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Residual effect of phosphatic and potassic fertilizers on nutrient content of rice

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Abstract: A pot culture experiment was conducted in the net house of the Department of Agricultural Chemistry, Bangladesh Agricultural University, Mymensingh with a test crop Aus rice (cv. BR21) was used to find out the residual effects of phosphatic and potassic fertilizer (P and K) in soils of five Agro-Ecological Zones (AEZs) on nutrient contents of rice. The five AEZs namely were Tista Meander Floodplain (AEZ-3), Old Brahmaputra Floodplain (AEZ-9), Old Meghna Estuarine Floodplain (AEZ-19), Eastern Surma-Kushiyara Floodplain (AEZ-20) and Chittagong Coastal Plain (AEZ-23). Two levels of fertilizer were without fertilizer and fertilizer applied in previous crop (wheat). The experiment was laid out in a Completely Randomized Design (CRD) with three replications. The soil samples were collected from each AEZ up to 0-15 cm and 15-30 cm depths. Significant residual effect of P and K in soil was observed on chemical composition of rice grain and straw viz. total nitrogen, phosphorus, potassium, calcium, magnesium and sulphur content. Phosphorus and potassium contents were lower in post harvest soil than pre harvest soil with no fertilizer at both the depth. The highest concentration of N & Mg, P & S, K & Ca in rice straw were found in AEZ-3, AEZ-19 and AEZ-25 respectively, at both 0-15cm and 15-30cm depths and the lowest concentration of P, K & S in rice straw were observed in AEZ-9 at both depths.
Keywords: Rice, Residual effect, Phosphatic and Potassic Fertilizers

Introduction

The use of chemical fertilizers is most important input to increase crop production, because residual effect is gaining consideration and popularity among the agriculture specialists. It is fact that nitrogenous fertilizers have little or no residual effects for following crops. Unlike nitrogen, phosphatic and potassic fertilizers have abundant residual effects for the subsequent crops depending on soil and climatic conditions. Though the concentration of available P in phosphatic fertilizer is high, it is retained in soil and becomes slowly available for the next crops. Several workers have reported that the residual effect of P lasts for 2-4 years (Saunders *et al.*, 1963; Venkata Rao *et al.*, 1963; Koltakava, 1965; Kamprath, 1967; Read, 1968; Lim, 1978). A portion of applied potassic fertilizer is fixed and becomes slowly available for the subsequent crops due to expansion and shrinkage properties of kaolinite mineral. It is observed that due to alternate wetting and drying this fixed K becomes exchangeable and available for the growing crop (Singh and Ram, 1976). Needless to say those other plant nutrients such as calcium, magnesium have synergistic interactions with the presence of major nutrients like nitrogen, phosphorus, potassium. Keeping the above facts in mind, the present study was initiated with a view to finding out the residual effect of TSP, MP under renewed application of urea on nutrient content of rice and chemical properties of pre and post harvest soils of five Agro-Ecological zones (AEZ) of Bangladesh.

Materials and Methods

A pot culture experiment with test crop rice (cv. BR21) was conducted in a net house at the Department of Agricultural Chemistry, Bangladesh Agricultural University, during *kharif* season in order to evaluate the residual effects of fertilizers applied earlier in the soils of five AEZs of Bangladesh. Amoung 30 Agro-Ecological Zones (AEZ) of Bangladesh only five AEZ was randomly selected. The soil samples were collected from 150 sampling sites up to 0-15 cm and 15-30 cm depths under the upazila of Bogra Sadar, Bogra; Fulpur, Mymensingh; Comilla Sadar, Comilla; Sylhet Sadar, Sylhet and Sitakundu, Chittagong district under the respective five selected AZEs of Bangladesh. Symbolic representation of various soils used in this study along with different treatments at 0-15 com and 15-30 cm depth with residual fertilizer were as follows:

Symbol	Name of AEZs	Treatments Combinations					
S_1	Tista Meander Floodplain (AEZ-3)	S_1F_0	S_1F_0	S_1F_0	S_1F_1	S_1F_1	S_2F_1
S_2	Old Brahmaputra Floodplain (AEZ-9)	S_2F_0	S_2F_0	S_2F_0	S_2F_1	S_2F_1	S_2F_1
S_3	Old Meghna Estuarine Floodplain (AEZ-19)	S_3F_0	S_3F_0	S_3F_0	S_3F_1	S_3F_1	S_3F_1
S_4	Eastern Surma-Kushiyara Floodplain (AEZ-20)	S_4F_0	S_4F_0	S_4F_0	S_4F_1	S_4F_1	S_4F_1
S_5	Chittagong Coastal Plain (AEZ-23)	S_5F_0	S_5F_0	S_5F_0	S_5F_1	S_5F_1	S_5F_1

* F_0 – Without fertilizer
* F_1 – Fertilizer applied in previous crop (wheat) (Urea 0.266 g. TSP 0.18 g, MP 0.13 g per pot with 5 kg soil).

Aus rice cv. BR21 was considered as a test crop for the experiment. The experiment was conducted in pots with a surface area of 707 cm^2. Each pot contained 5 kg sun dried soil. Experiment was conducted without fertilizer. In previous crops for experimental purposes two rates of fertilizer were applied in each pot. Urea

120 kg, TSP 80 kg, MP 60 kg per hectare basis with a control. The basal dose of urea was applied in three installments. The experiment was laid out in a Completely Randomized Design (CRD) with three replications. Straw samples were extracted and analyzed for N, P, K, Ca, Mg and S following the standard methods of analysis. Soil pH was determined by glass electrode pH meter method as described by Anderson and Ingram (1996). The electrical conductivity of collected soil samples were determined following the procedure outlined by Anderson Ingram (1996). Cation exchange capacity of each soil samples was determined by ammonium acetate saturation method (Black, 1965; Page *et al*., 1982). Available phosphorus in soil was determined by Olsen's method (Olsen *et al*., 1954). Potassium of soil samples were determined with the help of flame photometer following the methods outlined by Ghosh *et al.* (1983). All the collected data were analyzed statistically and the mean differences were adjudged Duncan's New Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Chemical characteristics of the pre-harvest and post-harvest soil of different AEZs

Soil pH: The pH values varied from 5.2 to 7.7 at 0-15 cm depth and from 5.7 to 8.4 at 15-30 cm depth in pre harvest soils. Similarly in post-harvest the soil pH were varied from 5.1 to 7.5 at 0-15 cm depth and from 5.4 to 7.8 at 15-30 cm depth (Table 1 & 2). The highest pH in pre-harvest (7.7) and post-harvest (7.5) soil were found in AEZ-23 at 0-15 cm depth but the lowest was found in AEZ 20 at the same depth. Similarly, the same tends of highest (8.4) and lowest (5.4) pH in pre-harvest and post-harvest soils was slightly decreased from the respective pre-harvest soils at two different depths. In all the soils the pH of post-harvest soil showed decreasing trend with pre-harvest soil but an increase trends with the increase of soil depth. Bhuiyan (1988) and Hannan (1995) obtained similar results in different soils series of Bangladesh. The lower pH at the surface layer might be due to the washing out and removal of basic cations from the soil.

Electrical conductivity (EC): The EC of pre-harvest and post-harvest soils ranged from 35.42µScm,$^{-1}$ to 168.67 µScm^{-1} and 31.33µSCm^{-1} to 130.60 µScm^{-1} at 0-15 cm depths, respectively (Table 1). The highest EC value (168.67 µScm^{-1}) and lowest EC value (35.42 µScm^{-1}) were found in AEZ-23 in and AEZ-9 at 0-15 cm depth in pre-harvest soils, respectively and in post-harvest soils the highest 130.60 µScm^{-1} and the lowest 31.33 µSCm^{-1} were found at the same AEZs. Similarly the EC of pre-harvest and post-harvest soils at 15-30cm depth ranged from 51.51 to 199.33 and 48.31 to 145.44 µScm^{-1}, respectively (Table 2). The highest (199.33 µScm^{-1}) and lowest (51.51µScm^{-1}) of EC values in pre-harvest soils were observed in AEZ-23 and AEZ-3 at 15-30 cm depth, respectively and in post-harvest soils the highest (145-44 µScm^{-1}) and the lowest (48.31 µScm^{-1}) were found in AEZ-23 and AEZ-9 at the same depth, respectively. The results also indicated that EC of surface soils were lower than that of sub-surface soils except Bogra Sadar in case of both pre and post-harvest soils. This might be due to the presence of comparatively higher amount of soluble salts in the sub-surface soils than the surface soils. This is the increasing trend of EC with the soil depth.

Table 1. pH, EC and CEC of pre-harvest and post-harvest soils at 0-15 cm depth of the study AEZs

AEZs	pH		EC (µScm^{-1})		CEC (me 100^{-1} g soil)	
	Pre-harvest	Post-harvest	Pre-harvest	Post-harvest	Pre-harvest	Post-harvest
AEZ-3	5.5	5.5	113.26	92.00	30.0	27.77
	5.5	5.4	122.26	99.20	29.51	25.23
	5.5	5.2	118.18	95.1	27.78	22.66
AEZ-9	6.0	5.8	37.67	36.73	12.77	10.32
	6.2	6.1	35.81	34.12	11.88	9.53
	5.8	5.6	35.42	31.33	10.68	9.72
AEZ-19	5.8	5.8	63.33	50.43	23.46	22.88
	5.8	5.7	62.25	47.23	21.66	19.17
	5.8	5.6	59.26	45.11	22.88	20.2
AEZ-20	5.4	5.6	61.67	51.62	10.39	8.15
	5.6	5.4	59.67	55.41	9.88	6.66
	5.2	5.1	56.67	48.50	10.30	8.20
AEZ-23	7.5	7.2	168.67	125.54	25.0	22.88
	7.3	7.1	162.62	130.6	22.22	20.71
	7.7	7.5	162.77	123.22	21.17	19.33

Cation Exchange Capacity (CEC): The CEC of pre-harvest and post-harvest soils ranged from 9.88 to 30.0 me 100^{-1} soil and 6.66 to 27.77 me 100^{-1} soil at 0-15 cm depth, respectively. The highest (30.0 me 100^{-1}g soil) and lowest (9.88 me 100^{-1} soil) of CEC values in pre-harvest soils were found in AEZ-3 and AEZ-20 at 0-15 cm depth, respectively and the post-harvest soil

Table 2. pH, EC and CEC of pre-harvest and post-harvest soils at 15-30 cm depth of the study AEZs

AEZs	pH		EC (μScm^{-1})		CEC (me 100^{-1} g soil)	
	Pre-harvest	Post-harvest	Pre-harvest	Post-harvest	Pre-harvest	Post-harvest
AEZ-3	6.3	6.1	54.67	49.0	21.34	21.33
	6.3	6.2	54.22	54.0	19.24	18.42
	6.3	6.2	51.51	48.13	21.1	20.1
AEZ-9	6.5	6.3	59.0	52.22	14.91	12.12
	6.4	6.2	57.0	48.31	14.1	10.16
	6.7	6.5	27.0	56.1	13.12	9.99
AEZ-19	6.7	6.4	78.0	65.34	26.54	19.18
	6.5	6.2	75.4	57.3	26.51	22.13
	6.6	6.3	72.55	52.35	18.18	13.23
AEZ-20	5.7	5.5	68.17	55.12	13.88	10.1
	5.8	5.4	65.25	50.22	9.26	7.16
	5.8	5.5	67.18	53.66	11.12	9.54
AEZ-23	8.3	7.5	199.33	145.44	27.91	16.27
	8.4	7.8	195.95	139.92	24.55	21.16
	8.3	7.7	193.87	142.33	21.44	18.15

the highest (27.77 me 100^{-1} g soil) and the lowest (6.66 me 100^{-1} g soil) were found in the same AEZs (Table 1).Similarly the CEC value of pre-harvest and post-harvest soils of five AEZs at 15-30 cm depth ranged from 9.26 to 27.91 me 100^{-1}g soil and 7.16 to 22.13 me 100^{-1} g soil, respectively the highest (27.91 me 100^{-1} g soil) and lowest (9.26 me 100^{-1} g soil) of CEC values in pre-harvest soils were found in AEZ-23 and AEZ-20, respectively but in post-harvest soils the highest (22.13 me 100^{-1} g soil) and the lowest (27.91 me 100^{-1} g soil) were found in AEZ- 19 and AEZ-20 at 15-30 cm depth, respectively (Table 2). The CEC values of the soils were increased with increasing soil depth in the study areas except Bogra Sadar incase of both pre and post-harvest soils. This might be due to the presence of higher clay content in sub-surface soils. The results of CEC of the study areas were maintained regular pattern with soil depth except Bogra Sadar soil. The higher amount of CEC indicates more availability of exchangeable cations in the soils.

Nutrient content of rice straw

Nitrogen (N): The amount of N content in straw varied from 0.34% to 0.51% and 0.37% to 0.42% in soils at 0-15 cm and 15-30 cm depth, respectively. The maximum and minimum percent of N content in straw were found in S_1 (0.51%) and S_5 (0.34%) soils, respectively at 0-15 cm depth while at 15-30 cm depth these were at in treatments S_1 (0.42%) and $S_{2,}$ S_3 (0.37%), respectively. It is therefore, assumed that there was some variations in the content of N which somewhat differed from the different depths and different soils of AEZs. There was similarity of the effect of soils and fertilizers on this particular crop showing same statistical findings with different depths. The highest and lowest percent N content in straw were found in F_1 (0.48%) and F_0 (0.32%), respectively at 0-15 cm depth while 15-30 cm depth showed at the treatments F_1 (0.45%) and F_0 (0.33%), respectively. The interaction effect of different soils and fertilizer on percent N content in straw was statistically significant at 1% level of probability at 0-15 cm and 15-30 cm depth. The highest and lowest percent N content in straw were found in S_1F_1 (0.65%) and S_5F_0 treatment combination at 0-15 cm depth, respectively while at 15-30 cm depth these were at in treatment combination S_1F_1 (0.55%) and S_1F_0 (0.20%), respectively (Table 5 & 8).

Phosphorus (P): The amount of P content in straw varied from 0.018% to 0.062% and 0.013% to 0.045% in soils at 0-15 cm an d 15-30 cm depth, respectively. The maximum and minimum percent of P content in straw were observed in S_3 (0.062%) and S_4 (0.18%) treatment, respectively at 0-15 cm while at 15-30 cm depth showed at the treatments S_3 (0.045%) and S_4 (0.013%), respectively. This indicated the content of P was much higher in straw at 0-15 cm depth than that of 15-30 cm depth. The highest and lowest percent P content in straw were found in F_1 (0.05%) and F_0 (0.03%), respectively at 0-15 cm depth while at 15-30 cm depth these were in treatment F_1 (0.04%) and F_0 (0.02%), respectively. The interaction effect of different soils and fertilizer on percent P content in straw was statistically significant at 1% level of probability at 0-15 cm and 15-30 cm depth. The maximum and minimum percent P content in straw were found in S_3F_1 (0.075%) and S_4F_0 (0.021%) treatment combination S_5F_1 (0.052%) and S_4F_0 (0.011%), respectively (Table 5 & 8). The results confirmed the same findings as obtained in case of soils and fertilizers. But it seemed that there were no significant differences in the availability in the concentration of P.

Potassium (K): K content in straw varied from 0.71% to 1.67% and 0.79% to 1.82% in the soils at 0-15 cm and 15-30 cm depth, respectively. The maximum and minimum percent K content in straw were observed in S_5 (1.67%) and S_2 (0.71%) treatment, respectively at 0-15 cm depth while at 15-30 cm depth these were at in treatment S_5 (1.82%) and S_4 (0.79%), respectively (Table 3 & 6). As regards major nutrients range in various soils it seems that N content was found lowest in S_5 having 0-15 cm whereas K content shoed highest concentration in the same soil of same depth. But P content differed in its presence showing concentration higher in S_3 and lowest in S_4 soils of therefore said depths. Therefore, these major nutrients are not available to the soils of same depth also did not show any marked differences in straw of the crops. The maximum and minimum percent K content in straw were found in F_1 (1.42%) and F_0 (1.03%) treatment, respectively at 0-15 cm depth while at 15-30 cm depth these were at in treatment F_1 (1.43%) and F_0 (1.11%), respectively. F_1 treatment (fertilizer) had shown 1% level of probability of significance as same finding was observed with N and P. The interaction effect of different soils and fertilizer on percent K content in straw was statistically significant at 1% level of probability at 0-15 cm and at 15-30 cm depth. The maximum and minimum percent K content in straw were found in S_5F_1 (196%) and S_4F_0 (0.63%) treatment combination, respectively at 0-15 cm depth while at 15-30 cm depth these were at in treatment combination S_5F_1 (2.07%) and S_4F_0 (0.58%), respectively (Table 5 & 8). The interaction of soils and fertilizers in case of K differed markedly in its contents but was statistically significant as found with N and P major nutrients.

Table 3. Effect of different soils on nutrients content of rice straw (cv.BR21) at 0-15cm depth

Factor- A (Soils)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
S_1	0.51a	0.048b	1.33b	0.24c	0.03a	0.048bc
S_2	0.39bc	0.022c	0.71d	0.36a	0.21b	0.035d
S_3	0.36cd	0.062a	1.42b	0.30b	0.14b	0.073a
S_4	0.41b	0.018c	0.99c	0.35ab	0.11c	0.038cd
S_5	0.34d	0.056ab	1.67a	0.38a	0.27c	0.055b
LSD (0.01)	0.0374	0.012	0.158	0.054	0.384	0.012

Table 4. Effect of different fertilizers on nutrients content of rice straw (cv.BR21) at 0-15 cm depth

Factor- B (Fertilizer)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
F_0 (No fertilizer)	0.32b	0.03b	1.03b	0.25b	0.15b	0.03b
F_1 (With fertilizer)	0.48a	0.05a	1.42a	0.39a	0.36a	0.07a
LSD	0.0384	0.012	0.158	0.054	0.0384	0.012

Table 5. Combined effect of different soils and fertilizers on the nutrient content of rice straw (cv. BR21) at 0-15 cm depth

Factor- A x Factor-B	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
S_1F_0	0.37de	0.031ef	1.16v	0.13	0.34	0.02
S_1F_1	0.65a	0.042ab	1.50b	0.35	0.36	0.08
S_2F_0	0.33ef	0.22f	1.67e	0.29	0.15	0.01
S_2F_1	0.45bc	0.040de	0.84d	0.43	0.26	0.06
S_3F_0	0.28fg	0.053bcd	0.39bc	0.22	0.11	0.06
S_3F_1	0.44bc	0.075a	1.45b	0.38	0.18	0.09
S_4F_0	0.33ef	0.021f	0.63de	0.29	0.05	0.03
S_4F_1	0.48b	0.032ef	1.34bc	0.40	0.16	0.05
S_5F_0	0.27g	0.050cd	0.38bc	0.33	0.22	0.03
S_5F_1	0.41cd	0.061abc	0.96a	0.43	0.32	0.08
LSD (0.01)	0.0543	0.017	0.223	-	-	-

Calcium (Ca): Percent Ca content in rice straw varied from 0.24% to 0.37% and 0.33% to 0.46% in soils at 0-15 cm and 15-30 cm depth, respectively. The maximum and minimum percent Ca content in straw were obtained in S_5 (0.38%) and S_1 (0.24%) treatment, respectively at 0-15 cm depth while at 15-30 cm depth showed in treatments S_5 (0.46%) and S_1 (0.33%), respectively. These indicate that the maximum and minimum Ca content were in same AEZs at 0-15 cm and 15-30 cm depths. The highest and lowest Ca content in straw were observed in F_1 (0.39%) and F_0 (0.25%) treatment, respectively at 0-15 cm depth while at 15-30 cm depth these were at in treatments F_1 (0.46%) and F_0 (0.31%), respectively. Deep layer has shown higher concentration of Ca in the availability by the crop in straw analysis. The interaction effect of different soils and fertilizer on percent Ca content in straw was statistically not significant at 1% level of probability at 0-15 cm and 15-30 cm. Numerically the maximum and minimum percent Ca content in straw were obtained in S_5F_1 (0.43%) and S_1F_0 (0.13%) treatment combination, respectively at 0-15 cm depth while at 15-30 cm depth showed in treatment combination S_5F_1 (0.53%) and S_1F_0 (0.24%), respectively. It may therefore, be concluded all the secondary major nutrients seemed to be not significant when interaction is considered but with major nutrients it gave different picture.

Table 6. Effect of different soils on nutrients content of rice straw (cv.BR21) at 15-30cm depth

Factor- A (Soils)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
S_1	0.42a	0.031bc	1.57b	0.33c	0.32a	0.04ab
S_2	0.37b	0.021cd	0.88d	0.37dc	0.18c	0.03b
S_3	0.37b	0.045a	1.28c	0.36bc	0.14c	0.06a
S_4	0.38b	0.013d	0.79d	0.40b	0.16c	0.04ab
S_5	0.41ab	0.035ab	1.82a	0.46a	0.30b	0.05a
LSD (0.01)	0.038	0.012	0.115	0.038	0.364	0.012

Table 7. Effect of different fertilizers on nutrients content of rice straw (cv.BR21) at 15-30 cm depth

Factor- B (Fertilizer)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
F_0 (No fertilizer)	0.33b	0.02b	1.11b	0.31b	0.16b	0.02b
F_1 (With fertilizer)	0.45a	0.04a	1.43a	0.46a	0.28a	0.06a
LSD	0.038	0.012	0.115	0.38	0.364	0.012

Table 8. Combined effect of different soils and fertilizers on the nutrient content of rice straw (cv. BR21) at 15-30 cm depth

Factor- A x Factor-B	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
S_1F_0	0.30C	0.022cde	1.44cd	0.24	0.25	0.03cd
S_1F_1	0.55A	0.041ab	1.71b	0.43	0.39	0.06a
S_2F_0	0.31C	0.013de	0.70f	0.28	0.16	0.02d
S_2F_1	0.42b	0.029bcd	1.05e	0.45	0.21	0.05ab
S_3F_0	0.34c	0.040abc	1.28d	0.29	0.06	0.03cd
S_3F_1	0.41b	0.050a	1.29d	0.43	0.23	0.06a
S_4F_0	0.33c	0.011e	0.58f	0.34	0.11	0.01d
S_4F_1	0.43b	0.016de	0.01e	0.45	0.21	0.04bc
S_5F_0	0.34c	0.022cde	1.57bc	0.39	0.24	0.03cd
S_5F_1	0.46b	0.052a	2.07a	0.53	0.36	0.07a
LSD (0.01)	0.054	0.017	0.163	-	-	0.014

Magnesium (Mg): The amount of Mg in straw varied from 0.11% to 0.30% and 0.14% to 0.32% in soils at 0-15 cm and 15-30 cm depth, respectively. The maximum and minimum percent Mg content in straw were obtained in S_1 (0.30%) and S_4 (0.11%) treatment, respectively at 0-15 cm depth while at 15-30 cm depth showed in treatments S_1 (0.32%) and S_3 (0.14%), respectively. The effect of fertilizer on percent Mg in straw was statistically significant at 5% level of probability at 0-15 cm and 15-30 cm depth. The maximum and minimum percent Mg content in straw were observed in F_1 (0.26%) and F_0 (0.15%) treatment, respectively at 0-15 cm depth while at 15-30 cm depth these were at in treatment F_1 (0.28%) and F_0 (0.16%), respectively. The interaction effect of different soils and fertilizer on Mg content was statistically not significant at 1% level of probability at 0-15 cm depth and 15-30 cm depth.

Sulphur (S): The amount of percent S content in straw varied from 0.035% to 0.073% and 0.03% to 0.06 in soils at 0-15 cm and 15-30 cm depth, respectively. The maximum and minimum percent S content in straw were obtained in S_3 (0.073%) and S_2 (0.035%) treatment, respectively at 0-15 cm depth while at 15-30 cm depth these were in treatments S_3 (0.06%) and S_2 (0.03%), respectively. These indicate that the content of S was slightly higher in straw at 0-15 cm depth than that of 15-30 cm depth. The effect of fertilizer on percent in straw was statistically significant at 1% level of probability at 0-15 cm and 15-30 cm depth. The maximum and minimum percent S content in straw were observed in F_1 (0.07%) and F_0 (0.03%) treatment, respectively at 0-15 cm depth while at 15-30 cm depth these were at in treatments F_1 (0.06%) and F_0 (0.02%), respectively. The interaction effect of different soils and fertilizer on percent S content in straw were statistically not significant at 0-15 cm depth but was statistically significant at 15-30 cm depth. The maximum and minimum percent S content in straw were obtained in S_1F_1 and S_5F_1 (0.08%) and S_2F_0 (0.01%) treatment combination, respectively at 15-30 cm depth. Here some differences are noted when two depths are considered in this aspect.

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