AN AJSS An Asian Journal of Soil Science
Volume **13** | Issue 1 | June, 2018 | 30-35 | e ISSN–0976–7231 ■ Visit us : www.researchjournal.co.in

Research Article

DOI : 10.15740/HAS/AJSS/13.1/30-35

Soil fertility status of some villages in Kalakankar block of plains of central agroclimatic zone of U.P.

■ Prashant Upadhyay, Pawan Sirothia, N. K. Singh **and** Manoj Kumar Singh

Received : 09.02.2018; **Revised :** 03.05.2018; **Accepted :** 17.05.2018

MEMBERS OF RESEARCH FORUM:

Corresponding author :
Prashant Upadhyay, Department of Soil Science, Mahatma Gandhi Chitrakoot Gramodaya Vishwvidyalya, Chitrakoot, **Satna (M.P.) India**

Co-authors :
Pawan Sirothia, N. K. Singh and Manoj Kumar Singh, Department of Soil Science, Mahatma Gandhi Chitrakoot Gramodaya Vishwvidyalya, Chitrakoot, **Satna (M.P.) India**

Summary

The current study on the status of the soil fertility in Kalakankar block of dist. Pratapgarh U.P. by total 36 (0-15) soil samples. Soil sample (were collected from): three villages namely Alapur, Shahabad and Sahijani of Kalakankar block District Pratapgarh. The organic carbon content of all the three villages varied from low to medium. The available N content of all the three villages was found to be low and it was found to be in positive co–relation with the carbon content of the lands. The available N content was higher in medium land type of Shahabad in comparison to similar land type of other two villages. The available P content of all soil in all the three villages was moderate. However, the P content of the Alapur village was higher than other two villages because of the higher content of organic matter. The available K contents of all the soil of all the three villages was moderate to high and especially in the Sahijani village it was highest. This is the good indication for the high yield of various vegetable, fruits and tuber crops with a high amount of K. The S content was found to be comparatively higher in the medium land soil of all three villages, The available Zn content was moderate to rich in all types of soil, however, upland of all three village were rich in Zn content in comparison to medium and low land of the village. Bo content was higher in all types of soil of three villages. The various result obtained from the different soil tests gave information about the nutrients status of the soil, under study and on the basis of these findings, a balanced recommendation of fertilizers and manures to various crops can be made, that will help in increasing the productivity of different food crops.

Key words : Soil fertility, Organic carbon, Pratpgarh, Nutrients

How to cite this article : Upadhyay, Prashant, Sirothia, Pawan, Singh, N.K. and Singh, Manoj Kumar (2018). Soil fertility status of some villages in Kalakankar block of plains of central agroclimatic zone of U.P. *Asian J. Soil Sci.*, **13** (1) : 30-35 : **DOI : 10.15740/HAS/AJSS/13.1/30-35.**

Introduction

Use of specified dose of fertilizer in the agricultural field is the most important agricultural input for increasing crop production. Soil testing is now considered as an important tool for the recommendation of the fertilizers doses for various crops in India. Soil testing is based on intimate knowledge of soil-crop-variety-fertilizer-climate-management interaction under a given situation. The fertilizer application by farmers in the field without knowledge of soil fertility status and nutrient requirement of different crops usually leads to adverse effect on soil as well as crops by way of nutrient deficiency or toxicity

due to over use or inadequate use of fertilizers. Finally these results in loss of precious financial resources of farmers and lowers the soil productivity and accelerates the soil degradation in long run determines the growth of plant. Soil fertility is determined by the presence or, absence of *i.e.* macro and micronutrients. Out of 17 essential plant nutrients N, P, K, Ca, Mg and S are macronutrients. The sustainable productivity of a soil mainly depends upon its ability to supply essential nutrients to the growing plants.

Soil fertility status preparation of soil fertility maps is an important requirement for District Pratapgarh of Uttar Pradesh but there is no any such work has been done for the villages under study in the present investigation.

Work on preparation of soil fertility maps have been done for Pratapgarh district of Uttar Pradesh but no such work has been done for the villages under study in the present investigation. Therefore, an attempt has been made in the present investigation to prepare soil fertility maps for three different villages of Kalakankar block and to find out the soil fertility related production constraints of different crops grown and to suggest remedial measures.

Study area:

Three villages namely Alapur, Shahabad and Sahijani of Kalakankar block which belong to Pratapgarh district are included in the present investigation. The block comes under plains of central agroclimatic zone of U.P. The Alapur and Shahabad villages is very near to Ganga River. The Sahijani village is located on the border of Kalakankar block after that Babanganj block of the District Pratapgarh started.

The mean annual rainfall is 969.8 mm. The mean maximum summer temperature is 44^0C and mean minimum winter temperature is 9.0^0C (APR 2015-16 KVK PBH) the climate is hot and sub-humid. Sandy loam, soils are found in this agroclimatic zone. As per modern system of soil classification 'Soil taxonomy', the soils are classified under the orders *Entisol, Inceptisols* and *Alfisol* (Bhattacharyya *et al.,* 2013).

Twelve numbers of surface soil samples (0-15cm depth), four from uplands, four from medium lands and four from low lands were collected from each of the three villages. As surface soil contains major portions of plant nutrients in available form and is utilized by the plants for higher production of food, fibre and fuels, nutrient content of surface soil sample is most important for crop production. The present investigation will help in knowing the soil fertility status of different land types as three villages selected for study are representative of the agroclimatic zone. Though the Shahabad village is having sharp slope but the soil sample have been collected from the higher elevation to the lower elevation along the slope. The agro climatic zone mainly consists of alluvial soil. In the three villages under study, sandy loam soils are found in Shahabad and Alapur villages where silty loam soils are found in the Sahijani village. The present investigation will show light on the fertility status of representative villages of Kalakankar block of Pratapgarh District.

Resource and Research Methods

Thirty six surface (0-15 cm) samples in total were collected from selected three villages of Kalakankar block of Pratapgarh district. These soil samples were air dried, crushed with wooden hammer and passed through two mm sieve and preserved in polythene bottle for laboratory study. The pH of the soil samples was determined in 1:2 soil. Water suspension: (Jackson *et al.,* 1973) after equilibration for half an hour with intermittent stirring using the Systronics pH meter. The EC of 1:2 soil.water suspension (Rhodes *et al.,* 1982) was determined using the conductivity bridge (Model: Systronics 306). The organic carbon percentage was calculated by wet digestion procedure of (Walkley and Black, 1936). Available nitrogen was determined by using alkaline $KMnO_4$ method (Subbaiah and Asija, 1956). Phosphorus content was determined by Olsen's method (Olsen *et al.,* 1954). Available potassium was analyzed by ammonium acetate method (Hanway and Heidel, 1952) with the help of Flame photometer (Model; Systronics 128). The amount of sulphur in the soil was determined by turbid metric method (Chesnin and Yien, 1950) and the colour intensity was measured at 410 nm wavelength in Systronics spectrophotometer model 167. The amount of Zn was determined by DTPA – $CaCl_2$ - TEA extraction method through AAS (Model: Elico SL173). The amount of B was determined by hot water soluble method using systronics spectrophotometer model 167.

Research Findings and Discussion

The results obtained from the present investigation

as well as relevant discussion have been summarized under following heads :

Soil reaction:

The pH of soils of the three villages under study is given in Table 1. The pH of the soils of those three villages Alapur, Shahabad and Sahijani was slightly base to alkaline, the pH of the soils of village Alapur was slightly to moderate alkaline as compared to Shahabad and Sahijani. The pH of the soils of Sahijani village was more alkaline in comparison to the other two villages (Silmara *et al.*, 2008).

Electrical conductivity:

The electrical conductivity of surface soils of the three villages under study is given in Table 1. The higher electrical conductivity in Sahijani village and all the low land soils of all three villages was due to the presence of salt Na^+, Ca^+ and Mg^+ ions **(**Felipe *et al.*, 2010).

Organic carbon:

The organic carbon content of surface soils of the 3 villages under study is given in Table 1. The organic carbon content of a soil reflects the soil health as the organic matter is decomposed by the activity of micro organisms and almost all the major and minor nutrients required by the plant are released. Therefore, higher the organic carbon content of the soil, higher is its fertility. Organic matter also imparts good physical properties of soils like soil structure, water-holding capacity, soil aeration etc. The result shows that organic carbon per cent in upland of Alapur village and medium land of Shahabad village was highest because in the village farmers are using FYM and poultry manure while the village Sahijani pond had lowest in organic carbon present (OC%) in all type of land because of less use of FYM (Elamin and Elagib, 2001).

Available nitrogen:

The available nitrogen content of surface soils of the three villages under study is given in Table 1. As there is a positive correlation between organic carbon content and nitrogen content of the soil, therefore, Alapur village contains more nitrogen compared to the Shahabad. The Sahijani village showed less nitrogen due to presence of low OC. This trend was similar to the content of organic carbon in all the three villages under study. Similar findings regardly available nitrogen have been observed by earlier worker (Ge *et al.*, 2013) and Gianello and Bremner, 1986).

Available phosphorus:

The available phosphorus content of surface soils of the three villages is given in Table 2.The comparatively higher value of available phosphorus in upland of Alapur and medium land of Shahabad was due to higher content

Table 1 : Mean and range value of pH, E.C. (dsm^{-1}) and O.C. (%) of three villages of Kalakankar block

Land type/ village name	pH			E.C(dsm^{-1})			O.C (%)		
	Alapur	Shahabad	Sahijani	Alapur	Shahabad	Sahijani	Alapur	Shahabad	Sahijani
Up land (4)	7.16 –7.97	7.95 – 8.17	7.81 – 7.99	0.23 –0.38	0.19 – 0.88	0.89 – 1.22	0.56 -	0.23 – 0.30	0.07 – 0.21
	(7.65)	(7.99)	(7.92)	(0.28)	(0.40)	(1.09)	0.96(0.78)	(0.28)	(0.13)
Medium land (4)	7.82 – 8.13	6.97 – 8.13	7.7 – 8.28	0.18 –0.52	0.13 – 0.87	0.81 – 2.39	0.10 – 0.57	0.60 – 1.14	0.07 – 0.19
	(7.99)	(7.76)	(8.09)	(0.30)	(0.58)	(1.42)	(0.39)	(0.97)	(0.12)
Low land (4)	7.90– 8.80	7.90 – 8.3	7.63 – 8.3	0.92- 1.36	0.76 – 1.98	0.75 – 2.75	0.01-0.73	0.23 – 0.71	0.07 – 0.19
	(8.39)	(8.07)	(8.07)	(1.108)	(1.27)	(1.32)	(0.52)	(0.59)	(0.10)

Table 2 : Mean and range value of available nitrogen, phasphorus and potassium (kg/ha) of three villages of Kalakankar block

Land type/ village name	Available N (kg/ha)			Available P (kg/ha)			Available K (kg/ha)		
	Alapur	Shahabad	Sahijani	Alapur	Shahabad	Sahijani	Alapur	Shahabad	Sahijani
Up land (4)	187.5-308.3	186.4 –	130.1 – 146.1	9.50-16.16	5.08 – 13.50	4.24 – 8.96	88.11-222.5	79.06 – 111.6	124.70 – 236.50
	(263.8)	205.7 (200)	(136.5)	(14.81)	(9.95)	(7.78)	(188.9)	(89.4)	(186.9)
Medium land	148 – 282.6	148 –212.9	118.7 – 146.1	9.07-14.6	5.08 – 16.16	4.63 – 16.60	64.34-	79.6 - 278.2	166.4 – 297.9
(4)	(235.9)	(270.3)	(133.6)	(12.27)	(11.06)	(10.17)	94.89(84.99)	(143.7)	(219.5)
Low land	148-269.8	186.4 – 225	118.7 – 149	9.07 - 17.60	6.41 – 16.61	5.18 – 14.6	46.26- 382.1	53.05 – 275	151 – 382.1
(4)	(239.35)	(200.8)	(132.4)	(13.62)	(12.2)	(12.6)	(166.13)	(244.5)	(236.4)

of organic carbon in the those land because phosphorus is released from the organic matter in a slow process. Similar findings have been observed by earlier worker (Mishra, 2005).

Available potassium:

The available potassium content of surface soils of the three villages is given in Table 2. The comparatively high content of potassium found in Sahijani village as compared to Alapur and Shahabad was due to the clay fraction of which the illite type of clay dominates. The illite clay has the higher cation exchange capacity; similar findings have been observed by earlier workers (Sekhon, 1999).

Available sulphur:

The available sulphur content of surface soils of all the three villages is given in Table 3. The comparatively higher amount of available sulphur was in the uplands of Alapur and medium in village Shahabad. Higher amount of organic carbon found in the low land soils because sulphur is mineralized from the organic matter by micro organisms and released to the soils (Anetta and Joanna, 2014).

Available zinc:

The available zinc content of surface soil of all the three villages is given in Table 3. The comparatively higher amount of available Zn was found in village Alapur and Shahabad in all types of land while in Sahijani village it was found lower as compared to Alapur and Shahabad because of higher pH (Regis, 1998).

Available boron:

The available boron contents of surface soil of all the three villages is given in Table 3. The availability of boron was found higher in medium to low lands of Sahijani and Alapur. In upland of Alapur, upland to medium land of Shahabad the available boron found lower because of coarse-textured soils often contain less available B than fine-textured soils (Takkar *et al.*, 1989; Raza *et al.*, 2002 and Malhi *et al.*, 2003). This might be one of the reasons that B deficiencies in crop plants.

Based on the above criteria the organic carbon content of all types of land of the village Sahijani upland Shahabad and medium land of Alapur village is low; while low land of Shahabad and Alapur is medium and upland of Alapur and medium land of Shahabad soil surface fond high.

The available nitrogen content of all the soils of three villages is low. The comparatively higher content of available nitrogen in all types of land in village Alapur and medium lands of Shahabad than Sahijani village is due to higher amount of organic carbon content.

The available phosphorus of surface soils of all the three villages is low. The relatively higher content phosphorus in low land soils.

The available potassium content of upland and medium land soil of all three village is low while the low land of all three villages is high. The higher amount of available potassium found in low land soils of all the three villages under study is due to the higher quantity of clay found in the low land. Similar findings have been observed by Mishra (2005).

The comparatively higher amount of available sulphur in the upland villages of Alapur and medium land of Shahabad attributed to the higher amount of organic carbon high amount of sulpher in the lowland soils found because sulphur is mineralized from the organic matter by micro-organisms and released to the soils, Anetta and Joanna (2014).

The comparatively higher amount of available Zn was found in village Alapur and Shahabad in all types of land while in Sahijani village it was lower as compared

Table 3 : Mean and range value of available zinc, sulphur and boron (ppm) of three villages of Kalakankar block

Land type/ village name	Available Zn (ppm)			Available S (ppm)			Available B (ppm)		
	Alapur	Shahabad	Sahijani	Alapur	Shahabad	Sahijani	Alapur	Shahabad	Sahijani
Up land	0.68 – 1.24	0.65 – 5.4	0.13 – 1.10	21.5- 34.60	4.0- 31.7	6.34 – 12.40	0.25-.35	0.28 – 0.32	0.23 – 1.33
(4)	(1.10)	(1.94)	(0.62)	(31.3)	(13.4)	(7.54)	(0.29)	(0.30)	(0.69)
Medium	0.72 – 0.95	0.35 – 5.4	0.37- 0.98	15.7 – 37.9	15.5 – 36.6	2.95 – 9.6	0.65 – 0.98	0.27 – 0.35	0.85 – 1.35
land (4)	(0.86)	(1.61)	(0.64)	(28.6)	(24.8)	(6.99)	(0.88)	(0.30)	(1.10)
Low land	0.84 –	0.04 – 2.88	0.46 – 1.1	8.05 – 19.8	3.7 – 40.7	3.47- 12.4	1.04 – 2.65	3.2 – 3.34	0.18 – 1.33
(4)	1.72(1.18)	(1.01)	(0.85)	(13.5)	(17.9)	(6.9)	(1.61)	(2.59)	(0.83)

to Alapur and Shahabad because of higher pH (Regis, 1998).

The availability of boron was found higher in medium and low land of Sahijani and Alapur while in upland of Alapur and upland medium of Shahabad the available boron was found lower because of coarse-textured soils often contain less available B than fine-textured soils (Takkar *et al.*, 1989; Raza *et al.*, 2002 and Malhi *et al.*, 2003).

As per the soil test based fertilizer recommendation followed in the state of U.P. Mishra (2005); Mitra *et al.* (1980) and Anetta and Joanna (2014) when any nutrient is low or deficient then 25 per cent more than the recommended dose for a particular crop has to be applied. Similarly when the nutrient content is high or excess then 25 per cent of the recommended dose for a particular crop can be reduced while applying fertilizer. Similarly when the nutrient content is medium or just above the critical limit, recommended dose of fertilizer on a particular crop has to be applied (Cooke,1982).

The present investigation showed the deficiency and sufficiency of available major plant nutrients in soils in representative villages of Kalakankar block of Pratapgarh district which represent the different types of soils of plains of central agroclimatic zone of U.P.

It will go a long way in balanced recommendation of fertilizers to various crops which will help in increasing the productivity of food grains, pulses, oilseeds, vegetables, fruits and fibre crops grown in that area. In addition to helping the farmers in application of balanced nutrition to crops the study will also help to reduce the cost of cultivation of farmers where they have high or sufficient amount of different plant nutrients.

Conclusion:

As per the experimentation carried out for the soil of Alapur, Shahabad and Sahijani villages of Kalakankar block of Pratapgarh district of U.P., the results show the deficiency and sufficiency of available plant nutrients in soils in representative villages of which represent the different types of soils of plains of central agroclimatic zone of U.P. It will go a long way in balanced recommendation of fertilizer to various crops. This will help to increase the production of different food crops like wheat, paddy, maize, mustard, sesame, black gram, greengram, papaya, arhar, coriander, garlic, brinjal, tomato, beans, banana, bottle gourd, fibre crops etc which are grown in these villages. This will also help the farmers in applying the balanced nutrition to crops for the better yield.

Literature Cited

Anetta, Siwik-Ziomek and Joanna, Lemanowicz (2014). The content of carbon, nitrogen, phosphorus and sulphur in soil against the activity of selected hydrolases as affected by crop rotation and fertilisation. *Zemdirbyste-Agriculture,* **101** (4): 367–372. DOI 10.13080/z-a.2014.101.046.

Bhattacharyya, T., Pal, D.K., Mandal, C., Chandran, P., Ray, S.K., Sarkar, Dipak, Velmourougane, K., Srivastava, A., Sidhu, G.S., Singh, R.S., Sahoo, A.K., Dutta, D., Nair, K.M., Srivastava, R., Tiwary, P., Nagar, A.P. and Nimkhedkar, S.S. (2013). Soils of India: Historical perspective, classification and recent advances in knowledge; A review. *Curr. Sci.,***104** (10): 1308-1323.

Chesnin, L. and Yien, C. H. (1950). Turbidimetric determination of available sulphur. *Soil Sci. Society of America Proc.,* **15** : 149-151.

Cooke, G. W. (1982). An introduction to soil analysis. *World Crops,* **1**: 8-9.

Elamin, A. E. and Elagib, M. A. (2001). Comperative study of organic and inorganic fertilizers on forage corn grown on two types of soil, *Sci. J.,* **21** : 47 – 54.

Felipe, de Campos Carmona, Ibanor, Anghinoni,Marquel, Jonas Holzschuh and Marcelo, Hoerbe Andrighetti (2010). Cation dynamics in soils with different salinity levels growing irrigated rice. *Rev. Bras. Ciênc. Solo.,* **34** (6): http://dx.doi.org/10.1590/S0100-06832010000600009.

Ge, Shunfeng, Xu, Haigang, Ji, Mengmeng and Jiang, Yuanmao (2013). Characteristics of soil organic carbon, total nitrogen and C/N Ratio in Chinese spple orchards. *Open J. Soil Sci.,* **3** : 213-217.

Gianello, C. and Bremner, J.M.(1986). A simple chemical method of assessing potentially available organic nitrogen in soil. *Commun. Soil Sci. Plant Anal.,* **17** : 195–214.

Hanway, J.J. and Heidel, H. (1952). Soil analysis methods as used in lova state college soil testing laboratory. *Lowa Agric.*, **57** : 1-31.

Jackson, M.L. (1973). *Soil chemical analysis*. Prentice Hall Inc, Englewood Cliffs, pp. 528.

Malhi, G.S., Mitchell, P.B. and Salim, S. (2003). Bipolar depression: management options. *CNS Drugs*, **17**: 9–25.

Mishra, Antaryami (2005). Characterization, fertility status and taxonomic classification of some soils of west central table and agroclimatic zone of Odisha; Ph.D. Thesis, Deparment of Soil Science and Agricultural Chemistry, Orissa

University of Agriculture and Technology, Bhubaneswar, Odisha (India).

Olsen, S., Cole, Watanabe F. and Dean, L. (1954). Estimation of available phosphorus in soil by extraction with sodium bicarbonate. USDA Circular NR 939, US Gov Print office Washington, D. C., U.S.A.

Raza, S.M., Cheema, I.U., Downs, W.R., Rajpar, A.R. and Ward, S.C. (2002). Miocene stratigraphy and mammal fauna from the sulaiman range, South-western Himalayas, Pakistan. *Palaeogeography, Palaeoclimatology,* **186** : 185-197.

Regis, Voss (1998). Department of Agronomy Iowa State University, Ames, IA 50011.

Rhodes, J.D. (1982). Soluble salts.In : A.L. Page (Ed) Method of soil analysis, chemical and microbiological properties. *Agron.,* **9** (2):149-157.

Sekhon, G.S. (1999). Potassium in Indian soil and crops, *PINSA,* **B65 (**3 and 4): 83-108.

Subbiah, B.V. and Asija, G.L. (1956). A rapid procedure for the estimation of available nitrogen in soils. *Curr. Sci.,* **25**: 259-260.

Silmara, R. Binchi, Mario Miyazawa , Edson L. de Oliveira and Marcos, A. Pavan (2008). Relationship between the mass of organic matter and carbon in soil, **51** (2) : 263-269,ISSN 1516- 8913 Brazil.

Subbaiah, B.V. and Asija, G.L. (1956). A rapid procedure for the estimation of available nitrogen in soil.*Curr. Sci.,* **25** : 259.

Takkar, P. N., Chibba, I. M. and Mehta, S. K. (1989). Twenty years of co-ordinated research on micronutrient in soils and plants. Bull. 314. Indian Institute of Soil Science, Bhopal, India.

Walkley, A. and Black, I.A. (1936). An examination of Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. *Soil Sci.,* **37**: 29-38.