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Distribution of different forms of soil potassium in surface and sub-surface layers of paddy growing areas of Nagpur District

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Abstract
The potassium dynamics in black soils of paddy growing areas of Nagpur district, Maharashtra was studied during 2018-19. Potassium exists in soil in different forms such as water soluble, exchangeable, non-exchangeable, lattice K. The available potassium on an average obtained highest in both the depths (190.75 mg kg^{-1} and 173.43 mg kg^{-1} in surface and sub-surface depths, respectively). The surface samples recorded high available potassium compared to sub-surface layer. The water-soluble K of black soils ranged from 5.10 to 8.10 mg kg^{-1} with a mean of 6.75 mg kg^{-1} in surface depth. The water-soluble potassium in sub-surface layer varied from 3.90 to 7.70 mg kg^{-1} with a mean of 6.21 mg kg^{-1}. In the black soils, exchangeable potassium varied from 139.76 to 217.25 mg kg^{-1} in surface layer and in sub-surface layer it varied from 120.84 to 207.29 mg kg^{-1}. The trend of decrease in water soluble and exchangeable potassium was noticed in these soils from surface to sub-surface layers. The non-exchangeable potassium of black soils in surface samples varied from 673.13 mg kg^{-1} to 789.50 mg kg^{-1}. The non-exchangeable potassium varied from 628.12 mg kg^{-1} to 778.00 mg kg^{-1} in sub-surface. The lattice potassium ranged from 5316.40 mg kg^{-1} to 7324.64 mg kg^{-1} in surface layer and 6013.73 mg kg^{-1} to 7241.60 mg kg^{-1} was observed in sub-surface depth. The black soils total potassium ranged from 6250 to 8322 mg kg^{-1} in surface and 6900 to 8140 mg kg^{-1} in sub-surface layer.

Keywords: forms of soil potassium, potassium dynamics, soil depth, paddy yield.

Introduction
The potassium is one of the major nutrient elements, is usually the most abundant in soils. However, the range of the total potassium content which occurs in soils is enormous. Although in the form of simpler chemical compound, it is one of the most soluble elements. In the soil-plant system, potassium behaves with extreme differences of solubility and mobility. Thus, its absorption from solutions and soils is highly efficient; its movement through plant is very rapid. Potassium exists in soil in different forms, viz., water-soluble K, which is taken up directly by plants; exchangeable K, held by negative charges on clay particles and is available to plants and fixed K, which is trapped between layers of expanding lattice clays. The knowledge of various forms of K viz., water-soluble, exchangeable and non-exchangeable and an understanding of conditions controlling the availability to growing crops is important for the appraisal of the available K in the soil. The available K constitutes only 1-2 per cent of total K and exists in soil in two forms i.e. water-soluble and exchangeable K adsorbed on soil colloidal surface (Brady and Well, 2002) [2]. These forms remain in a dynamic equilibrium with one another. The readily available or water-soluble K has been reported to be a dominant fraction in the initial stage while exchangeable and nonexchangeable K contribute more in the later stages of plant growth.

Material and Methods
The surface and sub-surface samples of depth 0-15 cm and 15-30 cm, respectively were collected based on predominance of soil type (black) and dominance of cropped area under paddy of Nagpur district and studied during 2018-19. The study location lies between the coordinates of 21˚ N to 79˚ E as shown in table 1.

Table 1: Location wise GPS readings of selected farmers' fields

Field No.	Location	GPS reading	
		Latitude	Longitude
1	Bhendala	N 21^0 19' 843"	E 79^0 34' 487"
2		N 21^0 19' 833"	E 79^0 34' 482"
3		N 21^0 19' 835"	E 79^0 34' 483"
4		N 21^0 19' 845"	E 79^0 34' 479"
5		N 21^0 19' 829"	E 79^0 34' 475"
6	Mangli (Chande)	N 21^0 19' 937"	E 79^0 35' 142"
7		N 21^0 19' 925"	E 79^0 35' 149"
8		N 21^0 19' 932"	E 79^0 35' 138"
9		N 21^0 19' 947"	E 79^0 35' 156"
10		N 21^0 19' 939"	E 79^0 35' 149"
11	Batnor	N 21^0 13' 969"	E 79^0 23' 774"
12		N 21^0 13' 973"	E 79^0 23' 778"
13		N 21^0 13' 978"	E 79^0 23' 769"
14		N 21^0 13' 971"	E 79^0 23' 776"
15		N 21^0 13' 975"	E 79^0 23' 769"
16	Tarsa	N 21^0 13' 819"	E 79^0 27' 099"
17		N 21^0 13' 816"	E 79^0 27' 095"
18		N 21^0 13' 812"	E 79^0 27' 091"
19		N 21^0 13' 810"	E 79^0 27' 101"
20		N 21^0 13' 813"	E 79^0 27' 098"
21	Nimkheda	N 21^0 14' 058"	E 79^0 25' 517"
22		N 21^0 14' 056"	E 79^0 25' 519"
23		N 21^0 14' 059"	E 79^0 25' 512"
24		N 21^0 14' 051"	E 79^0 25' 521"
25		N 21^0 14' 061"	E 79^0 25' 517"

The soil samples collected were air dried in shade, gently ground using wooden pestle and mortar and passed through 2 mm and 0.5 mm sieve. The sieved samples were preserved in labeled polythene bags for further analysis. Soil reaction was determined in 1:2.5 soil water suspension after stirring for 30 minutes using a pH meter (Jackson, 1973) [6]. EC was determined in 1:2.5 soil: water suspension after obtaining supernatant as described by Jackson (1973) [6] using conductivity meter. Organic carbon was determined by Walkley and Black's wet oxidation method as described by Piper (1966) [13]. Calcium carbonate was determined by using rapid titration method using phenolphthalein indicator as described by Piper (1966) [13]. Available nitrogen was estimated by using alkaline potassium permanganate method as described by Subbiah and Asija (1956) [17]. Available phosphorus was determined by using Olsen's reagent as extractant by using spectrophotometer (Jackson, 1973) [6]. Available potassium was determined by extracting soil with neutral normal ammonium acetate and the contents of K in solution and was estimated by flame photometry (Jackson, 1973) [6].
Different forms of potassium were estimated by,

1. Water-soluble potassium
The water-soluble K was determined by using saturation paste extract method. In this method, 5 g air dry soil was placed in conical flask, 25 ml distilled water was added in it (1:5 ratio) and shaken in mechanical shaker for one hour and was filtered. From filtrate, K was estimated on flame photometer (Pratt, 1982) [14].

2. Exchangeable potassium
Exchangeable potassium was determined by flame photometer using 1 N neutral ammonium acetate extraction. In this method 5 g soil was placed in conical flask and 2 ml 1 N NH_4OAc was added and shaken for 10 min. Then, the supernatant liquid was decanted into a 100 ml volumetric flask. Three additional extractions were made in the same manner. The combined extractions were diluted to 100 ml with 1 N NH_4OAc and K was determined by flame photometer (Piper, 1966) [13].

3. Non-exchangeable potassium
It was determined by using 1 N boiling HNO_3 extraction method. In this method, 2.5 g of finely ground soil (1 mm) was placed in 100 ml Erlenmeyer flask. 25 ml of 1 N HNO_3 was added and the flask was placed on hot electrical plate. The suspension was boiled gently for 10 min. Then the flask was removed and after cooling, the content was filtered and the filtrate was received in a 100 ml volumetric flask. The soil was washed for four times with 15 ml portions of 0.1 N HNO_3. The solution was diluted to volume, mixed thoroughly and K was determined using flame photometer (Pratt, 1982) [14].

4. Lattice K potassium
Lattice K was determined by subtracting the sum of above 3 fractions from total potassium (Ranganathan and Satyanarayana, 1980) [15].

5. Total potassium
Total K was determined by using HF digestion method. 0.5 g of soil was taken in to a crucible and 1 ml of 70 per cent HClO4 and 5 ml of 48 per cent hydrofluoric acid was added. The crucible was placed on a sand bath (maintained at 200 to 225 ^{0}C) till it gets evaporated to dryness. The crucible was cooled and 5 ml of 6 N HCl was added. Filtered the solution in to a 100 ml volumetric flask and made up the volume with water. The K concentration in this was measured using flame photometer (Jackson, 1973) [6].

Results and Discussion
Physico-chemical properties of the soil
All the soil under study were slightly to moderately alkaline in reaction, electrical conductivity gives insight about the non-saline nature. EC values for these soils were within safe limit. The results are in conformity with the Parihar *et al.*, (2013) [12] who reported that the normal EC ascribed to leaching of salts to lower horizons due to its light textured nature and surface runoff due to heavy rainfall. Organic carbon content varied from 4.7 to 6.9 g kg^{-1} and 3.2 to 5.7 g kg^{-1} in surface and sub-surface soil, respectively which comes under low to moderately high in category in different farmers field. Similar results were also noted by Verma *et al.*, (2013) [18] and Jatav and Mishra (2012) [8], as the use of chemical fertilizers in imbalanced manner are the main reason for poor organic carbon. Calcium carbonate of paddy soils of Nagpur district was observed in the range in surface soil (2.02 to 3.81 per cent) and in sub-surface soil (2.09 to 4.21 per cent). These are categorized under low and medium category, revealing their moderately calcareous nature. Findings are in accordance with anonymous (2011) and Katkar *et al.*, (2013) [9]. The available major nutrient content in these soils showed low to medium status for available nitrogen in the range in surface soil (193.42 to 288.86 kg ha^{-1}) and in sub-surface (151.25 to 263.42 kg ha^{-1}), low to medium for phosphorus content in the range of 11.23 to 21.43 kg ha^{-1} in surface, while 10.21 to 19.12 kg ha^{-1} in sub-surface soil and high to very high for available potassium status 324.48 to 502.99 kg ha^{-1} and 283.67 to 479.79 kg ha^{-1} in surface and sub-surface soils, respectively. In general, surface soils contained higher level of available N, P, K and organic carbon reflecting their maximum accumulation than the sub-surface layers. Similar results were obtained by Medhi *et al.*, (2007) [11].

Table 2: Important properties of the soil

Sr No.	Depth (cm)	pH	EC (dS m^{-1})	OC (g kg^{-1})	$CaCO_3$ (%)
		1:2.5 Soil: water suspension			
1	**2**	**3**	**4**	**5**	**6**
	Bhendala				
1	0-15	7.40	0.17	4.8	2.56
	15-30	7.93	0.41	3.2	2.81
2	0-15	7.38	0.64	6.9	2.63
	15-30	7.24	0.28	5.2	2.92
3	0-15	7.92	0.36	5.7	3.28
	15-30	8.15	0.35	4.4	3.64
4	0-15	7.94	0.34	5.1	2.91
	15-30	8.01	0.35	4.9	3.55
5	0-15	7.66	0.78	6.3	2.17
	15-30	7.42	0.65	6.2	2.77
	S mean	7.66	0.46	5.76	2.71
	SS mean	7.75	0.41	4.80	3.14
	Mangli (Chande)				
6	0-15	7.67	0.35	4.9	2.37
	15-30	7.89	0.44	4.5	2.67
7	0-15	8.00	0.34	6.5	3.00
	15-30	7.90	0.38	5.5	3.06
8	0-15	7.75	0.34	5.6	3.28
	15-30	7.31	0.72	5.2	3.57
9	0-15	7.26	0.25	6.6	2.02
	15-30	7.63	0.32	5.4	2.09
10	0-15	7.98	0.31	4.7	3.70
	15-30	7.71	0.24	3.2	3.92
	S mean	7.73	0.32	5.66	2.87
	SS mean	7.69	0.42	4.76	3.06
	Batnor				
1	2	3	4	5	6
11	0-15	7.45	0.34	6.7	2.26
	15-30	7.77	0.40	4.8	2.37
12	0-15	7.42	0.32	4.9	2.43
	15-30	7.63	0.31	4.7	2.73
13	0-15	7.45	0.35	5.5	2.31
	15-30	7.45	0.40	4.2	2.66
14	0-15	7.54	0.32	5.2	3.22
	15-30	7.36	0.70	4.5	3.43
15	0-15	7.12	0.51	6.3	2.61
	15-30	7.09	0.65	4.9	2.89
	S mean	7.39	0.37	5.72	2.57
	SS mean	7.46	0.49	4.62	2.82
	Tarsa				
16	0-15	7.66	0.37	6.8	3.81
	15-30	7.54	0.30	5.2	4.21
17	0-15	7.22	0.36	6.3	2.81
	15-30	7.45	0.55	5.7	3.21
18	0-15	7.65	0.27	5.2	2.69
	15-30	7.55	0.39	4.8	2.75
19	0-15	7.71	0.33	6.4	2.59
	15-30	7.83	0.35	5.6	2.70
20	0-15	7.12	0.65	5.2	3.39
	15-30	7.93	0.71	4.5	3.62
	S mean	7.47	0.39	5.98	3.06
	SS mean	7.66	0.46	5.16	3.30
	Nimkheda				
21	0-15	7.52	0.32	4.9	3.45
	15-30	7.76	0.35	4.5	3.49
22	0-15	7.32	0.70	6.2	2.47
	15-30	7.98	0.50	5.6	2.97
23	0-15	7.24	0.28	5.7	3.65
	15-30	7.61	0.31	5.2	3.72
24	0-15	7.36	0.71	6.7	3.21
	15-30	7.49	0.32	5.4	3.81
25	0-15	7.95	0.65	4.9	2.92
	15-30	7.26	0.44	3.9	3.73

	S mean	7.48	0.53	5.68	3.14
	SS mean	7.62	0.38	4.92	3.54
	Overall S Range	7.12-8.00	0.17-0.78	4.7-6.9	2.02-3.81
	Overall SS Range	7.09-8.15	0.24-0.72	3.2-5.7	2.09-4.21
	Overall S Mean	7.54	0.41	5.76	2.86
	Overall SS Mean	7.63	0.43	4.83	3.17

Table 3: Available macronutrients status of the soils

Sr No.	Depth (cm)	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})
1	**2**	**3**	**4**	**5**
	Bhendala			
1	0-15	251.23	19.54	388.09
	15-30	250.88	17.32	369.53
2	0-15	226.14	15.34	498.12
	15-30	213.60	14.67	479.78
3	0-15	193.42	15.71	463.18
	15-30	165.79	12.35	448.47
4	0-15	288.51	18.12	398.74
	15-30	250.88	17.86	362.99
5	0-15	251.23	13.76	434.60
	15-30	213.24	11.13	425.67
	S mean	242.11	16.49	436.55
	SS mean	218.88	14.67	417.29
	Mangli (Chande)			
6	0-15	251.23	21.43	347.38
	15-30	238.51	19.02	283.67
7	0-15	288.86	18.05	428.99
	15-30	238.68	15.01	392.36
8	0-15	276.32	20.56	427.34
	15-30	201.05	19.12	368.41
9	0-15	213.60	16.23	411.48
	15-30	188.51	13.23	382.81
10	0-15	271.40	14.45	324.48
	15-30	151.25	12.54	315.59
	S mean	260.28	18.14	387.93
	SS mean	203.60	15.78	348.57
	Batnor			
11	0-15	213.95	19.43	423.04
	15-30	198.68	18.45	366.71
12	0-15	276.32	17.12	336.49
	15-30	226.14	14.05	313.22
13	0-15	276.67	14.45	340.83
	15-30	213.60	11.23	323.70
14	0-15	254.30	16.26	352.10
	15-30	226.42	13.34	313.31
15	0-15	256.49	13.21	440.74
	15-30	221.23	10.55	422.06
	S mean	255.54	16.09	378.64
	SS mean	217.21	13.52	347.80
	Tarsa			
16	0-15	288.05	14.73	376.49
	15-30	263.42	13.51	355.69
17	0-15	281.40	13.40	465.61
	15-30	258.51	10.21	425.17
18	0-15	213.60	14.26	436.75
	15-30	175.96	12.24	385.26
19	0-15	239.04	15.21	503.00
	15-30	218.68	13.25	435.61
20	0-15	251.25	16.21	490.37
	15-30	213.60	15.02	403.00
	S mean	254.67	14.76	454.44
	SS mean	226.03	12.85	400.95
	Nimkheda			
21	0-15	214.30	11.23	495.74
	15-30	191.40	10.55	433.33
22	0-15	226.49	14.73	474.35
	15-30	216.14	14.45	440.61
23	0-15	226.84	13.34	470.61

	15-30	188.86	13.21	408.69
24	0-15	242.49	20.41	476.04
	15-30	238.68	18.26	419.13
25	0-15	251.25	17.35	477.69
	15-30	237.14	15.60	437.16
	S mean	232.27	15.41	478.89
	SS mean	214.44	14.41	427.78
	Overall S Range	193.42-288.86	11.23-21.43	324.48-502.99
	Overall SS Range	151.25-263.42	10.21-19.12	283.67-479.79
	Overall S Mean	248.97	16.18	388.48
	Overall SS Mean	216.03	14.25	405.06

Status of different forms of potassium

The different forms of potassium are quite important to know the potassium status of the soil. As such potassium is not rapidly available to plants but it is an important reservoir of slowly available K, if released gradually to more available forms. About 1 to 10 per cent of total K is present in non-exchangeable form which is slowly available because of its fixation by soil colloids. The data related to forms and distribution of potassium in surface and sub-surface depths is presented in table 2.

Water-soluble potassium

The water-soluble potassium in selected soils of paddy growing areas of Nagpur district varied from 5.10 to 8.10 mg kg^{-1} with a mean of 6.75 mg kg^{-1} in surface depth. The sub-surface water-soluble K content varied from 3.90 to 7.70 mg kg^{-1} with a mean of 6.21 mg kg^{-1}. The soils recorded more water-soluble K at surface as well as sub-surface depths due to the fact that black soils have greater moisture retention capacity and nutrient holding capacity than red soils and also organic matter content was relatively higher in these soils (Sharma *et al*., 2009) [16].

Exchangeable potassium

The exchangeable potassium content of soils ranged from 139.76 to 217.25 mg kg^{-1} in surface layer and in sub-surface layer it varied from 120.84 to 207.29 mg kg^{-1}. The mean value of exchangeable K was 183.93 and 167.22 mg kg^{-1} in surface and sub-surface layers, respectively. In both the soil depths, surface samples recorded high available potassium compared to sub-surface. The mean exchangeable potassium of soils was high, it may be due to fact that black soils are rich in organic matter content and in general, dominated by 2:1 type of clay minerals which offered more exchange sites for K. The results were in corroboration with that of Sharma *et al*., (2009) [16], Hebsur and Gali (2011) [5].

Non-exchangeable potassium

The lowest value of non-exchangeable K i.e. 673.13 mg kg^{-1} and 628.12 mg kg^{-1} was recorded in surface and sub-surface depth in Batnor whereas highest value i.e. 789.50 mg kg^{-1} and 778.00 mg kg^{-1} was observed in Tarsa location, respectively. The increase in non-exchangeable potassium at sub-surface may be attributed to adsorption and fixation of K removed from surface through leaching. The similar findings were obtained by Kundu *et al*., (2014) [10] and Divya *et al*., (2016) [4].

Lattice potassium

The lattice K content of soil ranged from 5316.40 mg kg^{-1} to 7324.64 mg kg^{-1} in surface layer and in sub-surface layer it varied from 6013.73 mg kg^{-1} to 7241.60 mg kg^{-1}. Based on degree of weathering and soil type the surface and sub-surface lattice K content might have been varied among the samples. The results corroborated with the findings of Divya *et al*., (2016) [4].

Total potassium

The total potassium in selected soils of paddy growing areas of Nagpur district varied from 6250 to 8322 mg kg^{-1} with a mean of 7517.60 mg kg^{-1} in surface depth. The sub-surface total K content varied from 6900 to 8140 mg kg^{-1} with a mean of 7605.28 mg kg^{-1}. This value of total potassium is slightly higher than the range 1900-5500 mg kg^{-1} reported by Deshmukh *et al*., (1991) [3]. It may be because of the rich K-bearing minerals in their lattice structure (Sharma *et al*., 2009) [16]. Depending on clay mineralogy, lattice K content and organic matter content, the total K content might have been varied in surface and sub-surface layers. The results were in comparison with those of research findings of Jagmohan and Grewal (2014) [7] and Divya *et al*., (2016) [4].

Table 4: Distribution of forms of soil potassium

Sr No.	Depth (cm)	Potassium fractionation status in soil					
		Av. K (mg kg^{-1})	Ws K (mg kg^{-1})	Ex. K (mg kg^{-1})	Non-Ex. K (mg kg^{-1})	Lattice K (mg kg^{-1})	Total K (mg kg^{-1})
	Bhendala						
1	0-15	173.25	7.4	165.85	729.02	6342.72	7245.00
	15-30	164.97	7.3	157.67	697.54	6392.49	7255.00
2	0-15	222.38	7.1	215.27	746.52	6884.10	7853.00
	15-30	214.19	6.9	207.29	718.83	7008.98	7942.00
3	0-15	206.78	6.2	200.28	752.40	6101.12	7060.00
	15-30	200.21	5.8	194.41	720.09	6829.70	7750.00
4	0-15	178.01	6.3	171.31	691.02	6511.37	7380.00
	15-30	162.05	5.9	156.15	676.94	6573.01	7412.00
5	0-15	194.01	7.6	186.42	695.58	6530.40	7420.00
	15-30	190.03	7.1	182.93	693.96	7066.01	7950.00
	S mean	194.89	6.92	187.83	722.91	6473.95	7391.60
	SS mean	186.29	6.60	179.69	701.47	6774.04	7661.80
	Mangli (Chande)						

6	0-15	155.08	6.5	148.58	695.25	6281.67	7132.00
	15-30	126.64	5.8	120.84	686.32	6241.04	7054.00
7	0-15	191.51	5.3	185.21	736.00	7248.49	8175.00
	15-30	175.16	4.8	170.36	726.50	6383.34	7285.00
8	0-15	190.78	6.8	183.98	729.80	6591.42	7512.00
	15-30	164.47	6.2	158.27	679.50	6566.03	7410.00
9	0-15	183.69	7.4	176.29	744.50	6602.80	7531.00
	15-30	170.90	7.0	163.90	727.50	7241.60	8140.00
10	0-15	144.86	5.1	139.76	758.00	6222.14	7125.00
	15-30	140.89	3.9	136.99	714.50	6119.61	6975.00
	S mean	173.18	6.22	166.76	732.71	6589.30	7495.00
	SS mean	155.61	5.54	150.07	706.86	6510.32	7372.80
	Batnor						
11	0-15	188.86	6.5	182.36	716.9	7747.20	8153.00
	15-30	163.71	4.8	158.91	691.33	7162.96	8018.00
12	0-15	150.22	5.7	144.52	686.32	6113.50	6950.00
	15-30	139.83	5.7	134.13	665.77	7019.40	7825.00
13	0-15	152.16	7.4	144.76	743.47	7227.37	8123.00
	15-30	144.51	6.3	138.21	730.76	7224.73	8100.00
14	0-15	157.19	6.7	150.49	695.07	7062.74	7915.00
	15-30	139.87	5.9	133.97	628.12	6932.01	7700.00
15	0-15	196.76	6.8	189.96	673.13	6980.11	7850.00
	15-30	188.42	6.2	182.22	656.50	6905.08	7750.00
	S mean	169.03	6.62	162.42	702.98	7026.19	7798.20
	SS mean	155.27	5.78	149.49	674.50	7048.84	7878.60
	Tarsa						
16	0-15	168.07	6.7	161.37	681.67	6400.25	7250.00
	15-30	158.79	6.7	152.09	647.50	6905.71	7712.00
17	0-15	207.86	7.4	200.46	789.50	7324.64	8322.00
	15-30	189.81	7.0	182.81	778.00	7017.19	7985.00
18	0-15	194.98	7.2	187.77	694.38	6985.64	7875.00
	15-30	171.99	6.9	165.09	691.55	6886.46	7750.00
19	0-15	224.55	7.3	217.25	744.50	7149.95	8119.00
	15-30	194.47	6.4	188.07	731.50	6186.03	7112.00
20	0-15	218.92	7.3	211.61	701.31	6199.77	7120.00
	15-30	179.91	6.7	173.21	690.00	7137.09	8007.00
	S mean	202.87	7.18	195.69	722.27	6812.05	7737.20
	SS mean	178.99	6.74	172.25	707.71	6826.49	7713.20
	Nimkheda						
21	0-15	221.31	7.1	214.21	758.08	6962.60	7942.00
	15-30	193.45	6.3	187.15	691.07	6815.48	7700.00
22	0-15	211.76	5.4	206.36	721.84	5316.39	6250.00
	15-30	196.70	4.9	191.80	698.36	6604.94	7500.00
23	0-15	210.09	6.2	203.89	751.02	6092.88	7054.00
	15-30	182.45	5.8	176.65	703.82	6013.73	6900.00
24	0-15	212.52	8.1	204.42	781.00	6356.48	7350.00
	15-30	187.11	7.7	179.41	737.50	6475.39	7400.00
25	0-15	213.25	7.4	205.85	752.50	6268.24	7234.00
	15-30	195.16	7.3	187.86	692.50	6612.34	7500.00
	S mean	213.79	6.84	206.95	752.89	6199.32	7166.00
	SS mean	190.97	6.40	184.57	704.65	6504.38	7400.00
	Overall S Range	144.86-224.55	5.1-8.1	139.76-217.25	673.13-789.50	5316.40-7324.64	6250.00-8322.00
	Overall SS Range	126.64-214.19	3.9-7.7	120.84-207.29	628.12-778.00	6013.73-7241.60	6900.00-8140.00
	Overall S Mean	190.75	6.75	183.93	726.75	6600.16	7517.60
	Overall SS Mean	173.43	6.21	167.22	699.03	6732.81	7605.28

Conclusions

The result of the present investigation on potassium dynamics under different soils of paddy growing areas of Nagpur district suggests that, the contribution of different K fractions at surface and sub-surface soil depth was in order of lattice K> non-exchangeable K> available K> exchangeable K> water-soluble K. In general, the available K, water-soluble K, exchangeable K and non-exchangeable K content was higher in surface layer than sub-surface layer in all locations while lattice K and total K was higher in sub-surface layer than surface layer. Higher availability of K may be due to occurrence of potash rich minerals like mica and feldspar in these soils.

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