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FERTILITY STATUS OF AGRICULTURE LANDS IN MUZAFFARABAD DIVISION OF AZAD JAMMU AND KASHMIR

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A B S T R A C T

A review of soil samples collected and analyzed from the cultivated lands of northern districts of AJ&K from 2017-2022 in the soil fertility laboratory of Agriculture Department was done know the fertility status of these land. These samples were analyzed for chemical and physical properties of soil. Chemical analysis was performed and organic matter was analyzed using walkely & black method whereas, extractable phosphorous in 0.5 $NaHCO_3$ was analyzed using the molybdate-ascorbic acid method. The results showed that the northern districts of AJK are rich in organic matter as 79% of the samples showed sufficient amount of organic matter. Available phosphorous (P_2O_5) was sufficient in 73% of the samples. Whereas, available potassium (K_2O) was sufficient in only 47% of the samples. Northern districts soil has a pH range of 6.0 to 7.5 which is neutral range where all major plant nutrients are available in the soil. As soils of these districts are cultivated without using any potash fertilizer and very low quantity of farm yard manure is used in the fields therefore, potash status in the soil is decreasing day by day. Therefore, if agriculture crops are grown on commercial basis it is necessary to use balance fertilization along with organic fertilizers in these districts.

Keywords: Soil; Fertility; Physical and chemical properties; Sufficiency; pH; Macro nutrients

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INTRODUCTION

Soil fertility refers to the ability of the soils to provide nutrients for plant growth on sustainable basis to ensure agricultural yield. Nutrients supply plays important role in crop productivity. Soil and water testing are important tools to estimate fertilizer dose recommendations for crops after soil sample analysis collected from different areas. The main purpose of the soil analysis is to assess the fertility status of soils and to suggest measures for improvement of available plant nutrient in the soil by use of recommended organic & in-organic fertilizers. Soil fertility depletion in Azad Kashmir includes continuous nutrient mining by intensive cropping, use of low qualities of fresh farmyard manure, very little or no use of chemical fertilizers and non-exploration of biological nitrogen fixation in the cropping system (Rashid, 1998; Watanabe and Olsen, 1965). Soils have inherent weakness, primarily deficient in nutrients essential to grow crops. Even if adequately supplied the nutrient supplying capacity of the nutrients invariably diminishes with time (Almas M.A and M.B But.2017). As human population continues to increase, human disturbance on the earth's ecosystem to produce food and fiber will place greater demand on soils to supply essential nutrients. Continuous cropping for enhanced yield removes substantial amounts of nutrients from soil. Imbalanced and inadequate use of chemical fertilizers, improper irrigation and various cultural practices also deplete the soil quality rapidly (Medhe et al., 2012). Soil fertility fluctuates throughout the growing season each year due to alteration in the quantity and availability of mineral nutrients through the addition of fertilizers, manure, compost, mulch, and lime in addition to leaching. Intensively cultivated soils are being depleted with available nutrients especially secondary and micronutrients (Denis Magnus Ken Amara et al., 2017). Considering the

nature and extent of nutrient disorders, fertilizer recommendations made by Chaudhry (1989) included application of nitrogen and phosphate fertilizers in addition to farmyard manure. Therefore, information of our land resources and assessment of fertility status of the soils is the basic requirement for starting any new development project. Proper utilization and management of soil is necessary for making agriculture productive and sustainable.

The objectives of this review were to know the present fertility status of agriculture lands in northern districts of Azad Kashmir by: Analyzing the fertility status for major soil nutrients in agriculture lands of district Muzaffarabad, Jhelum Valley and Neelum Valley and to Make recommendations on the basis of results of soil sample analysis to improve fertility of the soils in all Northern Districts of AJK.

MATERIALS AND METHOD

To examine and compare the fertility status of different districts of Muzaffarabad division soil samples were collected by lab staff from randomly selected villages of all tehsils of Muzaffarabad, Jhelum Valley and Neelum Valley. These samples were collected at the depth of 0-15 cm from the cultivated fields of these selected villages.

The collected samples were air dried ground and passed through 2 mm sized sieve in the laboratory for physical and chemical analysis. Physical analysis of samples included soil texture, saturation percentage and soil pH and chemical analysis included Organic matter, available phosphorous and available potassium in the soil samples. Chemical analysis was performed according to Page et.al. (1982). Organic matter was analyzed by Walkely-Black method whereas extractable phosphorous in 0.5 $NaHCO_3$ was analyzed by Olsen et.al. (1965) using the molybdate-ascorbic acid method. The analysis data was classified into deficient, adequate and sufficient fertility status on the basis of guidelines given in Soil and Plant Analysis laboratory Manual (Ryan et. al. 2001), published by International Centre for Agriculture & research in the Dry Areas (ICARDA).

RESULTS

The data obtained from sample analysis was compiled for further study purpose and for evaluation of fertility status in the northern districts. The present study was focused on the last five years status of fertility in these districts (2017 to 2022).

District Muzaffarabad

The data analysis of district Muzaffarabad shows the following results presented in table 1. The result shows that most of the soil in district Muzaffarabad is good in availability of organic matter as 84% of the soil has sufficient organic matter for plant growth. 13% of the soil showed adequate amount of organic matter while only 3% of the soil shows deficiency in organic matter. The sample were also analyzed for the available Phosphorous and Potassium in the soil and results showed that 79% of the soil is sufficient in availability of phosphorous while only 9% of the soil was deficient in available phosphorous. Whereas, potassium was 30% deficient and 23% of the samples have sufficient amount of potassium in the soil. The results of these areas are similar to the findings of Almas et al, (2017). The results imply that all the three key macro elements are present in adequate amounts in the soil which increases the fertility of the soil.

Table 1: Fertility status of soil in district Muzaffarabad.

Name of Tehsil	No. of samples	Organic Matter (%)			Phosphorous (%)			Potassium (%)		
		Deficient (<0.86%)	Adequate (0.86-1.29%)	Sufficient (1.29%)	Deficient (<10 ppm)	Adequate (10-15ppm)	Sufficient (>15ppm)	Deficient (<100 ppm)	Adequate (100-150ppm)	sufficient (>150 ppm)
Muzaffarabad	600	6	26	68	18	25	57	49	51	0
Naseerabad	67	0	0	100	0	0	100	11	43	46
Total /Average	667	3	13	84	9	22	79	30	47	23

Jhelum valley

The samples from different tehsils of Jhelum valley were analyzed in the laboratory. The results are as shown in the table (2).

The results obtained after the analysis of samples from Jhelum Valley showed 54% of sufficiency in the amount of organic matter only 14% of the samples showed deficiency in available organic matter. The results of Available Phosphorous show that 31% of the soil is deficient in the availability of phosphorous and 60% soil has sufficient

amounts of Phosphorus in it. Whereas, availability of Potassium in soil was deficient by 5% while 71% of the soil samples have sufficient amount of potassium and 23% of the soil has adequate amounts of available potassium. The overall results showed that the soil of district Jhelum valley is a good medium for the production of Agriculture products.

Table 2: Fertility status of district Jhelum valley.

Tehsil	No. of samples	Organic Matter (%)			Phosphorous (%)			Potassium (%)		
		Deficient (<0.86%)	Adequate (0.86-1.29%)	Sufficient (1.29%)	Deficient (<10 ppm)	Adequate (10-15)	Sufficient (>15)	Deficient (<100 ppm)	Adequate (100-150)	sufficient (>150 ppm)
Hattian Bala	275	6	26	68	12	0	88	3.5	9.5	87
Chikar	8	37	0	63	37	0	63	12.5	12.5	75
Leepa	14	0	71	29	44	28	28	0	50	50
Total / Average	297	14	32	54	31	9	60	5	23	71

The results soil samples analyzed from different tehsils of Neelum Valley showed the following results in table 3. The results of soil analysis of both tehsils of district Neelum valley showed that the soil of Neelum valley was sufficient in the availability of organic matter as 99% of the soil samples showed high concentration of organic matter whereas only 1% of the soil samples showed inadequate levels of organic matter which implies that the soil is more suitable for the production of a wide variety of agricultural produce. The results of phosphorous also showed 86% of the soil samples were sufficient in the availability of phosphorous nutrient and only 7 % were deficient. Potassium availability showed that 25% of the soil samples had sufficient amount of Potassium and 5 % of the soil samples showed deficient amount of available potassium in the soil whereas, 70% of the soil showed adequate amounts of potassium (Table 3). The results shows that the soil of district Neelum valley is adequate in all types of essential elements needed for healthier plant growth which in turn leads towards increase in production of various crops, vegetables and fruits.

Table 3: Fertility status of soil in district Neelum valley.

Tehsil	No. of samples	Organic matter (%)			Phosphorous (%)			Potassium (%)		
		Deficient (<0.86%)	Adequate (0.86-1.29%)	Sufficient (1.29%)	Deficient (<10 ppm)	Adequate (10-15)	Sufficient (>15)	Deficient (<100 ppm)	Adequate (100-150)	Sufficient (>150 ppm)
Athmaqam	43	0	2	98	13	13	73	10	79	11
Sharda	35	0	0	100	0	0	100	0	61	39
Total / Average	78	0	1	99	7	7	86	5	70	25

Comparison of fertility Status in all districts of Muzaffarabad division

Comparison of physical properties of soil samples analyzed in all tehsils of Muzaffarabad division is shown in table 4. The above results showed that most of the land in northern districts of AJK falls in the range of pH of 6.7 to 7.4 which means most of the land in the northern districts is neutral range. This range of pH is characterize as good medium for healthy plant growth and it also provide good conditions for microbial actions which are necessary to make the nitrogen, sulfur and phosphorous available in the soil. This range is slightly acidic and all macro & micro plant nutrients which are necessary for plant growth and fruit production are easily available in the soil. Overall saturation percentage of 47 is also a good sign for moisture holding capacity of the soil which is available to the plant for a longer time depending on the temperature and weather condition. Textural class of the soils in all northern districts of AJK falls in Loamy to Silt Clay Loam which is good for growing all major crops and fruit plants suitable in this region because loam soil has all the three types of sand, silt and clay in

equilibrium condition which make the soil ideal for growing a wide range of crops, vegetables and fruits. Overall comparison of fertility status of different nutrients is shown in Figure 1.

DISCUSSION

The partial nutrient balances at field scale represents revealed C and N 'accumulation' areas within the cultivated field. Soil depletion is natural process as there is continuous erosion due to rainfall and sediments are continued to be eroded from highlands to the plains. It has negative impact on nutrient balance at farm scale. This resource flow pattern, however, was not always clearly reflected by the results of the soil analysis (De Jager et al., 2001).

Table 4: Comparison of physical properties of soil in all tehsils of Muzaffarabad division.

S. No.	Name of tehsil	Saturation %	Textural class	pH
1	Muzaffarabad	44	Loamy Soil	7.2
2	Naseerabad	49	Silty Clay Loam	7.4
3	Hattian Bala	45	Silty Clay Loam	7.3
4	Chakar	46	Silty Clay Loam	6.9
5	Leepa	47	Silty Clay Loam	6.9
6	Athmaqam	49	Silty Clay Loam	6.7
7	Sharda	47	Silty Clay Loam	7.2
	Mean	47	Silty Clay Loam	7.1

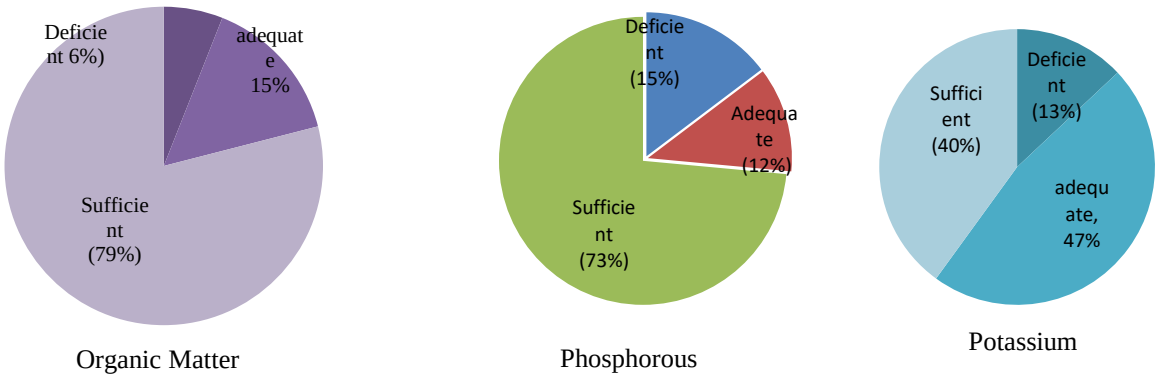

Figure 1. Comparison of fertility status in Muzaffarabad division of Azad Jammu and Kashmir.

Nutrient balances helped to identify trends of nutrient depletion and accumulation but these can only be interpreted in relation to nutrient stocks ((Smaling et al., 1996). The overall results showed that most of the agriculture land in northern districts of Azad Kashmir is rich in organic matter (79%) and phosphorous (73%). Soil analysis data from central highland of Ethiopia showed deficiency in the levels of N, P, S, Zn, Mo and B (Tittonell et al., 2005). Whereas, potassium is deficient in 13% of soils samples and is becoming alarming situation for the farmers and use of potash fertilizers is becoming necessary to get good yield from their fields. Potassium is important for plant because it participates in the activation of large number of enzymes which are involved in the physiological processes of plants. It controls the water economy and provides the resistance against a number of pests, diseases and environmental stresses (Denis Magnus Ken Amara et al., 2017). The sufficient doses of potassium will not only help in increasing the crop yield but will also increase fertility of their soils as NPK are the major macro nutrients required for crop production.

Hence it can be implied from this review that most of the cultivable land in District Muzaffarabad is fertile and fit for optimizing crop production as soil shows sufficiency in almost all the macro nutrients however in District Jehlum Valley and Neelum Valley there is inadequate amounts of phosphorous and potassium in few areas under considerations which can be improved by applying

recommended doses of organic and inorganic fertilizers. Farmers should be advised to also use organic fertilizers with chemical fertilizers accordingly on the basis of fertility status of their soils. Soil Fertility Section of Department of Agriculture is providing free of cost soil advisory services to the farming community by analyzing their soil samples for physical & chemical properties of soil and providing recommendations based on the results of their soil analysis. Northern districts falls in the pH range of 6.0 to 7.5 which is neutral range and all major plant nutrients are available in this range.

As the northern districts of AJK show the adequate amounts of the nutrients required for a good plant growth there should be less use of inorganic fertilizers and maximum use of organic fertilizers in the soil. Agronomic practices like crop rotation, mulching, reduced tillage, cover cropping and green manuring practices should be adopted to increase soil organic matter in the field. Results of last five-year fertility status of Jhelum Valley and Neelum Valley availability of potassium is depleting in the soil must be supplemented by potassium, nitrogen & phosphorous fertilizers for commercial crop production. Encouragement from policy makers Government should encourage such policies which can promote sustainable agriculture and emphasize the concerned persons in utilizing environment friendly technologies that also improve soil fertility without causing any harm to the quality of agriculture land.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

AUTHOR'S CONTRIBUTION

All authors contributed and supported towards writing of this manuscript.

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