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Nutritional and Physico-Chemical Status of Sonvad Peripheral Soil of Agricultural Use

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ABSTRACT

Sonvad is one of the villages of Shahada tehsil of district Nandurbar Maharashtra., The agricultural soil was collected from the adjacent agricultural area of this village to study its nutritional composition which important for agricultural crop production. There are disparities in the soil nutrient status. Study includes pH, EC, major, miner and trace element presents in the agricultural soil. There is difference in concentration of different nutrients. pH and EC of the soil are marginally high and the nitrogen and phosphorous insufficiency is detected throughout this study. In this study, it was discovered that, content of potassium is high in every location of soil. The nutritional statuses from this study are low, medium, moderately high, and high in some locations. The status of nitrogen is very low to moderate means there are deficiency of nitrogen. Phosphorous is very low to moderate, it means that, there is deficiency of phosphorous. The status of micronutrient in the study area, are very low to medium. The status of iron and boron is very low to moderately high for plant growth.

1. Introduction

Degradation of soil health and its nutritional status are continuous during last 7 decade, because of to increase the crop production at every place of world [1, 2]. According to population growth worldwide it is necessary to increase the crop production especially in India. Use of various types of chemicals in the form organic and inorganic fertilizers, herbicide, pesticide, insecticide, rodenticides, fungicides plant growth regulators, soil conditioners, decomposers liming, drip cleaner etc. these chemicals give temporarily effects of crop production but after some days these are very hazardous to the soil which reduces natural nutrients in the soil and plant growth assisting microorganism. Hence it is necessary of continuous monitoring of soil health for future plant growth and need of food to everyone [3, 4].

The soil fertility status should be conserved for extensive period of time for good soil health and its production. The essential nutrients which are present in soil maintain the soil quality is N, P, K, Ca, Mg, Fe, Zn, Cu, B, Mn etc. Contingent on the regularity of crops and it pattern there are constant changes in nutrient status [5]. As the yield production increases the soil fertility will be decrease, soil erosion leachout significant major, minor or micro nutrients with flood and rain water each year. Therefore, to reinstate and uphold the soil nutrients, soil health chequeup is very important factor to reach extreme yield production [6]; hence this study reveals such analysis.

2. Experimental Methods

Five illustrative places around the Sonvad village are selected for the representation of the soil samples. Subsequently these selected places, topsoil samples were collected in polythene bags, rendering to the typical procedures, Soil samples remained first dried out in open space, under the open shade then crushed casually with wooden tack hammer and detached by using 2 mm screens. This treated sample then reserved in sterile polythene bags for the investigation of different soil factors. Such as the physico-chemical factors of designated and composed samples were determined by the procedures recommended in the documents. The pH, electrical conductivity, organic carbon, available nutrients such as nitrogen, phosphorus and potassium, calcium, magnesium, are also determined by described measures and methods. The trace nutrients like Fe, Cu, Zn, B, Mn are estimated by atomic absorption spectroscopy techniques [7].

3. Results and Discussion

3.1 Determination of Available N, P, K

Nitrogen, phosphorous and potassium are major nutrients required for plant growth and development.

3.1.1 Available Nitrogen

Nitrogen is the key primary nutrient for growth of plants and crops. lower nitrogen content, the reason behind this is the loss of nitrogen through high leaching by rain water and their runoff, or lower use of farm yard manure and compost or it might be due to less nitrogen content minerals and their parental rock. Nitrogen source to the plants obtained through living organism, organic substance in the soil, rain water; nitrogenous chemical fertilizers, organic manure, compost and vermi-compost are the important source of nitrogen. The biotic activity is also significant for amount of nitrate nitrogen and ammoniacal nitrogen in the soil. The nitrogen absorption changes with changes in weather such as temperature, moisture, aeration humidity, and uses of pesticide.

It is detected that the available nitrogen status differs from 194.88 to 356.16 Kg/ha at E and C soil locations individually of Sonvad soil series. The outcome shown that amongst this, soil E location is low and C soil location has medium available nitrogen according to soil rating of available nitrogen. Low nitrogen content could be credited to leaching of nitrogen from soil due to rain water and running water. Additional cause of low nitrogen is fairly low compost count, little FYM, and short application of nitrogenous chemical fertilizers. The average available nitrogen concentration of this soil series is 280.896 Kg/ha. It is medium according to standard assessment of available nitrogen. Usually, the principal supply of nitrogen to this soil series is FYM, dung, chemical fertilizers, rain water, and kinds of minerals present in the soil. The nitrogen absorption changes with changes in weather such as temperature, moisture, aeration humidity, and usages of insecticide [8].

3.1.2 Available Phosphorous (P)

Phosphorous is similarly primary nutrient for plant as nitrogen, The examination of available phosphorous of soil series recommend that the variation of available phosphorous detected. The utmost significant soil factors which affect the fixation of phosphates are landscape and volume of clay, pH, organic matter, free oxide of aluminium and iron. The relation among soil pH and phosphorous is significant, because as pH of soil rises

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phosphate content declines and vice versa. Here in this province maximum of the farmers are uses granular and pulverized phosphatic fertilizer is insoluble in alkaline pH, hence in its place of solid phosphatic fertilizer farmers must practice liquid phosphatic fertilizers because it is easily available for plant development. Reaction of aluminium and iron hydroxide with the phosphate ions is maybe most significant for phosphate fixation in the soils [9].

It is detected that the available phosphorous status differs from 10.32 to 19.04 Kg/ha at C and E soil sites correspondingly of Sonvad soil series. Amongst this soil sequence both the C and E soil site has medium available phosphorous according to normal soil rating of available phosphorous. Low phosphorous content can be credited to leaching of phosphorous from soil due to rain and flood water and running water. Additional cause of low phosphorous is relatively low count of phosphate chemical fertilizers. The average available phosphorous contents of this soil series are 14.396 Kg/ha. It is medium according to normal rating of available. Usually, the main supply of phosphorous to this soil series is FYM.

Table 1 Major and minor nuctritional vaules

Soil S.No.	Available Primary Nutrients (Kg/h)			Available Sec. Nutrient (meq/L)	
	N	P	K	Ca^{+2}	Mg^{+2}
A	215.04	19.04	491.38	12.5	8.1
B	336	11.42	331.52	12.9	7.6
C	356.16	10.32	319.20	13.11	6.7
D	302.4	12.40	332.32	13.08	7.3
E	194.88	18.80	292.20	14.2	6.0

Table 2 Trace elements and physico-chemical factors

Soil Sr.	Available Micronutrients (ppm)					Physico Chemical Parameter		
	Fe	Cu	Mn	Zn	B	O.C. %	pH	EC Mhos
A	10.08	0.36	19.99	1.25	0.72	0.48	8.99	1.120
B	3.96	0.42	16.88	0.93	0.52	0.75	9.04	0.676
C	4.09	0.78	13.62	0.77	0.45	0.80	8.42	1.330
D	4.52	0.55	19.6	0.88	0.64	0.68	8.73	1.900
E	5.37	0.40	14.67	1.84	0.43	0.44	9.06	1.599

3.1.3 Available Potassium

According to normal assessment of soil, available potassium average assessment also high to very high. It is detected that the potassium content of utmost of the soil sample are high to very high and it may be credited to kinds of potassium minerals exist in these soil and parental rock and their weathering. These high values of total potassium in the soils put up with evidence to the detail that, these soils are loaded in K-bearing minerals like mica and feldspar. The most important soil factors which affect the fixation of potassium are nature and amount of clay, pH, and organic matter. The relation between soil pH and potassium is important, because as pH of soil increases potassium also increases. Most of the farmers uses unnecessary potassic fertilizer for every crop and it is also one of the causes of increasing potassium in the soil [10]. It is observed that the available potassium status varies from 292.2 to 491.38 Kg/ha at E and A soil locations respectively of Sonvad soil series. Among these soil series the E location has high and A location has very high amount of available potassium according to standard soil rating of available potassium. There are same causes of high K as in the Mohida soil series. Average available potassium contents of this soil series are 352.324 Kg/ha.

3.2 Exchangeable Calcium

Low exchangeable calcium and high pH may due to the presence of chief soluble salt Na_2CO_3 which boosted the soil pH caused nearly all soluble and exchangeable Ca^{2+} and Mg^{2+} get precipitated. Dominance of soluble salts such as carbonate and bicarbonates nature is concern with increasing pH of soil [11]. Calcium reacts with bicarbonate and precipitated as $CaCO_3$. As Ca and Mg are lost from soil and water, the relative proportion of sodium increases & causes sodium hazard. Therefore, the proportion of calcium in this series appears low, which deteriorates productivity of soil due to high proportion of sodium. The exchangeable calcium in Sonvad soil series ranges from 12.5 to 14.2 mEq/L of A and E sites respectively. It is reported low rating of exchangeable calcium. High pH of these series is observed that may be due to presence of chief soluble salt Na_2CO_3. Average exchangeable calcium is 13.158 mEq/L. which is low. Consequently, exchangeable calcium of this soil series is low.

3.3 Exchangeable Magnesium

The exchangeable magnesium results are recorded in Table 1 , calcium and magnesium makes water hard soil soft, for this reason calcium and magnesium rich water is desirable for irrigation. Domination of soluble salts such as carbonate and bicarbonates nature are related with increasing pH of soil. They also reported that such types of soil also had high pH more than 8.5, EC less than 4 ds/m, and ESP more than 15. The hydrolysis of $CaCO_3$ and $MgCO_3$ is insufficient due to their slight solubility and as a consequence they have a tendency to produce a pH not more than 8.2. Magnesium reacts with bicarbonate and precipitated as $MgCO_3$. As the Ca and Mg are lost from soil and water, the relative proportion of sodium increases consequently pH of the soil increases, hence sodium hazard**,** Therefore the proportion of magnesium in this series is moderately high. It is observed that in Sonvad soil series. The exchangeable magnesium of Sonvad village soil field varies from 6.0 to 8.1 mEq/L of E and A sites respectively. It is recorded medium to moderately high range in rating of exchangeable magnesium. High pH of these series is observed that may be due to presence of chief soluble salt Na_2CO_3.Average exchangeable magnesium is 7.14 mEq/L. which is reported medium. Consequently, exchangeable magnesium of this soil series is medium [12].

3.4 Determination of Available Micronutrients Fe, Cu, Mn, Zn and B:

Micro-nutrient requires in extremely small amount for plant growth (< 50 ppm). This case study includes the quantitative data of micro-nutrients such as Fe, Cu, Mn Zn and B, from 14 soil series of 70 soil samples from different soil locations of salt affected soil of Shahada tehsil are given in Table 2.

3.4.1 Iron (Fe)

Content of Fe might be attributed to high pH value of most of the soil samples sites, and types of iron minerals present and their weathering in these soil and parent rock. Low content of extractable iron in this sodic and sodic saline soil might be attributed to the small release of extractable iron at high pH from their minerals [13]. It is observed that the extractable iron status varies from 3.96 to 10.08 ppm at B and A soil locations respectively of Sonvad soil series. Among this the B location has very low and A location has medium amount of extractable iron according to the standard soil rating of extractable iron. Average extractable iron of this soil series is 5.604 ppm. Low extractable iron might be little weathering of iron containing rock, less aeration, and physico-chemical climate of the soil.

3.4.2 Copper (Cu)

It is observed that the extractable copper content of most of the soil sample is low, medium and high. It might be attributed to high pH value of most of the soil samples sites, organic matter present at these sites, leaching with rain and running water, and types of copper minerals and their weathering in this soil, bed rock, and parent rock present at these sites [14]. Here in this region the farmers are not aware about the uses of micronutrient and their benefits it may be one of the causes of low copper. It is observed that, the extractable copper status varies from 0.36 to 0.78 ppm at A and C soil locations respectively of Sonvad soil series. Both these A and C soil location has low amount of extractable copper according to the standard soil rating of extractable copper. Average extractable copper of this soil series is 0.502 ppm, it is also low. Low extractable copper might be due to little weathering of copper containing rock, less aeration, and physico-chemical climate of the soil etc.

3.4.3 Manganese (Mn)

Manganese is important in respiration, redox reaction, protein synthesis as a constituent of enzyme. Like other micronutrients manganese is also required for proper growth and development of plants. Mn content might be attributed to weathering of manganese minerals present in this soil, bed rock, and parent rock present at these sites from which the soil formation takes place. The physico chemical parameters of the climate such as temperature, humidity, organic carbon, soil pH, types of salt present and their electrical conductivity, are important. Generally, manganese deficiency occurs in soil with pH 7.0 or above [15].

It is observed that the extractable manganese status varies from 13.62 to 19.99 ppm at C and A soil locations respectively of Sonvad soil series. Both these C and A soil locations has very sufficient amount of extractable manganese for growth of plant. Especially the A soil location has highest amount of extractable manganese among all soil sample of this case study.

3.4.4 Zinc (Zn)

According to standard rating of soil extractable zinc, the average value of Zn is low to medium. It is observed that the extractable zinc content of most of the soil sample is very low, low and medium [16]. It might be due to alkaline pH value of most of the soil sample's location, organic matter present at these sites, leaching with rain and running water, and types of

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zinc minerals present in this soil, bed rock, and parent rock present at these sites. Micronutrient zinc require for enzyme system, plant metabolism, redox reaction, formation of hormones, reproduction in proper plant growth and development. It is observed that the extractable zinc status varies from 0.77 to 1.84 ppm at C and E soil location respectively of Sonvad soil series. The C soil location has low and E soil location has medium extractable zinc. Average extractable zinc of this soil series is 1.134 ppm, according to the normal soil rating of extractable zinc it is also low value.

3.4.5 Boron (B)

Micronutrients boron require for hormones movement, flowering and fruiting processes, carbohydrate metabolism, respiration etc. improper plant growth and development. There are very narrow variations among the toxicity and deficiency in boron. Hence it is difficult to judge the boron requirement to plants. When organic matter is low and weather is dry the decomposition gets slow down, consequently deficiency of boron may occur [17].

The average available boron of this series is 0.552 ppm. It is adequate for some plant. Occurrence of this much quantity of available boron is due to the types of boron minerals present in the above said soil. It is observed that the available boron status varies minimum 0.43 to maximum 0.72 ppm at E and A soil location respectively of Sonvad soil series. It has narrow range and is sufficient for plant growth and development.

3.5 pH

Average pH of Sonvad series is 8.84 which results that, the soil is strongly alkaline in nature. The high pH value in some locations is attributed to leaching of Ca^{2+} and Mg^{2+} ions due to running water. Soluble sodium content was more excessive in the saline-sodic soils than calcium plus magnesium, calcium and magnesium affects the soil pH in saline and saline-sodic soil. Exchangeable sodium value was higher than both magnesium and potassium contents of the soil. Excess of sodium exerts opposing effects on the absorption of calcium and magnesium in plant growth. The pH range of soil series Sonvad agricultural soil is observed from 8.42 to 9.06 of C and E locations respectively, this range of pH is narrow. Here B location show moderately alkaline, A and D show strongly alkaline, while pH of B and E indicates strongly alkaline soil property. These series of soil may content of sodium, magnesium, and also some chloride sulphate and bicarbonate [18].

3.6 Electrical Conductivity (EC)

Soil electrical conductivity of Sonwad agricultural soil series varies from 0.676 to1.9 ds/m of C and D sites of locations respectively. It suggested that the soil is very slightly saline to strongly saline.in nature. This range of electrical conductivity is not very narrow. Average electrical conductivity of this soil series is 1.325 ds/m indicates that the soil is saline in characteristics. Among all these soil locations A, C and E locations under saline in nature and D belong to strongly saline in nature. Electrical conductivity of B recorded is lowest among all soil series of Shahada tehsil. Soil locations recorded saline due to presence of inorganic cations and anions. Plant reaction gets unnatural due to salt circulation and their composition in the soil. It may be specific ion effect, osmatic pressure and imbalance nutrition.

3.7 Organic Carbon (O.C.)

It is observed that, organic carbon content of Sonvad agricultural soil area is varies from 0.44% at E location to 0.8% at C location. It ranges from moderately to high percentage of organic carbon content status. Average organic carbon content is 0.63%. High organic carbon content at C soil location might be due to landscape, soil category, and land use and soil management practices. Soil locations A and E are moderate organic carbon and B C, and D soil locations have moderate organic carbon content.

4. Conclusion

The nutritional statuses of this study are low, medium, moderately high, and high in some locations. The status of nitrogen is very low to moderate means there are deficiency of nitrogen, it must improve. Phosphorous is very low to moderate, it means that, there is deficiency of phosphorous, it is essential recover. Potassium is high to very high. It means that, it is more than sufficient. The status of micronutrient in the study area, are very low to medium. The status of iron and boron is very low to moderately high for plant growth. It means that, there are deficiency of iron and boron and it should be improved. The status of copper, manganese and zinc is very low to medium it means the sources of these micronutrients are short. It should be recovered. Exchangeable calcium and magnesium are low and medium respectively. The causes of low exchangeable Ca^{2+} and Mg^{2+} may due to the presence of chief soluble salt Na_2CO_3 which boosted the soil pH caused nearly all soluble and exchangeable Ca^{2+} and Mg^{2+} get precipitated.

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