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Research Article

Soil fertility status of wheat growing areas of union council cattle farm, Tehsil Jhat Pat, Balochistan

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Abstract

For sustainable agriculture, optimum soil fertility plays an important role. Analysis of soil nutrients status with the passage of is inevitable. In order to investigate the fertility status of soil in wheat growing areas of union council Cattle Farm, Tehsil Jhat Pat, Balochistan, 30 soil samples were collected from surface soil (0-15 cm) to analyse some physio-chemical properties and nutrients status. The results of the present study revealed that 100% soils were clay loam in texture. Electrical conductivity (EC) ranged from 0.59-2.55 dS m^{-1} (average 1.10 dS m^{-1}), 86.6% soils were grouped as non-saline (EC < 2 dS m^{-1}) while 13.4% samples were slightly saline (EC: 2-4 dS m^{-1}). For soil pH, all samples were observed moderately alkaline (7.4-8.4). Soil ABDTPA-P ranged from 0.30-49.80 mg kg^{-1} (average 8.44 mg kg^{-1}), about 43.3% of the soils were observed high (> 7 mg kg^{-1}) in P. Soil ABDTPA-K ranged from 237.5-762.5 mg kg^{-1} with an average value of 360.0 mg kg^{-1}. The K was high (> 150 mg kg^{-1}) in all soil samples. On the basis of present results, the EC of the soil is non-saline, P is marginal and K is high in the mentioned area. It is recommended that proper soil management, balanced fertilization and management can increase crop yield and maintain soil fertility.

Keywords: Fertility status; Potassium; Phosphorus

Introduction

Optimum soil fertility plays and important role in optimum crop yield. Analysis of soil with the passage of time is inevitable and gives basic and current soil status. The soils in arid and semi-arid regions of the world are generally infertile due to certain reasons. Nutrients removal results in a decline soil fertility when replenishment with organic or inorganic inputs which affects crop growth and yield **[1]**. Soil fertility decline is considered as an important cause for low productivity of field crops such as wheat, rice, sugarcane **[1]**. Wheat (*Triticum aestivum L.*) is one of the important staple food crops in the world including Pakistan, which contributes about 37% of the daily energy in the Pakistan's

food supply system [2] and grown all over the world for multiple purposes. It is one of the cash crops in Pakistan. Wheat is cultivated in all provinces of Pakistan as a bumper winter crop [3]. The wheat cultivated areas in Pakistan are about 8825 thousand hectares with 24.946 million tons production [4]. (Pakistan bureau of statistics, 2019-20). In Balochistan, 0.34 million hectares with 0.663 m tons production. The wheat cultivation of province has 4.1% area with a 3.4% production of the country [5, 6]. Balochistan produces only 60% requirement of the province [6]. In wheat, the usage of fertilizer is more as compared to other cash crops [7]. But, the average yield per unit area of wheat is comparatively very low to the other wheat growing countries [3,8]. There are number of factors which are responsible for low yield. Decline in soil fertility, is observed as one of the major contributing factors. It is estimated that about 100%, 90% and 70% of Pakistani soils are deficient in organic matter (OM), nitrogen (N), phosphorus (P) and zinc (Zn) respectively [9]. Due to the shortage of irrigation water only wheat crop is grown in UC Cattle Farm Tehsil Jhat Pat and rest of time the soil is barren which may affect its fertility and wheat productivity. To our knowledge no studies were found in this area for its fertility status.

Therefore, the survey study was conducted to investigate the nutrient status in union council Cattle Farm Tehsil Jhat Pat District Jafferabad, Balochistan in August 2019. The findings of survey will be helpful (i). to describe the current fertility status of the area and (ii). reasons for low productivity of wheat.

Materials and Methods

A total of 30 soil samples were collected in the month of August 2019 from a union council Cattle Farm of Tehsil Jhat Pat, District Jafferabad, Balochistan. The samples were collected at the depth of 0-15 cm. They were brought to the laboratory of Soil Fertility, Agriculture Extension Jafferabad, air-dried, ground and passed through 2 mm sieve for further analysis. The soil samples were analysed for various physico-chemical properties. These analyses were particle size distribution, pH, electrical conductivity and macronutrients (phosphorus and potassium) content. The particle size distribution was determined by Hydrometer method [10]. The EC and pH were determined in 1:2.5 soil water extract with EC and pH meters. Phosphorus and potassium were determined by ABDTPA method proposed by Estefan et al, (2013) [11]. The descriptive statistics (minimum, maximum, mean, mode and standard deviation) was performed through spread sheet software MS-Excel (Microsoft 2010).

Results

Soil texture

The results revealed that all the soils samples in UC Cattle Farm, Tehsil Jhat Pat were clay loam in texture. There was no difference in all the samples collected from the area (Table 1).

Electrical conductivity

The results regarding soil electrical conductivity are presented in (Table 1). The electrical conductivity of wheat growing areas of UC Cattle Farm, Tehsil Jhat Pat ranged from 0.59-2.55 dS m^{1} with an average value of 1.10 dS m^{-1}. According to the [12] categorization about 86.6% of the soil samples were non-saline (<2 dS m^{-1}) and rest of the soils 13.4% were slightly saline (2-4 dS m^{-1}).

Soil pH

The results regarding soil pH are given in (Table 1). The pH of wheat growing areas of UC Cattle Farm, Tehsil Jhat Pat ranged from 7.4-8.4 with an average value of 8.1. According to the categorization of [13] about 83.3% of the soil samples are medium alkaline (7.6-8.2) and 16.7% soils are strongly alkaline (8.3-9).

ABDTPA-P

The results about ABDTPA-P of wheat growing areas of UC Cattle Farm, Tehsil Jhat Pat are presented in (Table 1). It ranged from 0.30-49.8 mg kg^{-1} with an average value of 8.44 mg kg^{-1}. The samples were grouped on the basis of [14], are presented

in (Table 1). It was noted that about 43.3% soils were adequate (7> mg kg^{-1}) in ABDTPA-P, 36.6% were low (<4) and 20% samples were marginal (4-7 mg kg^{-1}).

ABDTPA-K

The ABDTPA-K of wheat growing areas of UC Cattle Farm, Tehsil Jhat Pat, ranged from 120-175 mg kg^{-1} with an average value of 148.7 mg kg^{-1}. The samples were grouped on the basis of **[14]** are shown in (Table 1). All the soil samples (100%) were found adequate (>150).

Table 1. Physico-chemical properties of UC Cattle Farm, Tehsil Jhat Pat, District Jafferabad, Balochistan

No. of Samples	Depth (cm)	Textural Class	EC dS m^{-1}	pH	P (ppm)	K (ppm)
1	0-15	Clay loam	1.39	8.2	5.10	362.50
2	0-15	Clay loam	0.96	8.1	4.00	325.00
3	0-15	Clay loam	0.88	8.3	0.60	337.50
4	0-15	Clay loam	0.73	8.1	0.30	237.50
5	0-15	Clay loam	0.83	8.1	3.40	287.50
6	0-15	Clay loam	0.78	8.3	0.50	375.00
7	0-15	Clay loam	0.62	8.0	1.80	300.00
8	0-15	Clay loam	2.43	8.2	2.30	350.00
9	0-15	Clay loam	0.85	8.2	1.50	262.50
10	0-15	Clay loam	1.10	8.0	1.40	300.00
11	0-15	Clay loam	0.75	8.0	8.10	325.00
12	0-15	Clay loam	0.99	8.0	22.00	487.50
13	0-15	Clay loam	0.68	8.0	6.60	350.00
14	0-15	Clay loam	1.14	7.9	8.80	350.00
15	0-15	Clay loam	2.51	7.9	7.60	337.50
16	0-15	Clay loam	0.73	8.0	49.80	762.50
17	0-15	Clay loam	0.59	8.0	15.90	337.50
18	0-15	Clay loam	0.81	8.2	20.10	337.50
19	0-15	Clay loam	2.54	8.2	8.00	437.50
20	0-15	Clay loam	0.61	8.1	12.60	325.00
21	0-15	Clay loam	0.91	8.1	17.50	500.00
22	0-15	Clay loam	1.46	8.1	3.10	312.50
23	0-15	Clay loam	0.62	8.0	6.80	275.00
24	0-15	Clay loam	0.68	7.4	7.40	275.00
25	0-15	Clay loam	0.63	7.8	5.90	387.50
26	0-15	Clay loam	0.91	7.4	9.90	362.50
27	0-15	Clay loam	2.55	8.3	4.60	450.00
28	0-15	Clay loam	0.62	8.4	5.30	412.50
29	0-15	Clay loam	1.34	8.2	2.80	300.00
30	0-15	Clay loam	1.25	7.9	9.50	337.50
Min			**0.59**	**7.4**	**0.30**	**237.50**
Max			**2.55**	**8.4**	**49.80**	**762.50**
Mean			**1.10**	**8.07**	**8.44**	**360.00**
Mode			**0.62**	**8.11**	**-**	**337.50**
STD			**0.61**	**0.17**	**9.68**	**98.73**

Discussion

Soil fertility evaluation is an important tool for site specific fertilization for sustainable agriculture. Evaluation of soil provides for the future forecasting for crop cultivation. This study evaluated the fertility status of major wheat growing area of UC Cattle Farm, Tehsil Jhat Pat of Balochistan province. Soil is the medium for plant growth which provides essential macro (phosphorus and potassium) nutrients to the plants for higher growth and yield. Macro nutrients such as P and K which are responsible for many physiological chemical processes, for example, photosynthesis, respiration, enzyme activation, cell division and enlargement, [9].

To the best of our knowledge, the present study is the first study conducted for fertility status of wheat growing areas of the UC Cattle Farm, Tehsil Jhat Pat. The study revealed all the soil samples (100%) were observed clay loam in texture.

The results regarding EC (dS m^{-1}) showed that 86.6% soil samples were non-saline and rest of the samples were slightly saline. The possible reason for non-saline soils may be canal water used in routine this area during wheat cultivation season, which leach down all the salts. These values are in accordance with the results of [15]. They investigated and revealed that soils in rice growing area of Tehsil Jhat Pat are about 40% moderately saline. [16] Collected soil samples from 32 tomato growing areas of district Badin Sindh and analysed for various physico-chemical and nutrients. They reported similar results. For example, they observed that 80% soils were non-saline and 20% soils were slightly saline. Similar results were obtained for soil pH. Most of the soil samples (83.3%) were found alkaline and remaining samples (16.7%) were medium alkaline. The present results are in the line with the results of [14]. The previous studies of various researches reported that Pakistani soils are alkaline in nature.

Phosphorus is key element for the plant growth and crop yield, its deficiency restricts plant growth in soil [17] due too various reasons. Pakistani soils are deficient (90%) in P [18]. A little variation was observed in all the soil samples while determining soil phosphorus in wheat growing area of UC Cattle Farm Tehsil Jhat Pat. Our results indicated that ABDTPA-P was adequate in most of the soil samples. In terms of percentage, 43.3% soils were adequate in ABDTPA-P while 36.6% samples were low in P. The possible reasons for high P in soil is balanced fertilization and the nature of P in which its availability is low and accumulates in soil. In alkaline calcareous soil P attaches with Ca to form Ca-P [19]. Similar results were obtained by Talpur et al, 2017; they analysed different soil samples in various Union Councils of Taluka Kunri and showed that about 50% soils had adequate P.

The lack of potassium may limit plant productivity. Potassium plays its role in plants as an enzyme's activator [20]. Our findings indicate that all the soil samples were adequate in ABDTPA-K in wheat growing area Tehsil Jhat Pat. There may be the reason of consistently application of inorganic K fertilization to soils and remained fixed in the soils. One of reasons for high K in soil may be that K fixation with other elements and it's unavailable to plants. Our findings are agreed with the results of [21]. They took soil samples from chili growing areas of Taluka Kunri and determined K. Similar results were reported in another long-term field experiment of wheat growing area of Terai Nepal. [22] found that application of FYM and inorganic fertilization increase soil K in their long-term field experiment in Nepal. Soil potassium was reported adequate quantity in the upper layer of soil (20 cm) in previous survey study of Tandojam and around [23].

Conclusion

It is concluded that soils in UC Cattle Farm, Tehsil Jhat Pat District Jafferabad,

Balochistan are non-saline and medium alkaline in nature, 100% adequate in K and marginal in P. Proper management and practices may increase wheat yield and other crops.

Authors' contributions

Conceived and designed the experiments: EE Bhanger & MMA Jamali, Performed the experiments: EE Bhanger, SA Umrani, SA Rakhshani & IK Lashari, Analyzed the data: MK Soothar & R Lal, Wrote the paper: MK Soothar & MK Sootaher.

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