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Effect of Tillage Practices and Nitrogen Rates on the Organic Matter (%) and N (%) Content in Soil

[1]M.S. Akter, [2]M.F. Hossain, [3]U.K. Majumder [4]M.S.I. Sikder and [5]M.M.A.A. Chowdhury
[1]Soil Analysis Division, Bangladesh Rural Advancement Committee (BRAC), Bangladesh
[2 & 4]Department of Agronomy and [3]Department of Statistics,
Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh
[5]Soil Resources Development Institute (SRDI), Dinajpur, Bangladesh

Abstract: An experiment was conducted to study the effect of tillage practices and nitrogen rate on organic matter and total %N content in Soil. Tillage and nitrogen had significant positive impact on organic matter and nitrogen content in Soil. Maximum organic content (0.69%) was measured in no tillage treatment (T_0) at surface layer and the highest total nitrogen content (0.163%) was recorded by 10 cm deep tillage (T_1) at surface layer. Maximum organic matter content (0.63%) and total nitrogen (0.176%) was observed at surface layer with the application of 105 kg N ha^{-1}. The interaction effect of tillage and nitrogen on organic matter content was not statistically significant. the highest organic matter content (0.71%) was measured in no tillage with higher rates of nitrogen (105 kg N ha^{-1}). Maximum nitrogen content (0.181%) was found by T_1N_3 treatment at 0-10 cm depth.

Key words: Tillage, nitrogen rates, organic matter, %N content, soil

INTRODUCTION

Tillage is the oldest and most fundamental activity of human being for crop production. Different tillage operations may influence organic matter, nitrogen content and other physical properties of soil (Singh *et al*., 1996). The organic matter content of the soil improves the biological and chemical capacities of the soil. Growth promoting substances and enzymes induce crop growth and yield and improve the quantity of the produce. The organic combination of nitrogen with organic matter in the soil constitutes the major store-house from which nitrogen is slowly made available to the crop. Tillage treatment significantly influenced the organic matter content of the soil upto a depth of 0-30 cm (Rahman, 1977). Different application rates of nitrogen influenced on the total %N content in soil. Nitrogen plays the key role in plant nutrient and its management practices is an extremely important aspect for crop production. Out of all nutrients the requirement of N for plant is far more than other elements (Gill *et al.,* 1978). The soils of tropical and sub tropical zones including all agro-ecological regions of Bangladesh are seriously deficient in nitrogen. This may be due to low level of organic matter and continuous cropping with little or no nitrogen fertilizer application. Therefore organic matter and nitrogen in soil could be increased by proper tillage operation along with optimum N application.

MATERIALS AND METHODS

The experiment was conducted at the Bangladesh Agricultural University Farm, Mymensingh during aman season, 1998. The soil was sandy loam having pH 6.9. The experiment was laid out in split-plot design with three replications. Three tillage treatments arranged to the main-plot and four nitrogen rates to the sub-plots. Three tillage practices, four nitrogen levels were used in this study (Table 1). The unit plot size was 4.0x2.5m. The experimental aman rice CV. Binashail plots were fertilised P_2O_5 @ 40 kg ha^{-1} K_2O @ 33 kg ha^{-1} with TSP and MP during final land preparation. Urea was top dressed in three installments after 10, 25 and 40 days after transplanting. The soil samples were taken from three different depth and spots at the area to make a composit soil sample before transplanting and after harvest. The samples were air dried and ground to pass through a 2 mm (10 mseh) sieve. The ground sample were stored in clean plastic containers for chemical analysis. The soil sample were analysed for the determination of nitrogen content in the laboratory of Soil Science Depaartment, Bangladesh Agricultural University, Mymensingh. Nitrogen contents of the soil were determined by modified Kjeldahl method after digestion with cone. H_2SO_4, catalyst mixture (K_2SO_4 + $CuSO_4$, $5H_2O$ + Sc powder, 100:10:1) and H_2O_2 and then distillation with 10 N NaOH solution. The ammonia distilled over was absorved in H_3BO_3 indicator solution

and titrated with 0.01 N H_2SO4 (Jackson, 1973). The results were expressed in percentage. Wet oxidation method was followed to determine percentage of organic carbon as described by Black (1965) and the organic matter content was calculated by multiplying the %organic carbon with Van Bemmelen factor 1.73 (Piper, 1950).

RESULTS AND DISCUSSION

Organic matter content: Organic matter content in soil was statistically significant due to different tillage practices (Table 1). Tillage operations changed organic matter content in soil at different depth. Maximum organic matter content (0.69%) was measured under no tillage (T_0) at 0-10 cm soil depth. Minimum organic matter content (0.24%) was found by 20 cm deep tillage (T_2) treatment at 20-30 cm depth. Deep tillage favoured for rapid decomposition of organic matter than no tillage. Decomposition rate of organic matter was reduced by no tillage as a result organic matter content becomes high under no tillage. The result was supported by Agenbag and Maree (1989) and Boyle *et al.* (1989). Also reported that no tillage and to a lesser extent shallow tine tillage tended to increase organic carbon contents in the 0-10 cm soil profile. Rahman (1997) reported that tillage operation significantly influenced the organic matter content of the soil upto a depth of 0-30 cm and highest organic matter content was measured by no tillage operation. The interaction effect of tillage and nitrogen on organic matter content was not statistically significant (Table 2). The highest organic matter content (0.71%) was measured in no tillage with higher rates of nitrogen (105 kg N ha^{-1}) and the lowest (0.22%) in deep tillage with no nitrogen application.

Total nitrogen content in soil: Total nitrogen content in soil was not statistically significant due to tillage operation (Table 1).Total nitrogen content in soil statistically significant due to different application rates of nitrogen (Table 1) and combined effect of tillage and nitrogen (Table 2). The highest N content (0.176%) was observed by highest levels of nitrogen (105 kg N ha^{-1}) at surface soil and the lowest (0.02%) was recorded under control (N_0) at 20-30 cm soil depth. This result was supported by Chowdhury (1992). He reported that total nitrogen content decreased with increasing the depth of soil. Bhuiyan (1988) reported that total nitrogen percentage of different soil series of Bangladesh ranged from 0.05-0.22%. Maximum N content (0.18%) was found by T_1N_3 combined treatment at 0-10 cm depth and the minimum value (0.02%) was observed under T_0N_0 treatment at 20-30 cm soil depth.

Table 1: Effect of tillage practice and nitrogen rates on the organic matter (%) and N (%) content in soil

	Organic matter content (%) Depth of soil			Nitrogen content (%) Depth of soil		
Treatment	0-10 cm	10-20 cm	20-30 cm	0-10 cm	10-20 cm	20-30 cm
Tillage practices						
T_0	0.69a	0.50a	0.37a	0.162	0.092	0.027a
T_1	0.66b	0.48b	0.31b	0.163	0.104	0.028a
T_2	0.51c	0.44c	0.24c	0.162	0.103	0.031a
CV (%)	0.1.62	2.11	3.26	6.13	3.16	10.90
Nitrogen rates						
N_0	0.61b	0.46b	0.28d	0.149b	0.060b	0.022b
N_1	0.61b	0.46b	0.30c	0.158b	0.077c	0.028ab
N_2	0.63a	0.48a	0.31b	0.168ab	0.120b	0.030ab
N_3	0.63a	0.49a	0.33a	0.176a	0.141a	0.036a
CV (%)	3.07	2.29	3.22	0.69	4.65	9.58

In a column, means having similar letter (s) do not differ significantly at 5% level of probability.
T_0 = no tillage, T_1= tillage unto 10 cm and T_2= tillage upto 20 cm depth.
N_0= no nitrogen, N_1= 35 kg Nha^{-1}, N_2= 70 kg Nha^{-1} and N_3=105 kg Nha^{-1}

Table 2: Interaction effect of tillage practices and nitrogen rates on the organic matter (%) and N (%) content in soil

	Organic matter content (%) Depth of Soil			Nitrogen content (%) Depth of Soil		
Treatment combinations	0-10 cm	10-20 cm	20-30 cm	0-10 cm	10-20 cm	20-30cm
T_0N_0	0.68	0.49	0.34	0.153dc	0.063cd	0.021
T_0N_1	0.68	0.49	0.36	0.158b-c	0.670cd	0.027
T_0N_2	0.70	0.51	0.38	0.167a-d	0.109b	0.029
T_0N_3	0.71	0.51	0.39	0.172a-c	0.127b	0.032
T_1N_0	0.62	0.47	0.29	0.147c	0.058d	0.021
T_1N_1	0.64	0.47	0.30	0.157cdc	0.079c	0.027
T_1N_2	0.69	0.49	0.32	0.169a-d	0.127b	0.029
T_1N_3	0.67	0.50	0.34	0.181a	0.151a	0.036
T_2N_0	0.51	0.43	0.22	0.147c	0.060d	0.024
T_2N_1	0.50	0.43	0.23	0.158bcdc	0.081c	0.030
T_2N_2	0.51	0.45	0.25	0.168a-d	0.125b	0.032
T_3N_3	0.50	0.45	0.27	0.176ab	0.146a	0.039
CV (%)	3.07	2.29	3.22	0.69	4.63	9.58

In a column, means having similar letter (s) do not differ significantly at 5% level of probability.

The highest %N content (0.163) was recorded by 10 cm deep tillage (T_1) at 0-10 cm soil depth and lowest %N content (0.027) was observed by no tillage (T_0) at 20-30 cm depth.

So, it was concluded that the organic matter content of soil statistically significant due to different tillage practices but not due to different level of nitrogen. Total nitrogen content in soil was statistically significant due to different application rates of nitrogen but not due to tillage practices.

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