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Changes in soil properties after residue incorporation in Alfisol of Vindhyan plateau

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Abstract
Soil respiration & catalase activity involves different sets of chemical, physical, and biological processes. Soil respiration processes are, in turn, influenced by an array of factors. The factors are organic and inorganic carbon, temperature, moisture, nitrogen, soil texture, soil pH, and soil EC and land use and management practices. Cumulative CO2 evolution curves obtained from the seven soils treated with the equivalent of 4 and 40 tons per acre, respectively, of finely ground hay having a C/N ratio of *E. crassipe* (36:1), wheat straw (64:1) and rice straw (47:1). The application of validamycin at 240 ml mg -1 caused a significant decrease (14%) in soil catalase compared with the control. Rice straw + wheat straw + E. *crassipe* treatment shows high soil respiration in different as compared to soil of. So rice straw +wheat straw + *E. crassipe* favor microbial community may be due to secretion of favorable. Crop C/N ratio and ash content have a significant relationship with soil respiration as it is affects soil mineralization of organic carbon.

Keywords: Soil respiration, Catalized activity, Organic corbon, Moisture

1. Introduction
Soil respiration plays a critical role in carbon cycling on regional and global scales. The carbon cycling on the global scale involves exchanges of CO2 among the land biosphere, the atmosphere, oceans, and the earth's crust. CO2 emission from soil is fundamentally a biochemical process. Ecologists measure soil respiration on point and local scale. Each year, photosynthesis of land-plants takes up approximately 120 Pg (1015 g) C yr^{-1} from the atmosphere. A similar amount of carbon is released back to the atmosphere through ecosystem respiration. Oceans absorb nearly 92 Pg C yr^{-1} from the atmosphere and release 90.6 Pg C yr^{-1}. Soil carbon dioxide emission (CO_2) is a process determined by biotic and a biotic factors influenced by land use and management practices. Soil respiration is a measure of carbon dioxide (CO_2) released from the soil from decomposition of soil organic matter (SOM) by soil microbes and respiration from crop residues and soil fauna. It is an important indicator of soil health because it indicates the level of microbial activity, soil organic matter content and its decomposition. In the short term high soil respiration rates are not always better; it may indicate an unstable system and loss of soil organic matter (SOM) because of excessive tillage, or other factors degrading soil health. It can be measured by simple methods or more sophisticated laboratory methods. The amount of soil respiration is an indicator of nutrients contained in organic matter being converted to forms available to crops (e.g., phosphate as PO_4, nitratenitrogen as NO_3, and sulfate as SO_4).

Materials and Method
The study area Mirzapur is centrally located in the district of Uttar Pradesh, which comes in Agro Climatic Zone (IV) which is situated in Vindhyan plateau and middle Gangetic plain region. The geographical area of district is 452.508 ha which is divided in 1971 villages. Vindhyan region of district Mirzapur (25º 10 "latitude, 82º 37" longitude and altitude of 147 meters above mean sea level. The normal period for the onset of monsoon in this region is the third week of June and it lasts up to end of the September or sometimes extends to the first week of October. Winter showers 12 are often experienced in between the month of December to mid-February. However, March to May is generally dry. On an average, out of the total annual rain fall 572.00 mm in 2015-16. Major fraction (75%) is received from June to September. The relative humidity varied between 92 per cent and 96.57 per cent.

A composite soil samples is taken before start of the experiment and final soil sample was drawn from the each treatment after harvest of crop to a depth of 0-15 cm, taking all the possible precautions prescribed for soil sampling. The samples were brought to the laboratory, air dried and crushed to pass through 2.0 mesh sieve. The processed samples were subjected to appropriate mechanical and chemical analyses. The soil of the experimental field was sandy loam in texture with high drainage. Three farm available plant species were selected. These included rice straw (*Oryza sativa*), wheat straw (*Triticumaestivum*) & water hyacinths *(Eichhorniacrassipe*). Plant residueswere washed with running tap water, rinsed three times with distilled water, dried at 650C for48 h, milled and passed through a 1mm sieve.

Physical property of soil
Bulk density was determined with the help of Pycnometer. Water holding capacity was determined by the method described by Piper (1966) with the help of perforated dish. Soil moisture determiined by the Weight moist soil immediately after sampling and record as "wet weight of sample" Dry the wet sample to a constant weight, at a temperature not exceeding 239º F(115 ºC) using the suitable hot air oven for 24 hours.

Chemical Analysis of Soil
A soil-water suspension was prepared in the ratio of 1:2.5 (10 g soil with 25 ml of distilled water) and pH was measured with the help of pH meter (Kanwar, 1982) [10]**.** Electrical conductivity was measured with the help of pocket EC meter and expressed as dS m -1 (Sparks, 1996) [18]. Organic carbon of soil was estimated as per method described by Wolkey and black, 1934. 1 g of soil was taken in a 500 mL of conical flask.

Soil Respiration measurement
The alkali-trap method (absorption of CO_2 in NaOH solution and titration of the remaining NaOH with HCl) is frequently used to estimate soil CO_2 emissions (Carter, Gregorich, 2008) [4]. With alkaline soils, however, it might be possible to underestimate soil CO_2 emissions due to slight dissolution of ammonia into NaOH solution and production of extra OH^- ions. As the experimental site belongs to alfisol with acidic in reaction so the alkali-trap method muds soil.

Catalase activity
Catalase activity was determined by the method of (Cohen *et al.*, 2004) [5] where decomposed hydrogen peroxide is measured by reacting it with excess of potassium tetra oxomanganate, KMnO4 and residual KMnO4 is measured spectrophotometrically at 480 nm.

Result and Discussion
Effect of residue addition on soil physicochemical properties
The treatments differed in soil pH and soil pH can influence microbial community composition and nutrient availability (Hinsinger, 2001) [8]. Soil pH on 1,15,30,42 and 70 day incubation the soil without residues (T1) and amended with control (p<0.01) addition of rice straw + wheat straw + *E. crassipe* straw (T7) 6.6pH significantly increased soil ph up to one unit, T7 treatment is significantly increased at the 30 day. Amendment with organic, rice straw (T2), wheat straw (T3) and *E. crassipe* straw (T4) statistically increased soil pH on 15, 30 and 42 day, but decreased wheat straw (T3) & *E. crassipe* straw (T4) adding soil pH on day 70. Compared to the soil amended with original residues (Wheat straw and *E. crassipe* sttraw), soil pH was lower in the amended soils with low C/N ratio or both low C/N and C/P ratios. The pH decrease was the greatest on day 21. Reducing the C/N ratio of eucalyptus, wheat, and sawdust did not influence soil pH compared to the soils with original residues. The greatest increase in soil pH occurred after water hyacinth addition as it is easily mineralized (i.e. low C: N) and had the highest potential alkalinity than either wheat. Ash alkalinity should be considered a coarse indicator of pH change see (table. 4.1) treatments differed in soil pH and soil pH can influence microbial community composition and nutrient availability (Hinsinger, 2001) [8]. Soil pH on 1,15,30,42 and 70 day incubation the soil without residues (T1) and amended with control (p<0.01) addition of rice straw+ wheat straw +*E. crassipe* straw (T7) 6.6pH significantly increased soil ph up to one unit,T7 treatment is significantly increased at the 30 day. Amendment with organic, rice straw (T2), wheat straw (T3) and *E. crassipe* straw (T4) statistically increased soil pH on 15, 30 and 42 day but decreased wheat straw (T3) & *E. crassipe* straw (T4) adding soil pH on day 70. Compared to the soil amended with original residues (Wheat straw and *E. crassipe* sttraw), soil pH was lower in the amended soils with low C/N ratio or both low C/N and C/P ratios. The pH decrease was the greatest on day 21. Reducing the C/N ratio of eucalyptus, wheat, and sawdust did not influence soil pH compared to the soils with original residues. The greatest increase in soil pH occurred after water hyacinth addition as it is easily mineralized (i.e. low C: N) and had the highest potential alkalinity than either wheat. Ash alkalinity should be considered a coarse indicator of pH change see (table. 4.1)

Table 4.1: Effect of different crop residue in soil pH on different days.

Treatment			**pH**		
	1 Day	**15 Day**	**30 Day**	**42 Day**	**70 Day**
Control (T1)	5.6	5.6	5.7	5.7	5.6
soil+ RS (T2)	5.4	5.5	5.8	6.1	6.2
Soil+ WS (T3)	5.5	5.6	5.8	6	5.7
soil+ *E. crassipe*,(T4)	5.6	5.8	6	6.2	5.8
Soil + RS+ *E. crassipe* (T5)	5.5	5.7	5.9	6.1	6.2
Soil+ WS + *E. crassipe* (T6)	5.6	6.1	6.2	6.4	6.3
Soil+ WS + RS+ *E. crassipe* (T7)	5.7	6.2	6.4	6.5	6.6
SE(mean)	0.1	0.0	0.1	0.1	0.1
CD	0.1	0.1	0.2	0.3	0.2
CV (1%)	1.4	1.3	1.5	2.6	1.6

The organic carbon from the residue treatment improved the soil pH status by increasing the soil buffer capacity. The rice straw +wheat straw + *E. crassipe* straw specifically increased the soil pH more than other residue treatment. The soil cation exchange capacity was also significantly (<0.01) higher when soil was treated with crop residue than, when the soil was not treated with residue. The highest organic matter levels of the residue treated treatment and their improved soil pH status and buffer capacity accounted for the higher cation status as a similar result was found by (Ogbodo E.N**.,** 2011). The change of soil chemical properties with rice straw with cutting height are shown in Cation exchangeable capacity (CEC), and content of available silicate, and organic matter decreased with rice straw retention. It is thought that application of organic matter will increase the holding capacity of nutrient due to the CEC increment. Organic matter contains trace element and nitrogen, phosphate, potassium, and the like. It has the function of nutrient supply and the buffering capacity of soil. Phosphate solubility increased according to high content of organic matter in soil. Salinity increased then EC is also increased similar result are found by (Stemmer *et al*., 1999) [9].

Soil EC on days 1, 15, 30, 42 and 70 incubation the soils without residues (T1)and amended with Compared to the control (p<0.01) increased soil EC by wheat straw (T3), rice straw (T2) and *E. crassipe* straw (T4) at 1 day incubation and slowly increasing rate as at 15 day all the treatment, after 27-30 day rice straw +wheat straw+ *E. crassipe* straw (T7) and wheat straw + *E. crassipe* straw (T6) increased at 30 day *E. crassipe* straw (T4) high EC 0.44 dSm^{-1},at 42 day rice straw +wheat straw + *E. crassipe* straw (T7) EC significantly increased 0.53 dSm^{-1} and 70 day incubation rice straw+ wheat straw+ *E. crassipe* straw (T7) 0.54 dSm-1, *E. crassipe* (T4) 0.53 dSm^{-1} EC significantly increased and also slow increasing other T6, T3,T2 and T5 treatment(table.4.2).

Table 4.2: Effect of different crop residue in soil EC on different days**.**

Treatment			**EC (dSm^{-1})**		
	1 Day	**15 Day**	**30 Day**	**42 Day**	**70 Day**
Control (T1)	0.27	0.29	0.30	0.34	0.33
soil+ RS (T2)	0.35	0.38	0.39	0.40	0.41
Soil+ WS (T3)	0.36	0.39	0.41	0.43	0.43
soil+ *E. crassipe*,(T4)	0.34	0.39	0.44	0.49	0.53
Soil + RS+ *E. crassipe* (T5)	0.31	0.33	0.37	0.39	0.40
Soil+ WS + *E. crassipe* (T6)	0.30	0.33	0.40	0.44	0.45
Soil+ WS + RS+ *E. crassipe* (T7)	0.30	0.37	0.44	0.53	0.54
SE(mean)	0.02	0.02	0.01	0.02	0.02
CD	0.05	0.05	0.04	0.07	0.05
CV (1%)	8.51	8.72	5.52	8.77	6.00

In general, the addition of the organic amendments had a noticeable effect on soil organic carbon contents. Soil organic carbon as days 1, 15, 30, 42 and 70 incubation addition of different type residues (wheat straw, rice straw and *E. crassipe* straw) For mineralized C:N ratio of residues are more effective low C:N ratio residue are easily mineralized. Carbon and nitrogen mineralization are the main processes regulating the availability of nutrients for plants and the release of toxic compounds. Although soil microbial biomass usually comprises only about 1–3% of total soil organic carbon, it has been recognized as the driving force for mineralization ofResidues in soil (Abaye and Brookes, 2006) [2].

At the 1 day incubation the soils without residues (T1) and amended with Compared to the control (p<0.01) at 1 day *E. crassipe.* (T4) adding soil significantly increased the organic carbon 0.40%/kg soil and all treatment are slow increased organic carbon, at 15 day wheat straw (T3) 0.46%/kg soil, wheat straw + *E. crassipe* straw (T6) 0.45%/kg soil organic carbon and *E. crassipe* straw (T4) 0.38%/kg soil *E. crassipe* straw OC decrease at 15 day other treatment significantly increase at the first day. At 30 day total soil organic carbon, it has been recognized as the driving force for mineralization of all residues in soil at this day more mineralized treatment was wheat straw + *E. crassipe* straw (T6) treatment 0.58%/kg soil and T2,T3 and T7 mineralized organic carbon percent was 0.53, 0.55 &0.49%/kg soil.T4 treatment increase organic carbon at the day of 15,T4 treatment was similarly increased at 42 day and last 70 day T4 treatment increased soil organic carbon 0.55%/kg of the soil. Wheat straw + *E. crassipe* straw (T6) adding soil organic carbon at 30 day incubation soil organic carbon increased 0.58%/kg soil and at 42 day the soil organic carbon decreased, 70 day also increased the organic carbon rice straw (T2) and wheat straw (T3) are significantly increased soil organic carbon at 42 to 70 day incubation the highest organic carbon rice straw & wheat straw given 0.68%/kg and 0.69%/kg soil organic carbon. T4, T5 and T7 treatment organic carbon decreased at the day 42, and at 70 day increased the T4, T5 and T7 (table. 4.3).

Table (4.3): Effect of different crop residue in soil Organic carbon on different days.

Treatment		**Organic Carbon (%)**			
	1 Day	**15 Day**	**30 Day**	**42 Day**	**70day**
Control (T1)	0.24	0.36	0.33	0.33	0.34
soil+ RS (T2)	0.24	0.38	0.53	0.47	0.68
Soil+ WS (T3)	0.32	0.46	0.55	0.65	0.69
soil+ *E. crassipe*,(T4)	0.40	0.38	0.49	0.49	0.55
Soil + RS+ *E. crassipe* (T5)	0.34	0.34	0.38	0.36	0.51
Soil+ WS + *E. crassipe* (T6)	0.34	0.45	0.58	0.52	0.55
Soil+ WS + RS+ *E. crassipe* (T7)	0.33	0.34	0.49	0.31	0.61
SE(mean)	0.02	0.03	0.04	0.02	0.05
CD	0.06	0.08	0.12	0.05	0.14
CV (1%)	10.69	11.23	14.94	7.05	13.97

The influence of crop residue treatment on soil chemical properties is presented in. Significantly (p<0.01) higher organic matter levels were detected on soil treated with rice straw (2), wheat straw (T3), *E. crassipe* straw (T4), rice straw + *E. crassipe* straw (T5), wheat straw + *E. crassipe* straw (T6) and rice straw + wheat straw + *E. crassipe* straw (T7) residue compared to the soil without residue treatment. The highest organic carbon levels on such treatment were as a result of the decomposition of the crop residue this is because organic carbon is the major product of crop residue decomposition. Such increase in organic organic carbon levels had also been associated with treating soil with crop residues reported by many researchers (Lal *et al.*, 2003) [6]. Incorporating plant residues into agricultural soils can sustain organic carbon content, improve soil physical properties, enhance biological activities and increase nutrient availability (Hadas *et al.*, 2004).

Soil respiration

During the 70 days of the incubation period, the highest absolute cumulative emission was 535.32 mg of CO2 $100g^{-1}$ of soil generated by the wheat straw+ rice straw + *E. crassipe straw* (T7) soil at 50% field capacity. Same time of incubation period cumulative emission was 415.32 mg of CO2 $100g^{-1}$ soil generated by wheat straw +*E. crassipe straw* (T6) soil at 50% field capacity. Same time of incubation period cumulative emission was 379.59 mg of CO2 $100g^{-1}$ of soil generated by the wheat straw (T3) soil at 50% field capacity. Same time of incubation period cumulative emission was 359 mg of CO2 100/g of soil generated by rice straw + *E. crassipe straw* (T5) soil at 50% field capacity and same time of incubation period cumulative emission was 340.80 mg of CO2 $100g^{-1}$ of soil generated *by E. crassipe straw* (T4) soil at same field capacity and same time of incubation period cumulative emission was 325.50 mg of CO2 100g -1 of soil generated by rice straw (T2)soil at same field capacity and without residue (T1) addition soil same time of incubation period cumulative emission was 114.25 mg of CO2 100/g at 50% field capacity. This variation is due to the organic matter content and microbial activities of soil in after ten days incubation CO2 emission is decrease of some days but cumulative CO2 emission at 21 days are increase due to the reduce the C:N ratio in soil. In the incubation before very fast decomposing rate and CO2 emission after seven-ten days decrease CO2 emission of soil. Soil CO2 efflux influenced by other factors like, the root respiration (Kutsch *et al.*, 2001) and comprises total soil CO2 efflux, and plants continuously excrete exudates into the soil (fig.1).

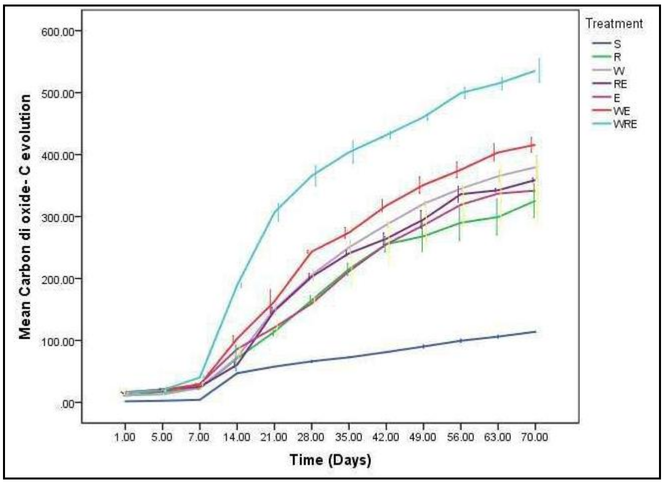

Fig 1:CO2 emission of 70 days incubation in different type crop residues

Represent cumulative CO2 evolution curves obtained from the seven soils treated with the equivalent of 4 and 40 tons per acre, respectively, of finely ground hay having a C/N ratio of *E. crassipe* (36:1), wheat straw (64:1) and rice straw (47:1). At the lower level of residue addition, no effect due to the added nitrogen was observed for the soil, however, which is low in organic matter, had a net decrease of CO2 evolution. The decomposition reactions occurring in the 4-tons-per-acre-of-each treatment were practically completed in all soils by the end of 70 days with approximately 535.32 mg of CO2 100g -1 soil, of the carbon of the residue evolved as CO2 as similar result was found by (ShuKee L. *et al.* 2002).

Catalase activity

The activity of soil enzymes provides an integrative measure of the biological status of the soil (Li *et al.*, 2005). Catalase is an intracellular enzyme that is in all aerobic bacteria and most facultative anaerobes in the soil (Khan *et al.*, 2007).catalase activity of added plant residues was determined on the basis of net cumulative catalase C mineralization activity. The C mineralization activity from *E. crassipe* straw (T4) and wheat straw(T3) throughout the incubation ranging from 23.36 to 37.33 mgkg-1 for wheat straw + *E. crassipe* straw (T5) 22.93 TO 37.3 mgkg-1(fig.5).Considering the cumulative catalase activity at the end day 70. However, the C catalase activity from wheat straw and rice straw + *E. crassipe* (T6), wheat straw (T3) C mineralization activity at day 1 to21 are positively but after 28 to 35 day response to slow mineralized values throughout the incubation and after 42 to 70 day increase the C mineralization. Rice straw + *E. crassipe* straw (T6),C mineralization activity 22.2 to 34.43 mgkg-1, rice straw at 1 day to 7 day 21.33 to 25.3 mgkg-1 C mineralized and 14 to 49 day 31.83 to 37.03 C mineralization are fast and after 56 to 70 day the C mineralized process are decrease, and *E. crassipe* straw (T4) was that day C mineralization at the day 1 to 49 are 22.2 to 37.3 mgkg-1 of the soil after 56 to 70 day the C mineralization are decrease 36.96 to 34.43 mgkg-1 soil carbon mineralization see(fig.2).

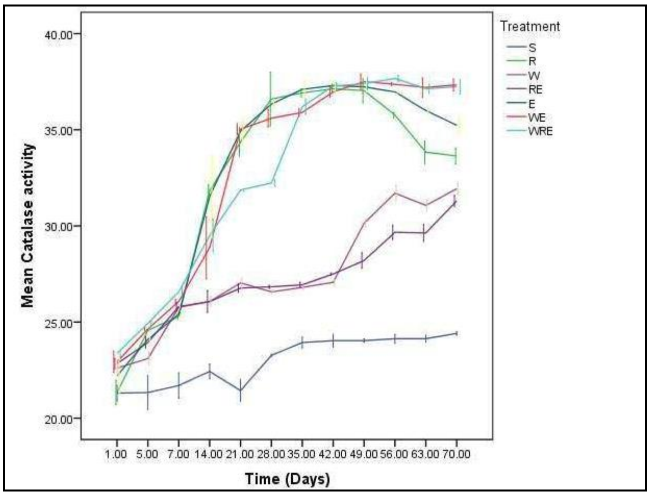

Fig 2: Effect on Catalase activity 70 days incubation in different type crop residues**.**

Catalase is an intracellular enzyme that is in all aerobic bacteria and most facultative anaerobes in the soil (Khan *et al*. 2007). Our results showed increased catalase activity 7 days the addition of residues and at the days 49 catalase activity are decrease, rice straw catalase activity are increase significantly at the day 42 after then this catalase activity are decrease at last 70 day(fig.4.5). Similarly, Xiong *et al*., 2013) showed that catalase activity significantly increased in soils treated with pyrimorph for 35 days. However, the application of validamycin at 240 ml mg -1 caused a significant decrease (14%) in soil catalase compared with the control. The increase in catalase activity is contrast to the increase in populations of cultural microbial organisms in the present study. Microorganisms in the soil may change their metabolic activity in response to the contamination of fungicide in the soil ecosystem (Tejada *et al*., 2009) [10].

Summary and Conclusion

Cumulative CO2 evolution curves obtained from the seven soils treated with the equivalent of 4 and 40 tons per acre, respectively, of finely ground hay having a C/N ratio of *E. crassipe* (36:1), wheat straw (64:1) and rice straw (47:1). At the lower level of residue addition, no effect due to the added nitrogen was observed for the soil, however, which is low in organic matter, had a net decrease of CO2 evolution. The decomposition reactions occurring in the 4-tons-per-acre-of-each treatment were practically completed in all soils by the end of 70 days with approximately 535.32 mg of CO2 $100g^{-1}$ soil, of the carbon of the residue evolved as CO2. Catalase is an intracellular enzyme that is in all aerobic bacteria and most facultative anaerobes in the soil. Our results showed increased catalase activity 7 days the addition of residues and at the days 49 catalase activity are decrease, rice straw catalase activity are increase significantly at the day 42 after then this catalase activity are decrease at last 70 day (fig.5).Showed that catalase activity significantly increased in soils treated with pyrimorph for 35 days. However, the application of validamycin at 240 ml mg^{-1} caused a significant decrease (14%) in soil catalase compared with the control.

Physicochemical properties and carbon di-oxide -C evolution (soil respiration) were significantly affected by variation in different crop properties in soil. In this study it has been found that organic carbon status of soil, pH and EC affects carbon di-oxide evolution. Rice straw +wheat straw +*E. crassipe* treatment shows high soil respiration in different as compared to soil of. So rice straw +wheat straw + *E. crassipe* favor microbial community may be due to secretion of favorable. Crop C/N ratio and ash content have a significant relationship with soil respiration as it is affects soil mineralization of organic carbon.

Reference

1. Anikwe AN, Mbah CN, Ezeaku PI, Onyia VN. Tillage and plastic mulcheffects on soil properties and growth and yield of cocoyam (*Colocasiaesculenta)* on an altisols in south eastern Nigeria. Soil and Tillage Research. 2007; 9(3):264-273.
2. Abaye DA, Brookes PC. Relative importance of substrate type and previous soilmanagement in synthesis of microbial biomass and substrate mineralization. European Journal of Soil Science. 2006; 57(8):179-189.
3. Cabrera F, Mareschal L, Turpault MP, Leclerc E. Rapid clay weathering in therhizosphere of Norway spruce and oak in an acid forest ecosystem. Soil Science Society of American Journal. 2003; 73(1):331-338.
4. Carter MR, Gregorich EG. Carbon and nitrogen storage by deep-rooted tall fescue (*Lolium arundinaceum*) in the surface and subsurface soil of a fine sandy loam in eastern Canada. Agriculture, ecosystems & environment. 2008; 136(1-2):125-132.
5. Cohen WB, Goward SN. Landsat's role in ecological applications of remote sensing. AIBS Bulletin. 2004; 54(6):535-545.
6. Jin HY, Renkou X, Wei O, Wang H. Comparison of the ameliorating effects on anacidic ultisol between four crop straws and their biochars. Agricultural. National Agricultural Research Centre, China. 2005; 4(7):54-96.
7. Kuzyakov Y, Gavrichkova O. Time lag between photosynthesis and carbon dioxideefflux from soil: A review of mechanisms and controls. Global Change of Biology. 2010; 16(12):3386-3406.
8. Hinsinger P. Bioavailability of soil inorganic P in the rhizosphere as affected by root-induced chemical changes: a review. Plant and soil. 2001; 237(2):173-195.
9. Hadas C, Madejion E, Cabrera F. Changes in soil organic matter, enzymatic activity and heavy metal availability induced by application of organic. Journal of Natural Agrobiology. 2008; 10(52):41-80.
10. Kanwar JS, Kampen J, Virmani SM. Management of vertisols for maximising crop production-ICRISAT experience. 1982.
11. Khan SA, Mulvaney RL, Ellsworth TR, Boast CW. The myth of nitrogen fertilization for soil carbon sequestration. Journal of Environmental Quality. 2007; 36(6):1821-1832.
12. Lal KD, Patel RK, Yadav DS. Comparative evaluation of guava selections undernorth eastern region of India. Journal of Horticulture. 2003; 73(5):99-103.
13. Lai L, Zhao X, Jiang L, Wang Y, Luo L, Zheng Y *et al*, Soilrespiration in different agricultural and natural ecosystems in an arid region. Department of Soil and Environmental Science. 2012; 8(10):48-57.
14. Lam SK, Chen D, Mosier AR, Roush R. The potential for carbon sequestration in Australian agricultural soils is technically and economically limited. Scientific Reports, 2013; 3:2179.
15. Li CJ. Organic reactions in aqueous media with a focus on carbon−carbon bond formations: A decade update. Chemical Reviews. 2005; 105(8):3095-3166.
16. Ogbodo EN. Effect of crop residue on soil chemical properties and rice yield on an Ultisol at Abakaliki, Southeastern Nigeria. World Journal of Agricultural Sciences. 2011; 7(1):13-18.
17. Shen C, Xiong J, Zhang H, Feng Y, Lin X, Li X *et al*. Soil pH drives the spatial distribution of bacterial communities along elevation on Changbai Mountain. Soil Biology and Biochemistry. 2013; 57:204-211.
18. Sparks DL, Helmke PA, Page AL. Methods of soil analysis: Chemical methods (No. 631.417/S736 V. 3). SSSA. 1996.
19. Stemmer L, Hepler LG. The effects of water potential on some active form of, phosphorus in a calcareous soil amended with sewage sludge. Journal of Agriculture Science Management. 1999; 13(3):19-25.
20. Tejada M, Lakshmi G. Water hyacinth as a green manure for organicfarming. Department of Botany College Ulhasnagar Maharashtra India. 2009; 4(3):54 76.
21. Xiong L, Wei G, Yingiun X, Jingyan G, Siyao D. The effect of organic residue quality on growth and reproduction of a porrectodestrapezoids under different moisture conditions in a salt-affected. National Agricultural Research Centre, China. 2007; 43(1):43-76.
22. Xu C, Zhang Y, Xu X, Sha L, You G, Liu Y *et al*. Influenceof interactions between litter decomposition and rhizosphere activity on soilrespiration and on the temperature sensitivity in a subtropical montaneforest. National Agricultural Research Centre, China. 2006; 381(2):215-224.