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Soil Fertility Status in Sawai Madhopur District of Rajasthan

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ABSTRACT

The soil research study was conducted from three block in Sawai Madhopur district of Rajasthan for evaluate the soil fertility status of cultivated land of farmers. The Total No. of 120 Soil samples were collected from different cultivated fields (0-15 cm depth) and analyzed for soil properties and macro nutrient fertility status viz. Soil P^H, EC, OC, & Available Nitrogen, Phosphorus, Potash and Sulphur by standard method. The Soil P^H, Electrical Conductivity, Organic carbon of soil samples were found with an average of 7.75, 0.54 dS m^{-1} & 0.38 % respectively. Available nitrogen, Phosphorus, Potash and Sulphur content of soil samples were reported with a mean value of 213.70 $kgha^{-1}$, 22.35 $kgha^{-1}$, 125.57 $kgha^{-1}$ and 15.34 $mgkg^{-1}$ respectively. It can be concluded that the soil samples under research study is categorized neutral to slightly alkaline in P^H, whereas organic carbon, electrical conductivity, Available N_2O, P_2O_5, and K_2O were low to medium range and sulphur content was found in medium range. Hence, various efforts viz. use of biofertilizers, organic manures with balanced chemical fertilizers were suggested for farmers regarding the benefits of improving soil fertility and nutrition status.

Key words: *Soil pH, Nitrogen, Phosphorus, Soil fertility status*

INTRODUCTION

Soil fertility plays a key role in increasing crop production in the soil. It comprises not only in supply of nutrients but also their efficient management. The fertility status of soil indicates their nutrient supplying capability. The most important constituents in soil is organic matter, an appreciable amount of organic matter in soil tremendously increase soil fertility. Decay of organic matter release nitrogen, phosphorus and mineral nutrients in a form available to plant. Availability of N, P, K, secondary and micronutrients induce better germination of seeds and hence subsequent better growth and stronger root development. Agriculture activities change the soil chemical, physical and biological properties. The core constraints in relation to land use include, depletion of organic matter due to wide spread use of biomass as fuel, depletion of macro and micro nutrients, removal of top soil by erosion, change of physical properties and increased soil salinity[1].

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Soil test based nutrient management has emerged as a key issue in efforts to increase agricultural productivity and production since optimal use of nutrients, based on soil analysis can improve crop productivity and minimize wastage of these nutrients, thus minimizing impact on environmental leading to bias through optimal production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas.

The increasing demand of food grain has forced farmers to use high doses of chemical fertilizers. Imbalanced use of chemical fertilizers is a serious threat to sustainable agricultural production system. Soil test-based fertilizer recommendation and management is an effective tool for increasing productivity of agricultural soils[2]. The objective of present investigation was evaluating the Soil fertility status in three blocks of Sawai Madhopur district of Rajasthan.

MATERIAL AND METHODS

The study of soil analysis was conducted from three blocks in Sawai Madhopur district of Rajasthan. The district was situated in Eastern region of Rajasthan between 25° 58' to 27° 83' North Latitude and 76° 53' to 78° 17' East Longitude and total geographical area of district is 5043 Square km. To evaluate the fertility status in study area the total No. of 120 farmers field selected and representative composite soil samples were collected with the help of a khurpi. A surface soil sample from 0 to 15 cm was collected at 250 m x 250 m grid samples in the study area. The soil samples were mixed thoroughly and about 500 gram of composite soil samples were taken for soil analysis. Soil samples were air-dried, passed through 2 mm and 0.5 mm sieve and stored in properly labeled plastic bags for physical and chemical analysis. The prepared samples were analyzed for physical-chemical properties and different nutrients using standard procedures for primary and macro nutrients *viz.* Soil pH, EC and organic carbon were estimated by the standard procedures as described by Jackson[3]. Available nitrogen was determined following the method of Subbiah and Asija[4]. Available phosphorus and potassium were determined by Bray and neutral ammonium acetate methods, respectively[5]. Available sulphur was determined by the procedure described by Chesnin and Yien[6].

RESULTS AND DISCUSSION

The analyzed soil data indicated the fertility status of soil of three blocks of Sawai Madhopur was presented in Table 3.

Physical-chemical properties of soil

The data revealed on Soil P^H of 120 soil samples was ranged from 6.77 to 8.40 with an average of 7.75 under research study in which 58 soil samples were recorded as Natural (7.0-7.5), 41 soil samples were as slightly alkaline (7.6-8.0) and 21 soil samples were reported as highly alkaline (8.0-8.5). The higher pH in soil might be due to presence of various salts which is also clearly visible from the EC values. [7]reported that the Soil pH was found in ranged from 6.8 to 8.7 which are neutral to alkaline medium in Nicchapura-2 Micro Watershed of Davanagere District, Karnataka, India. The data revealed on organic carbon percent were reported in ranges from 0.33% to 0.90% with an average value of 0.66% in which 74 soil samples were found low, 39 soil samples were found Medium and 7 soil samples were found high in organic carbon percent content. Thus, most of the soil samples of three blocks are low to medium in organic carbon per cent. [8]reported that C/ N ratio of the Vindhyan soils was higher in the low-laying areas than that of upland with terrace containing sand stone and lime stone shale. Also, high temperature during summer might be responsible for the rapid decomposition of organic matter, thus resulting in low organic C content of these soils. [9]also reported that the organic carbon, available nitrogen, phosphorus were found in low to medium range in soils of Jaisalmer district of Rajasthan. [10]evaluate the soil fertility status from Sangamner area, Ahmednagar district; Maharashtra on 62 surface soil samples analyzed that EC in the downstream part reflecting low flushing rate and sluggish ground water movement in the area. Organic carbon ranges from 0.165 to 1.575% in the soils in which 29.03% and 48.38% of soils showed low and medium status of organic carbon respectively. The Electrical conductivity of soil samples were ranged from 0.33 dS m^{-1} to 0.90 dS m^{-1} with an

average of 0.54 dS m^{-1} in which Electrical conductivity of 79 soil samples reported under safe range, and 41 samples reported under normal range so that the soil electrical conductivity in present studies no harmful for germination of seed, as in maximum number of soil samples. [11]reported that the electrical conductivity (53 dSm^{-1}), available phosphorus (26.74 $kgha^{-1}$), potash (255.52 $kgha^{-1}$) were found low to medium range under soil samples in Sriganganagar district of Rajasthan.

Available Nitrogen content ($kgha^{-1}$)

The available Nitrogen content in the 120 soil samples were ranged from 150 kg ha^{-1} to 320 kg ha^{-1} with an average value of 213.70 kg ha^{-1} in which 86 soil samples were found low, and 34 soil samples were found in medium range conditions. The low level of available nitrogen may be attributed to various factors such as low organic carbon, high pH and CaCO3 content. Major impact on availability of nitrogen, maximum soil samples were found in low category, it may be due to leaching and denitrification dry climate and use of low amount of bio fertilizers, green manures and use of nitrogenous fertilizers. The soils had organic carbon content in medium range, since organic matter content is an indicator of available Nitrogen status of soils, thus the soils of the investigating area are also dominantly medium in respect of their available Nitrogen[12]. [13]conducted a study for assess the fertility status of cultivated land soils in which Available nitrogen was low (194.23 $kgha^{-1}$), phosphorus was low to medium (14.05 $kgha^{-1}$), potassium was high (456.59 $kgha^{-1}$), sulphur was low too high (16.81 $mgkg^{-1}$) in range in soils of Mandal block of Bhilwara district of Rajasthan, India.

Available Phosphorus content ($kgha^{-1}$)

The data revealed on available phosphorus content in the soil samples was varied from 18.76 kg ha^{-1} to 32.96 Kg ha^{-1} with an average value of 22.34 Kg ha^{-1} in which 93 soil samples were found low, 27 soil samples were found medium in Available Phosphorus content. The variation in available phosphorus appears to be due to marked variation in organic carbon, CaCO3 and other soil characteristics. [7]reported that the available N_2O, P_2O_5, K_2O was found in ranged from 135 to 236 $kgha^{-1}$, 10 to 34 $kgha^{-1}$, 130 to 415 $kgha^{-1}$, respectively in Nicchapura-2 Micro Watershed of Davanagere District, Karnataka, India. [14]evaluate soil fertility status from Kanchanpur district of Nepal on sixty seven surface soil samples were analyzed the soil P^H value ranged from 5.5–6.8 reflecting slightly acidic to neutral nature of soils, E.C. ranges between 0.16–0.40 dSm-1 and organic carbon ranges from 0.96–4.20 %. Hundred percent samples showing high organic carbon status, 55.22% medium and 54.88% high status in available N and most of the soils sample has high status in P, 88.05% samples are high in phosphorous, while 34.32% samples are low, 58.20% medium and 7.46% high in available K.

Available Potassium content ($kgha^{-1}$)

The available potassium content in the soil samples was ranged from 121 kg ha^{-1} to 255 kg ha^{-1} with an average value of 125.57 kg ha^{-1} K_2O in which 56 soil samples were found under low condition and 64 soil samples were found under medium range in Potassium content. This may be due to absence of potash bearing minerals (muscovite, biotite and feldspar). The results suggest the K availability may not be limiting factor except in soils falling in the medium category in which crops might benefit by small application of K. However, there is a need for carrying out soil test crop response studies in soils containing various level of available Potash. [15]evaluate the fertility status on twenty soil samples of selected Bt. cotton growing soils of northern transition zone of Karnataka showed that the available nitrogen, phosphorus and potassium contents ranged from 101.80 to 270.20 kg ha^{-1} and 19.60 to 40.29 kg ha^{-1}, 245 to 551 kg ha^{-1}, respectively in Vertisols and 80.44 to 146.3 kg ha^{-1}, 12.56 to 32.40 kg ha^{-1} and 211 to 426 kg ha^{-1}, respectively in Alfisols of all the studied taluks. [16]reported that the medium to high organic carbon in surface soils, medium status of available N, P and K and low status of available S in soils of Mjhawa Block of Mirzapur district, UP.

Available Sulphur content ($mgkg^{-1}$)

The data revealed on sulphur content ranged from 8.20 mg kg^{-1} to 19.38 mg kg^{-1} with an average value of 15.34 mg kg^{-1} in which 106 soil samples were found under medium condition and 14 soil samples were found

under high range in available sulphur content. The available sulphur status in the soil ranged from medium to high but majority of the area indicate medium in available sulphur content. The coarse-textured sandy soils generally have low total S-content as compared to fine textured soils however also had no opinion that sufficiency of available sulphur is directly proportional to the organic matter content of the soil. [17]reported that the Rice growing soils in Kaithal, Kurukshetra and Karnal were neutral to slightly alkaline in reaction and loamy sand to clay loam. In surface soil, organic carbon ranged from 0.35 to 0.68, 0.27 to 0.67 and 0.36 to 0.69 % and 0.28 to 0.63, 0.21 to 0.56 and 0.27 to 0.61% in subsurface soil in Kaithal, Kurukshetra and Karnal, respectively. Available nitrogen, phosphorus, potassium and sulphur varied from 112 to 194, 86 to 180 and 115 to 193; 9 to 37, 6 to 37 and 9 to 46; 100 to 454, 54 to 306 and 126 to 456; 8 to 71, 4 to 60 and 6 to 108 kg/ha in surface soil while in sub-surface soils varied from 88 to 145, 67 to 141 and 86 to 140; 5 to 26, 4 to 27 and 7 to 38; 92 to 426, 38 to 278 and 118 to 359; 4 to 49, 3 to 42 and 3 to 72 kg/ha correspondingly in district Kaithal, Kurukshetra and Karnal.

Table 1: Methods adopted for estimation of different Soil properties

S.N.	Parameters	Adopted Methods
1	Soil P^H	Jackson,1973
2	Electrical conductivity	Jackson,1973
3	Organic carbon	Jackson,1973
4	Available nitrogen	Subbaiah and Asija,1956
5	Available phosphorus	Jackson,1971
6	Available potassium	Jackson,1971
7	Available sulphur	Chesnin and Yien (1951)

Table 2: Characterization of soil testing values for different nutrients

S.N.	Parameters	Status of Available Soil Nutrients		
		Low	Medium	High
1	Organic Carbon (%)	**< 0.5**	**0.5-0.75**	**> 0.75**
2	Available Nitrogen (kg/ha^{-1})	**< 280**	**280-560**	**> 560**
3	Available Phosphorus (kg/ha^{-1})	**< 10**	**10-25**	**> 25**
4	Available Potash (kg/ha^{-1})	**< 120**	**120-280**	**> 280**

Table 3: Status of Physical and chemical soil properties of Research Study

S. N.	Parameters	Min.	Max.	Range	Mean
1	Soil P^H	**6.77**	**8.88**	**6.77-8.40**	**7.75**
2	Electrical Conductivity (dSm^{-1})	**0.10**	**1.90**	**0.33-0.90**	**0.54**
3	Organic Carbon (%)	**0.12**	**1.29**	**0.25-0.73**	**0.38**
4	Available Nitrogen (kg ha^{-1})	**118**	**441**	**150-320**	**213.7**
5	Available Phosphorus (kg ha^{-1})	**10**	**38**	**18.75-32.95**	**22.35**
6	Available Potash (kg ha^{-1})	**59**	**225**	**121-255**	**125.57**
7	Available Sulphur (mg kg^{-1})	**8.2**	**22**	**8.20-19.80**	**15.34**

CONCLUSION

The result concluded that the soils of Sawai Madhopur district is categorized under neutral to slightly alkaline in P^H with low to medium fertility status. Most of the soil samples under research study were having low to medium range in Electrical conductivity; organic carbon and available nitrogen, Phosphorus and Potash thus apply the organic matter as an important source of nutrient, use of phosphorus rich fertilizers as required by a specific crop, use of compost or vermin-compost manure in the agricultural fields. Sulphur content under research study was found medium status in the soil.

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