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Research article

TO STUDY THE EFFECT OF FERTILIZER AND ORGANIC MANURE ON DYNAMIC CHANGES OF POTASSIUM UNDER CROPPING SEQUENCE

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ABSTRACT: A field experiment was conducted in a farmer's field in the Red and Laterite zone of West Bengal to evaluate the effect of integrated use of FYM and concentrated organic manures and chemical fertiliser on dynamics of potassium in soil in relation to growth and yield of component crops viz., Potato, Sesame and Rice. Three levels of chemical fertilisers viz., (i) 75% of the RDF, (ii) 100% of the RDF, and (iii) 150% of the RDF and three levels of organic manures (i) Control- applying no 0rganic manure; (ii) FYM at 20 ton/ha, and (iii) a consortium of concentrated organic manure were applied in potato after which sesame and rice were grown with the residual nutrients**.** Under all the three crops, application of higher doses of chemical fertilizer resulted in greater decrease in soil pH and increase in soil EC, soil OC, exchangeable, water soluble and non-exchangeable K contents of the soil. Among the two organic manures applied, the values of these parameters of the soil under all the three component crops were the highest under application of FYM. The highest pooled mean value of soil pH and lowest EC, OC, exchangeable, water soluble and non-exchangeable K contents of the soil, irrespective of the component crop in the cropping sequence, was observed under RDF_{75} without any organic manure and the highest under RDF_{150} with application of FYM. Pearson correlation co-efficient among different soil and plant parameters suggested strong relationship among themselves and K content of rice shoots, and straw of the component crops. Under limited availability of FYM, commercially available sea weed extract based concentrated organic manures could be handy and effective.

Key Words: Dynamics, R B D analysis

INTRODUCTION

Potassium (K) is most important in stabilizing the yield. It has been demonstrated convincingly that continued cropping without the proper application of K leads to drawl of the inherent potassium reserve of the soil which may denude the interlayer potassium of the Illitic clay minerals of soils. It will adversely affect the potassium dynamics of the soil, rendering entrapment of excess K in soil rather difficult and thereby causing extensive loss of applied potassium by leaching loss. The distribution and availability of K in soils is completely governed by the soil mineralogy and the complex dynamic equilibrium among the different forms of K in soil. The mineral sources of K are the dioctahedral micas, namely muscovite, glauconite, and hydrous mica or illite, the trioctahedral micas, namely biotite and phlogopite, and the feldspars, namely sanidine, orthoclase and microline. Williams (1962) categorized soil potassium into three distinct forms, namely (i) readily available k, which includes exchangeable and water soluble forms, (ii) the form which is moderately available, and (iii) the mineral K. The latter form seems to serve as the reserve source of soil K.

MATERIALS AND METHODS

The field experiment was conducted in a farmer's field during the Kharif season (2011), *Rabi* season 2011 and Kharif season (t) respectively. The experimental field was located at Village-Boida, P.S-Jhargram, District- Paschim Medinipur, West Bengal. The component crops are Potato-(*Solanum tuberosum*) cv. Kufri Jyoti - Sesame (*Sesamum indicum*) cv. Tilottama - Rice (*Oryza sativa*) cv. Annada, respectively in. loamy sand soils in Factorial RBD design of 1312 m^2 plots with nine treatments and three replications. The treatments comprised two factors, viz.,Chemical fertilisers and organic manures.

Three levels of chemical fertilisers viz., (i) 75% of the RDF, (ii) 100% of the RDF, and (iii) 150% of the RDF were applied. Three levels of organic manures comprised (i) Control- applying no 0rganic manure; (ii) FYM at 20 ton/ha, and (iii) A consortium of concentrated organic manure viz., Max Crystal and Max Power. All the treatments were applied in potato after which sesame and rice were grown with the residual nutrients and soil pH , EC, CEC were analysed as per procedure described by Jackson (1973).

Different Fraction of Soil Potassium were analyzed by:

Water soluble K was determined in a 1:5: soil:water extract by the method adopted by USSLS (1954). Available K was determined by extracting the soil with IN NH_4OAc (Hanway and Heidel, 1952) . 1 N HNO3 extractable K was determined by extracting the soil with boiling INHNO3 (Wood and Deturk, 1941). Non-exchangeable K was calculated substracting available K from IN HNO3 extractable K. Exchangeable K was calculated by subtracting water soluble from available K. Oxidisable organic carbon content of the soil was estimated through a modified Walkley and Black method (Walkley and Black, 1934).

RESULTS AND DISCUSSION

Exchangeable Potassium: Changes in values of exchangeable K content in soil (kgha^{-1}) during different stages of growth of the component crops viz., potato-Sesame-Rice, are presented in table 7. The values of exchangeable K content of the soil under different levels of chemical fertilizers ranged from 100.02-184.93 kgha^{-1} after harvesting of potato. While during harvest of sesame the values showed a decreasing trend ranging from 54.38-86.76 kgha^{-1}, during rice cultivation the values increased again and ranged from 70.11-103.92 kgha^{-1} during tillering stage and 151.42-399.48 kgha^{-1} at the harvest stage. Irrespective of the crop, the exchangeable K content of the soil under different levels of chemical fertilizer application ranged from 93.98-193.77 kgha^{-1}. Under all the three crops, application of higher doses of chemical fertilizer resulted in greater values of exchangeable K content of the soil. The exchangeable K content of the soil during tillering (85.94 kgha^{-1}) and harvest (282.43 kgha^{-1}) of rice were comparatively higher than its values during sesame harvest (70.08 kgha^{-1}). This can be attributed to the positive effects of flooding in increasing availability of K under rice ecology. Application of organic manures, bulky (FYM) or concentrated, resulted in significant changes in exchangeable K content of the soil during cultivation of different component crops in the cropping sequence. Bhattachary *et al*,(2008). Application of chemical fertilizers with organic manures resulted in higher values of exchangeable K content (ranging from 117.18-151.74 kgha^{-1}) during harvest of potato crop. Among the two organic manures applied the exchangeable K content of the soil under all the three component crops were the highest under application of FYM. The values (kgha^{-1}) ranged from 151.74 during potato harvest, 76.69 during sesame harvest, 95.20 during tillering stage of rice and 339.82 during harvest of rice. The overall exchangeable K content of the soil followed the order: zero Organic matter > concentrated organic manure > FYM.

Interaction between fertilizer and organic manures resulted in different level of exchangeable K contents of the soil under different component crops in the cropping sequence. While application of RDF_{75} without any organic manure resulted in the lowest value of exchangeable K in soil (84.65 kgha^{-1}), application of FYM with RDF_{150} resulted in its highest (213.67 kgha^{-1}) value during harvest of potato. Same trend in soil exchangeable K content with comparatively lower values (50.20 and 95.28 kgha^{-1}, respectively) during harvest of sesame were observed. In case of rice, the soil exchangeable K values were relatively higher than under potato and sesame. In rice while the highest values of soil exchangeable K during both tillering as well as during harvest stages (120.30 and 459.20 kgha^{-1}, respectively) were observed under application of the highest rate of chemical fertiliser (RDF_{150}) in combination with FYM, the corresponding lowest exchangeable K values (67.70 and 87.21 kgha^{-1}, respectively) were observed under application of the lowest level of chemical fertilisers (RDF_{75}) without any organic manure. The lowest pooled mean value of soil exchangeable K content, irrespective of the component crop in the cropping sequence, was observed under RDF_{75} without any organic manure (72.44 kgha^{-1}) and the highest (222.11 kgha^{-1}) under RDF_{150} in combination with FYM.

Water soluble Potassium

Changes in values of water soluble K content in soil (kgha^{-1}) during different stages of growth of the component crops viz., potato-Sesame-Rice, are presented in table 8. The values of water soluble K content of the soil under different levels of chemical fertilizers ranged from 44.63-61.24 kgha^{-1} after harvesting of potato. While during harvest of sesame the values showed an increasing trend ranging from 61.32-144.52 kgha^{-1}, during rice cultivation the values decreased again and ranged from 14.70 – 30.68 kgha^{-1} during tillering stage which increased to the level of 58.30-159.59 kgha^{-1} at the harvest stage. Irrespective of the crop, the water soluble K content of the soil under different levels of chemical fertilizer application ranged from 44.74-99.01 kgha^{-1}.

Under all the three crops, application of higher doses of chemical fertilizer resulted in greater values of water soluble K content of the soil (Datta, S. C. (2011). The water soluble K content of the soil during harvest (105.02 $kgha^{-1}$) of rice were comparatively higher than its values during harvest of sesame (100.80 $kgha^{-1}$) and potato (51.76 $kgha^{-1}$) and during tillering stage of rice (22.22 $kgha^{-1}$). This can be attributed to the recycling of decaying rice roots and the senescent rice leaves during harvest stage. Application of organic manures, bulky (FYM) or concentrated, resulted in significant changes in water soluble K content of the soil during cultivation of different component crops in the cropping sequence.

Table-1: Effects of different treatments on the exchangeable K (kg/ha) of Rhizosphere soil of potato-sesame-rice cropping sequence system:

Treatments	Potato Harvest	Sesame Harvest	Rice Tillering	Rice Harvest	Mean
RDF_{75}	100.02c	54.38c	70.11c	151.42c	93.98
RDF_{100}	129.61b	69.10b	83.80b	296.40b	144.73
RDF_{150}	184.93a	86.76a	103.92a	399.48a	193.77
Mean	**138.19**	**70.08**	**85.94**	**282.43**	**144.16**
Sem	**1.57**	**0.36**	**0.63**	**3.17**	**1.43**
LSD(p=0.05)	**4.69**	**1.09**	**1.89**	**9.51**	**4.30**
Org0	117.18c	61.66c	80.27c	230.36c	122.37
Concentrated OM	145.65b	71.89b	82.36b	277.13b	144.26
FYM	151.74a	76.69a	95.20a	339.82a	165.86
Mean	**138.19**	**70.08**	**85.94**	**282.43**	**144.16**
Sem	**1.57**	**0.36**	**0.63**	**3.17**	**1.43**
LSD(p=0.05)	**4.69**	**1.09**	**1.89**	**9.51**	**4.30**
Fert X Org					
1,0	84.65d	50.20e	67.70d	87.21i	72.44
1,1	105.45c	51.59e	70.57d	135.18h	90.70
1,2	109.96c	61.35d	72.05d	231.88g	118.81
2,0	128.62b	61.35d	77.39c	251.22f	129.65
2,1	128.64b	72.51c	80.77c	309.61e	147.88
2,2	131.58b	73.44c	93.24b	328.38d	156.66
3,0	138.25b	73.44c	95.71b	352.65c	165.01
3,1	202.87a	91.57b	95.74b	386.59b	194.19
3,2	213.67a	95.28a	120.30a	459.20a	222.11
Mean	**138.19**	**70.08**	**85.94**	**282.43**	**144.16**
Sem	**2.71**	**0.63**	**1.09**	**5.50**	**3.13**
LSD(p=0.05)	**8.13**	**1.89**	**3.27**	**16.48**	**7.44**

Application of chemical fertilizers with organic manures resulted in higher values of water soluble K content (ranging from 47.10-58.67 $kgha^{-1}$) during harvest of potato crop. Among the two organic manures applied the water soluble K content of the soil under all the three component crops were the highest under application of FYM. The values ($kgha^{-1}$) ranged from 58.67 during potato harvest, 117.28 during sesame harvest, 25.14 during tillering stage of rice and 127.08 during harvest of rice. The overall water soluble K content of the soil followed the order: zero Organic matter > concentrated organic manure > FYM. Interaction between fertilizer and organic manures resulted in different level of water soluble K contents of the soil under different component crops in the cropping sequence. While application of RDF_{75} without any organic manure resulted in the lowest value of water soluble K in soil (41.79 $kgha^{-1}$), application of FYM with RDF_{150} resulted in its highest (78.51 $kgha^{-1}$) value during harvest of potato. Same trend in soil water soluble K content with comparatively higher values (62.74 and 171.05 $kgha^{-1}$, respectively) during harvest of sesame were observed.

In rice while the highest values of soil water soluble K during both tillering as well as during harvest stages (34.02 and 195.28 $kgha^{-1}$, respectively) were observed under application of the highest rate of chemical fertiliser (RDF_{150}) in combination with FYM, the corresponding lowest water soluble K values (13.15 and 50.31 $kgha^{-1}$, respectively) were observed under application of the lowest level of chemical fertilisers (RDF_{75}) without any organic manure. The lowest pooled mean value of soil water soluble K content, irrespective of the component crop in the cropping sequence, was observed under RDF_{75} without any organic manure (42.00 $kgha^{-1}$) and the highest (119.72 $kgha^{-1}$) under RDF_{150} in combination with FYM Yadav, S.S.,Tikkoo, Abha and Singh, J.P. (2012). (Table-2).

Table-2: Effects of different treatments on the water soluble K (kg/ha) of Rhizosphere soil of potato-sesame-rice cropping sequence system

Treatments	Potato Harvest	Sesame Harvest	Rice Tillering	Rice Harvest	Mean
RDF_{75}	44.63c	61.32c	14.70c	58.30c	44.74
RDF_{100}	49.41b	96.56b	21.28b	97.18b	66.11
RDF_{150}	61.24a	144.52a	30.68a	159.59a	99.01
Mean	**51.76**	**100.80**	**22.22**	**105.02**	**69.95**
Sem	**0.58**	**1.34**	**0.17**	**0.96**	**0.76**
LSD(p=0.05)	**1.75**	**4.02**	**0.50**	**2.87**	**2.29**
Org0	47.10c	88.22c	18.96c	89.22c	60.87
Concentrated OM	49.51b	96.93b	22.56b	98.77b	66.94
FYM	58.67a	117.25a	25.14a	127.08a	82.04
Mean	**51.76**	**100.80**	**22.22**	**105.02**	**69.95**
Sem	**0.58**	**1.34**	**0.17**	**0.96**	**0.76**
LSD(p=0.05)	**1.75**	**4.02**	**0.50**	**2.87**	**2.29**
Fert X Org					
1,0	41.79e	62.74f	13.15g	50.31h	42.00
1,1	45.28de	59.12f	15.09f	53.09h	43.14
1,2	46.82cde	62.10f	15.86f	71.51g	49.07
2,0	48.38cd	71.77e	17.79e	80.77f	54.68
2,1	49.17bcd	99.28d	20.51d	96.32e	66.32
2,2	50.68bcd	118.62c	25.53c	114.44b	77.32
3,0	51.11bc	130.14b	25.94c	136.59c	85.95
3,1	54.09b	132.38b	32.09b	146.90b	91.36
3,2	78.51a	171.05a	34.02a	195.28a	119.72
Mean	**51.76**	**100.80**	**22.22**	**105.02**	**69.95**
Sem	**1.01**	**2.33**	**0.29**	**1.66**	**1.52**
LSD(p=0.05)	**3.03**	**6.97**	**0.87**	**4.96**	**3.96**

Non exchangeable Potassium: Changes in values of non-exchangeable K content in soil ($kgha^{-1}$) during different stages of growth of the component crops viz., potato-Sesame-Rice, are presented in table 9. The values of non-exchangeable K content of the soil under different levels of chemical fertilizers ranged from 417.02-987.85 $kgha^{-1}$ after harvesting of potato. While during harvest of sesame the values showed an increasing trend ranging from 670.86-982.28 $kgha^{-1}$, during rice cultivation the values increased further and ranged from 828.77-1127.72 $kgha^{-1}$ during tillering stage which increased to the level of 899.31-1749.59 $kgha^{-1}$ at the harvest stage. Irrespective of the crop, the non-exchangeable K content of the soil under different levels of chemical fertilizer application ranged from 703.99-1211.86 $kgha^{-1}$. Under all the three crops, application of higher doses of chemical fertilizer resulted in greater values of non-exchangeable K content of the soil. The non-exchangeable K content of the soil during harvest (1291.19 $kgha^{-1}$) of rice were comparatively higher than its values during harvest of sesame (827.86 $kgha^{-1}$) and potato (711.50 $kgha^{-1}$) and during tillering stage of rice (971.15 $kgha^{-1}$). Application of organic manures, bulky (FYM) or concentrated, resulted in significant changes in non-exchangeable K content of the soil during cultivation of different component crops in the cropping sequence.

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Application of chemical fertilizers with organic manures resulted in higher values of non-exchangeable K content (ranging from 589.96-805.11 kgha^{-1}) during harvest of potato crop. Among the two organic manures applied the non-exchangeable K content of the soil under all the three component crops were the highest under application of FYM. The values (kgha^{-1}) ranged from 805.11 during potato harvest, 892.41 during sesame harvest, 1025.07 during tillering stage of rice and 1546.35 during harvest of rice. The overall non-exchangeable K content of the soil followed the order: zero Organic matter < concentrated organic manure < FYM. Mahapatra, *et al*,.(2007)

Interaction between fertilizer and organic manures resulted in different level of non-exchangeable K contents of the soil under different component crops in the cropping sequence. While application of RDF_{75} without any organic manure resulted in the lowest value of non-exchangeable K in soil (209.70 kgha^{-1}), application of FYM with RDF_{150} resulted in its highest (1016.99 kgha^{-1}) value during harvest of potato. Same trend in soil non-exchangeable K content with comparatively higher values (576.35 and1013.26 kgha^{-1}, respectively) during harvest of sesame were observed. In rice while the highest values of soil non-exchangeable K during both tillering as well as during harvest stages (1208.48 and 2212.60 kgha^{-1}, respectively) were observed under application of the highest rate of chemical fertiliser (RDF_{150}) in combination with FYM, the corresponding lowest non-exchangeable K values (739.26 and 792.51 kgha^{-1}, respectively) were observed under application of the lowest level of chemical fertilisers (RDF_{75}) without any organic manure .Richards, J. E. and Bates, T. E. 1988 also found the same results as present studies The lowest pooled mean value of soil non-exchangeable K content, irrespective of the component crop in the cropping sequence, was observed under RDF_{75} without any organic manure (592.95 kgha^{-1}) and the highest (1362.83 kgha^{-1}) under RDF_{150} in combination with FYM as Singh, U. K. 2000 results shown, table-3.

Table-3: Effects of different treatments on the Non- exchangeable K (kg/ha) of Rhizosphere soil of potato-sesame-rice cropping sequence system

Treatments	Potato Harvest	Sesame Harvest	Rice Tillering	Rice Harvest	Mean
RDF_{75}	417.02c	670.86c	828.77c	899.31c	703.99
RDF_{100}	729.62b	830.44b	956.95b	1224.66b	935.42
RDF_{150}	987.85a	982.28a	1127.72a	1749.59a	1211.86
Mean	**711.50**	**827.86**	**971.15**	**1291.19**	**950.42**
Sem	**5.62**	**3.95**	**13.25**	**9.42**	**8.06**
LSD(p=0.05)	**16.84**	**11.84**	**39.71**	**28.24**	**24.16**
Org0	589.96c	765.37c	905.63c	1076.52c	834.37
Concentrated OM	739.42b	825.80b	982.74b	1250.69b	949.66
FYM	805.11a	892.41a	1025.07a	1546.35a	1067.24
Mean	**711.50**	**827.86**	**971.15**	**1291.19**	**950.42**
Sem	**5.62**	**3.95**	**13.25**	**9.42**	**8.06**
LSD(p=0.05)	**16.84**	**11.84**	**39.71**	**28.24**	**24.16**
Fert X Org					
1,0	209.70f	576.35g	793.26e	792.51g	592.95
1,1	532.95e	655.37f	841.79de	909.29f	734.85
1,2	508.41e	780.86e	851.28de	996.13e	784.17
2,0	600.82d	780.86e	899.81cd	1005.61e	821.78
2,1	698.09c	827.34b	955.58bc	1238.05d	929.77
2,2	889.95b	883.12c	1015.47b	1430.31c	1054.71
3,0	959.35a	938.90b	1023.83b	1431.44c	1088.38
3,1	987.22a	994.67a	1150.84a	1604.74b	1184.37
3,2	1016.99a	1013.26a	1208.48a	2212.60a	1362.83
Mean	**711.50**	**827.86**	**971.15**	**1291.19**	**950.42**
Sem	**9.73**	**6.84**	**22.94**	**16.32**	**15.28**
LSD(p=0.05)	**29.17**	**20.51**	**68.78**	**48.92**	**41.85**

Plant Nutrition: Potassium content of shoots, grains and mature straw of rice

The changes in the potassium contents of shoots, grains and mature straw of rice under the influence of integrated nutrient management are presented in below table-4. Statistical analysis of data and comparison of treatment mean values, through LSD (p=0.05) and DMRT (p=0.05) revealed significant influence of application of organic manures, different levels of applied fertilisers and their combination on K contents of shoots, grains and mature straw of rice. The K contents of shoot, grains and straw increased with increase in the level of fertiliser and integration of organic manures with chemical fertilisers also resulted in increased K contents in shoot, grains and straw the same results were correlated with Pasricha, N. S. (2002). Thakur Rishikesh, Sawarkar S.D., Vaishya U. K. and Singh Muneshwar (2011).

While the K contents of shoot, grains and straw were the lowest under RDF_{75} (1.46, 1.15 and 1.45 %, respectively), those with RDF_{150} were the highest (2.49, 2.04 and 2.33%, respectively). While the K contents of shoot, grains and straw were the lowest under no organic manure control (1.71, 1.43 and 1.76%, respectively), application of bulky (FYM) or concentrated organic manure resulted in significantly higher K contents. The K contents of shoot under the organic manures followed the order: FYM (2.19%)> Concentrated organic manure (1.89%) > Control (1.71%); the K contents of mature straw also followed the order: FYM (2.03%)> Concentrated organic manure (1.90%) > Control (1.76%) and the K contents of grains followed the order: FYM (1.75%)> Concentrated organic manure (1.60%) > Control (1.43%). Interaction between fertilizer and organic manures resulted in different level of K contents in shoot, grains and mature straw of rice. The treatment comprising RDF_{75} without organic manure resulted in the lowest K contents in shoot (1.36%), grains (0.86%) and mature straw (1.34%) while the treatment combining RDF_{150} with FYM produced the highest K contents in shoot (2.87%) as well as in rice straw (2.55%) and grains (2.18%). These were shown in below table-4.

Table-4: Effects of different treatments on the presence of K (%) content in different growth stages of Rice crop

Treatment	Rice shoot	Rice straw	Rice Grain	Rice husk
RDF_{75}	1.46c	1.45c	1.15c	1.12c
RDF_{100}	1.84b	1.92b	1.58b	1.64b
RDF_{150}	2.49a	2.33a	2.04a	2.05a
Mean	**1.93**	**1.90**	**1.59**	**1.61**
Sem	**0.01**	**0.03**	**0.01**	**0.01**
LSD(p=0.05)	**0.03**	**0.09**	**0.03**	**0.03**
Org0	1.71c	1.76c	1.43c	1.52c
Concentrated OM	1.89b	1.90b	1.60b	1.62b
FYM	2.19a	2.03a	1.75a	1.68a
Mean	**1.93**	**1.90**	**1.59**	**1.61**
Sem	**0.01**	**0.03**	**0.01**	**0.01**
LSD(p=0.05)	**0.03**	**0.09**	**0.03**	**0.03**
1,0	1.36g	1.34g	0.86g	1.03h
1,1	1.40g	1.48fg	1.27f	1.15g
1,2	1.62f	1.52f	1.32f	1.18g
2,0	1.69e	1.75e	1.50e	1.53f
2,1	1.76d	1.99d	1.50e	1.67e
2,2	2.07c	2.03cd	1.74d	1.73d
3,0	2.08c	2.20bc	1.92c	1.99c
3,1	2.51b	2.24b	2.03b	2.05b
3,2	2.87a	2.55a	2.18a	2.12a
Mean	**1.93**	**1.90**	**1.59**	**1.61**
Sem	**0.02**	**0.05**	**0.02**	**0.02**
LSD(p=0.05)	**0.05**	**0.15**	**0.06**	**0.06**

CONCLUSION

The Observing K status in these soils, it can be concluded that crop yield in these soils are more likely to boosted with K fertilization. Positive significant correlation was obtained among different K forms keeping in parity with the nature of relationship obtained in general.

All the forms of potassium showed a positive correlation with the application of different doses fertilizer and organic manure during the cropping sequences. The data from application of fertilizer and organic manures found under investigation that former treatment results significantly increases availability of K on short term basis while latter one results on a long term basis. This indicates that the presence of organic matter has a significant role in the availability of K to the plants and its uptake.

With the application of different doses of fertilizer significantly decrease soil pH and application organic amendments reverses its level. The application of different doses of fertilizer significantly increases EC and OC of soil. While application of organic amendments decreases EC and it s application increases OC.

It also found that changes in uptake of K during different growth stages of rice crop. Uptake is more in shoot followed by straw, husk and grain of rice in mean values during different doses of above said treatments.

So overally I can conclude application of fertilizers and organic manure combinedly i.e., in an integrated manner rather than individually results significant increase in availability of K in both short term and long term basis on a sustainable manner. This in turn increases crop production.

REFERENCES

Datta, S. C. (2011). Potassium dynamics and status in Indian Soils. Karnataka J. Agric. Sci.,24 (1) : (7-11) 2011

Pasricha, N. S. 2002. Potassium dynamics in soils in relation to crop nutrition. J. Indian Sci. 50: 333- 344.

Richards, J. E. and Bates, T. E. 1988. Studies on the potassium supplying capacities of southern Ontario soils. II. Nitric acid extraction of nonexchangeable K and its availability to Canadian J. Soil Sci. 68: 199-208.

Singh, U. K. 2000. Characterization of potassium reserve in some soils of West Bengal with particular emphasis on plant availability of non exchangeable potassium pools. Ph.D. Thesis, Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India.

Mahapatra, P., Singh, R.P.,Singh, B.P., Mishra, B. and Sarker, A.K.(2007) Long-term effects of fertilizer, organic manure and amendments on soil health, crop productivity and sustainability.*Technical Bulletin.* Department of Soil Science and Agricultural Chemistry. BAU, Ranchi (Jharkhand) 4, 1-75

Bhattacharya, Ranjan, Prakash, Ved, Kundu, S.,Ghosh, B.N. and Gupta H.S. (2008) Potassium availability as influenced by FYM application under continuous soyabean-wheat cropping system. Journal of the Indian Society of Soil Science 56, 182-185

Thakur Rishikesh, Sawarkar S.D., Vaishya U. K. and Singh Muneshwar(2011) Impact of continuous use of inorganic fertilizers and organic manure on soil properties and productivity under soyabean-wheat intensive cropping system of a Vertisol.Journal of the Indian Society of Soil Science 59, 74-81

Yadav, S.S.,Tikkoo, Abha and Singh, J.P. (2012)Effect of potassium on pearl millet-wheat cropping system in coarse textured soils of southern Haryana. Journal of the Indian Society of Soil Scienc 60, 145-149.

Anonymous (2011) Soil Maps, Department of Soil Science, CCS HAU, Hisar. Haryana Website soils@hau.ernet.in.