Research Paper
Impact Factor: 3.567
Peer Reviewed Journal

IJMDRR
E- ISSN –2395-1885
ISSN -2395-1877

EFFECT OF DIFFERENT PLANT MATERIALS AND NITROGEN FERTILIZER ON PHYSICO - CHEMICAL PROPERTIES OF SOIL

Chhaya Pawar* **Manisha Shyam***

**Department of Soil Science & Agriculture Chemistry, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya Gwalior, Madhya Pradesh.*

Abstract

An investigation on "Effect of different plant materials and nitrogen fertilizer on physico - chemical properties of soil" was carried out during Rabi 2011 – 2012 at Department of Soil Science and Agricultural Chemistry, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, (M.P.). The crop residue of wheat, mustard, chickpea, cowpea & guar viz : P_1, P_2, P_3, P_4 & P_5 respectively were filled in pot at 3 percent rate of total soil used & each have two level, one of them N_0-means with out nitrogen & other one as N_1 0.2 % nitrogen. The experiment conducted was in three time replications. The crop residue reduces experiment variation. The guar crop increases maximum element while mustard minimum in effect. The result indicate that if organic matter used in combination with nitrogen fertilizer then organic carbon content of soil, total nitrogen and C:N ratio of soil increased significantly however The total nitrogen of soil decreased with length of incubation periods. The highest total nitrogen of soil was recorded with guar straw and highest C: N ratio of soil was recorded with wheat straw. pH and electrical conductivity of soil did not influenced by the application of plant material and nitrogen.

Key Words: Crop Residues, Electrical Conductivity, Organic Carbon %, C:N Ratio.

Introduction

Crop residues are produced simultaneously with food grains and have tremendous potential to be used as source of organic matter and plant nutrients. Nearly 355 million tones (Mt) of crop residues are annually produced in India of which 180 Mt can be utilized to supply approximately 3.54 Mt of plant nutrients (Hedge and Sudakar Babu 2001). Crop residues management practices influence agricultural sustainability by improving physical, chemical and biological properties of soils (Surekha *et al.* 2004). However, a better understanding of nutrient cycling and the factors governing their decomposition in soil is necessary for their utilization as source of nutrients and development of management practices for sustainable production.

With the adoption of combine harvesting in India, rice, wheat and mustard crop residues are available to the tune of 15 million tones (Mt) per annum, which are generally brunt by farmers for easy farm operations and seed bed preparation for succeeding crops (Sharma and Mishra 2001). Burning of crop residues not only results in loss of organic matter and plant nutrients, but also causes environmental pollution, fire hazards and destruction of natural fauna and flora in the soil. The adverse effect of incorporation of rice and wheat straw can be counteracted by integrating organic amendments with crop residues. The continuous recycling of crop residues with organic amendments restores the organic matter content and also supplements the nutrients pool of the soil.

The effect of crop residues or tree leaves incorporation depend upon various factor like biochemical constituents of residues, C:N ratio, physico-chemical properties of soil and environmental condition(Becker *et al.*1994).

Material and Method

The experimental soil was sandy clay loam in texture, slightly alkaline in reaction (pH 7.6), having electrical conductivity (0.34 dSm^{-1}) at 25^0C, water holding capacity of soil (24.5%), organic carbon (0.40%), total nitrogen(0.039%) and C:N ratio of soil(10.9) respectively. Plant materials farm and were air dried and ground into find powder and stored in polythene bags with proper labeling. Plant materials were analyzed for organic carbon and total nitrogen by by chromic acid titration method (wakly & black1934) and modified kjeldalhl method (Jackson 1973) and also C:N ratio of soil was computed.

The treatment consisting of 5 plant material (wheat straw, mustard straw, gram straw, cowpea stover and guar stover added @ 3% of soil on weight basis in a pot filled with 4 kg soil designated as P_1, P_2, P_3, P_4 and P_5 respectively), 2 level of nitrogen control without addition of plant material and nitrogen designated as C_0 thereby making 11 treatments replicated three times in a completely randomized design. Initially soil was brought to field capacity in all the treatments through addition of distilled water and when the water depleted to 60% again it was brought to field capacity. At an interval of 30, 60, 90 and 120 days, the soil samples were taken from each pot and filled labeled cloth bags for chemical analysis.

Result and Discussion

Effect on pH and Electrical Conductivity of Soil

The pH and electrical conductivity of soil as effected by different plant materials and nitrogen was statistically analyzed and

presented in Table 1**.** In general, increasing period of incubation decreases the soil pH and electrical conductivity. Lowest soil pH was recorded at 120 days of incubation. Similarly lowest soil electrical conductivity was also recorded at 120 days of incubation. The application of nitrogen decreased the soil pH and electrical conductivity with increasing period of incubation.

Table 1: Effect of Different Plant Material and Nitrogen Level on Ph in Soil at Different Incubation Period

Treatments	Incubation Period (Days)							
	pH				Electrical Conductivity			
	30	60	90	120	30	60	90	120
$P_1 N_0$	7.6	7.6	7.5	7.4	0.36	0.36	0.36	0.35
$P_1 N_1$	7.6	7.6	7.6	7.5	0.35	0.35	0.34	0.34
$P_2 N_0$	7.6	7.6	7.4	7.3	0.34	0.34	0.34	0.33
$P_2 N_1$	7.6	7.6	7.5	7.4	0.36	0.37	0.35	0.35
$P_3 N_0$	7.7	7.6	7.3	7.4	0.35	0.34	0.34	0.33
$P_3 N_1$	7.6	7.6	7.6	7.4	0.36	0.35	0.35	0.36
$P_4 N_0$	7.7	7.6	7.4	7.4	0.34	0.35	0.33	0.33
$P_4 N_1$	7.6	7.6	7.5	7.4	0.36	0.36	0.35	0.34
$P_5 N_0$	7.5	7.5	7.5	7.5	0.35	0.35	0.36	0.35
$P_5 N_1$	7.6	7.6	7.4	7.3	0.36	0.35	0.36	0.35
CD(5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Control	7.6	7.6	7.7	7.6	0.34	0.36	0.35	0.34
Rest	7.6	7.6	7.5	7.4	0.35	0.35	0.35	0.34
CD(5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Mean								
P_1	7.6	7.6	7.5	7.5	0.35	0.35	0.35	0.34
P_2	7.6	7.6	7.5	7.4	0.35	0.35	0.35	0.34
P_3	7.7	7.6	7.4	7.4	0.35	0.34	0.35	0.34
P_4	7.6	7.6	7.4	7.4	0.35	0.35	0.34	0.34
P_5	7.6	7.5	7.5	7.4	0.36	0.35	0.36	0.35
CD(5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
N_0	7.6	7.6	7.4	7.4	0.35	0.35	0.34	0.34
N_1	7.6	7.6	7.5	7.4	0.36	0.35	0.35	0.35
CD(5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Organic Carbon Content (%) in Soil

The soil organic carbon and total nitrogen content as effected by different plant materials and nitrogen is given in Table 2.

Table 2: Effect of Different Plant Material and Nitrogen Level on Organic Carbon (%) in Soil at Different Incubation Period

Treatments	Incubation Period (Days)							
	Organic Carbon (%)				Total Nitrogen (%)			
	30	60	90	120	30	60	90	120
$P_1 N_0$	0.45	0.44	0.44	0.43	0.036	0.037	0.043	0.042
$P_1 N_1$	0.48	0.46	0.44	0.44	0.038	0.039	0.041	0.045
$P_2 N_0$	0.49	0.46	0.44	0.42	0.046	0.044	0.043	0.042
$P_2 N_1$	0.49	0.46	0.43	0.42	0.048	0.045	0.044	0.044
$P_3 N_0$	0.51	0.48	0.45	0.43	0.051	0.052	0.051	0.052
$P_3 N_1$	0.52	0.48	0.46	0.44	0.056	0.055	0.053	0.052
$P_4 N_0$	0.5	0.46	0.42	0.45	0.052	0.049	0.049	0.048
$P_4 N_1$	0.52	0.48	0.44	0.44	0.054	0.052	0.052	0.052
$P_5 N_0$	0.52	0.5	0.46	0.44	0.057	0.054	0.053	0.053
$P_5 N_1$	0.52	0.5	0.46	0.46	0.063	0.059	0.057	0.056
CD(5%)	-	-	-	-	**NS**	**NS**	**NS**	**NS**
Control	0.40	0.40	0.40	0.40	0.039	0.039	0.039	0.039
Rest	1.00	0.97	0.95	0.93	0.050	0.049	0.049	0.049

CD(5%)	**0.04**	**0.03**	**0.03**	**0.02**	**0.003**	**0.003**	**0.004**	**0.003**
Mean								
P_1	1.05	0.99	0.97	0.96	0.037	0.039	0.042	0.044
P_2	1.02	0.98	0.97	0.95	0.047	0.045	0.044	0.043
P_3	0.98	0.96	0.93	0.91	0.054	0.054	0.053	0.052
P_4	1.03	0.99	0.97	0.95	0.054	0.051	0.051	0.050
P_5	0.93	0.91	0.89	0.87	0.060	0.057	0.056	0.055
CD(5%)	**0.04**	**0.03**	**0.03**	**0.02**	**0.003**	**0.002**	**0.003**	**0.003**
N_0	0.99	0.96	0.93	0.91	0.049	0.047	0.048	0.048
N_1	1.01	0.97	0.96	0.94	0.052	0.050	0.050	0.050
CD(5%)	**NS**	**NS**	**0.02**	**0.01**	**0.002**	**0.002**	**NS**	**0.002**

The data showed that the soil organic carbon content of soil was less in clusterbean stover (0.93%) where as the highest organic carbon was recorded with wheat straw (1.05%) used as plant materials. wheat straw amended soil had highest organic carbon content due to it's wide C:N ratio, being above critical point, wheat straw decomposed very slowly resulting in high carbon content in the soil data also showed that organic carbon content decreases with the addition of each plant material and application of nitrogen fertilizer.

The total nitrogen content of soil was found to be significantly higher in all the treatments than control at all the stages of incubation. Total nitrogen content (%) decreased with the length of incubation in all the treatments except wheat straw. The highest total nitrogen content (0.060%) was recorded with the addition of clusterbean stover. However, the minimum value was recorded with wheat straw (0.037%).The total nitrogen content (%) in soil significantly affected by the application of nitrogen (1.2%) at all the incubation period except 90 DAI (days after incubation). Total nitrogen content was also decreases with the length of incubation period. The interaction effect of plant materials and nitrogen showed non-significant in 90 DAI.

C:N Ratio of Soil

The data pertaining to C:N ratio due to addition of plant materials and nitrogen application is presented in table 3. Data revealed from the table that addition of plant materials and nitrogen significantly influenced the ratio of the soil. As evidence by the C:N ratio the rate of decomposition was lower in wheat straw followed by cowpea, mustard, gram and clusterbean stover, respectively at all the intervals of incubation period. Addition of wheat straw showed wider (30.2) C:N ratio whereas the narrower C:N ratio (16.0) was recorded with the addition of clusterbean stover, during all the incubation period.

Application of nitrogen @ 1.2% also significantly affect the C;N ratio of the soil. The C:N ratio significantly decrease with 1.2% nitrogen application up to 120 DAI.

References

1. Becker, M., Ladha, J.K., Simpson, I.C. and Ottow, J.C.G.(1994) Parameters affecting nitrogen mineralization of flooded soil. *Soil science society of American journal* **58**:1666-1671.
2. Hedge, D.M. and Sudakarbabu, S.N.(2001) Nutrient management strategies in agriculture – A future and look. *Fertiliser News* **46**: 61-72.
3. Jackson, M.L. (1973) Soil Chemical Analysis. *Prentice Hall of India Pvt. Ltd. New Delhi.*
4. Janzen, H.H. and Kucey, R.M.N. (1988) C, N and S mineralization of crop residues as influenced by crop species and nutrient regime. *Plant and soil* 106, 35-41. Sharma, P. K. And Mishra, B. (2001) Effect of burning rice and wheat crop residues: Loss of N, P, K and S from soil and changes in nutrient availability. *Journal of the Indian Society of Soil Science* **49** (4): 425 - 429.
5. Surekha, K., Reddy, M.N., Rao, K.V. and Sta-Cruz, P. (2004) Evaluation of crop residues management practices for improving yields, nutrient balance and soil health under intensive rice-rice system. *Journal of the Indian Society of Soil Science* **52** (4): 448 – 453.
6. Walkley, A. J. And Black, I.A. (1934) An estimation of degtraref method for determination soil organic matter and proposed modification of chromic acid titration method. *Journal of Soil Science* **37**: 29.

Table 3: Effect of Different Plant Material and Nitrogen Level on C:N in Soil at Different Incubation Period

Treatments		**Incubation period(Days)**		
	30	**60**	**90**	**120**
$P_1 N_0$	31.60	27.00	22.10	23.60
$P_1 N_1$	28.80	27.40	24.70	22.50
$P_2 N_0$	23.13	22.70	22.40	23.40
$P_2 N_1$	22.20	22.80	22.40	22.20
$P_3 N_0$	19.70	19.30	18.50	18.10
$P_3 N_1$	17.20	18.00	17.60	18.50
$P_4 N_0$	20.40	21.00	20.80	20.20
$P_4 N_1$	19.70	19.80	19.60	20.70
$P_5 N_0$	16.00	16.66	16.20	15.80
$P_5 N_1$	16.10	16.70	16.30	16.70
CD(5%)	**0.55**	**0.60**	**0.71**	**0.84**
Control	10.9	10.9	10.9	10.9
Rest	21.4	21.1	20.0	20.1
CD(5%)	**0.41**	**0.45**	**0.53**	**0.62**
Mean				
P_1	30.2	27.2	23.4	23.0
P_2	22.6	22.7	22.4	22.8
P_3	18.4	18.6	18.0	18.3
P_4	20.0	20.4	20.2	20.4
P_5	16.0	16.6	16.2	16.2
CD(5%)	**0.39**	**0.42**	**0.50**	**0.59**
N_0	22.1	21.3	20.0	20.2
N_1	20.8	20.9	20.1	20.1
CD(5%)	**0.24**	**0.27**	**0.32**	**0.37**