of 0.70 dS m^{-1} and was non saline to saline. Kunikere village soils recorded highest electrical conductivity with a value of 2.00 dS m^{-1} in surface depths. Lowest electrical conductivity value (0.21 dS m^{-1}) was noticed in surface soils of M.G. Colony village.

In Dharmapura hobli, the electrical conductivity varied from 0.11 to 5.01 dS m^{-1} with a mean of 0.64 dS m^{-1} in surface depth and were non saline to saline. Devarakotta village soils recorded highest and lowest electrical conductivity with values of 5.01 dS m^{-1} and 0.11 dS m^{-1}.

The electrical conductivity of soils of Javagandanahalli hobli ranged from 0.16 to 10.21 dS m^{-1} with an average value of 0.84 dS m^{-1} and were non saline to saline in nature. The highest and lowest electrical conductivity with values of 10.21 dS m^{-1} and 0.16 dS m^{-1} were recorded in villages of Patrehalli and Adivala, respectivley.

The lands are bound to be saline because groundwater being highly saline both during pre-monsoon and post-monsoon and lesser leaching losses of cations due to arid and semi-arid climate (Varadarajan *et al*., 2010).

Organic carbon (OC)

The organic carbon in soils of Aimanagala hobli ranged from 0.30 to 0.99 % with an average of 0.64 % . The highest organic carbon was noticed in soils of Tavandi village (0.99 %) and the lowest was registered in Mayasandra village soils (0.30 %).

In soils of Hiriyur kasaba hobli, the organic carbon content varied from 0.27 to 0.99 % with a mean of 0.73 % . The soils of Babbur village recorded highest organic carbon (0.99 %) and the lowest (0.27 %) was recorded in M.G. Colony village.

The soils of Dharmapura hobli also recorded similar range of organic carbon content as Hiriyur kasaba hobli. It varied from 0.27 to 0.99 % with a mean value of 0.70 %. The highest organic carbon (0.99 %) content was recorded in Hariyabbe village and the lowest (0.27 %) was recorded in Devarakotta village.

The organic carbon in soils of Javagondanahalli hobli ranged from 0.36 to 0.99 % with a mean of 0.76 % . The highest and the lowest organic carbon were noticed in soils of Patrehalli village (0.99 and 0.36 %).

The low organic carbon content of some of the soils showed lower organic matter indicating poor soil fertility status. The higher contents of organic matter in some soils are due to management factors like application of FYM and green manures at regular intervals by the growers. Similar findings were reported by Babar and Kaplay (2004).

Available nitrogen

The available nitrogen status of soils of Aimanagala hobli was low to medium. The available nitrogen content in soils ranged from 154 to 451 kg ha^{-1} with a mean of 299.66 kg ha^{-1}. Highest available nitrogen content was recorded in Tavandi village soil (451 kg ha^{-1}) and the lowest in Mayasandra village soil (154 kg ha^{-1}).

In Hiriyur kasaba hobli, the available nitrogen status in soils ranged between 141 and 451 kg ha^{-1} with a mean of 337.83 kg ha^{-1}. The highest available nitrogen content (451 kg ha^{-1}) was recorded in soils of Babbur village and the lowest (141 kg ha^{-1}) was recorded in soils of M.G. Colony village.

The soils of Dharmapura hobli fall under low to medium rating in available nitrogen content. The available nitrogen content in soils ranged from 141 to 451 kg ha^{-1} with a mean of 325.46 kg ha^{-1}. Highest available nitrogen content was noticed in Hariyabbe village soil (451 kg ha^{-1}) and the lowest in Devarakotta village soil (141 kg ha^{-1}).

The available nitrogen status of soils of Javagondanahally hobli was low to medium. The available nitrogen content in soils ranged from 180 to 451 kg ha^{-1} with a mean of 351.80 kg ha^{-1}. Highest and lowest available nitrogen content was identified in Patrehalli village soil (451 and 180 kg ha^{-1}).

Majority of soil samples showed low to medium status of available nitrogen which might be due to the low organic matter in the surface soils and also the semi-arid climatic condition which have favoured rapid oxidation and lesser accumulation of organic matter which resulted in low nitrogen content, Bandopadhyay *et al.* (2004).

Available phosphorus (P_2O_5)

In Aimangala village, the available phosphorus varied from 11.4 to 65.6 kg ha^{-1} with an average of 30.69 kg ha^{-1}. Highest and lowest available phosphorus (65.6 and 11.4 kg ha^{-1}) was registered in soils of Metikurke village.

With respect to Hiriyur kasaba hobli, the available phosphorus status ranged from 15.0 to 71.4 kg ha^{-1} with a mean of 32.53 kg ha^{-1} in soils. Kunikere village soil recorded the highest available phosphorus (71.4 kg ha^{-1}) and the lowest available phosphorus was recorded in soils of M.G. Colony (15.0 kg ha^{-1}).

The available phosphorus content in soils of Dharmapura hobli were in low to high range and varied from 16.5 to 69.6 kg ha^{-1} with a mean of 31.83 kg ha^{-1}.

Chillahalli village soil recorded the highest available phosphorus (69.6 kg ha^{-1}) and the lowest available phosphorus was recorded in soils of Devarakotta (16.5 kg ha^{-1}).

The soils of Javagondanahalli ranged from 18.0 to 55.0 kg ha^{-1} with a mean of 32.49 kg ha^{-1} in available phosphorus content. Highest available phosphorus content was noticed in Patrehalli village soil (55.0 kg ha^{-1}) and the lowest in Adivala village soil (18.0 kg ha^{-1}).

Majority of soil samples showed medium status of available phosphorous which may be due to continuous application of phosphatic fertilizers to crops which resulted in build-up of phosphorus as efficiency of applied P is very low and it comes in available form very slowly, mainly due to the fixation as Ca-phosphate. The similar results are reported by Sharma *et al.* (2008). Farmers are using only DAP as a source of phosphorus nutrient in adequate quantity and as a result, P is available in medium range.

Available potassium (K_2O)

The available potassium status of soils of Aimangala hobli ranged from 139 to 1031 kg ha^{-1} with a mean of 388.88 kg ha^{-1}. Highest available potassium was recorded in surface samples of Suraganahalli village (1031 kg ha^{-1}) and the lowest in Mayasandra surface soil (139 kg ha^{-1}).

In Hiriyur kasaba hobli, the available potassium status varied between 169 and 2105 kg ha^{-1} with an average of 606.23 kg ha^{-1} in soils. Babbur and Lakkanahalli village soils recorded highest and lowest available potassium (2105 and 169 kg ha^{-1}), respectively in surface samples.

The available potassium content in soils of Dharmapura hobli were in medium to high range and varied from 186 to 1197 kg ha^{-1} with a mean of 664.37 kg ha^{-1}. Hariyabbe village soil recorded the highest available phosphorus (1197 kg ha^{-1}) and the lowest available phosphorus was recorded in soils of Devarakotta (186 kg ha^{-1}).

The soils of Javagondanahalli ranged from 325 to 1663 kg ha^{-1} with a mean of 757.77 kg ha^{-1} in available potassium content. Highest available potassium content was noticed in Patrehalli village soil (1663 kg ha^{-1}) and the lowest in Adivala village soil (325 kg ha^{-1}).

The higher content may be due to the predominance of potash rich micaceous and feldspar minerals present in parent rocks and the similar findings were reported by Ravi Kumar *et al.* (2007). Surface soil samples have high available potassium content which could be due to more intense weathering and upward translocation of potassium from lower depth along with capillary rise of ground water Basavaraju *et al.* (2005). Similar results were reported by Hirekurabar *et al.* (2000).

Available micronutrients

The DTPA extractable zinc content in Aimangala hobli ranged from 0.47 to 3.31 with a mean of 1.42 mg kg^{-1}, iron content ranged from 3.99 to 19.49 mg kg^{-1} with a mean of 8.65 mg kg^{-1}, manganese content ranged from 17.59 to 29.16 mg kg^{-1} with an average of 24.11 mg kg^{-1} and copper content ranged from 1.21 to 6.58 mg kg^{-1} with a mean of 2.83 mg kg^{-1}, respectively in surface soils. Among the soils of different villages studied, Tavandi village samples recorded higher DTPA extractable micronutrients (Zn, Fe and Cu) and Mayasandra village samples recorded lower DTPA extractable micronutrients.

In Hiriyur kasaba hobli, the available zinc, iron, manganese and copper contents ranged from 0.44 to 4.33, 5.7 to 23.86, 18.41 to 28.20 and 1.30 to 11.27 mg kg^{-1} with average values of 2.08, 10.96, 23.10 and 3.63 in soils, respectively. Among the different villages studied, Babbur village soil samples recorded higher DTPA extractable micronutrients *viz.,* iron, manganese and copper. Lower DTPA extractable micronutrients *viz.,* zinc was recorded in M.G.Colony village.

The DTPA extractable zinc content in Dharmapura hobli ranged from 0.42 to 2.82 with a mean of 0.93 mg kg^{-1}, iron content ranged from 4.07 to 20.04 mg kg^{-1} with a mean of 10.45 mg kg^{-1}, manganese content ranged from 13.77 to 26.20 mg kg^{-1} with an average of 20.70 mg kg^{-1} and copper content ranged from 0.91 to5.71 mg kg^{-1} with a mean of 2.29 mg kg^{-1}, respectively soils. Among the soils of different villages studied, Eshwaragere samples recorded higher DTPA extractable micronutrients *viz.,* copper, manganese and zinc and Devarakotta village samples recorded higher iron content.

In Javagondanahalli hobli, the available zinc, iron, manganese and copper contents ranged from 0.44 to 3.59, 5.95 to 42.40, 13.80 to 32.32 and 1.09 to 6.35 mg kg^{-1} with average values of 1.48, 11.42, 20.23 and 2.33 in soils, respectively. Among the different villages studied, Patrehalli village soil samples recorded higher DTPA extractable micronutrients *viz.,* iron, manganese and copper. Lower DTPA extractable micronutrients *viz.,* iron, manganese and copper were recorded in Adivala village. The variation in availability of DTPA extractable in all the villages did not show any significant variation. However, the zinc deficiency was found due to uptake of crop and iron dissolved in the soil solution which in turn reduces the zinc availability.

Conclusions :

References

Anonymous, 2004, Reclamation and management of salt affected soils. Central Soil Salinity Research Institute, Karnal. 12-153.

Ashok, L.B., 1996, Micronutrient fertility map of Ghataprabha command area of Belgaum district. *M. Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad (India).*

Bandyopadhyay, K.K., Ghosh, P.K, Chaudhary RS, Mati K, Mandal KG, Mishra AK. Integrated nutrient management practices in soybean and sorghum in sole and intercropping system in a Vertisol. Indian J. Agric. Sci. 2004; 74:55-63.

Babar MD, Kaplay RD. Influence of canal irrigation on groundwater fluctuation and soil properties in Jayakwadi command of Maharashtra. Agropedology, 2004; 14(2):82-86.

Basavaraju PK, Sharma SD, Badrinath MS, Sridhara S, Hareesh GR. Prosopis juliflora An efficient tree species for reclamation of salt - affected soils. Karnataka J. Agric. Sci., 2007; 20(4):727-731.

Binita, N.K., Dasog, G.S. and Patil, P.L. (2009) Soil fertility mapping in Ghataprabha left bank canal command area of north Karnataka by geographic information system technique. *Karnataka Journal Agricultural Sciences*, **22:** 73-76.

Bossio D, Critchley W, Geheb K, Van Lynden G, Mati B. Conserving land protecting water. In Comprehensive Assessment of Water Management in Agriculture: Water for Food, Water for Life, Molden D (ed). Stylus Publishing, LLC: Sterling, VA. 2007, 551-584.

Hirekurabar PM, Satyanarayana T, Sarangnati PA, Manjunatham HM. Forms of potassium and their distribution in soils under cotton-based cropping system in Karnataka. J. Indian Soc. Soil Sci., 2000; 48:604-608.

Lindsay, W. L. and Norvell, W. A., 1978, Development of a DTPA-soil test for Zn, Fe, Mn and Cu. *Soil Sci. Soc. American J.,* 42: 421-428.

Ravi Kumar MA, Patil PL, Dasog GS. Mapping of nutrients status under

48A distributary in Malaprabha right bank command of Karnataka by geographic information system technique-I: Major-nutrients. Karnataka J. Agric. Sci. 2007a; 20(4):735-737.

Sharawat, K. L. and Burford, J. R., 1982, Modification of alkaline permanganate method for assessing the availability of soil nitrogen in upland soils. *Soil Sci.,* 133: 53-57.

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Sharma RC, Saxena RK, Verma KS, Mondal AK. Characteristics and reclaimability of sodic soils in the alluvial plain of Etah district, Uttar Pradesh. Agropedology, 2008; 18(2):76-82.

Sparks, 1996, *Methods of soil analysis, Part -3: Chemical Methods,* Soil Science Society of America, USA.

Sumner, M.E., Miller, W.P., Kookana, R.S. and Hazelton, P. (1998) Sodicity, dispersion, and environmental quality. *In Sumner, M. E. and Naidu, R. (eds)* "Sodic Soils - Distribution, Properties, Management and Environmental Consequences". *Oxford University Press*, New York, pp. 149 - 172.

Soil Salinity in South India: Problems and Solutions G. Swarajyalakshmi,P. Gurumurthy &G. V. Subbaiah Pages 247-275 | Published online: 15 Oct 2008 https://doi.org/10.1300/J144v07n01_09

Varadarajan, N., Purandara, B.K. and Bhism Kumar (2010) Status of salinity in aquifers of Ghataprabha Command Area, Karnataka, India. *RMZ – Materials and Geoenvironment*, **57:** 347–362.

Wong VNL, Dala RC, Greene RSB. Carbon dynamics of sodic and saline soils following gypsum and organic material additions: A laboratory incubation. Applied Soil Ecology. 2009; 14:29-40.

Yuan JF, Feng G, Ma Hy, Tian CY. Effect of nitrate on root development and nitrogen uptake of *Suaeda physophora* under NaCl salinity. Pedosohere, 2010; 20(4):536-544.