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5. Physiochemical Analysis of Flooded (2019) Sugarcane Crop Field Soil of Shirol Tahasil in Kolhapur for Review of Cyanobacterial Biodiversity

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Abstract

Sugarcane is major cash crop of Shirol taluka. Huger works on Cyanobacteria that involve in recycling of nutrients makes major role the economy of soil and growth of crop. Improper use of synthetic fertilizers adversely effect on fertility of soil so testing of Soil determine fertilizers recommendation to the field. Due to flood in 2019 soil wealth of study area was drastically affected. At present study analyzed Physiochemical parameters such as pH, electrical conductivity, organic carbon, phosphorus, potassium, calcium carbonate, iron, manganese, zinc and copper of flooded field soil of study area with reference to sugarcane crop as well as cyanobacterial growth . After the investigation of soil it realize that parametric values become variable, the soil pH neutral to slightly alkaline, EC point out about salinity problem, organic carbon, calcium carbonate, potassium, iron, copper, potassium , manganese show an average higher range but phosphorus and zinc is limited in study area.

Keywords: Sugarcane, Cyanobacteria, Soil Analysis, Micronutrients, Shirol.

1. Introduction

In 2019 due to heavy rainfall in Study area has drastically affected human livelihood. Because of the flood, sugarcane production per hectare also declined. Everyone is worried, the average production of sugarcane is 120 tons per hectare and the average sugar yield is 12.5 %. The Sugarcane is important commercial led industrial crop in India, contributed significantly to the growth of India (A D Pathak 2007) Saccharum, tribe Andropogoneae tribe predominantly grows in tropical and subtropical regions. Sugarcane maximum yields obtained in various different environments (Irvine; 1983), native to the warm temperate to tropical South, Southeast

Asia, and New Guinea, and used for sugar production. Sugarcane grown in about 115 countries of the world. India i sugarcane in 2011-13, contributing about 15 percent of the total sugar production in the world .Maharashtra is the second-biggest producer of sugarcane after Uttar Pradesh. In 2017- 2018, Maharashtra accounted for 17.73 per cent (9.2lakh hectares) of the total area under sugarcane cultivation in India (52.00 lakh hectare).The country's total cane production (3769.05 lakh ton) was 25.22 percent production (950.65 lakh ton/ hectare) in Maharashtra state. Plant growth is enhanced in the presence of cyanobacterium, even without organic Nitrogen fertilizer application (Svircev et al. 1997). Beneficial effects of cyanobacterial inoculation were reported, not only for maize, but for other crops such as wheat, soybean, oat, tomato, radish, cotton, sugarcane, chili, bean, muskmelon and lettuce. The objective of these study is to analyses the soil samples of the sugarcane soil of shirol taluka for investigate the diversity of cyanobacteria in sugarcane field of study.

2. Materials and Method

Shirol is the sugarcane crop rich taluka of Kolhapur district extends between 16.37° and 16.52° north latitudes and 74.27° and 74.42° east longitudes. Taluka is prosperous because the Krishna, Panchganga, Dhudhganga and Warna rivers, which make this area an extensive alluvial tract. Soil samples were collected from completely flooded area and analyzed in Data sugar factory soil analysis laboratory. For sampling 4 representative villages each with different 15 sugarcane field are selected. This study was primarily focused on testing of various soil parameters of flooded sugarcane fields of village and to calculate average parameters. Such average analytical results were expected to be representative for the entire village. Out of 55 villages in Shirol taluka18 villages were completely flooded While 25villages were partially surrounded and 12 are non-flooded.The flooded villages are Akiwat, Arjunwad, Bastwad, Chinchwad, Hasur, June danwad, Kavathesar, khidrapur, Kurundwad, Kanwad, Nave Danwad, Nurshinwadi, Rajapur, Rajapurwadi, Shirati, Shirdhon, Terwad. From this 4 representative villages with different 15 sugarcane field each are selected as Arjunwad, Danwad, Kanwad, khidrapur, for soil sampling

3. Soil Sampling and Analysis

Soil analysis is always beneficial to check the soil texture and nutrients in the soil and apply fertilizers. Representative Samples should be taken separately from by proper method. Soil pH was determined by using a pH meter with combined glass electrode in water (H2O) at

1:2.5 soils: water ratio as described by Van Reeuwijk (1992).Electrical conductivity (EC) was measured according to Rhoades (1996) using portable EC meter. Organic Carbon was determined using the wet oxidation method (Walkley and Black, 1934) where, the carbon was oxidized under standard conditions with potassium dichromate in sulfuric acid solution. Available phosphorous determination was carried out by the Olsen method using NaHCO3 as extracting solution (Olsen and Sommer, 1982). CEC was measured after leaching NH4OAc extracted soil samples with 10% NaCl solution. The amount of ammonium ion in the percolate was determined by the usual Kjeldahl procedure and reported as CEC. Micronutrients (Fe and Zn) were determined with di-ethylene tri-amine penta-acetic acid (DTPA) method as described by Lindsay and Norvell (1978). Plant sampling for N, P, and Fe and Zn analysis Post harvest shoots were collected and oven dried in an oven at 70 o C for 48hrs, until constant weight was achieved. Total plant N and P the nutrient contents of total Nitrogen (N) and Phosphorous (P) of leaves were analyzed using Kjeldahl digestion method (Nelson and Sommers, 1980) and colorimetric method (Olsen and Sommer, 1982), respectively. Fe and Zn contents digested plant tissue was analyzed using atomic absorption technique (Isaac and Kerber, 1971).

4. Result and Discussion

Table: 1A showing different parameters of soil samples Village- Arjunwad and Danwad.

Sr.No	pH	EC	OC	Caco3	p	K	Fe	Mn	Zn	Cu	Sr.No	pH	EC	OC	Caco3	p	K	Fe	Mn	Zn	Cu
1	7.4	0.54	1.06	6.4	32.7	246	2.7	3	0.4	3.1	16	7.3	0.7	0.42	6	67.1	605	18.6	10.8	1.6	7.4
2	7.5	0.59	0.69	12	67.1	582	6.3	7.1	0.7	3.2	17	7.45	0.5	0.6	16	67.1	470	8.4	9.2	1	4.5
3	7.59	0.62	0.83	3.6	20.6	717	8.9	17	0.6	6.4	18	7.58	1.4	0.95	7.6	49.5	482	10	9.1	0.6	5.8
4	7.45	1.52	0.42	12	40.6	493	14.4	15	1.2	8.5	19	7.4	0.5	0.6	7.6	2.8	358	15.4	9.8	1.4	7
5	7.49	0.32	0.84	5.6	63.2	515	10.6	8	1.6	4.6	20	7.45	0.7	0.69	13.2	98.5	403	9.3	10.1	1.1	4.5
6	7.54	0.6	0.63	12.4	71	605	8.9	8	1	4.1	21	7.65	1.1	1.12	8.4	26.1	403	9.8	8.3	0.3	5.4
7	7.64	0.62	0.96	14.4	47.7	666	15.1	15	0.8	13	22	7.48	1.7	1.09	7.2	47.7	700	12	8.6	1.2	6.3
8	7.59	0.48	0.72	10.8	51.6	493	10.4	8	0.9	4.2	23	7.55	1.7	0.71	9.6	57.3	493	10.9	9.1	0.7	5.9
9	8.03	0.42	0.85	7.2	49.5	706	26	21	0.8	8.1	24	7.59	0.7	0.09	6.4	63.2	414	22.3	10.3	0.8	8.8
10	8.35	0.8	0.82	14.8	47.7	750	15.2	20	0.8	6	25	7.28	1.2	0.81	13.2	93.8	571	8.3	10.8	1.3	5.1
11	8.1	3.7	0.66	11.2	63.2	538	17.9	15	0.3	6	26	7.5	0.8	0.99	10.8	57.3	336	17.1	9.8	2.4	8.2
12	7.57	0.54	0.69	10.8	72.8	717	8.3	8	0.8	4.4	27	7.58	1.2	0.95	11.2	44.5	414	11.5	9	1	5.9
13	7.25	0.55	0.99	4.4	24.6	291	2.7	3	0.5	3.4	28	7.88	0.5	0.99	13.6	15.9	582	7.3	8.7	0.3	4.9
14	7.62	0.85	0.69	14	9.13	571	19.7	15	0.6	15	29	7.35	0.6	0.57	8	55.5	549	11.9	10.9	1.4	6.5
15	7.55	0.58	0.6	13.6	93.8	806	9.2	8	0.6	3.9	30	7.25	2.1	0.45	13.2	59.3	515	8.3	8.2	0.8	5.3

EC- mS/cm, C-org.& Caco3 .- % , P&K – Kg/hectre, Cu, Fe, Mn, Zn- ppm(Datta factory soil analysis laboratory)

Table: 1 B showing different parameters of soil samples Village kanwad And Khidrapur.

Sr.No	pH	EC	OC	Caco3	p	K	Fe	Mn	Zn	Cu	Sr.No	pH	EC	OC	Caco3	p	K	Fe	Mn	Zn	Cu
31	7.58	0.46	0.87	6.8	36.7	538	18.4	12	0.6	7	46	7.26	1.2	0.99	6.4	8	347	14.3	11.3	0.3	6.7
32	7.28	0.29	0.68	5.6	4.6	538	24	13	0.7	11	47	7.3	0.4	1.17	5.6	98.5	381	13.8	7.2	0.9	7.4
33	7.54	0.32	0.41	14.8	42	638	17.2	13	0.8	7	48	7.54	0.7	1.2	7.2	89	913	10	7.4	1.9	7.1
34	7.28	0.26	0.63	5.2	53.4	504	22.2	12	0.8	10	49	7.52	0.7	0.74	6.8	84.5	470	12.4	0.1	0.6	6.4
35	7.39	0.88	0.65	13.2	20.4	666	21.4	12	0.8	4.9	50	7.52	1.1	1.09	7.6	3.4	773	5.3	6.6	1.5	5.9
36	7.46	0.27	0.84	6.4	36.7	459	21	8.6	0.6	9	51	7.54	0.3	0.84	6.4	68.9	1120	10.8	7.9	0.9	6.1
37	7.45	0.37	0.74	10.4	53.4	381	22.1	12	0.6	7.1	52	7.56	0.4	0.81	5.2	63.2	1120	14	7.9	1	7.7
38	7.42	0.2	0.87	5.2	24.7	437	6.1	8.6	0	5.5	53	7.26	0.4	1.02	7.2	98.5	493	10.6	7.4	1	5.1
39	7.66	0.55	0.27	6.4	34.2	571	24.4	12	0.6	7.1	54	7.38	0.8	1.2	8	57.1	666	6.7	7.6	2.1	5.8
40	7.2	0.39	0.6	14.8	63.2	544	15.3	12	0.7	5.5	55	7.5	0.7	0.81	10	55.5	1098	9.6	7.8	0.7	5.8
41	7.48	0.3	0.76	16	44.5	605	14.8	12	0.7	4.6	56	7.35	0.4	1.11	5.6	98.5	343	13.7	7.3	1.1	9.9
42	7.32	0.52	0.49	6.4	55.5	538	24.2	12	0.6	6	57	7.52	0.5	1.02	4	72.8	638	6.2	7.7	1.4	5.9
43	7.3	0.29	0.41	6.8	36.7	493	23.2	12	0.7	9.6	58	7.68	0.2	0.69	5.6	91.5	571	20.5	4.4	0.9	8.9
44	7.18	0.22	0.63	5.2	59.3	470	18.8	12	0.7	11	59	7.52	0.4	1.02	5.6	55.5	829	7.9	7.7	1.9	7.5
45	7.68	0.5	0.27	3.6	14.2	493	21.1	12	0.6	5.9	60	7.58	0.3	1.11	5.2	32.9	605	6.7	7.7	1.2	6

EC- mS/cm, C-org.& Caco3 .- % , P&K – Kg/hectre, Cu, Fe, Mn, Zn- ppm(Datta factory soil analysis laboratory)

Table: 2. showing average, minimum and maximum value of different soil parameters.

Sr.No.	pH	EC	OC	Caco 3	p	K	Fe	Mn	Zn	Cu
Average	7.5035	0.705	0.773667	8.807	51.97	570.55	13.568	9.9644	0.9067	6.652
Minimum	7.18	0.18	0.09	3.6	2.8	246	2.7	0.1	0	3.1
Maximum	8.35	3.7	1.2	16	98.5	1120	26	21.4	2.4	15.4
standard value	6.5-7.5	<1	0.41-0.60	1-5	30-50	180-240	2.5-5.0	2.0-2.5	1.0-1.5	0.2-0.5

EC- mS/cm, C-org.& Caco3 .- % , P&K – Kg/hectre, Cu, Fe, Mn, Zn- ppm (Datta factory soil analysis laboratory)**(Source: Std. value. -Government soil analysis book, "krushidarshani" MFKV Rahuri)**.

After the overall analysis of soil samples of study area (Table1, 2) shows that the values for pH range from 7.18 to 8.3 specify that the nature of soils becomes neutral to slightly alkaline favors growth of cyanobacteria. Kaushik, B.D. (1994),Singh, R.N. (1961) point out that pH play significant role in growth, soil becomes neutral to slightly alkaline favors optimum growth establishment and diversity of cyanobacteria. But soil having more pH the plant cannot be absorb nutrients in soil like iron, zinc, copper and manganese, creating nutrient deficiencies in the sugarcane crop.Soil electrical conductivity (EC) calculate the quantity of soluble (salts) ion in

soil. It suggest actual quantity of soluble salts present in the soil. An examination of soil samples of study area value of Electrical Conductivity has variable ranges from 0.18 mS/cm to 3.7 mS/cm (Table.1, 2). Soil EC reading less than 1mS/cm soil become non-saline which do not effect on crop growth and microbial processes. The value of organic carbon (%) range from 0.09 to 1.2 % (Table.1, 2), much more than standard value in study area, so soil become open and more fertile. According to Perez-Garcia, O., Escalante, F. M. E., de-Bashan, L. E., Bashan(2011) Andrade, M. R., Costa, J. A. V.(2007) reported that significantly increase in cyanobacterial growth rate, biomass and lipid productivity with addiction of organic carbon addition, including glucose, dextrose, glycerol, and acetate.

Above Phosphorous in soil examination (Table1, 2) show ranges vary from 2.8Kg/hectare to 98.5 Kg/hectare. 70% area having more phosphorus. Cyanobacteria contribute in recycling in phosphorus As compared to inorganic phosphorus, organic algal phosphorus uptake was significantly higher showed in plant reported Fuller and Roger (1952). Potassium is essential micro nutrient play important role in photosynthesis, regulates the co2 uptake. From the examination of soil samples (Table1, 2) potassium ranges from 246 Kg/hectare to 1120 Kg/hectare indicating more amount of potassium present in soil. In study area 93% area shows calcium carbonate above the normal range varies from 3.6 to 16 %., So it is necessary that cyanobacteria widely used improve soil texture to neutralize soil acidity and supply calcium for plant nutrition, it help in optimizes nutrient absorption by balancing pH of soil. According to M. Dittrich and S. Sibler (2010) Cyanobacteriâ have been recognized as key players in the precipitation of calcium carbonate in marine and freshwater systems. Iron is important nutrients for plant growth and development because it exists in low-soluble form that is hardly available for plants. Useful for making chlorophyll, help to make the leaves dark green. Helps in absorption of other nutrients. The study area Soil samples iron (Table1,2) shows the variation of the Iron content ranges from 2.7 ppm to 26 ppm above the normal range accelerate the growth of cyanobacteria, Elder & Home (1977) ,Wurtsbaugh & Home (1983); Wurtsbaugh et al. (1985) reported that Iron has promotes cyanobacterial growth in natural waters. Iron additions have been shown to increase photosynthesis and nitrogen fixation by cyanobacterial populations.

Manganese concentrations in soils range varies from 0.1 to 21.40 ppm (Table1, 2). Play role in the process of photosynthesis. Its activities has many enzyme reaction involved in the metabolism of organic acids P and N. Zinc is one of the essential components for the production

of proteins and enzymes. Soil sample examination reveals that zinc concentrations range from 0.0ppm to 2.4 ppm (Table1, 2) indicating that in most of samples Zn is higher than the normal range of soils. The Copper is an important micronutrient need very little for growth. It is Helps in the formation of chlorophyll and protein, Necessary to regulate respiration. Soil analysis of Copper in soil show variation ranges from 3.00 to 15.4 ppm (Table1, 2) which is higher than normal range. Sunda W.G (2006) Copper is essential to cyanobacteria as a micronutrient.

5. Conclusion

After the investigation of soil it realize that parametric values become variable, the soil pH neutral to slightly alkaline, EC point out about salinity problem, organic carbon, calcium carbonate, potassium, iron, copper, potassium , manganese show an average higher range but phosphorus and zinc is limited in study area.

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