Soil Fertility Status and Soil Quality in Kolhapur District

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Abstract:

This paper seeks to study the response of soil fertility to irrigation and its impact on growth of agricultural productivity in the Kolhapur district. Productivity of crops depends on sufficient provider of nutrients from the soil. Generally, the quantity of nutrients removed by the crop is much greater than the quantity of applied nutrients resulting in poor fertility status of soils. Hence, to improve the fertility status of soil and to sustain the productivity of crops, soil fertility evaluation is unavoidable. In spite of the technological developments in providing improved crop varieties and better management practices in Kolhapur district. Irrigation is an significant for the agricultural productivity in Kolhapur district. Use of fertilizers, HVY seeds, use of technology, mechanization is closely based on the availability of irrigation and its impact of the soil fertility in a region. Comparing tahsil to tahsil differences of soil fertility and salinity, a profile of agricultural productivity is examined with a focus on impact of Nutrient index, fertility status and quality in study area.

Key words: Nutrient index, fertility status and quality, macronutrients, micronutrients

Introduction

Soil fertility is a intricate quality of soils that is closest to plant nutrient management. It is the part of overall soil productivity that deals with its presented nutrient status, and its ability to supply nutrients out of its own reserves and through external applications for crop production. It combines several soil properties (biological, chemical and physical), all of which influence directly or indirectly nutrient dynamics and availability. Soil fertility is a manageable soil property and its management is of greatest importance for optimizing crop nutrition on both a short-term and a long-term basis to achieve sustainable crop production.Soil productivity is the ability of a soil to support crop production determined by the entire spectrum of its physical, chemical and biological attributes. Soil fertility is only one aspect of soil productivity but it is a very important one. Good natural or better soil fertility is essential for flourishing cropping. It is the foundation on which all input-based high-production systems can be built.

Objective-

- To study soil fertility status and soil quality in Kolhapur district.

The Region-

The Kolhapur district is one of the southernmost districts of Maharashtra state. The district's courtiers a total area of 7,685 sq. kms. It lies between 16° 0' 0"N to 17° 0' 0" North latitude and 74° 0' 0" to 75° 0'0" East longitude. The length of the district south to north is 160 Kms. and east to west is 60 Kms. The Sahyadri ranges to the west and Warna river to the north, the river Krishna and Belgaum district to the south and east, forms the natural boundaries of the district. The region receives average rainfall 1900 mm.

LOCATION MAP OF KOLHAPUR DISTRICT
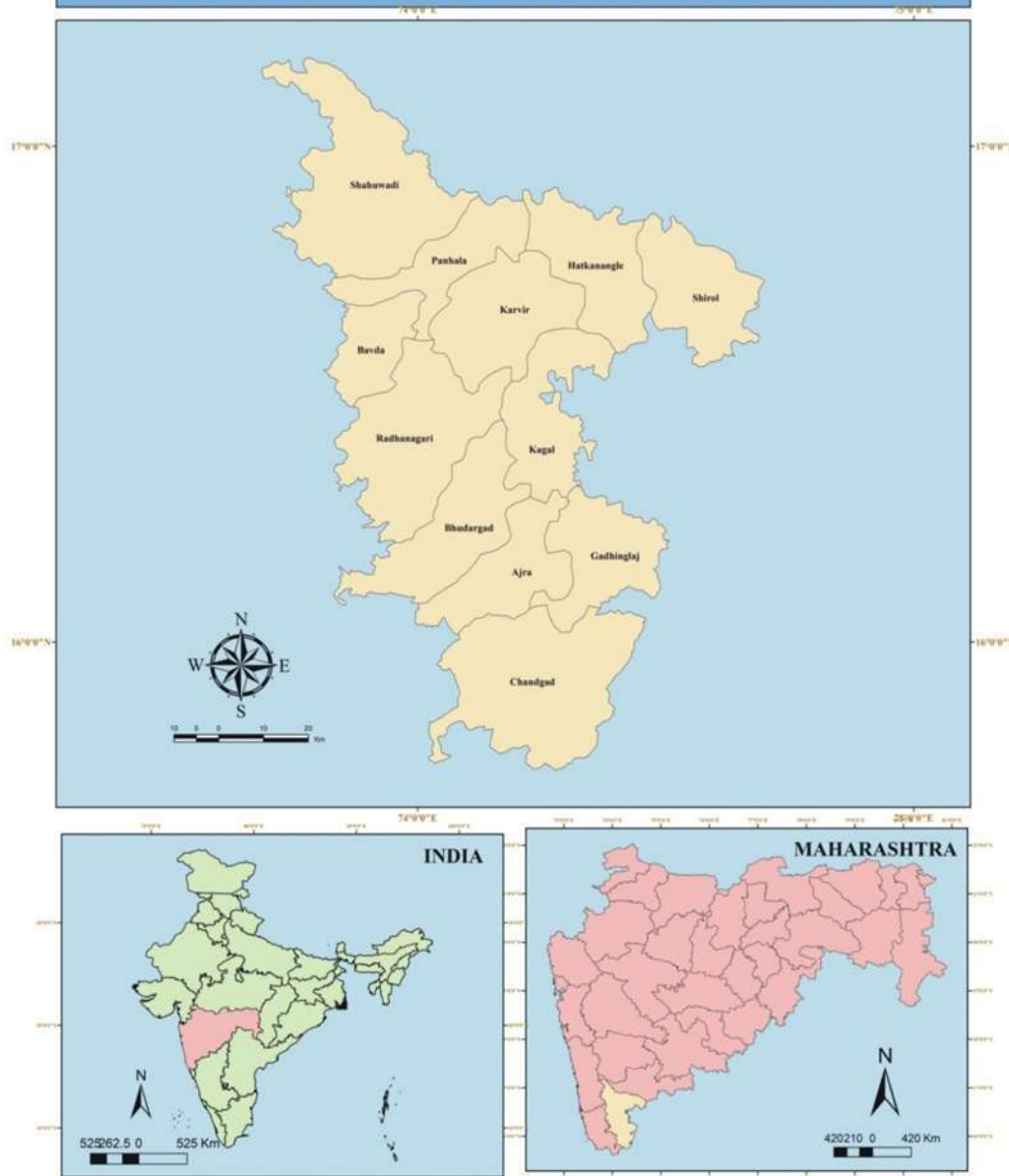
Methodology:

The study is based on data collected from secondary sources. To evaluate the fertility status of soils in the study area, different soil physico-chemical properties that affect nutrient availability including pH, electrical conductivity, available N, P, K and S and available micronutrients (Zn, Mn, Fe and Cu) were calculated based on percentage. In order to compare the levels of soil fertility of one area with those of another it was necessary to obtain a single value for each nutrient.

Soil fertility status and quality of soil-

The quality of soil is examined and measured through standardized soil testing method, which are pH or soil reaction which indicates acidity and alkalinity and salinity, in term of soluble salts determined through electrical conductivity test 'EC'. Soil quality and soil health are

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very general terms but generally describe a soil's potential for long-term productivity. Building healthy soils is a long-term process. Fortunately, organic soil management practices are designed to develop fertile soils with good tilth that will support crop health.

Nutrient index with range and levels.

Sr.No.	Fertility index range	level
A	0.50- 0.75	Very low
B	0.76- 1.25	Low
C	1.26- 1.75	Medium
D	1.76- 2.25	Medium high
E	2.26- 2.75	High
F	2.75-3.00	Very high

Source-District Soil Survey and Soil Testing Laboratory, Kolhapur.

The data collected from soil analysis for Government and non-Government centers and District Soil Survey and Soil Testing Laboratory Kolhapur is analyzed below:

I) Soil quality by alkanlinity:

On the basis of pH measurement of soil, the soil quality of study regions are categorized as follow.

Soil quality on basis of pH value

pH value	Reaction
< 4.5	**extremely acid**
4.5-5.2	very strongly acid
5.2-6	strongly acid
6.1-6.5	slightly acid
6.6-7.5	**neutral**
7.6-8.3	slightly alkaline
8.1-9.0	moderated alkaline
> 9.0	**very strongly alkaline**

Source- District Soil Survey and Soil Testing Laboratory Kolhapur

Soil response or the soil pH is the acidity or alkalinity of the soil. Soil pH influences the rate of plant nutrient released by weathering, the solubility of all minerals in soil and the amount of nutrients on the Cation Exchange Capacity. Cation exchange capacity (CEC) describes the amount of transferable cations (positively charged ions such as $H+$, $K+$, $Ca++$, $Mg++$) a soil can hold. Chemically, CEC is the negative surface charge of small, crystalline clay particles and organic matter in the soil .CEC is use by some as a measure of the potential fertility of a soil. pH affects the growth of beneficial soil organisms.(John Lamb, Sheri Huerd, Kristine Moncada,2000).The pH is therefore a very good guide for prediction of a soil which is likely to deficient in plant nutrients (De,1993).The region faced only the problem of alkalinity which is common problem in India. It is reported that about 7millon hectares of land in India have because saline or alkalinity or both (Bhavani, 1995).In the most of the semi-arid and arid regions the soil tend to be alkaline. In these region due to low rainfall and high temperature. There is a tendency for the accumulation of soluble salt at the surface. (Ramanaiah, 1996)

i) Normal soil:

In general soil with pH value is ranging from **6.5 to 7.5** are considered to be normal soil.

A pH value neutral is best for most plants. The availability of the entire plant nutrient is reasonably satisfactory where the pH value in between 6.5 to 7.5. About 38.48% of the soils are in normal category in study area. The high percentages (Above 45%) of these soils are observed in the circle of Gaganbavada (80.96%), Karvir (50.46 %) and Panhala (45.15 %) because the intensity of irrigation is low.

The moderate percentage (35 % to 45 %) of these soil are observed in the circle of Gadhinglaj (42.74 %), Kagal (41.67 %), Radhanagari (40.66) %), Hatkanangale (39.01%), Ajra (37.35 %), Shahuwadi (36.91 %) and Bhudargad (36.64 %).

The low percentage (below 35 %) of these soils is observed in the circle of Shirol (21.23%) and Chandgad (19.78%).
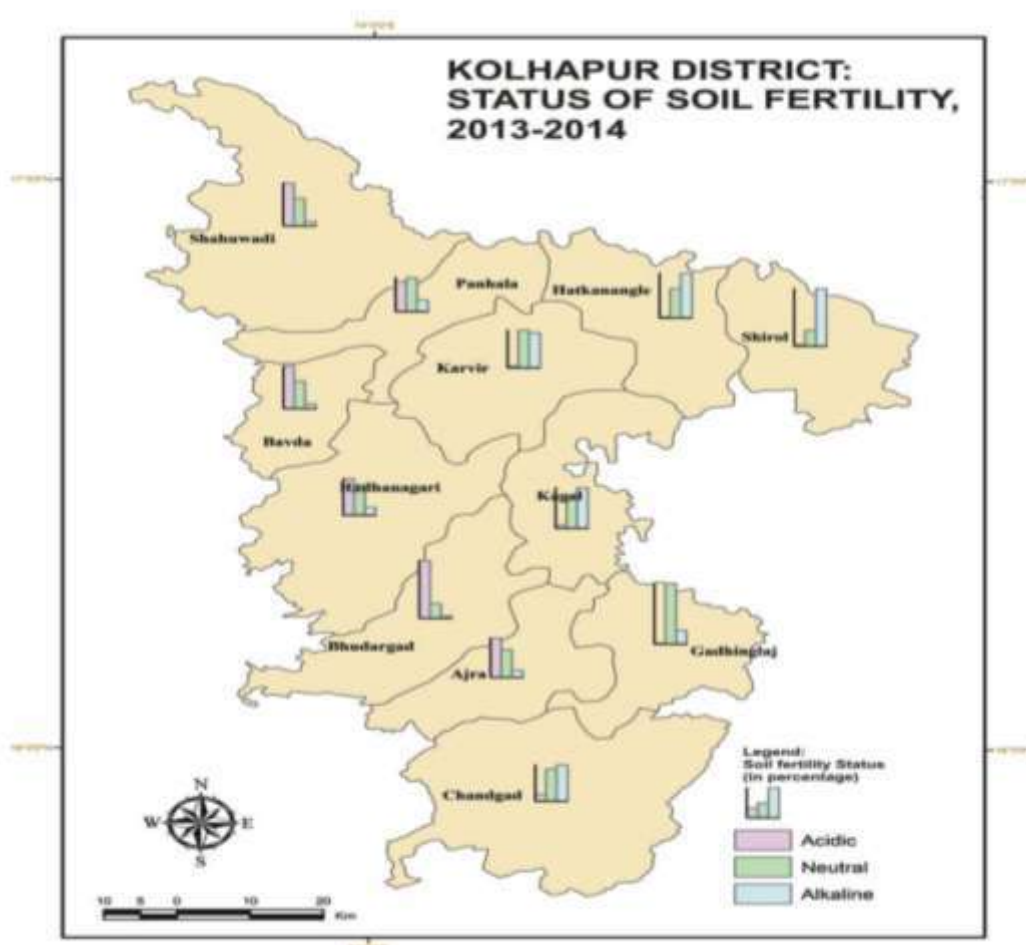
ii) Slightly alkaline soil:

In general soil with pH value is ranging from **7.5 to 9.0** are considered to be slightly alkaline soil. About 29.6 % of the soil is in alkaline soil category in study area.

The high percentage (Above 50 %) of these soils are observed in the circle of Shirol (76.77%), Hatkanangale (59.48 %) and Kagal (54.17 %).

The moderate percentage (10 % to 50 %) of these soil are observed in the circle of Gadhinglaj (48.32 %), Karvir (46.72 %), Gaganbavada (17.99 %), Panhala (15.27 %) and Radhanagari (10.64%).

The low percentage (below 35 %) of these soils is observed in the circle of Ajra (9.73 %), Bhudargad (6.25 %), Shahuwadi (5.9 %) and Chandgad (3.31%).

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Soil fertility status and Quality of Soil in Kolhapur District (2013-14)

Tahsil	Samples	Less than 4.5 Samples	Percent	4.51 To 5.2 Samples	Percent	5.21 To 6.0 Samples	Percent	6.01 To 6.5 Samples	Percent	Acidic soil	6.51 To 7.0 Samples	Percent	7.01 To 7.5 Samples	Percent	Neutral	7.51 To 8.3 Samples	Percent	8.31 To 9.0 Samples	Percent	More Than 9.0 Samples	Percent	Alkaline Soil	Total
Karvir	1524	0	0	0	0	7	0.46	36	2.36	2.82	280	18.37	489	32.09	50.46	684	44.88	28	1.84	0	0	46.72	1524
Panhala	773	1	0.13	14	1.81	142	18.37	148	19.15	39.46	193	24.97	156	20.18	45.15	118	15.27	1	0	0	0	15.27	773
Hatkanangale	1246	0	0	0	0	2	0.16	16	1.28	1.44	141	11.32	345	27.69	39.01	664	53.29	77	6.18	1	0.008	59.48	1246
Shirol	749	0	0	0	0	1	0.13	14	1.87	2	43	5.74	116	15.49	21.23	543	72.5	32	4.27	0	0	76.77	749
Kagal	240	0	0	0	0	2	0.83	8	3.33	4.16	24	10	76	31.67	41.67	126	52.5	4	1.67	0	0	54.17	240
Gadhinglaj	358	0	0	0	0	12	3.35	20	5.59	8.94	49	13.69	104	29.05	42.74	163	45.53	10	2.79	0	0	48.32	358
Chandgad	1057	4	0.38	123	11.64	428	40.49	258	24.41	76.92	140	13.25	69	6.53	19.78	34	3.22	1	0.09	0	0	3.31	1057
Bhudargad	737	0	0	23	3.12	187	25.37	211	28.63	57.12	177	24.02	93	12.62	36.64	45	6.11	1	0.14	0	0	6.25	737
Ajara	822	0	0	3	0.36	178	21.65	254	30.9	52.91	192	23.36	115	13.99	37.35	78	9.49	2	0.24	0	0	9.73	822
Radhanagari	883	0	0	17	1.93	184	20.84	229	25.93	48.7	218	24.69	141	15.97	40.66	87	9.85	7	0.79	0	0	10.64	883
Gaganbavada	189	0	0	0	0	2	1.06	0	0	1.06	81	42.86	72	38.1	80.96	33	17.46	1	0.53	0	0	17.99	189
Shahuwadi	848	0	0	5	0.59	180	21.23	300	35.38	57.2	230	27.12	83	9.79	36.91	49	5.78	1	0.12	0	0	5.9	848
Total Dist.	9426	5	0.05	185	1.96	1325	14.06	1494	15.85	31.92	1768	18.76	1859	19.72	38.48	2624	27.84	165	1.75	1	0.01	29.6	9426

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iii) Acidic soil:

In general soil with pH value is ranging from less than **4.5 to 6.5** are considered to be Acidic Soil. About 31.92 % of the soil is in acidic soil category in study area.

The high percentage (Above 50%) of these soils is observed in the circle of Chandgad (76.92 %), Shahuwadi (57.2%), Bhudargad (57.12%) and Ajra (52.91%).

The moderate percentage (10 % to 50%) of these soils is observed in the circle of Panhala (39.46%) and Radhanagari (48.07%).

The low percentage (below 10%) of these soil are observed in the circle of and Gadhinglaj (8.94%), Kagal (4.16 %), Karvir (2.82%) Shirol (2.00%), Hatkanangale (1.44 %) and Gaganbavada (1.06 %).

II) Soil quality and salinity:

The excess of salt that the soil contains is termed as the salinity. Saline soils usually have surface crust of white salts. Especially in dry season, when the net movement of soil moisture is upward. Salt dissolved in the soil water move to the surface. Where they are left as crust when the water evaporate. These white salts are mostly Chlorides, Sulphates and Carbonates of calcium magnesium and Sodium. (Penchalaiach ,1993)

The salinity of soil is determined by electrical conductivity (EC) method and the EC is expressed in ms/cm. The EC value are classified in to three categories viz

  i) **Normal** (Below 1.0 Dec/m)
  ii) **Critical for germination** (1 to 2 Dec/m)
  iii) **Injurious to plant** (above 2 Dec/m)

i) Normal category:(below 1.0 Dec/m)

The high percentage of this category of soil are observed in the circle of Panhala (100 %), Gadhinglaj (100 %), Gaganbavada (100 %), Chandgad (99.91%), Radhanagari (99.89%) Shahuwadi (99.88 %) and Ajra (99.88 %).Because intensity of irrigation is low and natural drainage. The moderate percentage of this category of soil are observed in the circle of Karvir (99.80 %) Shirol (99.87 %), and Hatkanangale (99.52 %).The low percentage of these soil are observed in the circle of Bhudargad (99.46 %) and Kagal (99.33 %).Where intensity of irrigation and sugarcane cropping is high proportion of low drained black soil are predominant.

ii) Critical for germination:(1 to 2 Dec/m)

The high percentage of this category of soil are observed in the circle of Kagal (0.8%), Bhudargad (0.3%), Hatkanangale (0.2 %).The moderate percentage of this category of soil are observed in the circle of Karvir (0.1%) and Ajra (0.1%). The low percentage (below 10 %) of these soil are observed in the circle of Bhudargad (0%), Shirol (0 %), Panhala (0 %), Gadhinglaj(0 %), Gaganbavada (0 %),Chandgad (0 %), Radhanagari (0 %) and Shahuwadi (0 %).

Soil quality and salinity in Kolhapur district (2013-14)

Tehsil	Total Samples	Normal Less Than 1	Critical for germination 1 To 2	Injurious to plant 2.01 To 3	More Than 3.01
Karvir	1524	99.8	0.1	0	131.0
Panhala	773	100	0	0	0.0
Hatkanangale	1246	99.52	0.2	0	0.2

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Shirol	749	99.87	0	0	0.1
Kagal	240	98.33	0.8	0.8	0.0
Gadhinglaj	358	100	0	0	0.0
Chandgad	1057	99.91	0	0.1	0.0
Bhudargad	737	99.46	0.3	0	0.3
Ajra	822	99.88	0.1	0	0.0
Radhanagari	883	99.89	0	0	0.1
Gaganbavada	189	100	0	0	0.0
Shahuwadi	848	99.88	0	0	0.1
Total	9426	99.77	0.1	3	0.1

Source- District Soil Survey and Soil Testing Laboratory Kolhapur

Conclusion

Soil fertility refers to the original capacity of the soil to supply nutrients in sufficient amounts and in suitable proportions for crop yield and crop growth. A pH value is ranging from 6.5 to 7.5 are considered to be normal soil. A pH value neutral is best for most plants. About 38.48% of the soils are in normal category in study area. The high percentage of this soil is observed in the circle of Gaganbavada, Karvir and Panhala. In general soil with pH value is ranging from 7.5 to 9.0 are considered to be slightly alkaline soil. About 29.60 % of the soil is in alkaline soil category in study area. In general soil with pH value is ranging from less than 4.5 to 6.5 are considered to be acidic soil. About 31.92 % of the soil is in acidic soil category in study area. The high percentages of this category of soil are observed in the circle of Panhala, Gadhinglaj,Gaganbavada, Chandgad,Radhanagari, Shahuwadi and Ajra. Very high salinity water (C4) is observed in circle Shirol and Hatkanangale. Present paper deals with the study of soil fertility and quality as a significant part of health and growth of plant. With its soil fertility index characteristic and distribution samples of its impact on crop productivity and soil improvement. The present study analyzed the spatial variation in utilization of NPK fertilizer and irrigation water.

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