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APPLICATION OF COW URINE AS BIO-FERTILIZER AND BIO-PESTICIDE IN BORO RICE PRODUCTION OF BANGLADESH

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ABSTRACT

This study focused on cattle urine utilization as bio-fertilizer and bio-pesticide and its effectiveness on boro rice production comparing with chemical fertilizer and chemical pesticides. Three groups were divided into completely randomized design (CRD) to conduct the experiment. No chemical/bio pesticides and/or fertilizers is being applied in the control group (T_0). The second group (T_1) is being applied by chemical fertilizer and pesticides in recommended dose. The third group (T_2) is being applied by cattle urine as bio-fertilizer and bio-pesticides in calculative dose. The germinated rice plant BINA boro rice (variety 28) was transferred to a well-prepared rice field after 21 days. The rice field was prepared using cow urine as bio fertilizer. The bio fertilizer solution prepared from mixing cow dung with cow urine (1:1) and then the solution was diluted into 1: 9 with water. One kg of fresh neem leaves were kept in 10 L (liters) container with cow urine and allowed 28 days for fermentation. Meanwhile, one liter of the solution extracted from neem leaves was mixed with 10L of fresh water in a ratio of 1:10 to produce a bio pesticide. Cow urine as bio-fertilizer was applied one thousand liters per hectare in boro rice production which was repeated every 28 days from transplant to harvest. Bio pesticide was applied one thousand two hundred liters per hectare by nozzle spraying at 15-day intervals from planting to flowering in boro rice production. Likewise the chemical pesticide was being applied at seven-day intervals. Plant height, chlorophyll content, number of the tiller/hill and grain yield was observed as growth and yield parameter respectively. The tallest plant height and chlorophyll content were 76 cm and 46.5 from T_2 on day 45 and 30 respectively, but number of effective tiller per hill, the maximum final score was 14 from T_1 . For all treatments, the mean production became identical. However, T_2 delivered the highest grain yield at 5.85 t/ha. In yield parameter chemical fertilizer and chemical pesticide (T_1) and bio fertilizer and biopesticide (T_2) group was non-significant, but in pest infestation bio fertilizer and biopesticide (T_2) group was lower.

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INTRODUCTION

Cow urine is a unique product of the cow industry which has huge property such as manure, antimicrobial agent, and disinfectant. Thus, Cow urine can be used as a biological tool for crop production instead of chemical fertilizer and pesticides. Additional input of nutrients into crops through fertilizer leads to a negative balance for the soil. Furthermore, it is not desirable to apply nutrients by inorganic sources alone. As a simple resource, cow urine has the property of long-term soil health maintenance and modification of microbial population convenient for better crop production (Vahenka *et al.*, 2010). Cow urine application records higher estimations of grain yield and organic yield. Because, proper dairy manure management promotes those biological tools like: bio-fertilizer and bio-pesticides which is effective in soil fertility and management of a large number of pest and disease (Deepak *et al.*, 2018) In addition, organic formulation cow urine extract and fish wash can be the potent source to move fertility of soil and additionally control the pest and disease of plant (Verma *et al.*, 2017).

Incorporation of organic manures mainly farmyard manure and cow urine have given a hope to reduce the cost of cultivation and minimize the adverse effects of chemical fertilizers. Application of cow urine up to 900 l/ha as basal dose markedly improved yield attributes as well as seed and stover yield of mustard (Pradhan *et al.*, 2016). Similarly protein content and chlorophyll content of methi and bhindi were increased with higher concentration of urine as compared to control (Jandaik *et al.*, 2015). Nitrogen at 150 kg/ha by urine through foliar application gave the most noteworthy soil pH (6.1), organic matter (5.43%), phosphorus (147 kg/ha) and the nitrogen (0.31%) which was essentially higher than N_0 (Sharma *et al.*, 2016). The combined effect of silicon and soil category at 200 mg Si kg⁻¹ soil and low and medium category soils registered its superiority over its lower levels in rice crop. (Malavet *et al.*, 2017). Application of cow urine accelerates the different aspects of growth in several crops like maize, rice, mustard, lettuce. (Pradhan *et al.*, 2018). The concentration of cow urine that produced the best yield of "Regina 2000" lettuce when 1.01% (14.92 t ha⁻¹) was applied to soil and 1.25% (17.00 t ha⁻¹) was applied to leaves (Oliveira *et al.*, 2009). From another study it is reported that height, number of leaves per plant at harvest in maize crop varied significantly due to application of different cow urine and fertility levels (Devakumar *et al.*, 2014). It was reported by Nwhite that different urine sources have an effect on soil chemical properties and maize yield in Abakaliki, Southeastern Nigeria (Nwhite, 2015). High dose of LCM (Liquid Cow Manure) application resulted in increased pH and EC values, nutrients and DOC (Dissolved Organic Carbon) content of amended soils (Aguilera *et al.*, 2010). The yield and soil health of irrigated maize (*Zea mays* L.) are impacted by various levels of FYM and cattle urine application as organic production practices (Pradeep, 2014). Rice (*Oryza Sativa* L.) production and growth are impacted by the timing and dosage of biourine applications, according to Qibtiyah (Qibtiyah *et al.*, 2015). The Vegetative growth, flowering, crop production, and vase life are all impacted by cow urine combined with plant growth regulator and vermiwash (Tamarakar, 2016). Nevertheless, as bio pesticide different blends of cow urine and pest killing plant parts have appeared critical synergistic impact to improve insects and vermin mortality (Gahukar, 2013).

MATERIALS AND METHODS

The experiment was conducted at Kusumhati under Laxmanpur union of Sherpur district in Bangladesh. Sherpur city is located about 198 kilometers north of Dhaka. Medium-sized BINA boro Dhan (Variety-28) seed with light golden husks was used as a test crop. Only healthy seeds had been separated by immersing in water for 24 hours. Finally, removed into a gunny bag after that kept two days for sprouting. Sprouted seeds were sown into the rice field as uniformly as possible with mild irrigation. There was no use of any fertilizer and bio pesticide in T_0 (Control Group). Chemical fertilizer was applied in the boro rice as per given doses like: Urea, TSP, K, S, Zn, B : 296, 124, 124, 74, 07, 05 (kg/hectare). Organophosphorus and Organochlorinated substances (Brand name: Khurodon Sobicron) as chemical pesticides were applied in the T_1 plots at seven days interval from planting up to flowering. For T_2 (Treatment group 2) freshly ejaculated and stored cow urine had been collected into a concrete pit after that stored in a gallon. The bio fertilizer solution prepared from mixing cow dung with cow urine (1:1) and then the solution was diluted into 1: 9 with water. Cow urine as bio fertilizer was applied on the basis of one thousand liter per hectare in boro rice production. 1kg fresh neem leaves were kept in 10L container with cow urine and allowed them fermentation by covering for 28 days. Therefore, the solution was thoroughly mixed and filtered five times through a sieve to obtain the absolute solution, which had been mixed with 10L fresh water in a 1:10 (cow urine and water) to produce bio pesticide. Cow urine as bio pesticide was applied at 15 days interval upto flowering stage on the basis of one thousand two hundred liters per hectare for boro rice production. All plots were irrigated and

weeding took place as per requirement. Traditional farming system was practiced for land preparation and crop cultivation. 90% of the grains golden yellow in color was the indication of well matured panicles. Finally, the yields of grain were measured and converted to tons per hectare.

Research Design and Data collection

The experiment was carried out on completely randomized design (CRD) measuring 7 feet X 7 feet, with two treatments (T_1 and T_2). Replication continued until it was one meter from the plot. Group T_0 indicates, there is not application of any fertilizer and pesticide. Group T_1 indicates the application of chemical fertilizer and chemical pesticide. Group T_2 indicates the application of cow urine as bio-fertilizer and bio-pesticide which made from cow urine with leaves extract.

T_0 (Control Group): Without any fertilizer or pesticide

T_1 (Treatment Group 1): Application of chemical fertilizer and chemical pesticide

T_2 (Treatment Group 2): Application of cow urine as biofertilizer and spraying biopesticide

R_1 , Replication 1; R_2 , Replication 2; R_3 , Replication 3

RESULTS AND DISCUSSIONS

Experiment was designed in completely randomized design (Table 1). All parameters in growth and yield of rice plant like plant height, number of tillers, Chlorophyll content yield were shown (Table 2) improvement in T_2 as compared to others. The data presented on plant height of boro rice was measured at 15, 30, 45 days after transplanting (DAT) revealed that average plant height for T_0 was 38 cm, 53 cm, 66 cm at 15, 30, 45 (DAT) respectively (Table 2). For T_1 plant height was 39.5 cm, 55.5 cm, 74 cm 15, 30, 45 (DAT), respectively (Table 2). For T_2 plant height was 40 cm, 56.3 cm, 76 cm 15, 30, 45 (DAT) respectively (Table 2). Where highest plant height was found 76 cm at 45 days from T_2 . Number of effective tiller per hill highest result was found 14 from T_1 and highest chlorophyll content was found 46.5 from T_2 at 45 days and 30 days, respectively (Table 2).

Table 1. Experimental design

Plot 1 T_0R_1	Plot 2 T_2R_2	Plot 3 T_1R_3
Plot 6 T_1R_2	Plot 5 T_0R_3	Plot 4 T_2R_1
Plot 7 T_2R_3	Plot 8 T_1R_1	Plot 9 T_0R_2

Table 2. Effect of boro rice at different date during growth state

Treatment	Plant height			No. of Tiller / Hill			Chlorophyll Content		
	15 days	30 days	45 days	15 days	30 days	45 days	15 days	30 days	45 days
T_0	38	53	66	4	6	8	35	39.6	37
T_1	39.5	55.5	74	6	8	14	37	45	39
T_2	40	56.3	76	7	8	13	38	46.5	38

Cow urine contains 95% water, 2.5% urea and 2.5% mineral salts, hormones and enzymes. Amounts of Nitrogen, Phosphorus, Potassium and Sulphur in cow urine are enough to conserve soil nutrients requirements. Application of cow urine not only improves soil texture but also act as a plant hormone. The effect of (N) nitrogen through cow urine and cow dung in a combination significantly increased the availability of nitrogen at all stages of crop growth. This is probably due to high level of applied nitrogen supplemented by N from cow urine.

In this study, we considered the boro rice yield characteristics (Table 3). Application of combined bio fertilizer and bio pesticide use had higher production records than others. Number of tiller per hill was higher for the chemical fertilizer and pesticide. But the values were very close. Higher panicle length was found 12 inches for combined use of bio fertilizer and bio pesticide than chemical fertilizer and chemical pesticide. Panicle length was found 11 inches for chemical fertilizer and pesticide (Table 3). The average highest number of grain per panicle was 253 when combined use of bio fertilizer and bio pesticide was applied for boro rice but the number of panicle was almost similar for other two treatments. Higher number of sterile spikelet per panicle was found in rice when no fertilizer and pesticide was applied. Very few number of sterile spikelet per panicle was found in case of combined application of bio fertilizer and bio pesticide.

Table 3. Yield Characteristics of boro rice

Yield Characteristics	T ₀	T ₁	T ₂
No. of total tiller /hill	8	14	13
No. of effective tiller /hill	6	12	11
Panicle length (Inches)	9	11	12
No. of grains per panicle	60	250	253
No. of sterile spikelet/panicle	43	32	29
Yield (ton/hectare)	1.1	5.42	5.85

BINA= Bangladesh Institution of Nuclear Agriculture; PACE= Promoting Agricultural Commercialization and Enterprise
PKSF= Palli Karma-Sahayak Foundation; IFAD= International Fund for Agricultural Development; CRD= Completely Randomized Design;
KG= Kilogram; L= Liter; %= Percentage; PH = Potential of Hydrogen

Yield record of rice cultivation had showed the comparative evaluation among without fertilizer and pesticide, chemical fertilizer, chemical pesticide and combined use of bio fertilizer and bio pesticide. In all treatments the average production was identical which around 5.30 ton/hectare. But the highest yield was 5.85 ton /hector from T₂ (Treatment group 2) (Table 3). In the yield of T₂ group was comparatively similar and some times higher than T₁ but T₀ was always significantly lower than T₁ and T₂ groups. It was observed that rice yields were 5.42 ton/hector and 5.85 ton /hector in T₁ and T₂, respectively (Table 3). No pest infestation was observed in T₂ group after applying 3 times of bio pesticide and no pest infestation was observed in T₁ group after applying 6 times of chemical pesticide. The study found that the pest infestation was higher in T₀ group than T₁ and T₂ group. In addition, potency of cow urine in terms of pest infestation of rice production compare with chemical fertilizer and chemical pesticide was same and some times better. Cow urine after addition of neem leaves is a wonderful bio pesticide. Such bio pesticides are safe to use, do not accumulate in the food chain and as such do not have the harmful effects like chemical pesticides (Dhama *et al.*, 2005)

CONCLUSION

Cattle urine having potency in pest infestation control and it improves the nutrient availability for boro rice plant growth, follicle development ultimately it improve boro rice production which is economically comparable with chemical fertilizers and pesticides. Elaborate filed trial and research is necessary for identifying cattle urine potency introduction in coming future.

COMPETING INTEREST

The authors declare that they have no competing interest.

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