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Impact of Crop Residues on Soil Organic Matter Content and the Production of Late Jute Seed

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Abstract: An investigation was undertaken to evaluate the impact of different crop residues on late jute seed yield and organic matter content of soil. The plant height, number of branch/plant, number of pod/plant, number of seeds/pod and seed yield/plant were significantly increased with different crop residues. The performance in seed yield were dry jute leaves (89.30%) > lentil straw (87.77%) wheat straw (43.28%) > compost (35.35%) > rice straw (32.740%) > saw-dust (16.91%) over the control. The resources increased the soil organic matter content in soil by 24.59, 22.92, 26.22, 19.67, 29.51 and 30.33% respectively over the control indicating the enrichment of soil health. In correlation studies it was observed that the jute seed yield parameters, the seed yield was highly correlated with plant height, number of branches/plant and number of pods/plant.

Key words: Crop residue, organic matter, late jute seed

Introduction

It has been observed in upland soils that there is a declination of organic matter content from 9.0 to 32.56%(Karim *et al*., 1995) due to increase in cropping intensity with HYV and chemical fertilizers. To conserve soil productivity it is needed to replenish organic manures for getting sustainable yield. To sustain soil productivity, it is essential to add a lot of organic matter along with chemical fertilizers to the soil (Rabindra *et al*., 1985; Bhatia and Shukla, 1982). From the successful soil and crop management practices the maximum crop yield may be obtained. The farmers may make the appropriate modifications and adjustments in their practices to obtain economically and environmentally sustainable yield levels (Beaton *et al*.,1992).

Organic matter content is considered as an indicator of soil health (Varvel, 1994).Incorporation of organic manures was found to influence favourably the bulk density, porosity and hydraulic conductivity of soil and to maintain its organic carbon level (Barathi *et al*., 1974; Halkiah *et al*., 1981; Robindra *et al*., 1985). In view of intensive cropping, the use of high yielding varieties and high cost of mineral fertilizers, it has become imperative to recycle organic resources for maintenance of soil health and crop productivity (Gaur, 1985). There is a dearth shortage of jute seed in Bangladesh. The country produces only 15.65% of country's need of jute seed which is being met up by BADC (Anonymous, 1999). Generally the farmers produce jute seed by themselves and if they can use their local organic resource in jute seed production it would help them in reducing the cost of production and to attaining self sufficiency in a large extent. Considering the above factors the present investigation was undertaken to study the effect of different organic resources on (1) soil organic matter content and (2) yield of late jute seed production.

Materials and Methods

A four year investigation was carried out at Bangladesh Jute Research Institute's green house during 1996-1999. The Tejgaon sandy loams were collected and filled in size of 6"X8"X9" earthen pot having 10 kg soil.

The collected organic materials were grinded and thoroughly incorporated to the soil at the rate of 250 g pot and a set of recommended dose of fertilizers (200-100-40-100-22-10 as urea-T.S.P- MP-gypsum-zinc sulphate-borax kg ha^{-1}) were applied.

Each treatment was replicated three times in CRD. Half of the urea and full dose of TSP, MP, zinc sulphate and borax was applied at the time of sowing. The rest half of urea was splitted twice and applied at 25 and 45 days after of sowing respectively. Twenty five healthy seeds of *Corchorus olitorius* variety 0-9897 were sown in each pot in the first week of September in each year. After germination and cultural practices only three plants per pot were allowed to grow. All the intercultural operations were done in time. When 80% of pods became brownish in colour, the crop was harvested, The pods and seeds were dried in the air and cooled in desiccators. The data of different parameters of jute seed yield e.g., plant height, number of branch per plant, pod length, number of seed per pod, 1000 seed wt and seed yield were recorded. The seed yield per plant was determined from the average of 4 years and were analyzed. Initial and final (after 4 years) soil samples were also collected and processed for chemical analysis. Crop residue samples were collected during harvest and saw-dust from a saw mill. The organic resources were digested with nitric per chloric acid (5:1) for P, K and S. These elements were analyzed after Hunter (1984). Nitrogen was determined by Microkjeldahl method as described by Jackson (1973) and organic carbon was determined by Wet oxidation method by Walkley and Black (1934). Statistical analysis were done after Gomez and Gomez (1983).

The details of the treatments were as following:

Control (T_1)	Dry Jute leaves (T_5)
Lentil straw (T_2)	Saw-dust (T_6)
Wheat straw (T_3)	RDF (Recommended dose of fertilizer) (T_7)
Rice straw (T_4)	Compost (T_8).

Results and Discussion

Initial soil nutrient status was determined (Table 2).It was observed from the cumulative data that the effect of organic matter on soil were observed markedly by all the organic sources. It was further observed that T2, T3, T4, T5, T6 and T8 increased the organic matter of soils significantly (Table 3). All the organic resources increased the organic matter content of soils over control(Table 3). The order of efficiencies of different organic resources in increasing organic matter were; saw-dust (30.33%) > rice straw (29.51%) > wheat straw (26.22%) > dry jute leaves (24.59%) > lentil straw

Table 1: Chemical analysis of rice straw, wheat straw, pulse (Lentil) straw, jute leaves, compost (General) and saw-dust.

Source	% N (total)	%P (total)	%K (total)	%S (total)
Rice straw	0.50	0.52	1.61	0.11
Wheat straw	0.63	0.54	0.86	0.15
Lentil straw	0.74	0.18	0.53	0.10
Jute leaves	2.90	0.42	3.16	0.14
Compost	0.51	0.45	0.88	0.08
Saw-dust	0.32	0.15	0.92	-

Table 2: Initial soil analysis

pH	O.M.	% N Total	P (ppm, available)	K (me%,Exchangeable)	S (ppm, available)
6.47	1.27	0.075	13.3	4.5	11

Table 3: Effect of different sources of crop residues on soil organic matter content

Treatments	% Organic matter	% O.M. increase over control
T1	1.22	-
T2	1.50**	22.92
T3	1.54**	26.22
T4	1.58**	29.51
T5	1.52**	24.59
T6	1.59**	30.33
T7	1.38	13.11
T8	1.46**	19.67

C.V.(%) 2.5 and ** indicates significant at 1% level

(22.92%) > compost (19.67%). The maximum organic matter increased of 30.33% was found by saw-dust and the minimum by compost of 19.67% (Table 3). Though saw-dust increased highest organic matter content in soils but its seed yield response was too low in comparison with others. It might be due to high C/N ratio in saw-dust. Manuel and Gines (1973) reported 3.54 to 4.24 % organic matter content of soil by incorporating green manure to soil. Meraz *et al*. (2000) reported successive green manure alone or with N fertilizer may develop significant organic matter build up in the long run.

The organic carbon of soil at harvest was increased by crop residue of jute (*Capsularis*) 25.69%, jute (*Olitorius*) 23.98%, soybean 28.47%, upland rice 23.12% and transplanted rice 23.76% over the control (Ahad, 1987). Biswas *et al*. (1971) and Pandey *et al*. (1985) also reported that the soil incorporated with maize and jower stalk, rice and wheat straw considerably increased the amount of organic matter content. Gani *et al*. (1999) reported 64% organic matter increase over control through crop residue of jute. The results of the experiments indicate that the successive use of organic resources might be a possible source of organic matter build up for maintaining good soil health.

Effect on jute seed production: The different crop residues contain a substantial amount of nutrients (Table 1). The results show that the different organic resources (Table 1) had significant effect on jute seed productivity (Table 4). Dry jute leaves produced higher seed yield (89.30%) over control. The seed yield increases by different organic sources over the control were 16.91% to 89.39%. The highest seed yield was obtained by T5 and the lowest was achieved by T1. This is in conformity with Bhat *et al*. (1991) and Motahar Hossain (1992).

Khandker *et al*. (1992) who reported that the application of organic matter in the same soil in consecutive two years improves the yield and yield contributing parameters of sugarcane in the following year. The investigation reveals the scope of producing the jute seed using local organic resources as a possible source of plant nutrients.

In the correlation co-efficient studies the seed yield was highly correlated with the plant height, number of branches per plant and the number of pods per plant (Table 5).

Positive correlation co-efficient between number of branches and number of pods and number of branches and seed yield were also reported by Talukder and Hossain (1989). Khan (1995) reported very high and positive correlation among the number of branches per plant with number of pods and seed yield.

Table 4: Effect of different sources of organic materials on late jute seed yield and yield contributing characters per plant

Tr.	Plant Height (cm)	Number of branch	Number of pod	Pod length (cm)	Pod diameter (mm)	Number of seed	1000 seed wt.(g)	Seed yield (g)
T1	48.44	1.59	7.18	5.50	4.14	160.07	1.883	2.086
T2	77.28**	3.40**	17.51**	5.10	4.20	149.81	1.907	3.917**
T3	64.77	2.89**	13.03**	6.09	4.20	178.85*	1.845	2.989* (43.28)
T4	54.52	2.18	10.63*	5.05	4.03	146.55	1.891	2.769* (32.74)
T5	109.07-**	3.44**	16.33**	5.52	4.01	167.66	1.905	3.949** (89.30)
T6	52.14	2.07	9.96	4.99	3.94	167.62	1.857	2.454 (16.91)
T7	71.07*	3.33**	13.18**	5.49	4.16	198.55**	2.073	3.410** (63.47)
T8	69.03	2.29	11.44	4.96	4.07	164.29	2.186	2.786 (33.55)
C.V.(%)	17.0	14.0	13.2	8.9	4.4	6.2	6.1	11.7

*Indicates significant at 5% and ** indicates significant at 1% level. Parenthesis indicates the percent of increase over control.

Table 5: Correlation co-efficient between plant characters of late jute seed crop

Plant characters	Number of branch	Number of pod	Pod length	Pod breadth	Number of seed	1000 seed wt.	Seed wt.
Plant height	0.801*	0.819*	0.173	0.033	0.146	0.142	0.866**
Branch	-	0.940**	0.283	0.333	0.359	0.100	0.944**
Number of pod		-	0.105	0.256	0.052	0.031	0.965**
Pod length			-	0.520	0.526	0.333	0.041
Pod breadth				-	0.211	0.060	0.189
Seed/pod					-	0.309	0.092
1000 seed wt.						-	0.111

* = Significant at $P<0.05$ ** = Significant at $P<0.01$

In conclusion it may be suggested that the different crop residues might be applied as a possible supplemental source of nutrients in the production of jute seed and nourishment of soil health.

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