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RESEARCH ARTICLE

STUDY OF AVAILABLE POTASSIUM BY DIFFERENT EXTRACTING REAGENTS AND FERTILITY STATUS OF SOILS OF BAIRIA SUB-DIVISION OF BALLIA, U.P.

***Anurag Kumar Singh, Ashok K. Singh and Anil Kumar Singh**

Department of Agricultural Chemistry and Soil Science, Shri Murli Manohar Town PG College (J.N.C. University), Ballia, (UP) – 27700, India

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****Corresponding author:***
Ashok Kumar Singh

ABSTRACT

The extracting reagent suitability is most important factor for the availability of potassium in soil and related soil fertility also. For that a depth wise soil sample was analyses by different available K extracting reagents as well as soil fertility status. The soil pH, EC, organic carbon, available N, P,K and S were found in considerable quantity in surface (0-15 cm) and sub-surface (15-30 cm) horizons soil. The fractionation study of different extractants for available K was 0.01M CaCl2 extractable K, HNO3 extractable K, EDTA extractable K, water soluble extractable K, 1 M NaCl extractable K, Mehlich III extractable K and total K, in the soil determine the availability of the soil potassium. Under this study, normal and neutral ammonium acetate extractant was found to appear for considerable amount of available K among the extractants for soils of Bairaia sub-division soil as per two village viz. Sripalpur and Tiwari Ke Milki based pedon samples.

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INTRODUCTION

Potassium is one of the major essential elements required for growth and development of plant animals and microbes. Among the essential nutrients it is present in largest quantity (1 to 4 percent) in most plant, regulate the activity of large number of plant enzymes and thus called as' master cation. It is also enhances the quality of fruits, vegetables and flowers and resistance against different biotic and abiotic stresses (Pal, 1992). Plant feed not only from of exchangeable K but also from non-exchangeable K, which mainly consists of K trapped in the interlayer of non-expanding clay minerals. Major contribution of non-exchangeable K by crop removal was reported particularly in soils under continuous cropping without K application (Srinivasa Rao *et al.,* 2007). Since potassium is the most dynamic nutrient, its availability in different forms and combinations depends upon the equilibrium and kinetics reaction between forms of soil K, soil moisture content, temperature and the concentrations of bivalent cations in solution, exchanger phase (Sparks and Huang 1985) and the various intrinsic and extrinsic components of soils viz. mineralogy, texture, cation exchange capacity (CEC), clay content, organic matter, etc. the hydrothermal regimes (thermic, hyper thermic, aquic and udic) along with soil parameters are not only influence different soil attributes but also the incorporation of K in soils (Patiram and Prasad 1984, Bhaskar *et al*. 2001, Singh and Dutta 1986, Singh *et al*. 1999, Basumatary and Bordoloi 1992). So that various attempts are made to assess the status of potassiumto draw the suitability in the recent alluvium.

MATERIALS AND METHODS

The depth wise soil samples were collected in April 2017 from two village of Ballia District in Bairia Block of Ballia District U.P.. Before the collection of samples two suitable spot (site) were dug soil profile in the two village (Sripalpur near Khapadia Baba Ashram and Tiwarike Milki near Kali Mata Mandir). The geographical extent of the district is from 25°23" to 26°11" North latitude and from 83°38" to 84°39" East longitudes and 213.2 feet above the sea level. About 500 g fresh soil sample per soil profile and each depth were collected and processed by air dried, powdered and sieved through 2 mm brass sieve and stored separately in polythene bags for physico–chemical, and chemical analysis. The collected soil samples from both soil profile were analyses for soil pH, EC, Organic carbon, available N, P, S, and fractions of K by using standard method described by different authors. The pH and EC were determined in 1:2.5 ratio of soil water suspension method described by Kanwar and Chopra (1998). Organic carbon content of soil was determined by Walkley and Black's (1934) rapid titration method as described by Kanwar and Chopra (1998). Available N was determined by alkaline potassium permanganate method (Subbiah and Asija 1956). Available P was estimated by using Olsen's *et al.* (1954),

method Available Sulphur content of soil was determined by Williams and Steinberg (1969), rapid extraction method. Ammonium acetate extractable K method described by Muhr *et al.* (1965). 0.01 M Calcium Chloride extractable Kmethod described by Woodruff and McIntosh (1960). EDTA extractable Kmethod described by Haynes and Swift (1983). Water soluble method described by Rouse and Bertramson, (1949).Nitric Acid extractable K method described by Wood and Deturk (1940). Mehlich-III extractable K method described by Mehlich (1984).1M Sodium Chloride extractable Kmethod described by Woodruff and McIntosh (1960). Total Potassium was determined by wet digestion method described by Jones *et al.* (1991).

RESULTS AND DISCUSSION

The soil pH was ranged from 7.2 to 7.9 (Table-1) in both pedon. The increasing ranged of pH was observed towards slightly alkaline from upper soil (0-15 cm) to the lower depth (135-160) cm in both pedon. Pedon-1 was showed 7.3 pH at 0-15cm increased with depth 7.7 pH at 135-160 cm depth. Pedon-2 electrical conductivity of soil (dSm^{-1}) from two pedon of Bairia sub-division soil were ranged from 0.996 to 1.022 dSm^{1}.The range was generally increased with increasing soil depth in pedon 1. But have very slightly variations at different horizons depths in pedon 2. The content of organic carbon (%) was (Table-1) appeared to decreased with increasing soil depth in both pedon. Pedon-1 was showed 1.62 % in surface soil (0-15 cm) and 0.12 in sub surface soil (135-160 cm) and Pedon 2 was showed 1.18 % in surface soil (0-15 cm) and 0.16 % in sub surface soil (135-160 cm). Available nitrogen content (Table 2) was found maximum 360.6 kg ha^{-1} in surface horizon (0-15 cm) and minimum 15.7 kg ha^{-1} in lowest depth of both pedon-1 and in pedon-2 it was fund maximum 266.6 kg ha^{-1} in surface horizon (0-15 cm) and minimum 37.6 kg ha^{-1} in lower depth.

Similarly available phosphorus content (Table-2) was found maximum 14.56 kg ha^{-1} in surface horizon (0-15 cm) and minimum 9.46 kg ha^{-1} in sub-surface (120-135) in pedon-1 and similarly pedon-2 showed maximum 9.86 kg ha^{-1} in surface horizon (0-15 cm) and minimum 5.37 kg ha^{-1}. The available sulphur content (Table-2) in soil 11.6 to 6.6 mg kg^{-1} in Pedon-1 (Sripalpura) and 12.0 to 5.8 mg kg^{-1} in Pedon-2 (Tiwari Ke Milki) in both Pedon it was found with increasing the depth decreased respectively.

Fraction of K-

Amount of ammonium acetate extractable K, (Table-3) was decreased with increase in horizon depth in pedon 1 similarly, 0.01 M $CaCl_2$ extractable K, HNO_3 extractable K, EDTA extractable K, water extractable K, 1M $Nacl_2$ extractable K, Mehlich-III extractable K and total K, were also decreased with increase horizon depth but slightly increase at further depth. In pedon-1, ammonium acetate extractable K was measured 123.2 kg ha^{-1} on 135-160 cm depth to 324.4 kg ha^{-1} in surface horizon (0-15 cm) depth; 0.01M $CaCl_2$ extractable K was measured 67.2 kg ha^{-1} in 135-160 cm depth to 145.6 kg ha^{-1} in surface horizon; HNO_3 extractable K was measured 201.6 kg/ha on 135-160 cm depth to 280 kg/ha in surface horizon; solubility exhibits their greater value in ascending order-EDTA extractable K was measured 67.2 kg/ha in 135-160 cm depth to 112 kg/ha in surface horizon; water extractable K was measured 168 kg/ha in 135-160 cm depth to 201.6 kg/ha in surface horizon; 1M NaCl extractable K was measured 100.8 in 135-160 cm depth to 145.6 kg/ha in surface horizon; Mehlich-III extractable K was found 78.4 in 135-160 cm depth to 123.2 kg/ha in surface horizon; total potassium K was measured 1388.8 kg/ha in 135-160 cm depth to 1814 kg ha^{-1} in surface horizon. Among the extractants for available K, potassium fraction of Pedon-2 viz498 kg ha^{-1} in surface

Table 1. Status of soil pH, EC (dSm^{-1}) and organic carbon (%) from different depth of soils of Bairia sub-division

EPTH (cm)	Sripalpura (P1)			Tiwarike Millikee (P2)		O.C.
	pH	EC (dSm^{-1})	O.C.	pH	EC(dSm^{-1})	
0-15	7.3	0.996	1.63	7.2	1.001	1.18
15-30	7.3	0.998	1.11	7.2	0.005	1.01
30-45	7.3	0.999	0.82	7.2	1.007	0.83
45-60	7.4	1.002	0.73	7.3	1.011	0.44
60-75	7.4	1.004	0.51	7.3	1.006	0.42
75-90	7.5	1.009	0.39	7.3	1.002	0.34
90-105	7.5	1.012	0.35	7.4	1.005	0.29
105-120	7.6	1.019	0.28	7.7	1.009	0.25
120-135	7.6	1.021	0.19	7.8	1.011	0.22
135-160	7.7	1.022	0.12	7.9	1.016	0.16

Table 2. Status of available nitrogen, phosphorus and Sulphur in different depth of Bairia sub-division of Ballia,U.P.

Depth(cm)	Sripalpura (P-1)			TiwarikeMillikee (P-2)		
	N Kg/ha	P Kg/ha	S Kg/ha	N Kg/ha	P Kg/ha	S Kg/ha
0-15	360.6	14.56	11.6	266.6	9.86	12.0
15-30	250.9	14.20	10.8	244.5	8.51	11.2
30-45	181.2	11.72	10.2	188.2	7.17	10.7
45-60	166.3	12.24	9.6	100.4	7.62	10.6
60-75	112.9	10.84	8.4	94.1	7.13	9.6
75-90	98.7	12.84	8.8	78.5	6.72	8.8
90-105	87.9	11.45	8.6	59.7	6.72	8.6
105-120	47.1	12.14	7.4	51.2	5.37	7.2
120-135	37.9	9.46	6.8	48.5	7.16	6.4
135-160	15.7	10.64	6.6	37.4	5.37	5.8

Table 3. Status of potassium in Shripalpur village pedon by different extracting reagents

Depth (cm)	Ammonium Acetate extractable K (Kg/ha)	0.01 M $CaCl_2$ extractable K (Kg/ha)	HNO_3 extractable K (Kg/ha)	EDTA extractable K (Kg/ha)	Water extractable K (Kg/ha)	1M NaCl extractable K (Kg/ha)	Mehlich- III extractable K (Kg/ha)	Total Potassium (Kg/ha)
0-15	324.4	145.6	280	112	201.6	145.6	123.2	1814
15-30	179.2	123.2	235.2	112	179.2	123.6	112	1792
30-45	168	134.4	246.4	89.6	201.6	112	112	1769.6
45-60	168	112	235.2	100.8	190.4	123.2	100.8	1792
60-75	156.8	112	224	78.4	179.2	100.8	112	1568
75-90	156.8	123.2	224	78.4	168	112	89.6	1612.8
90-105	145.6	100.8	212.8	89.6	168	112	112	1568
105-120	134.4	89.6	224	78.4	179.2	89.6	89.6	1523.2
120-135	123.2	78.4	201.6	67.2	168	100.8	78.4	1456
135-160	123.2	67.2	190.4	67.2	179.2	100.8	67.2	1388.8

Table 4. Status of potassium in TiwariKeMilkee village (Bairia, Ballia) pedon by different extracting reagents

Depth (cm)	Ammonium Acetate extractable K (Kg/ha)	0.01 M $CaCl_2$ extractable K (Kg/ha)	HNO_3 extractable K (Kg/ha)	EDTA extractable K (Kg/ha)	Water extractable K (Kg/ha)	1M NaCl extractable K (Kg/ha)	Mehlich-III extractable K (Kg/ha)	Total Potassium (Kg/ha)
0-15	448	156.8	392	112	179	134.4	123.2	1792
15-30	492.4	134.4	380.8	123	145.6	134.4	134.4	1836.8
30-45	470.8	128.8	358.4	112	145.6	128.8	123.2	1747.2
45-60	481.6	123.2	347.2	100.8	134.4	123.2	100.8	1747.2
60-75	369.6	112	347.2	100.8	145.6	116	112	1657.6
75-90	246.4	100.8	336	89.6	134.4	100.8	112.8	1635.2
90-105	201.6	100.8	324.8	67.2	123.2	89.6	100.8	1702.4
105-120	235.2	95.2	313.6	67.2	134.4	84	89.6	1635.2
120-135	257.6	89.6	302.4	67.2	145.6	78.4	67.2	1612.8
135-160	212.8	78.4	291.2	44.8	134.4	67.2	67.2	1456

horizon (0-15 cm) depth; 0.01M $CaCl_2$ extractable K was measured 78.4 kg ha^{-1} in 135-160 cm depth to 156.8 kg ha^{-1} in surface horizon; HNO_3 extractable K was measured 291.2 kg ha^{1} on 135-160 cm depth to 392 kg ha^{-1} in surface horizon; EDTA extractable K was measured 44.8 kg/ha in 135-160 cm depth to 112 kg ha^{-1} in surface horizon; water extractable K was measured 134.4 kg ha^{-1} in 135-160 cm depth to 179 kg ha^{-1} in surface horizon; 1M NaCl extractable K was measured 67.2 in 135-160 cm depth to 134.4 kg ha^{-1} in surface horizon; Mehlich-III extractable K was measured 67.2 in 135-160 cm depth to 134.4 kg ha^{-1} in surface horizon; total potassium K was measured 1456 kg/ha in 135-160 cm depth to 1792 kg ha^{-1} in surface horizon. It is rather inert in context of plant K uptake as K is bound mainly in structure from (Huang 2005). Mica group minerals contribute to K plant uptake (Madaras *et al.,* 2013).

Conclusion

The soil pH, EC, organic carbon, available N, P,K and S were found in considerable quantity in surface (0-15 cm) and sub-surface (15-30 cm) horizons f both villages recent alluvial soil. The fractionation study of different extractants for available K was 0.01M $CaCl_2$ extractable K HNO_3 extractable K, EDTA extractable K, water soluble extractable K, 1 M NaCl extractable KM ehlich III extractable K and total K, in the soil determine the solubility of the potassium. Under this study, normal and neutral ammonium acetate extractant was found to appeared for considerable amount of available K among the extractants for soils of Bairaia sub-division soil as per two village viz. Sripalpur and Tiwari Ke Milki based Pedon samples.

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REFERENCES

Haynes, R.J. and Swift, R.S. 1983. An evaluation of the use of DTPA and EDTA as extractants for micronutrients in moderately acid soils. *Plant and Soil,* 74:111-122.

Jones, Jr, J.B., Wolf, B. and Mills, H.A. (1991). Plant Analysis Handbook. Micro-Macro Publishing, Athens, 30507, USA, 213p.

Kanwar, J.S. and Chopra, S.L. 1998. Analytical Agricultural Chemistry (Edn.) Kalyani Publisher, New Delhi.

Mehlich, A, 1984. Mehlich III soil test extractable: A. modification of Mehlich 2. *Communications of Soil Science and Plant Analysis,* 15:1409-1416.

Pal, S.K. and Mukhopadhyay, A.K. 1992. Distribution of different forms of potassium in profiles of some Entisols. *Journal of the Indian Society of Soil Science,* 40(2):371-373.

Ranjan, A., Singh, R.P. and Singh, A.K. Singh, 2018. Physico-chemical properties and fertility status of soils of Dubahar Block of District Ballia (U.P.), *International Journal of Agriculture Sciences,* 10(22):7522-7527

Singh, Dhyan, Chhonkar, P.K. and Pandey, R.N. 1999. Soil, Plant and Water analysis, A Methods Manual, IARI, New Delhi.

Srinivasrao, Ch., Vittal, K.P.R., Tiwari, K.N., Gajbhiye, P.N., Kundu, Sumanta, Pharande, A.L., Reddy, Yellamonda, T and Shankar, M.A. 2007. Potassium supplying characteristics of twenty-one soil profiles under diverse rain fed production system. *Journal of the Indian Society of Soil Science,* 55(1):14-22.

Subbiah, B.V. and Asija, G.L. 1956. A rapid method for estimation of available Nitrogen in soils. *Current science,* 25:259-260.

Willams,C.H., Steinbarg, S.A. 1969. Soil sulphur fractions as chemical indices of available sulphur in some Australion soils. Aust. J. Agric. Res. 10:340-352.

Woodruff, C.M. and McIntosh J.L. 1960. Testing soil potassium. Transaction 7th International Congress Soils of Science, 3:80.

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