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## Performance of poultry bio-slurry as a source of organic manure on potato production

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**Abstract:** The experiment was conducted at Lahirirhat FSRD site, Rangpur, during 2007-08 and 2008-09 and at Domar MLT site, Rangpur during 2008-09 to observe the effect of poultry bio-slurry on the performance of potato production. Significantly highest tuber yield was obtained from IPNS (3 t/ha poultry bio-slurry) for HYG in both the years (19.36 t/ha in 2007-08 and 26.72 t/ha in 2008-09) in FSRD site. In FSRD site, the tuber yield obtained from IPNS (3 t/ha poultry bio-slurry) for HYG differed significantly from other fertilizer treatments in 2007-09 while in 2008-09 it was identical to IPNS (3 t/ha poultry manure) for HYG. In MLT site, the highest tuber yield was also obtained from IPNS (3 t/ha poultry bio-slurry) for HYG (26.77 t/ha) which differed significantly from other fertilizer treatments. In FSRD site, two years mean gross return (Tk.231600/ha), gross margin (Tk.113919/ha) and benefit cost ratio (1.97) was highest from poultry bio-slurry. Similarly, in MLT site, the highest gross return (Tk.267700/ha), gross margin (Tk.148364/ha) and benefit cost ratio (2.24) was also obtained from poultry bio-slurry.

**Key words:** Poultry bio-slurry, Organic manure and Potato.

### Introduction

The potato is now one of the major versatile food crops of the world because of the dry matter, edible energy and edible protein content (Anonymous, 2008). Now a day's potato is commercially grown in almost all countries of the world. In terms of total production of energy, potato gained 5<sup>th</sup> rank of world in importance after wheat, rice, maize and barley (Sharma and Grewal, 1988). Amongst the vegetables potato is ranked at the 1<sup>st</sup> place for the production of per hectare dry matter or total energy. During the year 2009-2010 total area under potato cultivation in Bangladesh was 401.8 thousand hectares with a yield of 16.54 t ha<sup>-1</sup> (BBS, 2010). Potato contributes alone 55% of the total annual vegetable production in Bangladesh (BBS, 2010). Compared to other roots and tubers and also many cereals, potato tubers have a high amount of protein 2.0%, carbohydrate 19.0%, dietary fiber 2.2%, fat 0.1% and ash 1.0% and some important minerals (Shekhawat *et al.*, 1994). Potato is a good source of starch and vitamin C. Among the horizontal and vertical system, emphasis should be given to vertical increase in potato production due to shortage of land and judicious application of organic and inorganic fertilizer. Different organic materials like cow dung, poultry litters, human faces, crop residues household wastes etc. are used as substrate in biogas plant. After emission of biogas semi liquid cow dung or poultry manure derived from outlet, is called biogas slurry. Biogas slurry is an improved type of organic manure which is applied in the form of semi-liquid, dry or compost. It contains considerable quantities of plant nutrients than traditional cow dung, poultry manure, farmyard manure and compost which may be used to improve soil fertility and thus the use of chemical fertilizers can be reduced to a great extent. Application of bio-slurry gave significantly higher yield in vegetables (Joshi, *et al.*, 1994). Jayakumar and Elangovan found that biogas slurry @ 300 g per pot produced the largest head of sun flower (1993). Application of biogas slurry increased cob yield of maize as was reported by Manna and Hazra (1996). Soil fertility is declining day by day though the magnitude of variation varies in different Agro-ecological zone. This is caused due to deterioration of soil physical, chemical and biological properties. It occurs due to imbalance use of fertilizer and loss of nutrient from the

soil. This situation is further aggravated by low organic matter content of the soil. A good soil should have organic matter content more than 3.5 percent. However, most soils have organic matter content less than 1.7 percent even in many cases it is less than 1 percent. The organic matter content of the soil is declining day by day which reduces productivity of the soil. To cope with this situation proper use of organic manure along with inorganic fertilizer is urgently needed to arrest soil health deterioration. Bio-slurry in this regard can play a vital role in combination with chemical fertilizer. Further, management and utilization of bio-slurry still was not properly taken care off. Under these circumstances, the trial was undertaken to observe the effect of bio-slurry on potato production.

### Materials and Methods

The experiment was conducted at Lahirirhat Farming system Research Division (FSRD) Site, Rangpur during 2007-08 to 2008-09 and at Domar Multi Location Testing (MLT) site during 2008-09. The land was medium high and the soil was sandy loam in texture. In FSRD site, the experiment was laid out in a RCB design with three compact replications which was also replicated in three dispersed farmer's field while in MLT site the experiment was laid out in a RCB design with six dispersed replications. There were five treatments related to fertilizer (calculated by initial soil analysis) manure and bio-slurry nutrient supplement in FSRD site in 2007-08 and four treatments in FSRD site in 2008-09 (Table 1). In MLT site, there were three fertilizer treatments (Table 1). The initial soil status of Lahirirhat FSRD site and Domar MLT site are shown in Table 2 and Table 3. The entire amount of poultry manure and poultry bio-slurry was applied 4 days before final land preparation. The whole of P, K, S, Mg, Zn, B and ½ of N were applied during final land preparation. The rest N was top dressed at 30-35 DAP followed by earthing up at both sites. The crop was irrigated thrice at 30, 50, 70 DAP at both sites. Plant protection measures and other intercultural operation were done as and when necessary. The crop was planted on 3-4 December in 2007 and 2-5 December in 2008 at FSRD site maintaining 60 cm x 25 cm plant spacing. Similarly, the crop was planted on 02 December in 2008 at Domar MLT site maintaining 60 cm x 25 cm plant

spacing. The crop was harvested on 3-6 March in 2009 on both the years at FSRD site and 25 February, 2009 to 03 March, 2009 at Domar MLT site. Data on yield and yield

contributing characters were taken and statistically analyzed following MSTAT software package.

**Table 1.** Fertilizer treatment at Lahirirhat FSRD site and Domar MLT site, Rangpur

Treatment	FSRD Site (N-P-K-S-Mg-Zn-B+CD/CS kg/ha)		MLT Site (N-P-K-S-Zn-B+CD/CS kg/ha)
	2007-08	2008-09	2008-09
	T <sub>1</sub> =STB inorganic fertilizer for HYG	135-25-140-17-15-3-1.5-0	135-25-140-17-15-3-1.5-0
T <sub>2</sub> =IPNS (3 t/ha poultry manure) for HYG	129-20-132-17-15-3-1.5-3000	129-20-132-17-15-3-1.5-3000	-
T <sub>3</sub> =IPNS (3 t/ha poultry bio-slurry) for HYG	112.5-18-115-17-15-3-1.5-3000	112.5-18-115-17-15-3-1.5-3000	112-2-60-13-4-1-3000
T <sub>4</sub> =Farmers practice	110-25-160-20-0-4-1-6500	110-25-160-20-0-4-1-0	124-7.5-69-12-0-0-0
T <sub>5</sub> =Native fertility	0-0-0-0-0-0-0	-	-

CD= Cow dung, CS=Cow dung Slurry, HYG=High yield goal, IPNS=Integrated Plant Nutrient System.

**Table 2.** Initial status of soils of the experimental plots at Lahirirhat FSRD site, OFRD, Rangpur during 2007-08

pH	OM (%)	Total N (%)	P	S	Zn	B	m.eq/100 g soil
			(Micro gram/g soil)				
6.03	1.25	0.06	30.66	33.30	0.82	0.52	3.11
Slightly acidic	Low	Very low	Very high	High	Low	Optimum	Very high

**Table 3.** Initial status of soils of the experimental plot at Domar MLT site, OFRD, Rangpur during 2008-09

pH	OM (%)	Total N (%)	P	S	Zn	B	m.eq/100 g soil
			(Micro gram/g soil)				
6.03	1.29	0.07	30.23	31.50	0.88	0.55	3.13
Slightly acidic	Low	Very low	Very high	High	Low	Optimum	Very high

### Results and Discussion

The yield and yield contributing characters of potato as affected by different fertilizer treatments are presented in Tables 4, 5 & 6. In Lahirirhat FSRD site, the highest tuber yield was obtained from IPNS (3 t/ha poultry bio-slurry) for HYG in both the years (19.36 t/ha in 2007-08 and 26.72 t/ha in 2008-09). In FSRD site, the tuber yield obtained from IPNS (3 t/ha poultry bio-slurry) for HYG

differed significantly from other fertilizer treatments in 2007-09 while in 2008-09 it was identical to from IPNS (3 t/ha poultry manure) for HYG. The lowest yield was obtained from native fertility in 2007-08 and from farmers practice in 2008-09. In Domar MLT site, the highest tuber yield was also obtained from poultry bio-slurry (26.77 t/ha), which differed significantly from other treatments. The lowest yield (19.34 t/ha) was obtained from farmers practice.

**Table 4.** Effect of bio-slurry on the yield of potato at FSRD site Lahirirhat Rangpur during 2007- 08

Treatment	No. of tubers/plant	Wt. of tubers/plant (g)	Tuber yield (t/ha)
T <sub>1</sub> =STB inorganic fertilizer dose for HYG	7.87a	295a	14.13b
T <sub>2</sub> =IPNS (3 t/ha poultry manure) fertilizer dose for HYG	7.83a	318a	15.39b
T <sub>3</sub> =IPNS (3 t/ha poultry bio-slurry) fertilizer dose for HYG	7.67a	370a	19.36a
T <sub>4</sub> =Farmers practice	7.03ab	323a	15.88b
T <sub>5</sub> =Native fertility	6.43b	177b	7.97c
CV (%)	8.0	5.2	6.4

**Table 5.** Effect of bio-slurry (Poultry) on yield and yield contributing characters of potato at FSRD site, Lahirihat, OFRD, ARS, Rangpur during rabi 2008-09

Treatments	Plant height (cm)	No. stems/hill	No. tubers/hill	Wt. of tubers/hill (g)	Yield (t/ha)
T1=STB fertilizer dose for HYG	54.97c	2.10c	7.88b	336.1c	22.47b
T2=IPNS (3 t/ha poultry manure) fertilizer dose for HYG	57.80b	2.20b	8.33b	373.3b	25.27a
T3=IPNS (3 t/ha poultry bio-slurry) fertilizer dose for HYG	61.69a	2.33a	9.22a	402.2a	26.72a
T4=Farmers practice	52.61d	2.01d	7.11c	294.4d	19.50c
CV (%)	4.08	3.64	5.76	6.66	6.57

**Table 6.** Effect of bio-slurry (poultry) on yield and yield contributing characters of potato at Domar MLT site, OFRD, ARS, Rangpur during rabi 2008-09

Treatments	Plant height (cm)	No. stems/hill	No. tubers/hill	Wt. of tubers/hill (g)	Yield (t/ha)
T <sub>1</sub> =STB fertilizer dose for HYG	59.20a	2.03ab	7.65ab	389.3a	24.63b
T <sub>2</sub> =IPNS (3 t/ha Poultry bio-slurry) fertilizer dose for HYG	61.70a	2.20a	7.98a	401.5a	26.77a
T <sub>3</sub> =Farmers practice	59.08a	1.86b	7.23b	311.2b	19.34c
CV (%)	6.23	6.47	5.55	4.99	5.65

**Economic performance:** The cost and return analysis of different fertilizer treatments are presented in Table 7 & 8. In FSRD site, the highest mean gross return (Tk.231600/ha), gross margin (Tk.113919/ha) and benefit cost ratio (1.97) was obtained from poultry bio-slurry. Similarly, in MLT site, the highest gross return

(Tk.267700/ha), gross margin (Tk.148364/ha) and benefit cost ratio (2.24) was also obtained from poultry bio-slurry. The lower gross return, gross margin and benefit cost ratio was obtained from native fertility and farmers practice in FSRD and MLT site, respectively.

**Table 7.** Cost and return analysis of potato as influenced by poultry bio-slurry at FSRD, Lahirihat, Rangpur during 2007-08 and 2008-09.

Treatment	Yield (t/ha)		Gross return (Tk/ha)		TVC (Tk/ha)		Gross margin (Tk/ha)		Mean gross return (Tk/ha)	Mean TVC (Tk/ha)	Mean gross margin (Tk/ha)	BCR
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09				
T <sub>1</sub>	14.13	22.47	141000	224700	89589	132507	51411	92193	182850	111048	71802	1.65
T <sub>2</sub>	15.39	25.27	153900	252700	97407	134111	56493	118589	203300	115759	87541	1.76
T <sub>3</sub>	19.36	26.72	196000	267200	99785	135578	96215	131622	231600	117681	113919	1.97
T <sub>4</sub>	15.88	19.50	158800	195000	107482	130109	51318	64891	176900	118795	58105	1.49
T <sub>5</sub>	7.97	-	79700	-	72495	-	7205	-	79700	72495	7205	1.10

Potato (2007-08) = Tk 9/kg, Urea= 5.90/kg, TSP=15.60/kg, MP=22.88/kg, Zinc sulphate =120/kg, Boric acid=160/kg, Lab= 112/day, Gypsum=6/kg; Potato (2008-09) = Tk 10/kg, Urea= 11.80/kg, TSP=74.36/kg, MP=55/kg, Zinc sulphate =140/kg, Boric acid=180/kg, Lab= 112/day, Gypsum=7/kg, Poultry manure=1.50/kg, Poultry bio-slurry=3.00/kg

**Table 8.** Cost and return analysis of potato as influenced by poultry bio-slurry at MLT site, Domar, OFRD, Rangpur during rabi season 2008-09

Treatment	Tuber yield (t/ha)	Gross return (Tk/ha)	TVC (Tk/ha)	Gross margin (Tk/ha)	BCR
T <sub>1</sub>	24.63	246300	116650	129650	2.11
T <sub>2</sub>	26.77	267700	119336	148364	2.24
T <sub>3</sub>	19.34	193400	111020	82380	1.74

Potato (2008-09) = Tk 10/kg, Urea= 11.80/kg, TSP=74.36/kg, MP=55/kg, Zinc sulphate =140/kg, Boric acid=180/kg, Lab= 112/day, Gypsum=7/kg, Poultry manure=1.50/kg, Poultry bio-slurry=3.00/kg

The higher tuber yield of potato was obtained from T<sub>2</sub> (IPNS (3 t/ha poultry bio- slurry) fertilizer dose for HYG) at FERD site, Lahirirhat in 2007-08 and 2008-09 and at MLT site, Domar in 2008-2009. Bio-slurry compensated N, P and K requirement of the crops and showed its superiority over other treatments hence, it may be concluded that 'IPNS (5 t/ha CD bio- slurry) fertilizer dose for HYG' may be the good alternatives for maximizing tuber yield of potato and management of soil health. Farmers were very much impressed by getting higher yield and economic return from poultry bio-slurry but its non-availability in the locality and carrying hazard was a problem to the farmers.

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