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Incorporation of Inorganic Fertilizer With Poultry Manure Without Minimizing Yield of Jute

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Abstract

Appropriate inorganic fertilizer and poultry manure are important agronomic practices for optimum yield of jute. A field experiment was carried out at the Agronomy Field Laboratory, Department of Agronomy and Agricultural Extension, Rajshahi University, Rajshahi, during the period from May 2018 to September 2018 to study on "replacement of inorganic fertilizer with poultry manure without minimize yield of jute." The experiment consisted of three inorganic fertilizer levels *viz*.F_1:100% RDF, F_2: 75% RDF, F_3: 50% RDF and three poultry manure levels i.e.P_1: without poultry manure, P_2:5t ha^{-1}, P_3: 10t ha^{-1}. The experiment was laid out in a split-plot design with three replications. The results show that maximum inorganic fertilizer significantly influenced plant height (339.46 cm), TDM (65.99 g m^{-2}), CGR (60.94), leaf area (587.05 cm^2), number of leaves (30.29), canopy cover (85.24%), stem diameter (20.35mm), fibre area (4.30 mm), fibre yield (3.488 t ha^{-1}), stick yield (8.49 t ha^{-1}) and biological yield (11.98 t ha^{-1}). Considering poultry manure rates, highest plant height (330.99 cm), TDM (61.47g m^{-2}), CGR (53.01), leaf area (537.83 cm^2), number of leaf (28.97), canopy cover (82.87%), stem diameter (19.66 mm), fibre area (4.14 mm), fibre yield (3.36 t ha^{-1}), stick yield (8.11 t ha^{-1}) and biological yield (11.478 t ha^{-1}) were recorded with application of poultry manure @ 10 t ha^{-1}. The interaction between inorganic fertilizer and poultry manure was not significant. Although higher inorganic fertilizer and higher poultry manure give higher yield but our recommendation goes to medium amount of inorganic fertilizer (75% of BJRI recommendation) with maximum poultry manure (@10 t ha^{-1}) as it can produce 17% more yield than conventional practice (F_1P_1) with 25% less inorganic fertilizer. Thus we can reduce the use of inorganic fertilizer by using poultry manure.

Keywords: Total Dry Matter (TDM), CGR (Crop Growth Rate), Canopy cover, Inorganic fertilizer and Organic fertilizer.

Introduction

Agriculture, which plays a pivotal role in meeting the food demands of the growing world population, is becoming increasingly dependent on chemical fertilizers (Santos V.B. 2012), as a good correlation has been found by the application of industrially manufactured fertilizers with crop yields (Wang Q. *et al*.,2010. Zaman M. 2010). Plant growth and development necessarily depend on nitrogen as it is a crucial component of chlorophyll required for photosynthesis, nucleic acids, amino acids, proteins and some organic acids (Zhao D, 2005). However, the over application of synthetic nitrogenous fertilizers is not effective for increasing crop yields, because of higher vulnerability to nitrogen losses in the form of volatilization (emitting oxides of nitrogen), denitrification, leaching, (polluting underground water reserves), and eutrophication (polluting surface water bodies), not only increase the cost of production but also lead to serious environmental health hazards (Zhao D, 2005, Emilsson T. 2007, Chandna P.2011, Tilman D,2011)

Among organic manures, poultry manure (PM) is easily available, environment friendly, rich in nutrients with quick release, capable of increasing soil organic carbon and supplying all essential macronutrients (N, P, K, Ca and Mg) for plant growth and development (Rawat SK, 2012, Tewolde H,2005). Although organic manure has the limitations of slow release of nutrients with lesser nutrient utilization, it also has the benefits of boosting soil physiochemical processes by increasing microbial activity. Poultry manure appeared as the best source of organic manure over cowdung (Khan *et. al*.,2008). The N content of the poultry manure is in the range of 1.99 to 2.51%, with a mean of approximately2.25% Gani, N. (2015). Adekiya and Agbedi (2009) also reported that poultry manure contains about 2.25 % N. Miah *et al*., (2006) analyzed fresh poultry litter in the laboratory of

Bangladesh Rice Research Institute and found that poultry litter has N-2.25 %,P-1.88%, K-2.80%,S -0.16% and Zn-279 ppm, respectively. As nutrient rich products, the droppings need to be managed in a sustainable manner without causing environmental pollution. Poultry droppings could be used as organic manure for crops, vegetables and apiculture. Poultry manure is important for continuous supply of nutrient elements which hold a great promise as source of multiple nutrients and ability to improve the soil physical, chemical and biological properties (Agbede *et al.*,2008.) and increased the crop yield. The C:N ratio of poultry manure is narrow,(range 7.9-9.1) as reported by Hasan, M. *et al*., (2019) which probably contributes to higher mineralization (the process converting organic-N to ammonium-N) rate of N available for plant uptake (Yuan L., 2021).

Jute is an important fibre crop as well as one of the main cash crops of Bangladesh. It is considered as the golden fibre of Bangladesh. It is one of the cheapest and the strongest of all natural fibres. Bangladesh used to enjoy a monopoly position in the production and marketing of Jute during 1950's and 1960's. It is the foreign exchange earning crop of Bangladesh which plays a significant role in the national economy of the country. Bangladesh ranks first to export raw jute and second among the jute growing countries in respect to production. Other major jute growing countries of the world are India, Myanmar, China, Venezuela, Australia, Indonesia and The Philippines. Jute grows abundantly in Bangladesh having best quality in comparison with that of India Ahmed, Z., & Nizam, S. A. (2008). Total jute production in this year has been estimated at 82,46,797 bales which is 9.10% higher than that of last year. It fetched Tk. 2,939.5 crore by exporting raw jute and jute products in the last fiscal year. According to Bangladesh Bureau of Statistics (BBS), its present contribution to GDP is 4.9 percent (BBS 2016-2017).

There are many references that poultry manure improves the quality of cereal crops, fruits and fibre crops. Poultry manure with inorganic fertilizer promoted the quality of soybean over inorganic fertilizer. Zhang *et al*.,(2010) cited improve fruit quality of peach with chicken litter. The findings of Tewolde *et al.,* (2007) suggest that the effect of Poultry litter/broiler litter both sole and integrated application on cotton fibre quality (fibre strength, elongation, uniformity index, fineness and micronaire) is similar to or better than the effect of conventional manufactured fertilizers. Considering the above facts as stated, the present study was undertaken with the following objectives:

1. To study on the effectiveness of poultry manure as an alternative source of inorganic fertilizer
2. To increase the jute fibre yield using poultry manure and inorganic fertilizer.
3. To find out the interaction effects of poultry manure Inorganic fertilizer.

Materials and Methods

Plant materials and growth condition

The experiment was conducted at the Agronomy Field Laboratory, Department of Agronomy and Agricultural Extension, University of Rajshahi during the period from May 2018 to September 2018. The experimental field was situated at the western side of Agronomy and Agricultural Extension Department. Geographically the experimental field was located at $24^0$22'36'' N latitude and $88^0$38' 36''E longitude at an elevation of 20m above the sea level belonging to the agro ecological zone (AEZ-11)**.** The land of the experimental field was flat, well drained and above flood level (Medium high land). The soil was sandy loam textured having pH value of 8.1.

A popular *tossa* jute variety O- 9897 released by The Bangladesh Jute Research Institute (BJRI) was used for the study. It is a high yielding variety with fibre yield potential of 34 to 36 q ha^{-1}. It exhibits resistance to premature flowering when sown from 2nd week of March to middle of May. It has field resistance to yellow mite and root rot. Fibre is easier to extract after retting.

Experimental treatments

The experiment was carried out with two factors.Factor A: Inorganic fertilizer (three rates)F_1=100% Recommended dose of major inorganic (N, P, K, S and Zn) fertilizer(RDF), F_2=75% RDF and F_3=50% RDF. Factor B: Poultry manure application rate (three rates)P_1=without poultry manure, P_2= application of poultry manure @ 5 tha^{-1} and P_3= application of poultry manure @ 10 t ha^{-1}. Recommended dose of inorganic fertilizer (urea 200 kg ha^{-1}, TSP 50 kg ha^{-1}, MOP 60 kg ha^{-1}, gypsum 95kg ha^{-1} and $ZnSO_4$ 11 kg ha^{-1}, respectively) was followed from the instruction of BJRI. All together 9 treatments were replicated three times using a split plot experimental design placing inorganic fertilizer rates in the main plot and poultry manures in the sub plot. Each experimental plot occupied an area of $10m^2$ (5m × 2m).

Crop cultivation and agronomic management

The land was first opened with power tiller on 14 May, 2018. Later on the land was ploughed and cross ploughed three times followed by laddering. Individual plots were prepared by repeated spading until the soil achieved a good tilth and was ready for sowing. The weeds and stubbles were removed to clean the land. In order to supply water, drainage channels were made around the experimental plots. The following quantities of fertilizer were applied. Poultry manure was applied during the final land preparation. Nitrogen was applied in the form of urea (46 % N) in 3 splits *i.e.,* ½ as basal dressing and rest ½ was applied at 20 and 45 DAS.As per treatment the dose of 50 kg $P_2O_5ha^{-1}$, 60 kg K_2O ha^{-1}, S95 kg $ha^{-1}$and Zn 11 kg $ha^{-1}$was applied in the form of triple superphosphate (TSP), muriate of potash (MOP), gypsum and $ZnSO_4$, respectively, at the time of sowing.

Bold and healthy seeds were hand dibbled into the soil. Thinning was done to maintain required plant population. Weeding was done manually at 20 and 45 DAS. Thereafter, the jute crop has smothered the weeds which did not necessitate weeding. Irrigation was given immediately after sowing for ensuring proper germination and plant stand. Subsequent irrigations were provided as and when required.

Incidence of hairy caterpillar was observed during crop growth period, which was controlled by spraying Diazinon 60 EC @ 1.5 ml/L twice at 30 and 45 DAS to protect the crop. The field was under constant observation. Crop production was satisfactory throughout the experiment.

At maturity, the experimental crops were harvested plot-wise at 5 September, 2018 Prior to harvesting $1m^2$ plant sample were selected randomly and uprooted from each plant for data recording. The harvested crops from each plot were bundled separately, tagged and brought to clean threshing floor. The same procedure was followed for sample plant (5 plants from each plot). Different phyto-physiological responses as well as growth, yield components, yield of jute and fibre development of jute subjected to experimental treatment was collected and recorded carefully. Growth responses of field crops was measured from randomly selected tagged plant. Given inorganic fertilizer, poultry manure was monitored at different growth stages. Yield component and yield was measured after harvest.

Statistical procedure

The data recorded were compiled and tabulated for statically analysis. The collected data were analyzed statistically using the statistical package "STATVIEW".The mean differences were adjudged by Duncan's multiple range test (DMRT).

Results and Discussion

During our study the effect of inorganic fertilizer and poultry manure on fibre development, yield and yield components of jute were evaluated. The data recorded on dry matter accumulation of jute at 21, 42, 63 and 84,105 was presented in **Table 1**. Total dry matter of jute varied significantly due to application of inorganic fertilizer at 42, 63, 84 and105 DAS and most of the cases highest total dry matter was observed with increased inorganic fertilizer.At 21 DAS, the highest TDM (0.093 gm^{-2}) was observed in F_1 and the lowest (0.062 gm^{-2}) was in F_3. At 42 DAS, the highest TDM (2.057 gm^{-2}) was observed in F_1. TDM reduced significantly 27.95% and 46.52% in F_2 and F_3, respectively. At 63 DAS, the highest TDM (26.18 gm^{-2}) was obtained with F_1 which reduced significantly 11.84% and 25.7% in F_2 and F_3, respectively. At 84 DAS, maximum TDM (50.00gm^{-2}) was observed at F_1 which reduced significantly 14.6% and 28.08% in F_2 and F_3, respectively. At 105 DAS, maximum TDM (65.99gm^{-2}) was observed in F_1 which reduced significantly 20.83% and 34.05% in F_2 and F_3, respectively.

The effect of poultry manure on Total Dry Matter (TDM) production of jute was not statistically significant at 21 DAS but it varied significantly at 42,63, 84,105 DAS **Table-1**. At 21 DAS, the highest TDM (0.076 gm^{-2}) was observed in P_3 and the lowest (0.069 gm^2) was in P_2. At 42 DAS, the highest TDM (1.882 gm^{-2}) was observed in P_3 and it reduced significantly 18.6% and 34.9% in P_2 and P_1, respectively. At 63 DAS, the highest TDM (25.65 gm^{-2}) was obtained with P_3 which reduced significantly 11.3% and 20.9% in P_2 and P_1, respectively. At 84 DAS, the highest TDM (47.55 gm^{-2}) was found with P_3 which reduced significantly 9.61% and 19.8% in P_2 and P_1, respectively.At 105 DAS, the highest TDM (61.47 gm^{-2}) was found with P_3 which reduced significantly 12.5% and 24.38% in P_2 and P_1, respectively.

The interaction effect between inorganic fertilizer and poultry manure rate on TDM was significant at all growth stages **Table 1**. At 21 DAS, the highest TDM (0.095 gm^{-2}) was observed in combination of F_1 with P_1 and the lowest value (0.047 gm^{-2}) was obtained in F_3P_2.At 42 DAS, the highest TDM (2.487 gm^{-2}) was observed in combination of F_1 with $P_3$and the lowest value (0.882 gm^{-2}) was obtained in F_3P_1. At 63 DAS, the highest TDM (29.04 gm^{-2}) was observed in combination of F_1 with P_3 and the lowest value (16.75 gm^{-2}) was observed in F_3P_1. At 84 DAS, the highest TDM (55.60 gm^{-2}) was observed in combination of F_1 with P_3 and the lowest (31.85 gm^{-2}) in F_3P_1. At 105 DAS, the highest TDM (73.18 gm^{-2}) was observed in combination of F_1 with $P_3$and the lowest (38.31 gm^{-2}) in F_3P_1.Similar observations of higher dry matter per plant at higher level of inorganic fertilizer compared to lower level of inorganic fertilizer was also reported by Verma, R. *et al.* (2014). This result is on conformity with that of Charles *et al.* (2007).

Results showed that at 21-42, 42-63, 63-84 and 84-105 DAS, inorganic fertilizer had significant effect on crop growth rate **Table 1**. At 21-42 DAS, significant difference was found in CGR due to inorganic fertilizer. The highest CGR (7.48 $gm^{-2}day^{-1}$) was observed in F_1 which reduced significantly 27.8% and 47.19% for F_2 and F_3, respectively. At 42-63 DAS, the highest CGR (91.89 $gm^{-2}day^{-1}$) was observed in F_1 which reduced significantly 10.46% and 23.91% in F_2 and F_3, respectively. At 63-84 DAS, the highest CGR (90.76 $gm^{-2}day^{-1}$) was observed in F_1 which reduced significantly 17.63% and 30.68% in F_2 and F_3, respectively. At 84-105 DAS, the highest CGR (60.94 $gm^{-2}day^{-1}$) was observed in F_1 which reduced significantly 40.36% and 52.78% in F_2 and F_3, respectively.

Poultry manure had significant progressive effect on crop growth rate at 21-42 and 42-63, 63-84, 84-105 DAS **Table 1**. At 21-42 DAS, the highest CGR (6.88 $gm^{-2}day^{-1}$) was obtained in P_3 and the value reduced significantly 18.89% and 36.33% in P_2 and P_1, respectively. At 42-63 DAS, the highest CGR (90.55 $gm^{-2}day^{-1}$) was observed in P_3 which reduced marginally 10.67% in $P_2$and significantly 19.76% in P_1. At 63-84 DAS, the highest CGR (83.44 $gm^{-2}day^{-1}$) was observed in P_3 which reduced marginally 7.71%for P_2but significantly 18.52% in P_1. At 84-105 DAS, the highest CGR (53.011 $gm^{-2}day^{-1}$) was observed in P_3 which reduced marginally 22.49% in P_2but significantly 39.73% in P_1.

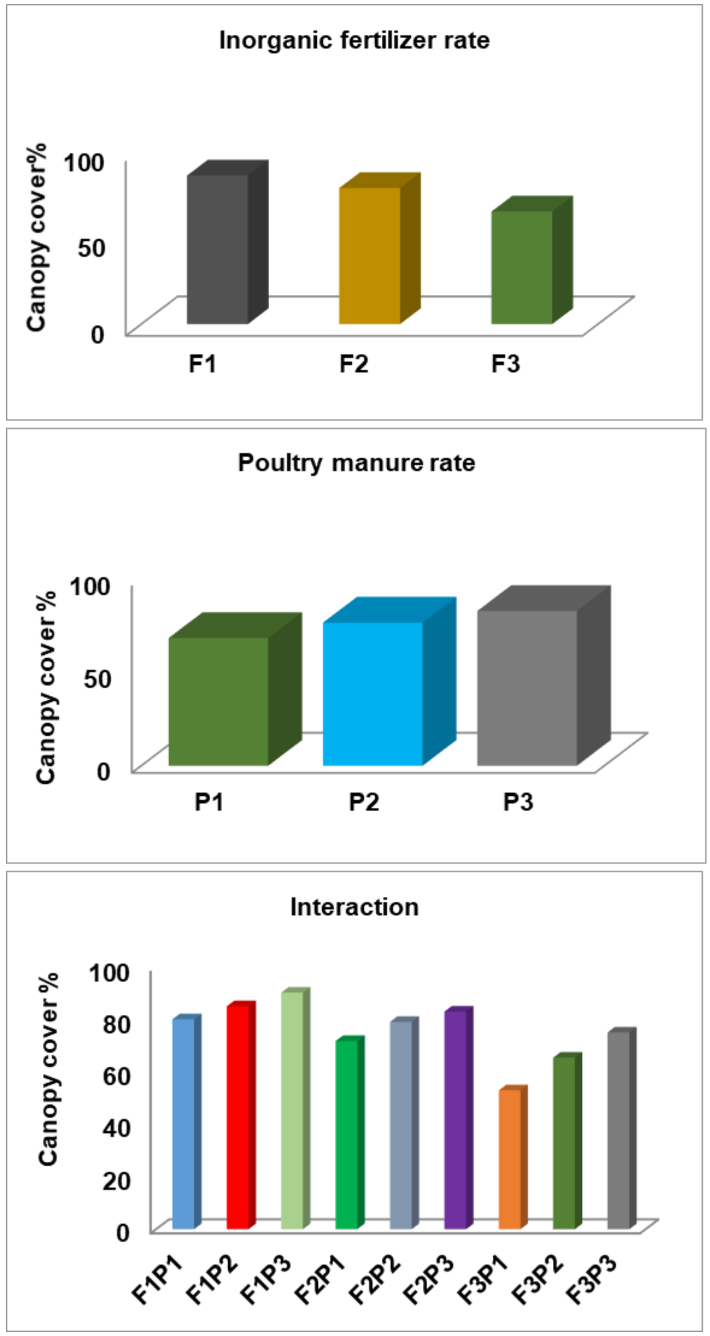

Figure 1 (a): Effect of inorganic fertilizer on canopy cover (%) of jute, (b): Effect of poultry manure on canopy cover (%) of jute,(c): Interaction effect of inorganic fertilizer and poultry manure rate on canopy cover (%) of jute.

The interaction between inorganic fertilizer and poultry manure showed significant effect on CGR at all growth stages (21-42, 42-63, 63-84, 84-105 DAS). In all of the cases the highest CGR was

Table 1. Effect of inorganic fertilizer, poultry manure and interaction on TDM and CGR of jute

	Total Dry Matter (TDM) gm-2					Crop Growth Rate (CGR) g m-2 day-1				Leaf area (LA) cm2		
	21 DAS	42 DAS	42 DAS	42 DAS	42 DAS	21-42 DAS	42-63 DAS	63-84 DAS	84-105 AS	42 DAS	63 DAS	84 DAS
Inorganic fertilizer												
F1	0.093	2.06 a	347.62 a	347.62 a	347.62 a	7.48 a	91.89 a	90.76 a	60.94 a	347.62 a	1162.94 a	587.05 a
F2	0.063	1.48 b	271.60 b	271.60 b	271.60 b	5.40 b	82.28 b	74.75 b	36.34 b	271.60 b	970.88 b	426.59 b
F3	0.062	1.10 c	203.49 c	203.49 c	203.49 c	3.95 c	69.91 c	62.91 c	28.77 b	203.49 c	783.24 c	319.25 c
LS	NS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Poultry manure												
P1	0.074	1.22 c	223.15 c	223.15 c	223.15 c	4.38 c	72.65 a	67.99 a	31.95 a	223.15 c	833.81 c	356.33 c
P2	0.069	1.53 b	282.06 b	282.06 b	282.06 b	5.58 b	80.88 a	77.00 ab	41.09 a	282.06 b	985.45 b	438.74 b
P3	0.076	1.88 a	317.51 a	317.51 a	317.51 a	6.68 a	90.55 b	83.44 b	53.01 b	317.51 a	1097.80a	537.83 a
LS	NS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Interaction Effect												
F1P1	0.095	1.66	23.4	43.57	58.26	5.97	82.81	76.84	55.95	282.71	1030.71	459.66
F1P2	0.093	2.02	26.1	50.84	66.55	7.34	91.72	94.25	59.86	372.91	1190.83	605.48
F1P3	0.09	2.49	29.04	55.6	73.18	9.13	101.14	101.18	66.99	387.24	1267.27	696.03
F2P1	0.058	1.13	20.73	39	43.01	4.07	74.69	69.6	15.28	225.04	847.86	340.86
F2P2	0.065	1.53	23.17	42.25	51.01	5.59	82.43	72.68	33.39	268.05	993.45	413.62
F2P3	0.065	1.79	25.34	46.86	62.69	6.55	89.73	81.97	60.34	321.72	1071.34	525.29
F3P1	0.068	0.88	16.75	31.85	38.31	3.09	60.46	57.52	24.61	161.69	622.85	268.46
F3P2	0.047	1.04	19.02	35.85	43.72	3.79	68.5	64.08	30.01	205.22	772.08	297.11
F3P3	0.072	1.38	22.58	40.21	48.53	4.97	80.78	67.17	31.7	243.56	954.78	392.17
LS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	43.5	6.78	7.7	8.68	6.19	7.13	7.84	10.51	16.13	4.27	2.53	6.32

NS= Non significant, CV= Co-efficient of variation, LS= Level of significance, F_1= Urea 200 Kg/ha, TSP 50 kg/ha, MP 60 kg/ha ,Gypsum 95 kg/ha,ZnSO4 11 kg/ha F_2=Urea 150 kg/ha, TSP 37.5 kg/ha, MP 45 kg/ha, Gypsum 71.3 kg/ha ZnSO4 8.25 kg/ha F_3=Urea 100kg/ha, TSP 25 kg/ha MP 30 kg/ha, Gypsum 47.5 kg/ha, ZnSO4 5.5 kg/ha, P1 =Without poultry manure,P2 = 5 tn/ha, P3= 10tn/ha.

found in the interaction of $F_1$with P_3 and the lowest was in F_3P_1**Table 1**.

The total leaf area (cm^2) was not differed significantly at 21 DAS but it was significantly influenced at 42, 63 and 84 DAS and most of the cases maximum leaf area were observed in higher amount of chemical fertilizer **Table 1**. At 42 DAS, maximum leaf area (347.62cm^2) was observed in F_1 which reduced significantly 21.90% and 41.46 % for F_2 and F_3, respectively. At 63 DAS, maximum leaf area (1162.94 cm^2) was observed in F_1 which reduced significantly 16.52% and 32.65% for F_2 and F_3, respectively. At 84 DAS, maximum leaf area (587.05 cm^2) was observed in F_1 which reduced significantly 27.33% and 45.62% for F_2 and F_3, respectively.

Poultry manure showed significant variation in leaf area (LA) at 42, 63 and 84 DAS (Table 8). At 42 DAS, it was detected that the highest leaf area (317.51 cm^2) was found in P_3 which reduced significantly 11.16% and 29.71% in P_2 and P_1, respectively. At 63 DAS, the highest LA (1097.80 cm^2) was found in P_3 which reduced significantly for P_2 and P_1, respectively. At 84 DAS, the highest LA (537.83 cm^2) was found in P_3 which reduced significantly 18.42% and 33.75% for P_2 and P_1, respectively.

Significant change of leaf area was observed due to the interaction between inorganic fertilizer and poultry manure **Table 1**. At 42 DAS, the highest leaf area (387.24cm^2) was observed in interaction of $F_1$with P_3 and lowest (161.69 cm^2) was observed in F_3P_1. At 63 DAS, the highest LA (1267.27cm^2) was recorded in interaction of $F_1$with $P_3$and lowest (622.85cm^2) was recorded in F_3P_1. At 84 DAS, the highest LA (696.03cm^2) was recorded in interaction of $F_1$with $P_3$and lowest (268.46cm^2) was recorded in F_3P_1. Similar result was observed by Noufal (2005).

Result showed that the canopy cover (%) was significantly affected by inorganic fertilizer at 63 DAS (Figure 6.a). Canopy cover was found highest (85.24%) in F_1 which reduced significantly 8.42% and 24.25% for F_2 and F_3 respectively. Canopy cover (%) was significantly influenced by poultry manure at 63 DAS (Figure 1.b). Canopy cover was found maximum (82.87%) in P_3 which reduced slightly 7.53% in P_2 but significantly 17.49% in P_1. Canopy cover was significantly influenced due to interaction between inorganic fertilizer and poultry manure. Apparently, maximum canopy cover (90.38) was observed in the interaction of $F_1$with $P_3$and minimum (53.04) was in F_3P_1 (Figure 1.c).

Experimental results showed that the plant height of jute varied significantly due to application of inorganic fertilizer. The highest plant height (339.46 cm) was observed in F_1. Plant height reduced significantly 8.41% and 7.40 % in F_2 and F_3, respectively (**Table 2**). Significant differences in plant heights were recorded due to different poultry manure rates. The highest (330.989 cm) plant height was observed with P_3 which reduced slightly 6.08% in P_2 but significantly 10.46% in P_1 (Table 2).

The interaction between inorganic fertilizer and poultry manure rate had significant effect on plant height (Table 15). The tallest plant (368.37cm) was obtained in interaction of F_1 with P_3 and the

Table 2. Effect of inorganic fertilizer, poultry manure and interaction on yield and yield components of jute.

Inorganic fertilizer	Plant height (cm)	Stem diameter (mm)	Fibre area (mm)	Fibre yield (t/ha)	Stick yield (t/ha)	Biological yield (t/ha)	Harvest index (%)
F1	339.46 a	20.35 a	4.30 a	3.49 a	8.49 a	11.98 a	29.32
F2	310.88 b	18.93 a	3.86 b	3.03 b	7.25 b	10.28 b	29.67
F3	287.87 c	16.83 b	3.45 c	2.48 c	5.93 c	8.43 c	29.44
LS	0.05	0.05	0.05	0.01	0.01	0.01	NS
Poultry manure							
p1	296.37a	17.65 a	3.60 a	2.68 c	6.36c	9.04c	30.04
p2	310.85ab	18.81 ab	3.87 ab	2.96 b	7.21 b	10.19 b	28.99
p3	330.99 b	19.66 b	4.14 b	3.36 a	8.11 a	11.47 a	29.39
LS	0.05	0.05	0.05	0.01	0.01	0.01	NS
Interaction Effect							
F1P1	315.4	19.25	3.95	3.2	7.5	10.69	30.33
F1P2	334.62	20.53	4.3	3.54	8.67	12.21	29
F1P3	368.37	21.28	4.64	3.72	9.32	13.04	28.61
F2P1	297.67	17.77	3.68	2.7	6.42	9.12	30.2
F2P2	310.57	19.51	3.89	3.01	7.23	10.25	29.41
F2P3	324.4	19.51	4	3.37	8.12	11.48	29.39
F3P1	276.03	15.93	3.17	2.14	5.15	7.32	29.59
F3P2	287.37	16.39	3.4	2.32	5.74	8.1	29.56
F3P3	300.2	18.18	3.79	2.98	6.89	9.87	28.56
LS	NS	NS	NS	NS	NS	NS	NS
CV (%)	8.14	10.68	9.09	4.72	4.89	4.91	5.33

NS= Non significant, CV= Co-efficient of variation, LS= Level of significance, F1= Urea 200 Kg/ha, TSP 50 kg/ha, MP 60 kg/ha ,Gypsum 95 kg/ha,ZnSO4 11 kg/ha F2=Urea 150 kg/ha, TSP 37.5 kg/ha, MP 45 kg/ha, Gypsum 71.3 kg/ha ZnSO4 8.25 kg/ha F3=Urea 100kg/ha, TSP 25 kg/ha MP 30 kg/ha, Gypsum 47.5 kg/ha, ZnSO4 5.5 kg/ha, P1 =Without poultry manure,P2 = 5 tn/ha, P3= 10tn/ha.

smallest plant height (276.03 cm) was observed in F_3P_1.The increase in plant height in response to higher levels of poultry manure was in conformity with the previous findings of Charles *et al.(*2007). Masud M.M. *et al.(*2000) observed the similar result. He reported that the plant height was significantly affected by inorganic fertilizer.

The result presented in (**Table 2**) exhibited that the stem diameter differed significantly due to inorganic fertilizer.The highest stem diameter (20.35 mm) was observed in F_1 which reduced marginally 7.0% in F_2 and significantly 17.29 % in F_3.Different poultry manure rate had significant variation in terms of stem diameter of jute. Stem diameter progressively increased with increasing level of poultry manure. The highest stem diameter (19.66 mm) was observed in P_3 which reduced slightly 4.31%for P_2 but significantly 10.19% for P_1(**Table 2**). Significant interaction was found between inorganic fertilizer and poultry manure rate on stem diameter of jute (Table 2).The highest value (21.28 mm) was observed in combination of F_1 withP_3 and lowest (15.93 mm) in F_3P_1.

Inorganic fertilizer significantly affected the fibre area of jute (Table 13). The highest fibre area (4.30 mm) was observed in F_1 which reduced significantly 10.23% and 19.76 % for F_2 and F_3, respectively. Fibre area of jute was increased significantly with the increasing level of poultry manure (Table 2). The highest fibre area (4.14 mm) was observed in P_3which reduced slightly 6.66% and significantly by 13.13 % in P_2 and P_3, respectively. Significant effect was observed due to the interaction between inorganic fertilizer and poultry manure (Table 2). The highest value (4.64 mm) was observed in interaction of $F_1$with P_3 and the lowest (3.17mm) in F_3P_1.

The fibre yield increased significantly with increasing inorganic fertilizer (Table 13). The highest fibre yield (3.49 t/ha) was obtained from F_1, which reduced significantly by 13.16% and 28.92% in F_2 and F_3 respectively. The decrease in fibre yield is closely related to the amount of inorganic fertilizer.

There was a significant variation in respect of fibre yield due to different level of poultry manure (**Table 2**). It was observed that the fibre yield was gradually increased with increasing level of poultry manure. The highest fibre yield (3.36 t/ha) was obtained in P_3, which reduced significantly 11.91% and 20.19% in P_2andP_1, respectively.

Fibre yield was significantly affected by the interaction between inorganic fertilizer and poultry manure rate (**Table 2**). Apparently, the highest fibre yield (3.72ha^{-1}) was found in the combination of $F_1$with P_3 and the lowest fibre yield 2.14(t ha^{-1}) was found in F_3P_1. Significant increase in fibre yield owning on inorganic fertilizer application was also reported by Alam *et al*.(2002). During our observation it was observed that increasing poultry manure increased all yield contributing characters which in term increased fibre yield. Similar result was observed by Sistani *et al*.(2008).

The stick yield increased significantly with increasing inorganic fertilizer (**Table 2**).The highest stick yield (8.49 t/ha) was observed from F_1, which reduced significantly by 14.65% and 30.27% in F_2 and F_3,respectively.

Progressive and significant increase in stick yield was observed with each successive increase in poultry manure (**Table 2**). The highest stick yield (8.11 t/ha) was recorded in P_3which reduced significantly by 11.02% and 21.60% in P_2 and P_1,respectively.

Stick yield was significantly affected by the interaction between chemical fertilizer and poultry manure (**Table 2**). Apparently, the highest stick yield (9.32 t ha^{-1}) was found in the combination of F_1withP_3 and the lowest stick yield (5.15 t ha^{-1}) was found in F_3P_1. The increase in stick yield with increasing inorganic fertilizer was in agreement with results of Olaniyi and Ajibola (2008).

Biological yield of jute plant showed significant variations due to inorganic fertilizer (**Table 2**). Maximum value was showed by F_1 (11.98 t/ha) which reduced significantly by 14.17% and 29.63% in $F_2$and F_3, respectively. Remarkable differences were observed in biological yield for different poultry manure rates (**Table 2**). The highest biological yield (11.47tha^{-1}) was recorded in P_3 which reduced significantly by 11.15% and 21.15% inP_2 and P_1, respectively. Biological yield was significantly affected by the interaction between inorganic fertilizer and poultry manure rate (**Table 2**) revealed that the highest biological yield (13.04tha^{-1}) was found in the combination of F_1withP_3 and the lowest biological yield (7.32 t ha^{-1}) was found in the combination of F_3P_1.

Harvest index was not significantly differed due to inorganic fertilizer (**Table 2**). Numerically, maximum harvest index (29.67%) was found in F_2 and minimum harvest index (29.32%) was obtained in F_1. Different nitrogen fertilizer rate had no significant effect on harvest index (**Table 2).** Numerically, the highest harvest index (30.04 %) was obtained in P_1 and the lowest (28.99%) was in P_2. Harvest index was not significantly differed due to the interaction of inorganic fertilizer and poultry manure. Numerically, the highest harvest index (30.33 %) was produced from F_1P_1combination and the lowest harvest index (28.56 %) was produced from F_3P_3combination (**Table 2**). Mahmood F. *et al*.(2017) also observed that havest index was not varied due to different level of inorganic fertilizer.

Cocclusion

The results show that inorganic fertilizer affected the plant height, total dry matter and crop growth rate significantly and the taller plants, highest TDM and CGR were produced at higher inorganic fertilizer. Considering poultry manure rates, highest plant height, TDM and CGR were recorded with application of 10 t ha^{-1}. Inorganic fertilizer also significantly influenced different growth parameters and the maximum leaf area, number of leaves, canopy cover, stem diameter and fibre area were achieved with increased inorganic fertilizer. The maximum leaf area, number of leaf, canopy cover, stem diameter and fibre area were recorded with application of poultry manure @ 10 t ha^{-1}. The interaction between inorganic fertilizer and poultry manure was not significant for plant height, TDM, CGR, canopy cover, leaf area, number of leaf, stem diameter and fibre area at all stages. Fibre yield, stick yield and biological yield were significantly influenced by different inorganic fertilizer doses. Significantly highest fibre yield, stick yield and biological yield were found with increased inorganic fertilizer. The interaction effect showed marginal effect on all the yield and yield contributing characters. Apparently, the highest fibre yield, stick yield and biological yield were found in the combination of higher inorganic fertilizer with higher poultry manure while the lowest fibre yield, stick yield and biological yield were observed in the combination of lower inorganic fertilizer with lower poultry manure. Although higher inorganic fertilizer and higher poultry manure give higher yield but our recommendation goes to medium amount of inorganic fertilizer with maximum poultry manure as it can produce more yield than conventional practice with less inorganic fertilizer. Thus the use of inorganic fertilizer reduced the by the using poultry manure and farmers can be suggested to use this combination.

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