EFFECT OF POULTRY MANURE AND WEEDING ON GROWTH AND YIELD OF TRANSPLANTED AMAN RICE

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CERTIFICATE

This is to certify that the thesis entitled, **"EFFECT OF POULTRY MANURE AND WEEDING ON GROWTH AND YIELD OF TRANSPLANTED AMAN RICE"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (MS) IN AGRONOMY**, embodies the result of a piece of bona-fide research work carried out by **MORSALIN HASAN, Registration No.13-05393** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged.

Dated:
Place: Dhaka, Bangladesh

(Dr. Md. Shahidul Islam)
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The author

EFFECT OF POULTRY MANURE AND WEEDING ON GROWTH AND YIELD OF TRANSPLANTED AMAN RICE

ABSTRACT

An experiment was carried out at the Agronomy Research Field, of Sher-e- Bangla Agricultural University (SAU), Dhaka-during the period from July to November 2018. The experiment was consisted of two different factors *viz*. factor A: Poultry manure (4 levels); P_0 = Recommended fertilizer (Urea, TSP MoP and Gypsum@ 150,53,82 and 60 kgha^{-1} respectively) without poultry manure; P_1 = Recommended fertilizer with poultry manure 2 ton ha^{-1}; P_2 = 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} and P_3 = 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} and factor B: Weeding (3 Levels); W_0 = No weeding; W_1= Weeding at 20 DAT(before applying 2nd installment of urea & rest ½ M_0P) and W_2 = Weeding at 20DAT (before applying 2nd installment of urea & rest half of M_0 P) and at 40 DAT. The experiment was laid out in split-plot design with three replications. The data on plant growth characters, yield contributing characters and harvest index were analyzed using analytical computer software program statistix-10. The mean differences among the treatments were compared by least significant difference test (L.S.D) at 5% level of significance. Experimental results revealed that recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1) showed the best performance in terms of higher yield and yield contributing characters viz; number of effective tillers hill^{-1} (11.62) , panicle length (23.51 cm), filled grains panicle^{-1} (104.42), 1000–seed weight (26.21g), seed weight hill^{-1}(26.70g) , grain yield (5.36 t ha^{-1}), straw yield (7.93 t ha^{-1}); where as the lowest results were recorded in recommended fertilizer (Urea, TSP, and MoP and gypsum @ 150, 53, 82, and 60 kg ha^{-1} respectively) without poultry manure (P_0). Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (W_2) showed higher results on growth and yield attributes over no weeding (W_0). The results suggest that recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1) and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (W_2) can be practiced for transplanted aman rice cultivation. Among the interactions P_1W_2 demonstrated as the best combination of treatments for better growth, yield and yield contributing characters towards increasing grain yield of transplanted aman rice in Bangladesh.

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ABBREVIATIONS AND ACRONYMS

AEZ = Agro-Ecological Zone

Agric=Agricultural

BBS = Bangladesh Bureau of Statistics

BCSIR = Bangladesh Council of Scientific and Industrial Research

cm = Centimeter

CV % = Percent Coefficient of Variation

DMRT = Duncan's Multiple Range Test

et al., = And others

e.g. = exempli gratia (L), for example

etc. = Etcetera

FAO = Food and Agriculture Organization

g = Gram (s)

i.e. = id est (L), that is

Kg = Kilogram (s)

LSD = Least Significant Difference

m^2 = Meter squares

ml = Millilitre M.S. = Master of Science

No. = Number

SAU = Sher-e-Bangla Agricultural University

var. = Variety

% = Percentage

GM = Geometric mean

mg = Milligram

P = Phosphorus

K = Potassium

Ca = Calcium

μg = Microgram

USA = United States of America

WHO = World Health Organization

J= Journal

R=Research

CHAPTER 1

INTRODUCTION

Rice *(Oryza sativa)* is the staple food crop in Bangladesh and the cropping pattern of the country is predominately rice-based. In Bangladesh, rice dominates over all other crops and covers 77 % of the total cropped area and 93% farmers grow rice (BBS, 2018). The total area and production of rice in Bangladesh are about 11.7 million hectares and 31.98 million metric tons, respectively (BBS, 2018). The soil fertility status in Bangladesh is gradually declining. The deficiency of N, P, K, S, Zn and in this country's soils has arisen chronologically (Islam, 2008). The stagnating trend in the yield of major crops of the country has become an alarming issue for the scientist and policy makers (Bhuiyan, 1994). Low organic matter content of the soil, imbalanced use of chemical fertilizers, less use of organic manures and inadequate attention given for its improvement and maintenances are the major causes behind declining soil fertility in Bangladesh (Karim *et al.,* 1994). Unbalanced use of chemical fertilizers has affected soil health, causing a substantial decrease in soil organic carbon. Many farmer's use more amount of N fertilizer than needed while they use less amount of other fertilizers such as P, K and S. They seldom use micronutrient fertilizers e.g. Zn and B. This practice in turn produces a negative impact on crop production (Rijpma and Jahiruddin, 2004). Soil organic matter (SOM) plays an important role in maintaining soil fertility and productivity. Organic matter acts as a reservoir of plant nutrients especially N, P and S and micro-nutrients and check leaching of the nutrients. Losses of SOM can be replenished in the short term by application of organic matter such as poultry manure. Poultry manure is a good source of nutrients, especially N, P, K & S and it's a good means of soil rejuvenation (Jeptoo *et al.*, 2013). Rice

is one of the major contributor of total food grain production of Bangladesh, is now witnessed the yield stagnation and declining productivity due to continuous use of high level of chemical fertilizers had led to soil degradation problem. The production of rice is the nutrient requirement and the use of chemical fertilizers has been increased worldwide for cereal production (Abril *et al.,* 2007) due to availability of inexpensive fertilizers (Graham and Vance, 2000). The continued use of chemical fertilizers causes health and environmental hazards such as ground and surface water pollution by nitrate leaching

(Pimentel, 1996). So, reducing the amount of nitrogen fertilizers applied to the field without a nitrogen deficiency will be the main challenge in field management. One of the possible options to reduce the use of chemical fertilizer could be recycling of organic wastes. Poultry manure as the organic waste can be a valuable and inexpensive fertilizer and source of plant nutrients. Positive effects of organic waste on soil structure, aggregate stability and water-holding capacity were reported in several studies (Jedidi *et al.*, 2004; Odlare *et al.,* 2008; Shen and Shen 2001; Wells *et al.,* 2000). A number of workers have reported that maintenance of a critical level of rice plant population in field was necessary to maximize grain yields. Faruk *et al.,* (2009) reported that the highest grain yield of rice was recorded from two plants per hill and the lowest one was recorded from single plant per hill. Organic farming provides a way for continued rice production by resource poor farmers. Further the low yields obtained in the organic farming are well compensated by higher price offered to organic foods. Studies suggest that yields could be sustained without increasing the nutrient inputs by compensating the nutrient cycles through organic nutrition (Stockdale *et al.,* 2001). Proper selection of a variety and appropriate nutrient management are important in organic rice production (Manjunath *et al*; 2009) . Organic manures have the capacity to fulfill nutrient demand of crops adequately and promotes the activity of macro and micro flora in the soil (Sharma,2005).The area under scented rice varieties is increasing day by day with the opening of the world market as well as increased domestic consumption due to their premium quality (Singh *et al.,* 2008). High altitude and tribal area zone of middle region is endowed with the special soil and climate which suits better for organic farming particularly with scented rice cultivation compared to coastal plains, Now a days market facilities are also improved due to intervention of several agencies. Selection of proper variety, suitable to the specific ecological situation may prove to be a boon to the farmer. Unchecked weed growth in rice can reduce crop yield up to 80% (Babu *et al*., 1992).

In spite of substantial fertilizer use in crop yields are not increasing correspondingly, which reflect low fertilizer use efficiency (FUE). Poultry manure is an excellent organic fertilizer, as it contains high nitrogen, phosphorus, potassium and other essential nutrients (Mehdizadeh *et al.* 2013). In contrast to chemical fertilizer, it adds organic matter to soil which improves soil structures, nutrient retention, aeration, soil moisture holding capacity and water infiltration (Deksissa *et al.* 2008). It was also reported that poultry manure more readily supplies Phosphorus to crops than other organic manure sources (Garg and Bahla, 2008). Organic fertilizers including farmyard manure, sheep manure and poultry manure may be used for the crop production as a substitute of the chemical fertilizers because the importance of the organic manures can not be overlooked. Different weed management methods in rice have different effects on weed suppression and growth enhancement (Hasanuzzaman *et al.*, 2007). No weed management method is equally effective under all conditions (Riaz *et al.*, 2006). For instance, hoeing twice increased rice yield by decreasing weed density (Ekeleme *et al.*, 2007). Furthermore, sorghum and sunflower extract water could effectively suppressing weeds in rice (Cheema *et al.*, 2010). Manual weeding is an effective means of controlling weeds, but a declining labor force in the rural areas along with the rising cost of labor have encouraged the usage of herbicides (*Fischer et al.* 2004). Selective herbicides (Bispyribac-sodium) are easy to use, effective and not expensive (Khaliq *et al.* 2014). Now-a-days, there is growing interest in the use of organic manures due to depletion in the soil fertility (Hamma and Ibrahim, 2013). Economic premiums for certified organic grains have been driving many transition decisions related to the organic farming (Delate and Camberdella,2004), (Danmaigoro *et al.* 2004). Continuous and excessive use of agrochemicals creates potential contamination effect in the environment (Oad *et al*.; 2004; Mehdizadeh *et al;* 2017). Production of agrochemicals needs a large amount of energy and money (Gellings and Parmenter, 2004). However, an organic farming with or without chemical fertilizers seems to be possible solution for these situations (Prabu *et al.* 2003). The application of both organic and synthetic sources of nutrients not only supply essential nutrients but also have some positive interaction with chemical fertilizers to increase their efficiency and thereby reduce environmental risks (Jaya and Barber, 2017). Hence, the present research work will attempt to find out a good possible combination of poultry manure with chemical fertilizers to maintain soil organic matters (SOM) .

Considering the present situation the present study was undertaken to:

a. determine reduction limit of inorganic fertilizer in combination with poultry manure in rice.
b. determine the most suitable time and frequency of weeding in rice.
c. determine the suitable combination of fertilizer application and weeding treatment.

CHAPTER 2

REVIEW OF LITERATURE

Rice (*Oryza sativa* L.) is the world's most important staple food for more than two billion people in Asia and hundreds of millions in Africa and Latin America (Ladha *et al.*, 2007). Within Southeast Asia, rice provides about 60% of the human food consumption. About 55% of the Asian rice is produced in irrigated areas, which accounts for about 75% of Asia's total rice production with an estimated 2.2 billion Asian rice farmers and consumers depending upon the sustainable productivity of the transplanted aman rice ecosystem for their food supply (Buresh *et al.*, 2005).

2.1 Effect of poultry manure

Proper nutrition throughout the crop growth season plays a determining role in the final harvest of the crop. Various researchers have tried organic, inorganic and a combination of both types of fertilization, with or without other management techniques to check their validity to improve economic yields. Recent and on-going studies demonstrate that farmers in Iran are applying more chemical fertilizers than is economically optimal. Taking into consideration concerns about the sustainability of input-intensive agriculture and the economical, ecologiccal, and environmental effects of chemical fertilizer over-use, it is clear that over all application should be reduced. Generally, individual farmers make decisions about agricultural practices. In order to change behavior regarding chemical fertilizer application it is necessary to understand the factors that influence how farmers make these decisions

Wander *et al.* (2006) reported that soil organic matter (SOM) is potentially the single best integrator of inherent soil productivity and should be developed as an index of soil quality. Maintenance of soil quality, which is the capacity of soils to sustain productivity, maintain environmental quality, and promote plant and animal health (Doran and Parkin, 2004); is the key to agricultural sustainability (Wander *et al.* 1996). Over a longer period of time, application of organic materials such as animal manures and crop residues have been found to bring about a gradual improvement in soil productivity and crop performance (Siavoshi, 2011). A study carried out on five crops in Japan showed that application of organic matter enhance root growth and nutrient uptake, resulting in higher yields (FFTC, 2012).

Recommendation of chemical fertilizers should be based upon soil analysis and crop response. Practice of using imbalanced chemical fertilizers by farmers has been posing a serious problem not only to agriculturists but also to policy makers, ecologists and environmentalists (Yadav *et. al*. 2014). The organic manures and crop residues should be used as an alternative source of N, and also increased efficiency of applied N (Salem, 2006). The major possible sources of organic manures are Farm yard manure (FYM), Poultry manure (PM) and rice straw (RS), but their availability and nitrogen release in sufficient amount during crop season is a major consideration and required a technology to integrate these materials with inorganic fertilizers. Integrated use of organic manures and inorganic fertilizers can contribute to increase in the N content of rice soil as well as to increase in long term productivity (Gill and Meelu, 2008) and enhancement of ecological sustainability. About 25% of nitrogen (N) and phosphorus (P), 50% of sulfur (S), and 75% of potassium (K) uptake by cereal crops are retained in crop residues, making them valuable nutrient sources (IRRI.; 2013). Incorporation of chemical and organic fertilizer can enhance the contents of micronutrients in plants and, obviously, their uptake in plant and grain and straw at harvest in comparison to rest of the N sources and among organic N sources, supplication of N through combination of D.S + P.M + C.W @ 40 kg N ha^{-1} each increased the grain and straw yield significantly (Dash *et al.*, 2010). Among various bio-fertilizers, BGA in combination with *Azospirillum* proved beneficial for different growth characters.

Nutrient availability from organic sources is due to microbial action and improved physical condition of soil (Sarker *et al.*, 2015). Organic farming relies on soil health and cycling of nutrients through the soil using natural processes. Crop residues incorporation performs the vital function of fertilization, in concert with the addition of animal manures if those are used. Crop residues have been found quite promising in enhancing crop yield and fertilizer saving (Dixit, 2007).

Saliha *et al.* (2005) tested different organic manures for their impact on lowland rice. They found that, among all other organic manures, application of poultry manure at the rate of 3 tons ha^{-1} not only improved yield, but also considerably improved chemical and biological properties of soil. They called organic manures as "commercially viable, environmentally acceptable and practically enforceable option" for increasing yields with sustainable soil fertility. Satyanarayana *et al.* (2002) revealed that the highest grain yield of rice was obtained when the field was fed with 10 tons organic manure plus 45 kg NPK ha^{-1}. Both types of manures interacted well to improve nutrient uptake, number of tillers, filled grains per panicle and 1000-grain weight. Effect of poultry manure on growth and yield of rice was studied by Boonsiri*et al*. (2009).

Conventional rice cultivation frequently relies on targeted short-term solutions to solve nutritional problems e.g. application of a soluble fertilizer. In contrast, use of organic fertilizers in rice production is a strategically different approach, which relies on longer-term solutions. It involves nutrient cycling and conservation of soil health as well as management and control of weeds, pest and disease (Stockdale *et al*., 2001). It was observed that the crop yield under organic fertilization could be improved from 50% to more than 95% when compared to those in conventional chemical fertilization (Lampkin and Measures 2001,). It was also documented that spring cereals perform better than winter cereals in organic systems. The large shortfall in cereal yields is linked to the difficulty of managing soils to synchronize N mineralization with the period of maximum N demand (Stockdale *et al.,* 1992). Most European studies of organic farming reported lower crop yields in organic than conventional systems. In contrast, some American studies have reported similar yields in organic systems which are reported by Poudel *et al.* (2002) for tomatoes and corn and Reganold *et al*. (2001) for apples. These studies clearly indicate that in the future, the crop production with organic fertilizers have more scope towards improved crop yields and quality. In respect to this, Sanchez *et al.*(2001) suggests that the key to increase the capacity of the soil to supply N to a growing crop can be achieved by addition of a diverse range of substrates to the farming system. According to them improved management of manures and composts has the potential to improve crop nutrition in organic farming. There are few reports, which indicate positive influence of organic fertilizers on rice productivity. The productivity of rice plant is greatly dependent on the number of productive tiller (tillers that bears panicle) rather than the total tiller numbers. Sometimes tillers are fertile but grains are not filled properly that causes reduction in crop yields. Luong and Heong (2005) observed reduction in unfilled grain percentage, and increase in grain weight of rice with application of organic manure. Channabasavanna and Biradar (2001) reported that organic fertilizers significantly affect 1000-grain weight in rice and Mirza *et al*. (2010) supported these results. Increased growth parameters of rice crop with conjunctive effect of fertilizers with N and organic sources have been established by Reddy and Reddi (1997), Rao *et al*, (1998), Selvam (2000). The increase in biological and grain yield in rice are endorsed to the increase in yield attributes like plant height, number of productive tillers per hill, panicle weight and 1000-grain weight (Ebaid and El-Refaee, 2007).

Sarkar *et. al.* (2015). was conducted an experiment at Sher-e-Bangla Agricultural University Farm, Dhaka, Bangladesh during the period from August to December 2012 to study the effect of various combinations of organic manure and inorganic fertilizer on the growth, yield, chlorophyll and nutrient content of rice var. BRRI dhan33. The treatment consists of T1: 100% Inorganic fertilizer (Recommended dose) + 5 ton poultry manure (PM) /ha , T2: 75 % N of recommended dose + 5 ton PM /ha, T3: 50 % N of recommended dose + 5 ton PM /ha, T4: 25 % N of recommended dose + 5 ton PM /ha, T5: 75 % S of recommended dose + 5 ton PM /ha, T6: 50 % S of recommended dose + 5 ton PM /ha, T7: 25 % S of recommended dose + 5 ton PM /ha, T8: 100% Inorganic fertilizer and T9: 5 ton PM /ha. Significant variation was found in growth and yield parameters as well as in chlorophyll content and nutrient content of aman rice. The most of the growth parameters (plant height, leaf length and diameter, leaf number and total tiller plant-1) results were found better in 100% Inorganic fertilizer + 5 ton PM ha^{-1} which was statistically similar with 75 % of recommended dose of S + 5 ton PM ha^{-1}, 75 % of recommended dose of N + 5 ton PM ha^{-1} and followed by 50 % of recommended dose of S + 5 ton PM ha^{-1}, respectively while the lowest from 5 tha^{-1} PM treatment. On the other hand, significantly higher chlorophyll "a", "b" and total chlorophyll content were recorded in 100% Inorganic fertilizer + 5 ton PM ha1and it was closely followed by

75 % of recommended dose of N + 5 ton PM ha^{-1} and lowest in 5 ton PM ha^{-1}. Number of effective tillers $hill^{-1}$, panicle length, number of rachis $plant^{-1}$, filled grain $plant^{-1}$ and fresh weight of plant were highest in 100% Inorganic fertilizer + 5 ton PM /ha and it was either statistically similar or closely followed by 75 % of recommended dose of S + 5 ton PM ha^{-1}. Higher grain yield (4.18 t ha^{-1}) was recorded in T_1 which was statistically similar with T_5 (4.13 tha^{-1}) whereas lowest grain yield (3.67 tha^{-1}) was from sole PM. Similarly, N content in grain and N, K content in straw were also showed similar trend. S content in grain and P, S content in straw were higher in 75 % of recommended dose of S + 5 ton PM /ha compared to other fertilizer treatments. The lowest N and S content in grain and N, P, K, S content in straw were found from the treatment using poultry manure only.

Subedi *et. al.* (2018) explored that the potentiality of poultry manure is to use as fertilizer in agricultural practices through using descriptive statistics and probits regression model. Result showed that Poultry manure was comparatively more economical than chemical fertilizers regarding same amount of NPK availability for crop production. Sampled households' age, income, agriculture as main occupation, credit access and membership had significantly determined the level of the application of poultry manure. Farmers perceived that affordable price and soil fertility improvement were the main reasons behind applying it. However, volatilization, leaching, improper decomposition, poor market infrastructure and transportation and branding were identified as the major problems associated with its use. Study also revealed that willingness to pay for processed poultry manure was 4 to 7 times higher than what farmers were paying for raw poultry manure. Therefore, either the government or private firms should take initiative in production of processed poultry in Nepal.

Islam *et. al.* (2013) conducted an experiment at Sher-e-Bangla Agricultural University research farm, Dhaka, Bangladesh during December 2010 to April 2011 to study the effect of fertilizer and manure with different water management on the growth, yield and nutrient concentration of BRRI dhan28. The experiment consisted of 2 factors i.e. irrigation and fertilizer plus manure. There were 2 irrigation levels (I_0= Alternate wetting and drying, I_1= Continuous flooding) and 8 fertilizer treatment (T_0: control, T_1: 100%

RDCF, (N100P15K45S20Zn2), T_2: 10 ton cowdung/ha, T_3: 50% RDCF + 5 ton cowdung/ha, T_4: 8 ton poultry manure/ha, T_5: 50% RDCF + 4 ton poultry manure/ha, T_6: 10 ton vermicompost/ha, T_7: 50% RDCF + 5 ton vermicompost/ha). There were 16 treatment combinations and 3 replications. Irrigation had no significant effect on the yield and yield parameters of BRRI dhan 28. The yield contributing characters and yields were significantly influenced by applied fertilizer and manure. The T_5 (50% RDCF + 4 ton poultry manure/ha) showed the highest effective tillers/hill, plant height, panicle length, 1000 grain wt., grain yield (5.92 kgplot^{-1}) and straw yield (5.91 kgplot^{-1}). The higher grain and straw yields were obtained organic manure plus inorganic fertilizers than full dose of chemical fertilizer and manure. The highest grain (5.93 kgplot^{-1}) and straw yields (6.42 kgplot^{-1}) were recorded from I_0 T_5 (Alternate wetting and drying + 50% RDCF plus 4 ton poultry manure/ha) and the lowest was found in I_1T_0 (Continuous flooding + control treatment) treatment combination. The highest concentrations of grain and straw N, P, K, S were recorded in T_5 treatment. The levels of organic matter and nutrient concentration were increased in the post harvest soils due to added manure plus inorganic fertilizer.

Hossain *et. al.* (2012); reported that the performance of 75% RFD with poultry manure @ 3 tha^{-1} was the best in producing yield components, grain and straw yields of rice. At both locations, the performance of same dose (3 tha^{-1}) of poultry manure and Kajaiboshar was almost similar in producing growth and yield contributing characters, grain and straw yields, - nutrient content and uptake by rice while each of these manures compensated up to 25% of recommended chemical fertilizers. Therefore, considering the soil health, poultry manure or KazijaiboShar @ 3 tha^{-1} is recommended for growth and yield enhancement in rice.

The current farming system is heavily reliant on chemical fertilizers, which negatively affect soil health, the environment, and crop productivity. Improving crop production on a sustainable basis is a challenging issue in the present agricultural system. To address this issue, we assumed that the combined use of organic manure and inorganic nitrogen (N) fertilizers can improve rice grain yield and soil properties without the expense of the environment. This study explores the combined eff ects of cattle manure (CM), poultry manure (PM), and chemical fertilizer (CF) on soil properties, rice growth, physiology, and grain yield and quality. Six treatments in the following combinations were included: T_1- no N fertilizer; T_2- 100% CF; T_3- 60% CM + 40% CF; T_4- 30% CM + 70% CF; T_5- 60% PM+ 40% CF; and T_6- 30% PM+70%CF. Results showed that across the seasons, treatment T_6- increased the net photosynthesis rate, total biomass, grain yield, and amylose content by 23%, 90%, 95%, and 10%, respectively, compared with control. This increment in net photosynthetic rate and growth was the result of 24%, 14%, 19%, and 20% higher total root length, root surface area, root volume, and root diameter, respectively. Improvements in the attributes further enhanced the grain yield and nitrogen use efficiency of rice. No significant difference between T_4 and T_6 was observed. The correlation analysis also confirmed that root morphological traits were positively correlated with grain yield, N uptake, and biomass accumulation. Similarly, improvement in grain yield and NUE was also associated with improved soil properties, i.e., bulk density, soil porosity, soil organic carbon, and total N under combined organic and inorganic N fertilizers treatment. Conclusively, the integration of 30% N from PM or CM with 70% N from CF (urea) is a promising option not only for higher grain yield and quality of rice but also for improved soil health. This study provides a sustainable nutrient management strategy to improve crop yield with high nutrient use efficiency.

Selvam (2000) investigated the effects of integrated organic and inorganic fertilizers on the growth and yield of indica rice variety Manawthukha and japonica rice variety Genkitsukushi. In a split-plot design, the two rice varieties were assigned as main plot factors, and the integrated treatments were the subplot factors, including no-N fertilizer (N0), 50% chemical fertilizer (CF) (CF50), 100% CF (CF100), 50% CF + 50% poultry manure (PM) (CF50PM50), 50% CF + 50% cow manure (CM) (CF50CM50), and 50% CF + 50% compost (CP) (CF50CP50). CF100 was equivalent to N at 85 kg/hm2. Manure was applied based on the estimated mineralizable nitrogen (EMN) level, which is dependent on total N (%) of each manure type. Manawthukha rice plants were taller with higher tiller number and dry matter content. However, higher soil-plant analysis development (SPAD) values were measured in Genkitsukushi throughout the crop growth period, resulting in higher seed-setting rate (%) and greater yield. At the same N level, CF50PM50 application in both rice varieties resulted in higher SPAD values, plant height and tiller number than CF100. CF50PM50 containing total N more than 4% supplied synchronized N for the demands of the rice plants, resulting in maximum dry matter, yield and yield components. CF50CM50 and CF50CP50 treatments containing total N less than 4% resulted in lower yields which were similar to CF100. These results indicated that integrating organic and inorganic fertilizers enhanced growth parameters and yields of Manawthukha and Genkitsukushi, while reducing the dose of chemical fertilizer.

Arif (2014). determined that the effect of organic and inorganic sources of nutrients on growth and yield of rice variety Basmat– 2000, comprising of 11 different treatments using randomized complete block design with four replications was conducted at Post–Graduate Agricultural Research Station, University of Agriculture, Faisalabad. Application of NPK @ 50–37.5–30 Kg ha^{-1} along with poultry manure @ 20 tha^{-1} showed significantly maximum leaf area index (2.98), plant height at maturity (130.31 cm), grain yield (3.82 t ha^{-1}) and harvest index (46.46%). This treatment also produced maximum number of tillers hill^{-1} , number of grains panicle^{-1}, 1000–grain weight and straw yield which was at per with T_6, where NPK @ 50–37.5– 30 kg ha^{-1} along with FYM @ 20 tha^{1} was applied.

Shah *et. al.* (2014). reported that the residual effect of organic N (Poultry Manure) and mineral N on maize crop in field experiments carried out on silty clay loam soil at NIFA, Tarnab, Peshawar, Khyber Pakhtunkhwa (KP) Pakistan during 2014-15. Combined dose of N from both sources were 120 kg ha^{-1} applied to wheat crop alone and in different combination making six treatments. Maize variety (Azam) was sown in Randomized complete block (RCB) design with four replications. Agronomic data, grains ear^{-1}, 1000 grain weight, biomass grain yield data, N-uptake in maize grain and straw were recorded. Results showed that maximum grain ear^{-1}, 1000 grain weight, biomass and grain yield was obtained from treatment where 25% N applied from poultry manure + 75% from mineral N source applied to previous wheat crop. Agronomic efficiency and nitrogen use efficiency were also found maximum in treatment where 75% poultry manure + 25%

mineral N was applied. It was concluded from the study that residual effect of organic manure with mineral N in different ratios enhances crop productivity and soil fertility.

2.2. Effect of weeding

Weed management is highly important for obtaining crop yield close to genetic potential of the cultivars. There can be a large yield difference between completely weed free and totally infested conditions. Different crops vary in their competitive ability with weeds (Heemst, 1985). Moody (1993) told that a comprehensive weed management strategy was mandatory for economic rice production. Although herbicides exhibit desirable results for weed management, there is a need to give importance to non-chemical and cultural methods of weed control in order to minimize total reliance on herbicides. More than 50 weed species are reported to cause yield losses in transplanted aman rice that ranges between 30 to 98% (Oerke and Dehne, 2004; Rao *et al.*, 2007; Gowda *et al.*, 2009). Rice yield losses due to pests may amount to 40%, nonetheless, weeds have the greatest potential (32%) of inflicting yield loss (Rao et al., 2007). Losses due to weeds are indeed much higher than those caused by N deficiency, pests, or diseases (WARDA, 1996). Karim *et al.*,2004; Rao *et al.*, 2007; Kumar and Ladha, 2011; Chauhan, 2012). Globally rice yield losses due weeds have been estimated about 10% of the total production (Oerke and Dehne, 2004). Ramzan (2003) reported a potential yield loss up to 48, 53 and 74% in transplanted, direct seeded in flooded conditions and direct seeded in dry soils rice, respectively. In the absence of weed control, losses due to weeds in DSR ranged from 1163% in the Philippines (Zhao, 2006), 70-76% in India (Singh *et al*., 2005), 16-100% in Bangladesh (Rashid *et al.*, 2012), 40-100% in South Korea (Kim and Ha, 2005), 10-35% in Malaysia (Karim *et al.*, 2004) and 75-80% in Pakistan (Khaliq *et al.*, 2013). Unchecked weed growth caused average yield losses of 60% in rainfed lowland rice (Moody, 1990b; Moorthy and Rao, 1991), and 80-100% in upland rice (Akobundu, 1987). It has been estimated that rice yield is lowered by 0.75 kg for 1 kg of weed biomass produced. Recently, Chauhan and Opena (2013) reported 39-41% yield loss in DSR due to weeds (one weeding at 28 DAS) relative to weed free yield. However, these estimates sometimes lack creditability and might be an overestimate as these are worked out from research stations trials dealing with herbicide efficacy. According to Rao *et. al*.

(2007) such estimates often neglect the variation and extremes that are otherwise prevalent at farmer's fields. Yield reductions owing to weed infestation in DSR fields suggest significance of timely and effective weed control and scope for yield increment. Haefele *et al.* (2000) concluded a yield advantage of 1 tha^{-1} (almost 25% yield increase) at farmer's field as a consequence of improved weed management. Weed infestation is particularly severe in the early stages when the crop grows under an aerobic upland environment. In the later stages, aquatic weeds emerge and grow mostly at or below the water surface, particularly when the crop stand is poor. Season, magnitude, type and duration of weed association, fertilization practices, competitive ability of the cultivar, weed and rice density dynamics, and cultural management are few aspects related to weed-crop competition in direct seeded rice (Rao *et al.*, 2007; Kumar and Ladha, 2011).Weeds compete for space, water, nutrients and sunlight (Farooq *et al*., 2011). Besides, competition for growth resources, weeds in rice also harbor insect pest that can further deteriorate the quality of produce (Tindall *et al.,* 2005). In transplanted, the most important competition is usually preemptive competition that occurs among seedlings, since it is almost impossible for a seedling of one species to knock out an established adult of another species.

Field trials of dry seeded irrigated rice in the Senegal River delta, revealed that a 95% of a weed free rice yield can be obtained by controlling weeds until 0-32 DAS in the wet season and 4-83 DAS in the dry season (Johnson *et al.*,2004). Under saturated conditions, CPWC was found between 2-71 DAS than 15-73 DAS in flooded conditions (Juraimi *et al.,*2011). Recently, Chauhan and Johnson (2011) showed that CPWC varied as a function of row spacing and was 18-52 DAS and 15-58 DAS for crop sown in 15 and 30 cm spaced rows, respectively. Anwar *et al.* (2012), assessed CPWC in rice based on 10% yield loss (90% weed free rice yield) as it seems more appropriate from economic perspective and proposed that for higher rice yields and net benefits, the crop must be kept weed free from 21-43 DAS. Weed infestation up to 15 DAS or weed free till 60 or 75 DAS produced grain yields similar to those plots kept weed free throughout the growing season (Singh, 2008). The relationship between duration of weed competition (time of removal) and associated yield reduction in rice is approximately sigmoidal. This was shown by El-Desoki (2003) who reported that weed competition after 20 days of rice seeding caused drastic reduction in number of panicles and grain yield per unit area and that yield increase was proportional to increasing duration of weed-free period.

Root and shoot growth of two different rice varieties was adversely affected by weed infestation. It was observed by Rabbani *et al.* (2011), who also noted that Super Basmati was more tolerant to weeds' infestation than Basmati-385. Kavitha *et al.* (2010) undertook an investigation in which they tested impact of different weed management practices on transplanted aman rice. The findings of the study were that pre-emergence herbicide application along with one mechanical weeding (30 DAT), and humic acid application (once as seedling dip and twice as foliar spray) suppressed weeds and improved yield and quality of rice. In another weed management experiment on rice, Akobundi and Ahissou (1985) found that weed weight increased with the increase in row spacing from 15 cm to 45 cm and vice versa. They also observed that, although narrow row spacing suppressed yield, number of tillers and number of panicles also decreased with decreasing row spacing. Importantly, keeping the rice weed free did not take impact of row spacing no matter it was 15, 30 or 45 cm. Nevertheless, yield reduction was observed in the widest row spacing when the field was weeded 30 days after sowing. Moreover, the competitive ability of various cultivars with weeds was better at narrow inter-row spacing than at wider inter-row spacing

According to Singh *et al.* (2008), weed fresh weight in rice ranged 78 to 96 percent and 38 to 92 percent grain yield loss was recorded. In terms of competition with weeds, rice transplanted under puddle conditions was found to be superior than aerobic rice cultivation system, but when weeds were equally controlled in both the systems of stand establishment, aerobic rice cultivation system was recorded better. Hasanuzzaman *et al.* (2009 a) also regarded combination of herbicide and hand weeding suitable for economic weed control in transplanted rice. Akbar *et al.* (2011) reported that hand pulling lead to more suppression of weeds and higher yield than mechanical weed control. Islam and Molla (2001) recommended that ponding was not supportive to economic weed management , however, in case of no ponding and sufficient labor availability, two times hand weeding could be the best. Otherwise, herbicide application was left as a sole choice. Ismail *et al.* (2011) recommended hoe weeding at 25, 45 and 65 days after sowing for proper weed suppression and yield improvement in rice. Effect of different water regimes on weed diversity was investigated by Juraimi *et al.* (2011). They found that flooding up to panicle initiation suppressed weed biomass from 14 to 57 percent and reduced weed population from 18 to 58 percent, compared with the highest values obtained from the field kept continuously at field capacity. Among different weed management practices i.e. control, one hand weeding at 30 DAT, two times hand weeding at 30 and 45 DAT, one mechanical weeding at 30 DAT, one hand weeding at 30 DAT plus one mechanical weeding at 45 DAT, pretilachlor 500 g a.i. / L @ 1.5 L ha^{-1}, pretilachlor 500 g a.i. / L @ 1.5 L ha^{-1} plus one hand weeding at 30 DAT and pretilachlor 500 g a.i. / L @ 1.5 L ha-1 plus one mechanical weeding at 45 DAT, Hasanuzzaman *et al.* (2007) found pretilachlor 500 g a.i. / L @ 1.5 L ha^{-1} plus one hand weeding at 30 DAT to lead to highest grain yield in rice. Adeosun *et. al.*, (2009) also narrated, after experimentation on farmers' field, that integration of pre emergence and post emergence herbicides with hand weeding was good for improving rice yield by the suppression of weeds, compared to chemicals or hand weeding alone. Danmaigoro *et al.*(2004). investigated the experiment to evaluate the performance of upland rice varieties as affected by herbicide and poultry manure application. The two locations lie in the Sudan savanna ecological zone with a mean annual rainfall of 600 mm distributed between May and October. The treatments consisted of three rates of poultry manure (0, 5 and 10 t/ha) and five weed control treatments factorially combined in the main plot while two upland varieties of rice (Nerica and Faro 48) in the sub-plot. The treatments were laid out in a split-plot design with three replications. Application of pendimentaline+one hoe weeding at 6 WAS produced significantly greater plant height, leaf area, leaf area index, length panicle, panicle weight per plant, biological yield and the grain yield of rice than the other rates comparable with the hoe weeded control while the weedy check had the least. The application of 10 t/ha of poultry manure gave significantly greater plant height, leaf area, leaf area index, length of panicle, number of grain per panicle, harvest index and the grain yield of rice than the lowest rates (0 and 5 t/ha). It can be concluded that rice farmers in the sudan savanna zone of Nigeria can adopt 10 t/ha of manure, pendimentaline+one weeding control at 6 weeks after sown and the Faro 48 rice variety since the combination of these treatments gave better weed control, growth and yield of paddy rice. Muhammad (2009). conducted a experiment to evaluate performance of upland rice as affected by weed control treatments, poultry manure and stand density. The treatments consisted of three rates of five weed control treatments (0.6+0.4, 1.2+0.8, 1.8+1.2 kg.a.i/ha spropanil+2.4-D, hoe weeding and weedy check) and poultry manure (0, 5 and 10t /ha) factorially combined in the main plot while there were three stand density (2, 4 and 6 plants per hill) in the sub-plot given a total of 45 treatments. The treatments were laid out in a split-plot design with three replications. Results revealed that application of 1.2+0.8Kg.a.i./ha of Orizoplus (propanil+ 2-4 D) produced significantly larger leaf area, high leaf area index, higher crop growth rate, relative growth rate, net assimilatory rate and grain yield of rice than the other rates but were comparable with the hoe weeded control. The application of 10t/ha of poultry manure gave significantly larger leaf area, high leaf area index, higher crop growth rate, relative growth rate, net assimilatory rate and grain yield of rice than the lowest rates and the control (0 and 5t/ha). The four plants per hill resulted in significant increase larger leaf area, high leaf area index, higher crop growth rate, relative growth rate, net assimilatory rate and grain yield of rice and higher yield of rice in both locations. The study showed that application of 10t/ha of manure, 1.2+0.8kg.a.i/ha of oriza plus and four plants per hill gave the best yield of rice. Singh *et. al.* (2007). application of pendimentaline+one hoe weeding at 6 WAS produced significantly greater plant height, leaf area, leaf area index, length panicle, panicle weight per plant, biological yield and the grain yield of rice than the other rates comparable with the hoe weeded control while the weedy check had the least. The application of 10 t/ha of poultry manure gave significantly greater plant height, leaf area, leaf area index, length of panicle, number of grain per panicle, harvest index and the grain yield of rice than the lowest rates (0 and 5 t/ha). It can be concluded that rice farmers in the sudan savanna zone of Nigeria can adopt 10 t/ha of manure, pendimentaline + one weeding control at 6 weeks after sown and the Faro 48 rice variety since the combination of these treatments gave better weed control, growth and yield of paddy rice. Babar *et al* (2012). The system of rice intensification has emerged as a promising rice production package but weed infestation could lead to incomplete benefits from the system. A two-year field study was performed to determine an appropriate method of weed management in SRI. Weed management treatments were manual hoeing 20, 40 and 60 days after transplanting (DAT), hoeing with rotary hoe at 20, 40 and 60 DAT, hoeing with rotary hoe at 20 DAT + spray with sorghum and sunflower water extracts at 15 L ha^{-1} 40 DAT, manual hoeing 20 DAT + spray with sorghum and sunflower water extracts, both in equal amount, at 15 L ha^{-1} 40 DAT, orthosulfamuron at 145 g a.i. ha^{-1} 7 DAT, weedy check and weed free. Manual hoeing at 20, 40 and 60 DAT was the treatment that exhibited the maximum kernel yield i.e. 5.34 and 4.99 t ha^{-1}., which was 8.4 and 7.2% higher than orthosulfamuron and 61.0 and 64.9% higher than weedy check, during both years of study, respectively. The highest weed suppression was also achieved by manual hoeing at 20, 40 and 60 DAT with weed control efficiency of 87.89 and 82.32% during 2010 and 2011, respectively. Manual hoeing at 20, 40 and 60 DAT is an eco-friendly, non-chemical weed control method to increase kernel yield of fine rice under SRI.

CHAPTER 3

MATERIALS AND METHODS

The experiment was carried out under field conditions during aman season 2018-19 at the Agronomy field of Sher-e-Bangla Agricultural University, Dhaka -1207. The details of the research work carried out, materials used and methodologies adopted in this research are described here under.

3.1 Experimental site

The farm is geographically located at $23^0 77'$ N latitude and $90^0 35'$ E longitude at an altitude of 8.6 m above mean sea level under the Agro-ecological zone of Modhupur Tract, AEZ-28.

3.1.1 Weather during the crop growth period

The climate of the experimental site is subtropical. It receives rainfall mainly from South West monsoon (May-October) and winter season from November to February. The weather data during experimental period was collected from the Bangladesh Meteorological Department (Climatic Division), Agargaon, Dhaka-1207, presented in Appendix II.

The maximum temperature during the crop growth period ranged from 28^0C to 33.7^0 C with an average of 27.1^0 C during 2018, while the minimum temperature 15.6^0 C to 26^0 C with an average 22.92^0 C. The mean relative humidity ranged from 68 percent to 82 percent. The total rainfall received during the crop growth period was 1931 mm received in 57 rainy days.

3.1.2 Soil

The soil of the research field belongs to “The Modhupur Tract”, *AEZ* – 28 is slightly acidic in reaction with low organic matter content. The experimental area was above flood level and sufficient sunshine with having available irrigation and drainage system during the experimental period. Soil sample from 0-15 cm depth were collected from experimental field and the soil analysis were done from Soil Resources Development

Institute (SRDI), Dhaka. The experimental plot was high land having pH 5.6. The physical properties and nutritional status of soil of the experimental plot are given in Appendix III.

3.2 Plant materials and features

BRRI Dhan72: BRRI Dhan72 variety is grown in aman season. This variety is recommended for cultivation in medium high land and medium low land. Average plant height 116 cm. It`s life cycle about 125-130 days. The average yield is 5.7 t ha^{-1}, maximum 7.5 tha^{-1} with proper management.

3.3 Experimental details

The sets of treatments included in the experiment as follows:

3.3.1 Treatments : Two factors

Factor A : Poultry manure (4 levels)

$P_{0:}$: Recommended fertilizer (Urea, TSP, and MoP and gypsum @ 150, 53, 82, and 60 kg ha^{-1} respectively) without poultry manure

P_1 : Recommended fertilizer with poultry manure 2 tha^{-1}

P_2 : 25% reduction of recommended fertilizer with poultry manure 2 tha^{-1}

P_3 : 50% reduction of recommended fertilizer with poultry manure 2tha^{-1}

Factor B : Weeding (4 levels)

W_0: No weeding

W_1: Weeding at 20 DAT(before 2^{nd} installment of urea & rest ½ M_0P)

W_2: Weeding at 20DAT (before 2^{nd} installment of urea & rest half of M_0 P)
and at 40 DAT

3.3.2 Experimental design

The experiment was laid out in a split-plot design with three replications having poultry manure in the main plots and weeding in the sub-plot. There were 12 treatment combinations. The total numbers of unit plots (2m ×1.7m) were 36 .

3.4 Cultivation details

Details of cultivation practices are presented here under.

3.4.1 Seed collection

The seeds of the test crop BRRI Dhan 72 were collected from Bangladesh Rice Research Institute (BRRI), Joydevpur, Gazipur.

3.4.2 Seed sprouting

Healthy seeds were selected by specific gravity method and then immersed in water bucket for 24 hours and then it was kept tightly in gunny bags. The seeds started sprouting after 48 hours and were sown in nursery bed after 72 hours.

3.4.3 Nursery

The field selected for nursery was thoroughly ploughed. Seed rate was calculated based on test weight and germination percentage. Sprouted seed was sown uniformly in the nursery bed on 20-07-2018. Later, the seed was covered immediately and then a light irrigation was given. The nursery of $3m^2$ was fertilized with a basal dose of 65g urea, 95g of single super phosphate and 25g of muriate of potash as BRRI recommended dose. Weeding and plant protection measures were taken up as and when necessary. Top dressing of urea @ 25g $3m^2$ was given 10 days after sowing.

3.4.4 Main field preparation

The experimental field was ploughed twice with a tractor drawn puddler to obtain the required puddle after impounding 5 cm of standing water in the field. After thorough puddling, leveling was done accordingly.

3.4.5 Poultry manures

According to BRRI annual report (14-15) IPNS based application of PM on BRRI dhan69,

recommended rate is $2tha^{-1}$. Poultry manure was applied during final land preparation. As per calculation 680gm/plot of $3.4m^2$ total of 27 plot out of 36 plots.

3.4.6 Fertilizer application

A recommended dose of Urea, TSP, and MoP and gypsum @ 150, 53, 82, and 60 kg ha^{-1} respectively were applied in the field for N,P_2O_5, K_2O and S. The whole amount of TSP and gypsum fertilizer and half of the MoP were applied at the time of final land preparation except urea and rest half of MoP. Urea was applied half at 10DAT and rest half at 20DAT. After basal dose rest half MoP was applied at 20 DAT.

3.4.7 Transplanting

Twenty-seven-day old rice seedlings were transplanted in the experimental plots keeping two seedlings $hill^{-1}$ maintaining a spacing of 20 cm × 15 cm on 17 August,2018.

3.5 Intercultural operations

3.5.1 Gap filling

Some seedlings from the nursery were transplanted alongside of the irrigation channels at the time of transplanting for the purpose of gap filling. Gap filling was done at the 13th day of transplanting by using seedlings planted alongside the channels which were also lifted along with the intact soil in order to maintain uniform population.

3.5.2 Irrigation

A thin film of water was maintained at the time of transplanting for better establishment of the seedlings. From the third day onwards, 2 to 3 cm depth of water was maintained up to the panicle initiation stage except at the time of top dressing of nitrogen, where the water was drained out and reflooded after 48 hours to maintain 5 cm depth of water up to physiological maturity. After dough stage, water was gradually drained out to facilitate easy harvesting of the crop.

3.5.3Weeding

Weeding in the experimental plots were done as per treatments.

3.5.4 Plant Protection

No major incidence of pests and diseases were observed except minor incidence of leaf folder, observed at 35 days after planting, which was controlled by spraying curbofuran 3G @ 1.5 kg a.i. ha^{-1} of water.

3.5.5 Harvesting and Threshing

At maturity, five hills from each plot except border rows were harvested and data yield attributes were taken from this five sample hills. For taking yield data central $1m^2$ area was harvested and carried than in the threshing floor. The plot wise crops were dried in the threshing floor for three days. Than threshing was done by manually and the grain was cleaned and sun dried. Grain and straw yields were recorded plot wise after drying to constant weight.

3.6 Sampling

Five representative hills were selected randomly and tagged in each plot second rows opposite from destructive sample from each side of the plot. Plant height and tillers $hill^{-1}$ data were recorded at different growth stage of the crops from these five hills.

3.7 Data recording

The following data were collected during the study period:

A. **Crop growth parameters :**

i. Plant height from 25, 50, 75 DAT and at harvest.

ii. Number of tillers $hill^{-1}$ from 25, 50, 75 DAT and at harvest.

iii**.** Plant dry weight from 25, 50, 75 DAT and at harvest.

B :- **Yield contributing characters-**

i. Number of effective tillers $hill^{-1}$

ii. Number of non-effective tillers $hill^{-1}$

iii. Panicle length

iv. Filled grain $panicle^{-1}$

v. Unfilled grain $panicle^{-1}$

vi. Weight of 1000 seeds

vii. Seed weight $hill^{-1}$

viii. Grain yield (tha^{-1})

ix. Straw yield (tha^{-1})

x. Biological yield (tha^{-1})

xi. Harvest index (%)

3.7.1 Plant height

Plant height was recorded for the five randomly tagged hills in each treatment in all the three replications. Plant height was measured from the base of the plant to tip of the top most leaf of every labeled hill at each sampling at 25, 50, 75 days after transplanting and at harvest. The plant height was expressed in centimeters (cm).

3.7.2 Number of tillers hill^{-1}

Number of tillers was counted in 5 plants per treatment at 25, 50, 75 days after transplanting and at harvest then average tillers per plant were worked out.

3.7.3 Plant dry weight hill^{-1}

At 25, 50, 75 days after transplanting and at harvest five hills within each treatment were harvested. Leaves and stems and panicles were separated, dried and weighed by an electronic balance to record data on dry weight of leaf, stem, and panicles (no panicle were observed at tillering). Dry weight hill^{-1} at each growth stage was calculated as sum of the dry weights of the hill components.

3.7.4 Number of effective tillers hill^{-1}.

Number of ear bearing tillers from the five labeled hills at harvest were counted and expressed as effective tillers hill^{-1}.

3.7.5 Number of non-effective tillers hill^{-1}

Number of without ear bearing tillers from the five labeled hills at harvest were counted and expressed as non-effective tillers hill^{-1}.

3.7.6 Panicle length (cm)

Ten panicles were harvested from each plot from primary tillers at maturity and panicle length was measured and averaged. Measurement of panicle length was taken from basal node of the rachis to apex of each panicle. Each observation was an average total panicles of five hills.

3.7.7 Filled grains panicle^{-1}

Grain was considered to be filled if any kernel was present there in. The number of total filled grains present total panicles of ten hill were recorded and finally averaged.

3.7.8 Unfilled grains panicle^{-1}

Unfilled grains means the absence of any kernel inside in and such grains of the total panicles of five hills were counted and finally averaged.

3.7.9 Seed weight hill^{-1}

The mature seed were collected from a randomly selected five hills and sun-dry then averaged. weighed and expressed as seed weight hill^{-1}(g).

3.7.10 1000 seed weight (g)

Thousand grains were taken at random from the grains lot of each treatment and weighed by electronic balance. This was repeated thrice and then average weight per 1000 grains was calculated and recorded.

3.7.11 Grains yield (tha^{-1})

The material harvested for biological yield was threshed after drying. The grain was separated and weighed, and then converted into grain yield in t ha^{-1}.

3.7.12 Straw yield (tha^{-1})

Straw yield per plot was recorded after sun drying for one week and expressed in **(**tha^{-1}.).

3.7.13 Biological yield (tha^{-1})

After maturity, one meter square area within each treatment was harvested, the material was dried and weighed and was converted into biological yield **(**tha^{-1}) with the following formula:

Biological yield (tha^{-1}) = Grain yield (tha^{-1}) + Straw yield (tha^{-1})

3.7.14 Harvest index

Harvest index (%) Harvest index was calculated as the ratio of grain yield to total (above ground) biological yield by using the formula

$$\textbf{Harvest index (\%)} = \frac{\text{Grain yield (t ha}^{-1}\text{)}}{\text{Biological yield (t ha}^{-1}\text{)}} \times \mathbf{100}$$

3.8 Statistical analysis

The collected data on different parameters were Statistically analyzed to obtain the level of significance using the Statistix-10 computer package program and mean separations were done by least significant difference (LSD) test at 5% level of significance.

CHAPTER IV

RESULTS AND DISCUSSION

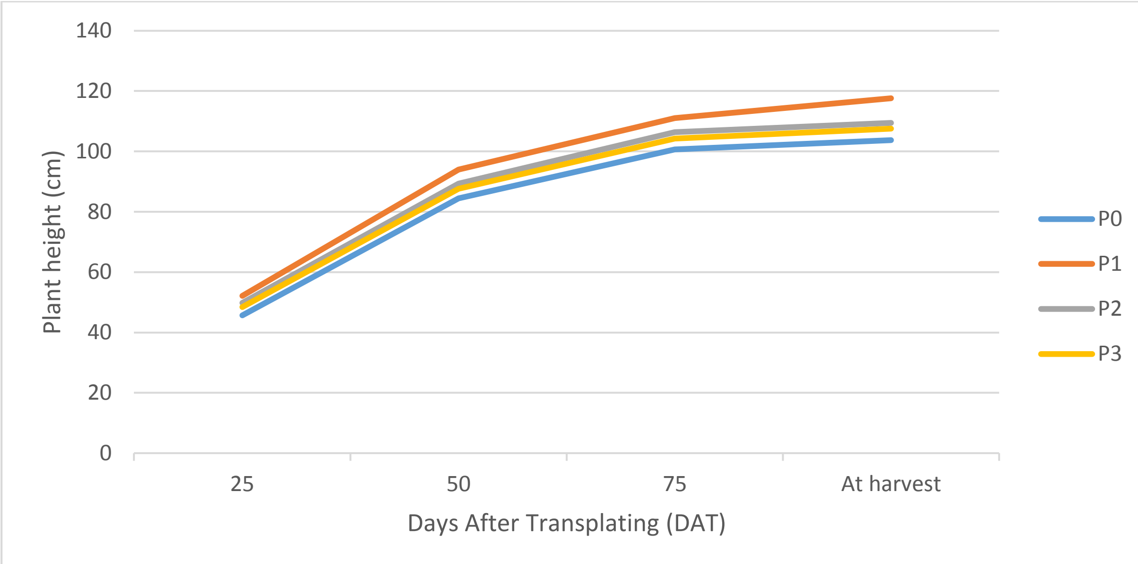
The present experiment was carried out at Agronomy Research Field, Sher-e- Bangla Agricultural University (SAU) Farm, SAU, Dhaka during the period from July - November2018 to investigate the ''**Effect of poultry manure and weeding on growth and yield of transplanted rice''** The results of the experiment analyzed statistically are discussed in this section through tables, figures, appendices, and other information with cause, effects and corroborative research findings of the scientists.

4.1 Crop growth parameters:

4.1.1 Plant height (cm)

Effect of poultry manure

Plant height of transplanted aman rice at different days after transplantation has been presented in Figure 1. It observed from the figure that plant height was significantly influenced by poultry manure at different days after transplanted (DAT) and at harvest. The result revealed that plant height progressively increased with the increasing age of the crop. The growth rate was much higher from 25 to 75 DAT. The maximum plant height (52.11, 94.02, 111.00 and 117..61 cm) was found in the treatment consisting recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1) at 25, 50, 75 DAT and at harvest, respectively which was statistically similar to25% reduction of recommended fertilizer with Poultry manure 2 ton ha^{-1}(P_2) at 25 DAT, 25% reduction of recommended fertilizer with Poultry manure 2 ton ha^{-1}(P_2) and 50% reduction of recommended fertilizer with Poultry manure 2 ton ha^{-1} (P_3) at 50 and 75 DAT. The shortest plant (45.68 84.43, 100.69 and 103.74 cm) was recorded from the treatment having recommended fertilizer without poultry manure (P_0) at 25, 50, 75DAT and at harvest, respectively which was statistically similar with 50% reduction of recommended fertilizer with Poultry manure 2 ton ha^{-1} (P_3) at 25, 50, 75 DAT and at harvest.

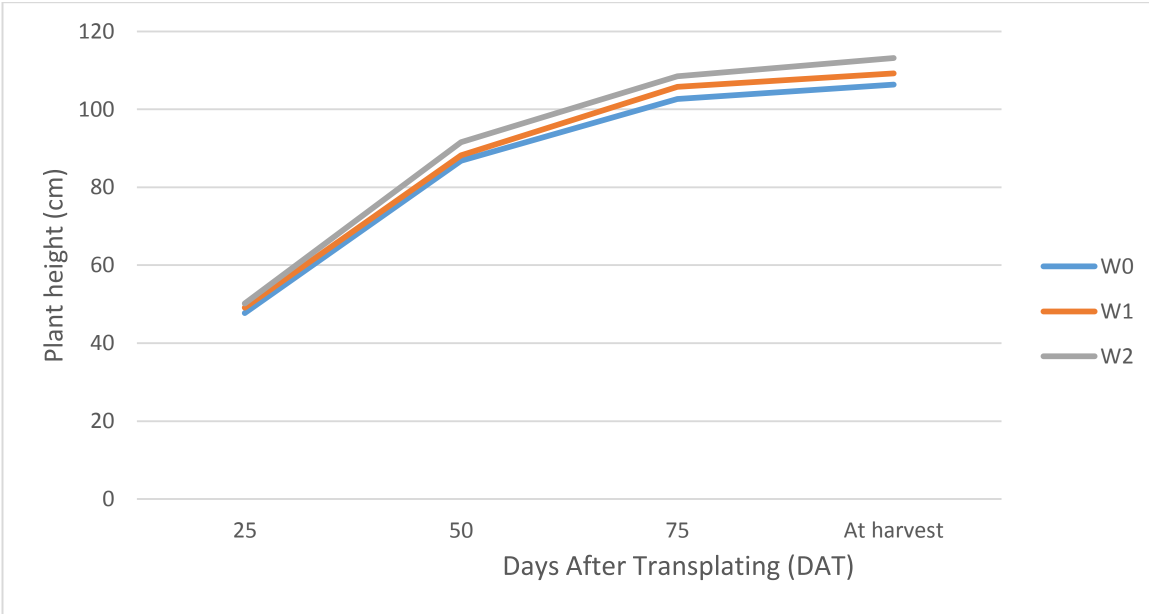


P_0 = Recommended fertilizer without poultry manure, **P_1** = Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2** = 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} , **P_3** = 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

Figure 1. Effect of poultry manure on plant height of transplanted aman rice at different days after transplanting and at harvest (SE (±) = 1.00, 3.07, 3.24 and 2.86 at 25, 50, 75 and at harvest respectively)

Effect of weeding

Plant height of transplanted aman rice at different days after transplanting as influenced by weeding are shown in Figure 2. It is inferred that the plant height was increased gradually at harvest and the highest plant (50.16, 91.60, 108.45 and 113.19 cm) was obtained from treatment of Weeding at 20 DAT (before 2^{nd} installment of urea & rest half of M_0P application) and weeding at 40 DAT (W_2) at 25, 50, 75 and at harvest, respectively which was statistically similar with Weeding at 20 DAT (before applying 2^{nd} installment of urea & rest ½ M_0P) (W_1) at all sampling dates. The shortest plant (47.75, 86.76, 102.63 and 106.37 cm) was recorded at no weeding treatment (W_0) at 25, 50, 75 DAT and at harvest respectively which was statistically similar to Weeding at 20 DAT (before 2^{nd} installment of urea & rest ½ M_0P) (W_1) at 50, 75 DAT and at harvest. The results showed that all the weeding treatments significantly increased the plant height over no weeding.



W_0 = No weeding **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

Figure 2. Effect of weeding on plant height of transplanted aman rice at different days after transplanting (SE (±) = 0.65, 2.02, 2.13 and 1.95 at 25, 50, 75) and at harvest respectively

Interaction effect

Significant variation was found in plant height at different days after transplanting as influenced by interaction of poultry manure and weeding (Table 1). The tallest plant (51.63, 93.17 113.00 and 125 cm at 25, 50, 75 and at harvest, respectively) was remarked on treatment combination of recommended fertilizer with poultry manure 2 ton ha^{-1} and Weeding at 20DAT (before applying 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2) which was statistically similar to P_1W_0, P_1W_1, and P_2W_2 at 25 DAT, all combination except P_0W_0 and P_0W_1 at 50 and 75 DAT. The shorted plant (42.61, 79.40, 95.67 and 99.00 cm at 25, 50, 75 and at harvest, respectively) was noticed on treatment combination of recommended fertilizer without poultry manure and no weeding (P_0W_0) which was statistically similar with P_0W_1, P_2W_0, P_2W_1, P_3W_0, $P_3W_1$and P_3W_2 at 50 DAT and P_0W_1, P_2W_0, P_2W_1, P_3W_0, and P_3W_1 at 75 DAT and at harvest.

Table 1. Interaction effect of poultry manure and weeding of plant height on transplanted aman rice at different days after transplanting and at harvest

Interaction	Plant height (cm) at different days after transplanting and at harvest			
	25	**50**	**75**	**At harvest**
P_0W_0	42.61 f	79.40 c	95.67 c	99.00 d
P_0W_1	46.77 e	82.90 bc	101.31 bc	104.50 cd
P_0W_2	47.66 de	91.00 ab	105.10 ab	107.72 bc
P_1W_0	51.20 a-c	92.91 ab	108.85 ab	112.51 bc
P_1W_1	51.63 ab	93.17 a	111.21 ab	115.31 b
P_1W_2	53.50 a	96.00 a	113.00 a	125.00 a
P_2W_0	49.15 b-e	88.17 a-c	103.13 a-c	107.36 b-d
P_2W_1	49.61 b-e	89.37 a-c	107.50 ab	109.97 bc
P_2W_2	50.74 a-d	90.50 ab	108.63 ab	111.12 bc
P_3W_0	48.05 c-e	86.56 a-c	102.87 a-c	106.60 b-d
P_3W_1	48.57 b-e	87.31 a-c	102.92 a-c	107.13 b-d
P_3W_2	48.74 b-e	88.92 a-c	107.07ab	108.93 bc
SE(±)	**1.031**	**4.05**	**4.27**	**3.91**
CV (%)	**3.27**	**5.58**	**4.95**	**4.37**

P_0 = Recommended fertilizer without poultry manure **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1}, **P_2 =** 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}, **P_3 =** 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

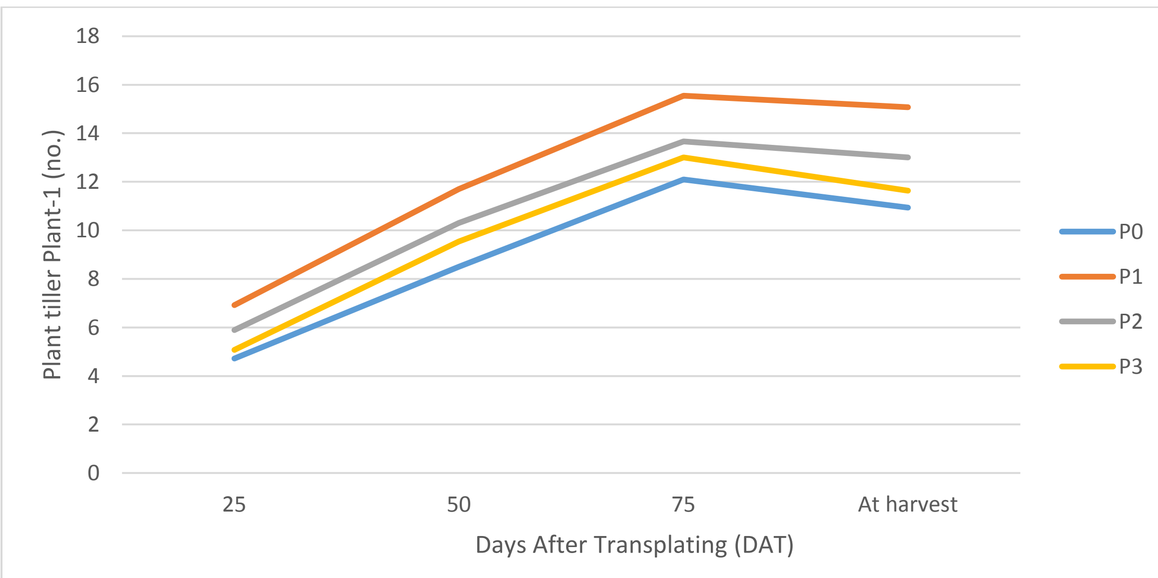
W_0 = No weeding **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

4.1.2 Number of tillers hill^{-1}

Effect of poultry manure

Number of tiller hill^{-1} of transplanted aman rice at different days after transplanting as influenced by poultry manure has been presented figure was observed that number tillers hill^{-1} was significantly influenced by different dose of poultry manure. The result revealed that numbertillershill^{-1}were increased progressively up to 75 DAT and it reached the highest 12.10, 15.54 13.66 and 13.01 for P0, P1, P2 and P3, respectively at 75 DAT. The number of tillers was reduced due to dry and rotten some non-effective tillers. The maximum tiller (6.92, 11.70 15.54 and 15.07) was found in recommendation fertilizer with poultry manure 2 tha^{-1} (P_1) at 25, 50, 75 DAT and at harvest, respectively which was statistically different from other treatment. The lowest number of tiller (4.72, 8.5 12.10 and 10.94) was obtained from recommended fertilizer without poultry manure (P_0) at 25, 50, 75 DAT and at harvest, respectively which was statistically similar with 50% reduction of recommended fertilizer with Poultry manure 2 tha^{-1} (P_3) at 25, 50, 75 DAT and at harvest.

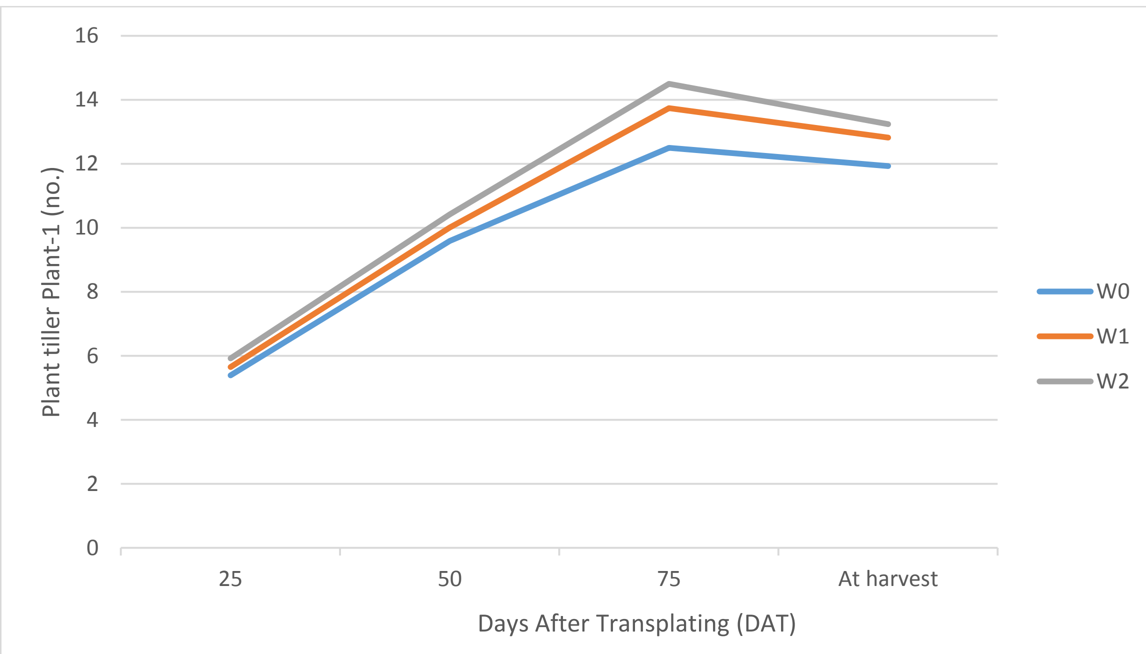


P_0 = Recommended fertilizer without poultry manure, **P_1** = Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2** = 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} **, P_3** = 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

Figure 3. Effect of poultry manure on number tillers hill^{-1} of transplanted aman rice at different days after transplanting (SE (±) = 0.16, .53, 0.89, and 0.71 at 25, 50, 75 and at harvest respectively)

Effect of weeding

The data on number of tiller hill^{-1}in transplanted aman rice at different days after transplantation as influenced by weeding significantly has been shown in Figure 4.The maximum number of tiller hill^{-1}(5.92, 10.42, 14.50 and 13.24) was achieved from the treatment having Weeding at 20 DAT (before applying 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2) at 25, 50, 75 and at harvest, respectively which was statistically similar with Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The lowest number of tiller hill^{-1}(5.39, 9.59, 12.50 and 11.93) was recorded at no weeding (W_0) at 25, 50, 75 DAT and at harvest respectively which was statistically similar to that obtained from the treatment consisting Weeding at 20 DAT (before applying 2nd installment of urea & rest ½ M_0P) (W_1) at 25, 75 DAT and at harvest.



W_0 = No weeding W_1 = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

Figure 4. Effect of weeding on number of tillers hill^{-1} of transplanted aman rice at different days after transplanting (SE (±) = 0.16, 0.35, 0.52, and 0.46 at 25, 50, 75 and at harvest respectively)

Table 2. Interaction effect of poultry manure and weeding on number of tillers hill^{-1} in transplant aman rice at different days after transplanting and at harvest

Interaction (Poultry manure ×Weeding)	Tillers hill^{-1} (no.) at different days after transplanting and at harvest			
	25	50	75	At harvest
P_0W_0	4.11f	8.01f	11.02d	10.11f
P_0W_1	4.93e	8.51ef	13.00b-d	11.20d-f
P_0W_2	5.13de	8.98d-f	12.300cd	11.52d-f
P_1W_0	6.65ab	11.01 bc	13.66 b-d	14.15a-c
P_1W_1	6.80ab	11.55ab	15.343 b	15.15ab
P_1W_2	7.32a	12.54a	17.633a	15.93a
P_2W_0	5.70cd	9.98 b-e	12.65b-d	12.51c-e
P_2W_1	5.87c	10.50 b-d	13.64 b-d	13.02 b-e
P_2W_2	6.12bc	10.42b-d	14.70bc	13.51b-d
P_3W_0	5.12de	9.37c-f	12.67b-d	10.98ef
P_3W_1	5.01 e	9.50c-f	12.99b-d	11.93c-f
P_3W_2	5.11de	9.75c-f	13.37b-d	12.02c-f
SE(±)	**0.32**	**0.70**	**1.03**	**0.92**
CV (%)	**7.01**	**8.60**	**9.32**	**8.91**

P_0 = Recommended fertilizer without poultry manure, **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2 =** 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1},**P_3 =** 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

W_0 = No weeding, **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

Interaction effect

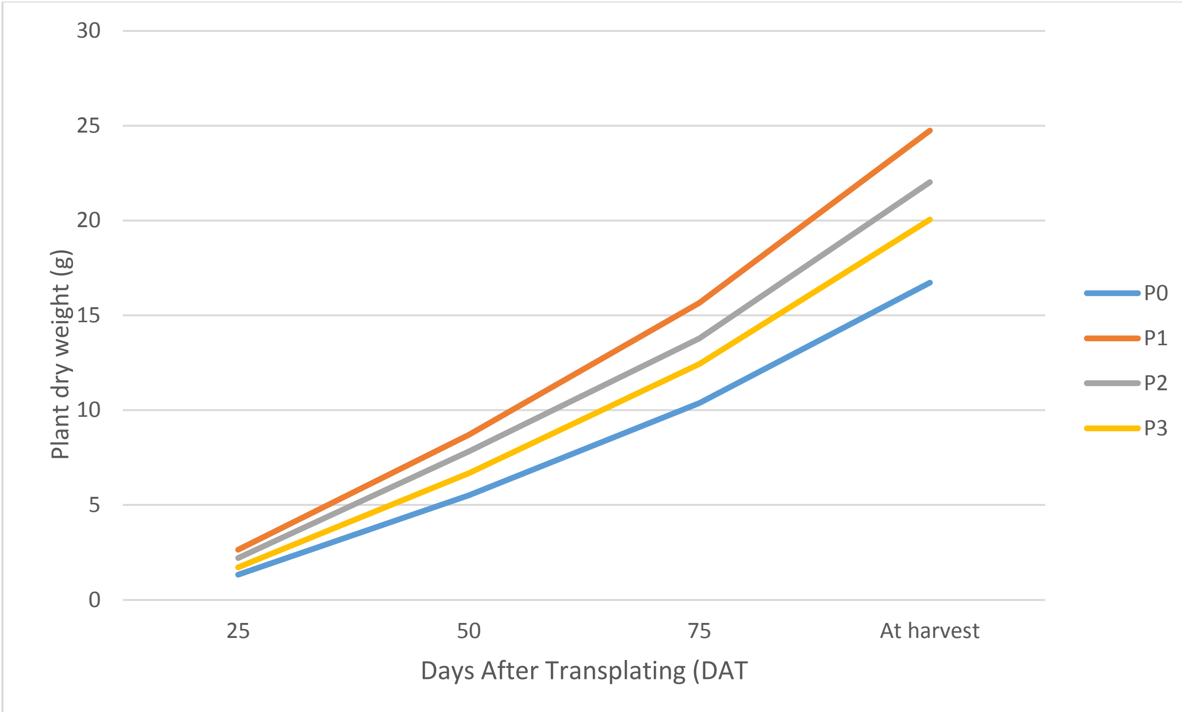
Interaction effect of poultry manure and weeding on number of tillers hill^{-1} at different days after transplanting was significant (Table 2). The maximum number of tillers hill^{-1}

(7.32, 12.54, 17.63 and 15.93) was observed on treatment combination of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before applying 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2) which was statistically similar to P_1W_0, and P_1W_1, at 25 DAT, P_1W_1 at 50 DAT at harvest. The minimum number of tillers hill^{-1} (4.11,8.01, 11.02 and 10.11) was noticed in treatment combination of recommended fertilizer without poultry manure and no weeding (P_0W_0) which was statistically similar to P_0W_1, P_0W_2, P_2W_1, P_3W_0, $P_3W_1$and P_3W_2 at 50 DAT and P_0W_1, P_2W_0, P_2W_1, P_3W_0, $P_3W_1$and P_3W_2 at 50, 75 DAT and at harvest.

4.1.3 Plant dry weight (g plant^{-1})

Effect of poultry manure

Plant dry weight of transplanted aman rice at different days after transplantation presented in Figure 5. This figure indicates that plant dry weight was significantly influenced by different poultry manure. The result revealed that plant dry weight progressively increased with increasing age of the crop. The growth rate was much higher from 25 to 75 DAT. The highest plant dry weight (2.65, 8.70, 15.66 and 24.75 g plant^{-1}) was found in the treatment consisting recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1) at 25, 50, 75 DAT and at harvest, respectively which was statistically different from other treatment except at harvest, at harvest statistically 25% reduction of recommended fertilizer with Poultry manure 2 ton ha^{-1}(P_2) . The lowest plant dry weight (1.33, 5.52, 10.38 and16.73 g plant^{-1}) was recorded from recommended fertilizer without poultry manure (P_0) at 25, 50, 75 DAT and at harvest, respectively which was statistically different from all other treatment.

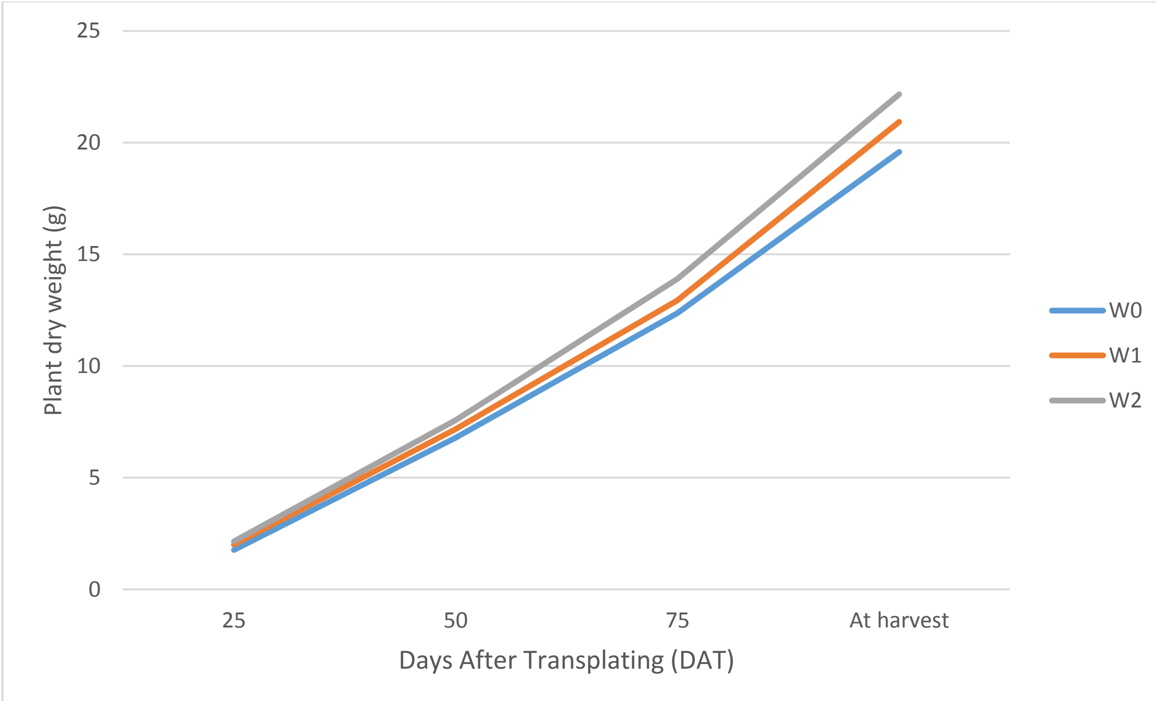


P_0 = Recommended fertilizer without poultry manure **P_1** = Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2** = 25% reduction of recommended fertilizer with Poultry manure 2 ton ha^{-1} , **P_3** = 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

Figure 5. Effect of poultry manure on plant dry weight of transplanted aman rice at different days after transplanting and at harvest (SE (±) = 0.07, 0.12, 0.24 and 1.15 at 25, 50, 75 and at harvest respectively)

Effect of weeding

Plant dry weight of transplanted aman rice at different days after transplanting as influenced by poultry manure are presented (Figure 6). It is observed that the highest plant dry weight (2.15, 7.58, 13.89 and22. plant^{-1}) was obtained from treatment consisting Weeding at 20 DAT (before applying 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2) at 25, 50, 75 and at harvest, respectively which was statistically different from other treatment except 25 DAT, at 25 DAT statistically identical Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The lowest plant dry weight (1.77, 6.79, 12.36 and 19.58 g) was recorded from no weeding (W_0) at 25, 50, 75 DAT and at harvest, respectively.



W_0 = No weeding W1 = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

Figure 6. Effect of weeding on plant dry weight of transplanted aman rice at different days after transplanting and at harvest (SE (±) = 0.09, 0.17, 0.34 and 0.56 at 25, 50, 75 and at harvest respectively)

Interaction effect

Interaction between poultry manure and weeding significantly influenced plant dry weigh at all sampling dates (Table 3). The highest plant dry weight (2.82, 9.18 17.54 and26.75 g) was found on interaction of recommended fertilizer with poultry manure 2 ton ha^{-1} and Weeding at 20 DAT (before applying 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2) which was statistically similar with P_1W_1at 25 DAT and different from all combination. The lowest plant dry weight (1.01, 5.20 9.66 and 14.76 g) was noticed on interaction of recommended fertilizer without poultry manure and no weeding (P_0W_0) which was statistically similar to P_0W_1, P_0W_2 at 50, 75 DAT and at harvest .

Table 3. Interaction effect of poultry manure and weeding on plant dry weight of transplanted aman rice at different days after transplanting and at harvest

Interaction	Plant dry weight (g plant^{-1}) at different days after transplanting and at harvest			
	25	**50**	**75**	**At harvest**
P_0W_0	1.01h	5.20h	9.66g	14.76g
P_0W_1	1.45g	5.58h	10.51g	17.08fg
P_0W_2	1.54fg	5.80gh	10.99fg	18.34ef
P_1W_0	2.49a-c	8.24 bc	14.31 bc	23.12 bc
P_1W_1	2.65ab	8.70ab	15.13 b	24.38 b
P_1W_2	2.82a	9.18a	17.54a	26.75a
P_2W_0	1.99de	7.45de	13.52cd	21.13 b-e
P_2W_1	2.24cd	7.96cd	13.81c	22.15 b-d
P_2W_2	2.42bc	8.10b-d	14.01 bc	22.82 bc
P_3W_0	1.58fg	6.30fg	11.98ef	19.32d-f
P_3W_1	1.71e-g	6.49f	12.30de	20.12c-f
P_3W_2	1.85ef	7.26e	13.02c-e	20.72c-e
SE(±)	**0.18**	**0.36**	**0.67**	**1.12**
CV (%)	**11.33**	**6.11**	**6.30**	**6.54**

P_0 = Recommended fertilizer without poultry manure **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2 =** 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-}1, **P_3 =** 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

W_0 = No weeding **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

4.2 Yield contributing characters

4.2.1 Effective tillers hill^{-1}(no.)

Effect of poultry manure

The data regarding the number of effective tillers hill^{-1} were influenced significantly by poultry manure in the present study (Table 4). The maximum number of effective tillers hill^{-1}(11.62) was found in the treatment having recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1), which was statistically identical to that of P_2 and P_3. The minimum number of effective tillers hill^{-1}(8.90) was recorded from recommended fertilizer without poultry manure (P_0), which was statistically different from that of all other treatments.

Effect of weeding

The number of effective tillers hill^{-1}of transplanted aman rice was significantly influenced by weeding (Table 5). The maximum number of effective tillers hill^{-1}(11.05) was obtained from weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2), which was statistically similar to the treatment consisting weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The minimum number of effective tillers hill^{-1}(10.19) was recorded at no weeding treatment (W_0), which was statistically similar to the treatment having weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Significant variation was noticed on plant height as influenced by interaction effect of poultry manure and weeding (Table 6). The maximum number of effective tiller hill^{-1}(12.51) was found from treatment combination of Recommended fertilizer with poultry manure 2 ton ha^{-1} × Weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2) which was statistically similar with P_1W_0, P_1W_1, P_2W_1 andP_2W_2). The minimum number of effective tiller hill^{-1}(8.00) was noticed on treatment combination of recommended fertilizer without poultry manure × no weeding (P_0W_0) which was statistically similar with P_0W_1, P_1W_2.

Table 4. Effect of poultry manure on yield attributes of transplanted aman rice

Poultry manure	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Panicle length (cm)	Filled grains panicle^{-1} (no.)	Unfilled grains panicle^{-1} (no.)
P_0	8.90 b	3.94a	18.87 b	73.14 c	57.27a
P_1	11.62a	2.18c	23.51a	104.42a	50.08b
P_2	11.12a	2.77bc	21.11b	100.44a	45.72b
P_3	10.75a	2.93 b	20.57 b	88.22 b	35.72c
SE(±)	**0.49**	**0.28**	**0.92**	**3.21**	**2.84**
CV (%)	**9.89**	**19.86**	**9.26**	**7.45**	**12.75**

P_0 = Recommended fertilizer without poultry manure **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2 =** 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}**P_3 =** 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

Table 5. Effect of weeding on yield attributes of transplanted aman rice

Weeding	Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Panicle length (cm)	Filled grains panicle^{-1} (no.)	Unfilled grains panicle^{-1} (no.)
W_0	10.19 b	3.26a	20.22b	87.396 b	50.37a
W_1	10.55ab	2.96b	20.95ab	91.271ab	47.08b
W_2	11.05a	2.65c	21.86a	96.000a	44.14c
SE(±)	**0.37**	**0.13**	**0.48**	**2.29**	**2.27**
CV (%)	**8.64**	**10.83**	**5.58**	**6.12**	**6.57**

W_0 = No weeding **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

4.2.2 Non-effective tillers hill^{-1} (no.)

Effect of poultry manure

The number of non-effective tillers hill^{-1} of transplanted aman rice was influenced significantly by poultry manure presented in Table 4. The maximum number non-effective tillers hill^{-1}**(**3.94) was found in the treatment having recommended fertilizer without poultry manure (P_0), which was statistically different from all other treatments of poultry manure. The lowest number of non-effective tillers hill^{-1}**(**2.18) was recorded from the treatment having recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1), which was statistically similar to that found in the treatment with 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}(P_2).

Effect of weeding

The number of non- effective tillers hill^{-1}of transplanted aman rice was also significantly influenced by weeding that are shown in Table 5. The highest number non- effective tillers hill^{-1}(3.26) was obtained from no weeding (W_0) treatment and the lowest value (2.65)was recorded in the treatment receiving weeding at 20 DAT (before applying 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2). The results showed that weeding significantly influenced and decreased the non- effective tillers hill^{-1}over no

Interaction effect

The number of non- effective tillers hill^{-1} of transplanted aman rice differed significantly due to the interaction of poultry manure and weeding (Table 6). The maximum number of non- effective tillers hill^{-1}(4.50) was found from the interaction of recommended fertilizer without poultry manure and no weeding ($P_0W_{0),}$which was statistically differed from all other interactions. The minimum number of non- effective tillers hill^{-1}(2.10) was recorded from the interaction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2), which was statistically similar with $P_1W_{0,}$ $P_1W_{1,}$ $P_2W_{1,}$ P_2W_2 and P_3W2.

4.2.3 Panicle length (cm)

Effect of poultry manure

Data on panicle length, shown in Table 4, was significantly influenced by poultry manure. The highest panicle length (23.51 cm) was found in recommendation fertilizer with poultry manure 2 ton ha^{-1} (P_1). The shortest panicle (18.87 cm) was found from recommended fertilizer without poultry manure (P_0), which was statistically identical with that of $P_2$and $P_{3.}$

Effect of weeding

Panicle length of transplanted aman rice was influenced significantly by weeding (Table 5). The longest panicle (21.86 cm) was exerted from weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2), which was statistically similar with that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The shortest panicle (20.22 cm) was recorded at no weeding (W_0), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Significant variation was noticed for panicle length that influenced by interaction of poultry manure and weeding (Table 6). The tallest panicle (25.13 cm) was found from the interaction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2), which was statistically similar to $P_1W_{1.}$ The shortest panicle(17.50 cm) was noticed for the interaction of recommended fertilizer without poultry manure and no weeding (P_0W_0), which was statistically similar to $P_0W_{1.}$

4.2.4 Filled grains panicle^{-1} (no.)

Effect of poultry manure

The data regarding number of filled grains panicle^{-1} (Table 4) were significantly influenced by poultry manure (Table 5). The maximum number of filled grains panicle^{-1}(104.42) was found in treatment consisting recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1), which was statistically identical with that of P_2. The minimum number of filled grains panicle^{-1}(73.14) was recorded from the treatment having recommended fertilizer without poultry manure (P_0), which was statistically different from that of other treatments.

Effect of weeding

The number of filled grains panicle^{-1}was influenced significantly by weeding (Table 5). The maximum number of filled grains panicle^{-1} (96.00) was obtained from the treatment having weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2), which was statistically similar to that of the treatment consisting weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The minimum number filled grains panicle^{-1} (87.39) was recorded from the treatment having no weeding (W_0), which was statistically similar to that of the treatment having weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Significant variation was noticed for filled grains panicle^{-1} at different days after transplanting as influenced by interaction effect of poultry manure and weeding (Table 6). The maximum number of filled grains panicle^{-1} (109.66) was found from the interaction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2), which was statistically similar to that of P_1W_0, P_1W_1, P_2W_0, P_2W_1 and P_2W_2. The minimum number of filled grains panicle^{-1} (67.25) was recorded from the interaction of recommended fertilizer without poultry manure and no weeding (P_0W_0), which was statistically similar to that of P_0W_1.

4.2.5 Unfilled grains panicle^{-1} (no.)

Effect of poultry manure

The number of unfilled grains panicle^{-1}of transplanted aman rice was also influenced significantly by poultry manure (Table 4). The highest number of unfilled grains panicle^{-1}(57.27) was found in recommended fertilizer without poultry manure (P_0), which was statistically different from that of all other treatments. The lowest number of unfilled grains panicle^{-1}(35.72) was recorded in the treatment having recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1).

Effect of weeding

Weeding in transplanted aman rice field was significantly influenced unfilled grains panicle^{-1}(Table 5). The highest number of unfilled grains panicle^{-1}(50.37) was obtained from no weeding (W_0) and the lowest (44.14) from treatment having weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2).

Table 6. Interaction effect of poultry manure and weeding on yield attributes of transplanted aman rice

Interaction	Effective tillers hill^{-1}(no.)	Non-effective tillers hill^{-1}(no.)	Panicle length (cm)	Filled grains panicle^{-1} (no.)	Unfilled grains panicle^{-1} (no.)
P_0W_0	8.00e	4.50a	17.50e	67.25f	61.50a
P_0W_1	9.20de	3.76b	19.10de	72.41ef	56.83ab
P_0W_2	9.52c-e	3.56bc	20.02cd	79.75de	53.50bc
P_1W_0	11.15a-c	2.16f	22.20 bc	100.25ac	51.83b-d
P_1W_1	11.20a-c	2.30ef	23.20ab	103.34ab	50.75b-d
P_1W_2	12.51a	2.10f	25.13a	109.66a	47.66c-e
P_2W_0	10.98a-c	3.15 b-d	20.80bd	99.50a-c	46.67c-e
P_2W_1	11.09a-c	2.78c-f	21.02bd	99.92a-c	46.58 ce
P_2W_2	11.30ab	2.40ef	21.51bd	101.92ab	43.91de
P_3W_0	10.65b-d	3.23bc	20.40cd	82.59de	41.50e
P_3W_1	10.71b-d	3.03b-e	20.51bd	89.41cd	34.16f
P_3W_2	10.90a-d	2.54d-f	20.81 bd	92.67 bc	31.50f
SE(±)	**0.75**	**0.26**	**0.96**	**4.58**	**2.53**
CV (%)	**8.64**	**10.83**	**5.58**	**6.12**	**6.57**

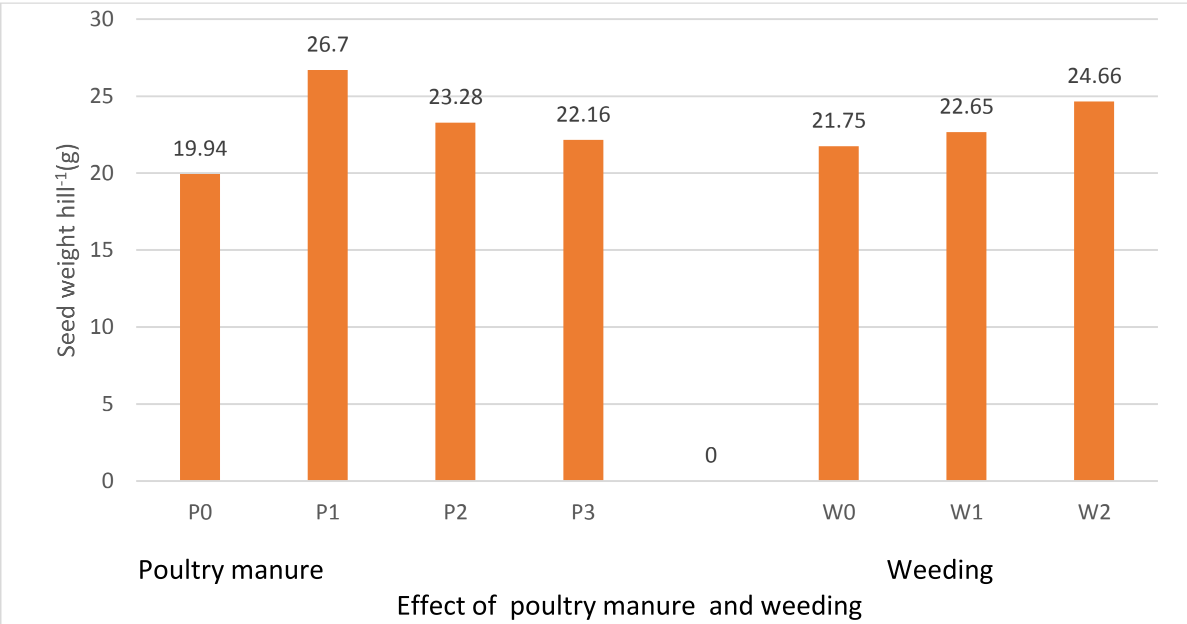
P_0 = Recommended fertilizer without poultry manure **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2 =** 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1},**P3 =** 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

W_0 = No weeding **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

Interaction effect of poultry

The number of unfilled grains panicle^{-1}of transplanted aman rice was differed significantly due to interaction of poultry manure and weeding (Table 6). The highest number of unfilled grains panicle^{-1}(61.50) was found from interaction of recommended fertilizer without poultry manure × and no weeding (P_0W_0),which was statistically similar to that of P_0W_1. The minimum number of unfilled grains panicle^{-1}(31.50) was recorded from the interaction of 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_3W_2), which was statistically similar to P_3W_1.



P_0 = Recommended fertilizer without poultry manure **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2 =** 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} ,**P_3 =** 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

Figure 7. Effect of poultry manure and weeding on seed weight hill^{-1} of transplanted aman rice (SE (±) = 0.74 for poultry manure and 1.22 for weeding.

4.2.6 Seed weight hill^{-1} (g)

Effect of poultry manure

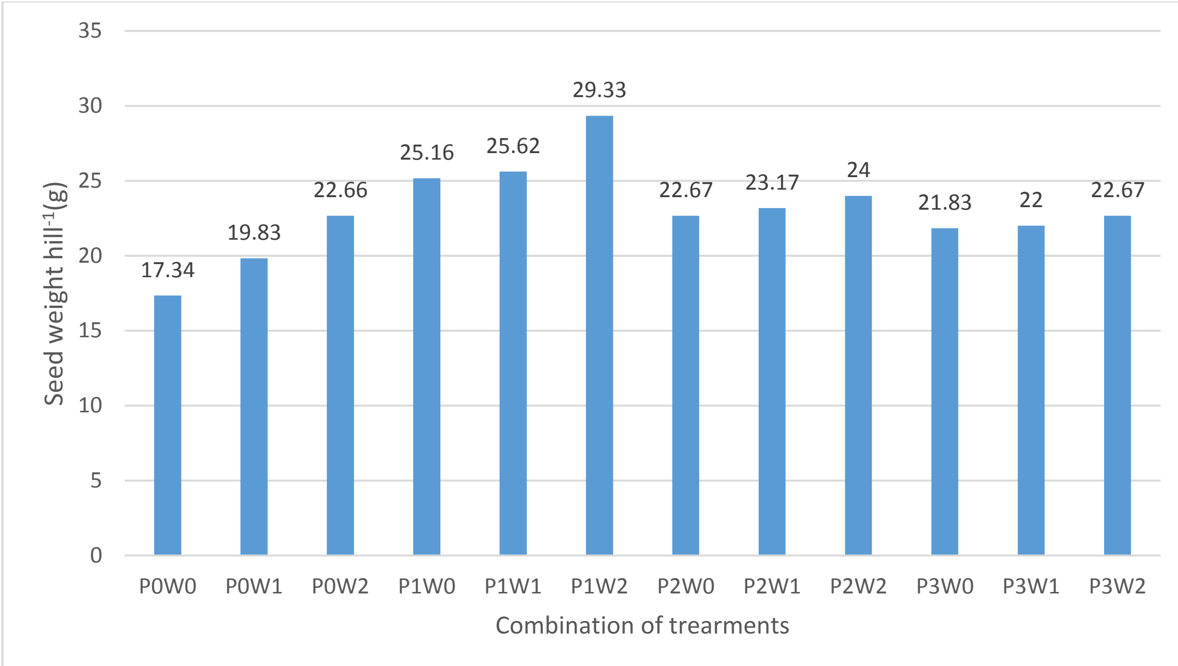
The data regarding seed weight hill^{-1} was significantly influenced by poultry manure (Figure 7). The highest seed weight hill^{-1} (26.70 g) was found in recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1) and the minimum (19.94 g) was recorded from recommended fertilizer without poultry manure (P_0).

Effect of weeding

Seed weight hill^{-1} of transplanted aman rice as influenced significantly by weeding are shown in figure 7. The highest seed weight hill^{-1} (24.66 g) was obtained from Weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2) which was statistically similar with Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The lowest seed weight hill^{-1} (21.75 g) was recorded at no weeding (W_0) which was statistically similar with Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Interaction effect of poultry manure and weeding on seed weight hill^{-1} of transplanted aman rice was statistically significant (Figure 8). The highest seed weight hill^{-1} (29.33 g) was found from the interaction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2), which was statistically similar to that of P_1W_0 and $P_1W_{1.}$ The lowest seed weight hill^{-1} (17.34 g) was noticed for the interaction of recommended fertilizer without poultry manure and no weeding (P_0W_0), which was statistically similar to that of P_0W_1 and P_3W_0.



P_0 = Recommended fertilizer without poultry manure **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2 =** 25% reduction of recommended fertilizer with Poultry manure 2 ton ha^{-1} ,**P3 =** 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

W_0 = No weeding **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

Figure 8. Interaction effect of poultry manure and weeding of seed weight hill^{-1}on transplanted aman rice (SE (±) = 2.44).

4.2.7 Weight of 1000-seed (g)

Effect of poultry manure

The data regarding the weight of 1000-seed was exerted significant influence due to poultry manure (Table 7). The highest weight of 1000-seed (26.21 g) was found in recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1) which was statistically similar to that of $P_2$and P3. The lowest weight of 1000-seed (22.49 g) was recorded from recommended fertilizer without poultry manure (P_0) which was statistically similar with $P_2$and P3.

Effect of weeding

Weight of 1000-seed of transplanted aman rice was influenced significantly by weeding (Table 8). The highest weight of 1000-seed (25.61 g) was obtained from weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The lowest weight of 1000-seed (22.78 g) was recorded at no weeding (W_0), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Significant variation was noticed on weight of 1000-seed due to the interaction effect of poultry manure and weeding (Table 7). The highest weight of 1000-seed (29.23 g) was found from the interaction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of MoP) and at 40 DAT (P_1W_2), which was statistically similar to that of P_0W_2, P_1W_0, P_1W_1, P_2W_1 andP_2W_2). The lowest weight of 1000-seed (19.14 g) was obtained the interaction of recommended fertilizer without poultry manure and no weeding (P_0W_0), which was statistically similar to that of P_0W_1, P_2W_0, P_2W_1, P_2W_2, P_3W_0, P_3W_1 and P_3W_2.

Table 7. Effect of poultry manure on yields and harvest index of transplanted aman rice .

Poultry manure	Weight of 1000-seed (g)	Grain Yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
P_0	22.49b	4.00c	5.06c	9.06c	36.59
P_1	26.21a	5.36 a	7.93a	13.29 a	35.09
P_2	24.10ab	4.88 ab	6.97 ab	11.85 b	35.35
P_3	23.83ab	4.38 bc	6.40 b	10.78 b	34.24
SE(±)	**1.02**	**0.22**	**0.53**	**0.53**	**2.46**
CV (%)	**8.94**	**10.11**	**13.08**	**8.46**	**14.76**

P_0 = Recommended fertilizer without poultry manure **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1} **, P_2 =** 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} ,**P_3 =** 50% reduction of recommended fertilizer with Poultry manure 2 ton ha^{-1}

Table 8. Effect of weeding on yields and harvest index of transplanted aman rice

WEEDING	Weight of 1000-seed (g)	Grain Yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
W_0	22.78 b	4.39 b	6.20 b	10.59 b	35.124
W_1	24.07 ab	4.70 ab	6.53 ab	11.24 ab	35.665
W_2	25.61 a	4.87 a	7.03 a	11.90 a	35.172
SE(±)	**1.33**	**016**	**0.35**	**0.45**	**1.03**
CV (%)	**13.45**	**8.15**	**10.09**	**8.36**	**7.13**

W_0 = No weeding, **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

4.2.8 Grain yield (t ha^{-1})

Effect of poultry manure

The data regarding the grain yield of transplanted aman rice was significantly influenced due to poultry manure (Table 7). The highest value of grain yield (5.36 t ha^{-1}) was obtained in recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1), which was statistically identical with that of (P_2). The lowest value for grain yield (4.00 t ha^{-1}) was recorded from recommended fertilizer without poultry manure (P_0), which was statistically similar to that of P_3.

Effect of weeding

Grain yield of transplanted aman rice was significantly influenced by weeding (Table 8). The highest value for grain yield (4.87 t ha^{-1}) was obtained from weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The lowest value for grain yield (4.39 t ha^{-1}) was recorded at no weeding (W_0), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Interaction effect of poultry manure and weeding on grain yield of transplanted aman rice was significant (Table 9). Results indicated that the highest grain yield (5.62 t ha^{-1}) was found in the interaction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2), which was statistically similar to that of P_1W_0, P_1W_1, P_2W_1 andP_2W_2. On the other hand, the lowest result was obtained from the interaction of recommended fertilizer without poultry manure and no weeding (P_0W_0), which was closely followed by the of P_0W_1 and P_3W_0.

4.2.8 Grain yield (t ha^{-1})

Effect of poultry manure

The data regarding the grain yield of transplanted aman rice was significantly influenced due to poultry manure (Table 7). The highest value of grain yield (5.36 t ha^{-1}) was obtained in recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1), which was statistically identical with that of (P_2). The lowest value for grain yield (4.00 t ha^{-1}) was recorded from recommended fertilizer without poultry manure (P_0), which was statistically similar to that of P3.

Effect of weeding

Grain yield of transplanted aman rice was significantly influenced by weeding (Table 8). The highest value for grain yield (4.87 t ha^{-1}) was obtained from weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The lowest value for grain yield (4.39 t ha^{-1}) was recorded at no weeding (W_0), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Interaction effect of poultry manure and weeding on grain yield of transplanted aman rice was significant (Table 9). Results indicated that the highest grain yield (5.62 t ha^{-1}) was found in the interaction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2), which was statistically similar to that of $P_1W_{0,}$ $P_1W_{1,}$ P_2W_1 andP_2W_2. On the other hand, the lowest result was obtained from the interaction of recommended fertilizer without poultry manure and no weeding (P_0W_0), which was closely followed by the of P_0W_1 and $P_3W_{0.}$

4.2.9 Straw yield (t ha^{-1})

Effect of poultry manure

The data on straw yield was significantly influenced by poultry manure (Table 7). The highest value of straw yield (7.93 t ha^{-1}) was obtained in recommended fertilizer with poultry manure 2 t ha^{-1} (P_1), which was statistically identical with that of P_2. The lowest value of straw yield (5.06 t ha^{-1}) was recorded from recommended fertilizer without poultry manure (P_0), which was statistically differed from that of others.

Effect of weeding

Straw yield of transplanted aman rice was significantly influenced by weeding (Table 8). The highest value of straw yield (7.03 t ha^{-1}) was obtained from weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1). The lowest value of straw yield (6.20 t ha^{-1}) was recorded at no weeding (W_0), which was statistically similar to that of weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Significant variation was noticed on straw yield of transplanted aman rice due to the interaction effect of poultry manure and weeding (Table 9). Results indicated that the highest straw yield (8.50 t ha^{-1}) was found due to the interaction of 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20DAT (before 2^{nd} installment of urea & rest half of M_0 P) and at 40 DAT (P_3W_2), which was statistically similar to that of P_0W_0, P_0W_1, P_2W_2, P_3W_0 and P_3W_1. On the other hand, the lowest result was obtained from P_1W_0which was closely followed by that of P_1W_1.

4.2.10 Biological yield (t ha^{-1})

Effect of poultry manure

The data on biological yield of transplanted aman rice was significantly influenced by poultry manure. (Table 7).The highest value (13.30 t ha^{-1}) was found in recommendation fertilizer with poultry manure 2 ton ha^{-1} (P_1), which was statistically differed from that of other treatments. The minimum value for biological yield (9.06 t ha^{-1}) was recorded from recommended fertilizer without poultry manure (P_0).

Effect of weeding

Biological yield of transplanted aman rice was significantly influenced by weeding (Table 8). The highest value of biological yield (11.90 t ha^{-1}) was obtained from weeding at 20 DAT (before 2^{nd} installment of urea & rest half of M_0P) and at 40 DAT (W_2), which was statistically similar to that of weeding at 20 DAT (before 2^{nd} installment of urea & rest ½ M_0P) (W_1). The lowest value of biological yield (10.59 t ha^{-1}) was recorded at no weeding (W_0), which was statistically similar to weeding at 20 DAT (before 2^{nd} installment of urea & rest ½ M_0P) (W_1).

Interaction effect

Significant variation was noticed on biological yield due to the interaction effect of poultry manure and weeding (Table 9). Results indicated that the highest biological yield (14.12 t ha^{-1}) was found with interaction of recommended fertilizer with poultry manure

2 t ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT (P_1W_2), which was statistically similar to that of P_1W_0, P_1W_1, and P_2W_2. The lowest value for biological yield (7.81 t ha^{-1}) was obtained from P_0W_0, which was closely followed by that of P_0W_1.

4.2.11 Harvest index (%)

Effect of poultry manure

Statistically analyzed data on harvest index are shown in Table 7. The result revealed that harvest index was non- significant regarding poultry manure. However, the heighest value of harvest index (36.59 %) was found in recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1) and the minimum value of harvest index (34.24 %) was recorded from 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} (P_3).

Table 9. Interaction effect of poultry manure and weeding on yield and harvest index of transplanted aman rice

Interaction	Weight of 1000-seed (g)	Grain yield ($t\ ha^{-1}$)	Straw yield ($t\ ha^{-1}$)	Biological yield ($t\ ha^{-1}$)	Harvest index (%)
P_0W_0	19.14 c	3.48f	4.33e	7.81 f	36.52
P_0W_1	23.30 bc	4.09 ef	4.91de	9.00 ef	37.29
P_0W_2	25.04ab	4.45 ce	5.93cd	10.38de	35.96
P_1W_0	24.40ab	5.17ac	7.50a-c	12.67 a-c	35.26
P_1W_1	25.00ab	5.31ab	7.81ab	13.12 ab	35.15
P_1W_2	29.23a	5.62a	8.50 a	14.12 a	34.87
P_2W_0	24.00 bc	4.71be	6.77a-c	11.48 b-d	34.83
P_2W_1	24.10a-c	4.91ad	7.02a-c	11.93 b-d	35.35
P_2W_2	24.20a-c	5.02 a-c	7.12a-c	12.14a-d	35.86
P_3W_0	23.60 bc	4.21d-f	6.22b-d	10.43de	33.87
P_3W_1	23.90 bc	4.52c-e	6.41b-d	10.93 c-e	34.86
P_3W_2	24.00 bc	4.42c-e	6.57b-d	10.99 c-e	33.98
SE(±)	**2.65**	**0.31**	**0.71**	**0.90**	**2.06**
CV (%)	**13.45**	**8.15**	**10.09**	**8.36**	**7.13**

P_0 = Recommended fertilizer without poultry manure **P_1 =** Recommended fertilizer with poultry manure 2 ton ha^{-1} **P_2 =** 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} **P_3 =** 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}

W_0 = No weeding **W_1** = Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P)

W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT

Effect of weeding

Harvest index was not significantly influenced by weeding (Table 8). The height value of harvest index (35.66 %) was obtained from Weeding at 20 DAT (before 2nd installment of urea & rest ½ M_0P) (W_1) and the lowest was obtained from no weeding (W_0).

Interaction effect

Harvest index was not significantly influenced by interaction effect of poultry manure and weeding (Table 9). But numerically the maximum harvest index (37.29 %) was observed in interaction of recommended fertilizer without poultry manure and weeding at 20 DAT (before 2^{nd} installment of urea & rest ½ M_0P) (P_0W_1). The lowest harvest index (33.87) was noticed due to the interaction of P_3W_0.

CHAPTER V

SUMMARY AND CONCLUSION

A field experiment was carried out at Agronomy Research Field of Sher-e- Bangla Agricultural University (SAU) Farm, SAU, Dhaka to evaluate the effect of poultry manure and weeding on growth and yield of transplant aman rice (var. BRRI Dhan 72). The experiment comprised of two different factors *viz*., factor A: Poultry manure (4 levels)

P_0 = Recommended fertilizer (Urea, TSP, MoP and Gypsum @150,53,82 and 60 kgha^{-1}) without poultry manure, P_1 = Recommended fertilizer with poultry manure 2 ton ha^{-1},P_2 = 25% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1}, and P_3 = 50% reduction of recommended fertilizer with poultry manure 2 ton ha^{-1} and factor B: Weeding (Level-3) W_0 = No weeding, W_1= Weeding at 20 DAT(before 2nd installment of urea & rest ½ M_0P) and W_2 = Weeding at 20DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT. The experiment was laid out in split-plot design with three replications. There were 12 treatment combinations and total of 36 plots. All the data recorded are statistically analyzed using analytical computer software program STATISTIX-10. The differences among the treatment means were compared by least significant difference test (L.S.D) at 5% level of significance.

The weather during the crop growing period did not exhibit any major fluctuations and was congenial for crop growth. A total rainfall of 1931 mm was received in 57 rainy days during the investigation period, which was insufficient for rice crop. Hence, need based irrigations were given to avoid moisture stress.

The observation were recorded on plant height (cm), number of tillers hill^{-1} , plant dry weight (g plant^{-1}), number of effective tillers hill^{-1} , number of non-effective tillers hill^{-1} , panicle length (cm), filled grain panicle^{-1} (no.), unfilled grain panicle^{-1} (no.), 1000 –seed weight, seed weight hill^{-1} (g), grain yield (t ha^{-1}), straw yield (t ha^{-1}), biological yield

(t ha^{-1}) and harvest index (%).

The effect of poultry manure showed significantly variation on different growth and yield parameters among the different treatments. Considering growth parameters, recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1) showed the highest (52.11, 94.02, 111.00 and 117..61 cm at 25, 50, 75 DAT and at harvest, respectively), number of tillers $hill^{-1}$ (6.92, 11.70 15.54 and 15.07 at 25, 50, 75 DAT and at harvest, respectively), plant dry weight (2.65, 8.70, 15.66 and 24.75 g at 25, 50, 75 DAT and at harvest, respectively) and the lowest value of plant height (45.68 84.43, 100.69 and 103.74 cm at 25, 50, 75 DAT and at harvest, respectively), number of tillers $hill^{-1}$ (4.72, 8.5 12.10 and 10.94 at 25, 50, 75 DAT and at harvest, respectively), plant dry weight (1.33, 5.52, 10.38 and 16.73 g $plant^{-1}$ at 25, 50, 75 DAT and at harvest, respectively were recorded from recommended fertilizer without poultry manure (P_0). Considering yield contributing characters, number of effective tillers $hill^{-1}$(11.62), panicle length (23.51 cm), number of filled grain (104.42), seed weight $hill^{-1}$ (26.70 g), weight of 1000-seed (26.21 g), grain yield (5.36 t ha^{-1}), straw yield (7.93 t ha^{-1}), biological yield (13.30 t ha^{-1}) and harvest index (36.59 %) was found in recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1). The lowest number of effective tillers $hill^{-1}$(8.90), panicle length (18.87 cm), number of filled grains $panicle^{-1}$(73.14), seed weight $hill^{-1}$ (19.94 g), weight of 1000-seed (22.49 g), grain yield (4.00 t ha^{-1}), straw yield (5.06 t ha^{-1}), biological yield (9.06 t ha^{-1}) and harvest index (34.24 %) were recorded from recommended fertilizer without poultry manure (P_0). The highest number of non-effective tillers $hill^{-1}$**(**3.94) and unfilled grains $panicle^{-1}$ (57.27) were found in recommended fertilizer without poultry manure (P_0) and the lowest value for number of non-effective tillers $hill^{-1}$ **(**2.18) and unfilled grains $panicle^{-1}$ (35.72) were recorded from recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1).

The effect of weeding showed significantly variation on different growth and yield parameters among the different treatments. Considering growth parameters, weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2) showed the highest plant height (50.16, 91.60, 108.45 and 113.19 cm at 25, 50, 75 and at harvest), respectively, number of tillers $hill^{-1}$(5.92, 10.42, 14.50 and 13.24) at 25, 50, 75 and at harvest), respectively and plant dry weight (2.15, 7.58, 13.89 and 22.16 g $plant^{-1}$) at 25, 50, 75 and at harvest, respectively. The lowest plant height (47.75, 86.76, 102.63 and 106.37 cm at 25, 50, 75 DAT and at harvest respectively, number of tillers $hill^{-1}$ (5.39, 9.59, 12.50 and 11.93 at 25, 50, 75 DAT and at harvest), respectively and plant dry weight (1.77, 6.79, 12.36 and 19.58 g $plant^{-1}$at 25, 50, 75 DAT and at harvest), respectively were recorded from no weeding (W_0). Considering yield contributing characters, weeding at 20 DAT (before 2nd installment of urea & rest half of M_0P) and at 40 DAT (W_2) showed the highest number of effective tillers hill^{-1} (11.05), length (21.86 cm), filled grains panicle^{-1} (96.00), seed weight hill^{-1} (24.66 g), weight of 1000-seed (25.61 g), grain yield (4.87 t ha^{-1}), straw yield (7.03 t ha^{-1}), biological yield (11.90 t ha^{-1}) and harvest index (35.66 %). The lowest number of effective tillers hill^{-1}(10.19), panicle length (20.22 cm), filled grains panicle^{-1} (87.39), seed weight hill^{-1} (21.75 g), weight of 1000-seed (22.78 g), grain yield (4.39 t ha^{-1}), straw yield (6.20 t ha^{-1}), biological yield (10.59 t ha^{-1}) and harvest index (35.12 %). were obtained from no weeding (W_0). The number of non-effective tillers hill^{-1} (3.26) and unfilled grains panicle^{-1}(57.27) was found in recommended fertilizer without poultry manure (P_0) and the lowest number non effective tillers hill^{-1} (2.65) and unfilled grains panicle^{-1}(35.72) were recorded from recommended fertilizer with poultry manure 2 ton ha^{-1} (P_1).

Interaction of poultry manure and weeding showed significant variations on different growth and yield parameters. P_1W_2 showed the highest plant height (51.63, 93.17 113.00 and 125 cm at 25, 50, 75 and at harvest, respectively), number of tillers hill^{-1} (5.92, 10.42, 14.50 and 13.24 at 25, 50, 75 and at harvest) respectively, plant dry weight (2.82, 9.18 17.54 and 26.75 g plant^{-1} at 25, 50, 75 and at harvest) respectively, number of effective tillers hill^{-1}(12.51), panicle length (25.13 cm), number of filled grains panicle^{-1} (109.66), seed weight hill^{-1} (29.33 g), weight of 1000-seed (29.23 g), grain yield (5.62 t ha^{-1}), straw yield (8.50 t ha^{-1}) and biological yield (14.12 t ha^{-1}). The lowest plant height (42.61, 79.40, 95.67 and 99.00 cm at 25, 50, 75 and at harvest, respectively), number of tillers hill^{-1} (5.39, 9.59, 12.50 and 11.93) at 25, 75 DAT and at harvest, respectively), plant dry weight (1.01, 5.20 9.66 and 14.76 g plant^{-1} at 25, 50, 75 and at harvest, respectively), number of effective tillers hill^{-1} (8.00), panicle length (20.22 cm), number of filled grains panicle^{-1} (67.25), seed weight hill^{-1} (17.34 g), weight of 1000-seed (19.14 g), grain yield (3.48 tha^{-1}),straw yield (4.33 t ha^{-1}) and biological yield (7.81 t ha^{-1}) was obtained from $P_0W_{0.}$ The highest number of non-effective tillers hill^{-1} (4.50) and number of unfilled grains panicle^{-1} (61.50) was found in P_0W_0. The lowest number of non-effective tillers hill^{-1} (2.10) was found P_1W_2 and number of unfilled grains panicle^{-1} (31.50) was found in P_3W_2. The highest straw yield (10.50 t ha^{-1}) was found from P_3W_2

and the lowest straw yield (6.33 th $^{-1}$) was obtained from P_1W_0. The maximum harvest index (37.29 %) was observed in (P_0W_1) and the lowest (33.87) from $P_3W_{0.}$

From the above result it may be concluded that the combination of P_1W_2 i.e., recommended fertilizer with poultry manure 2 ton ha^{-1} and weeding at 20 DAT (before 2nd installment of urea & rest half of M_0 P) and at 40 DAT is optimum for the maximum growth and yield of transplanted aman rice compared to other treatment combinations.

From the findings of this experiment, further studies may be suggested in different agro-ecological zones of Bangladesh for regional adaptability.

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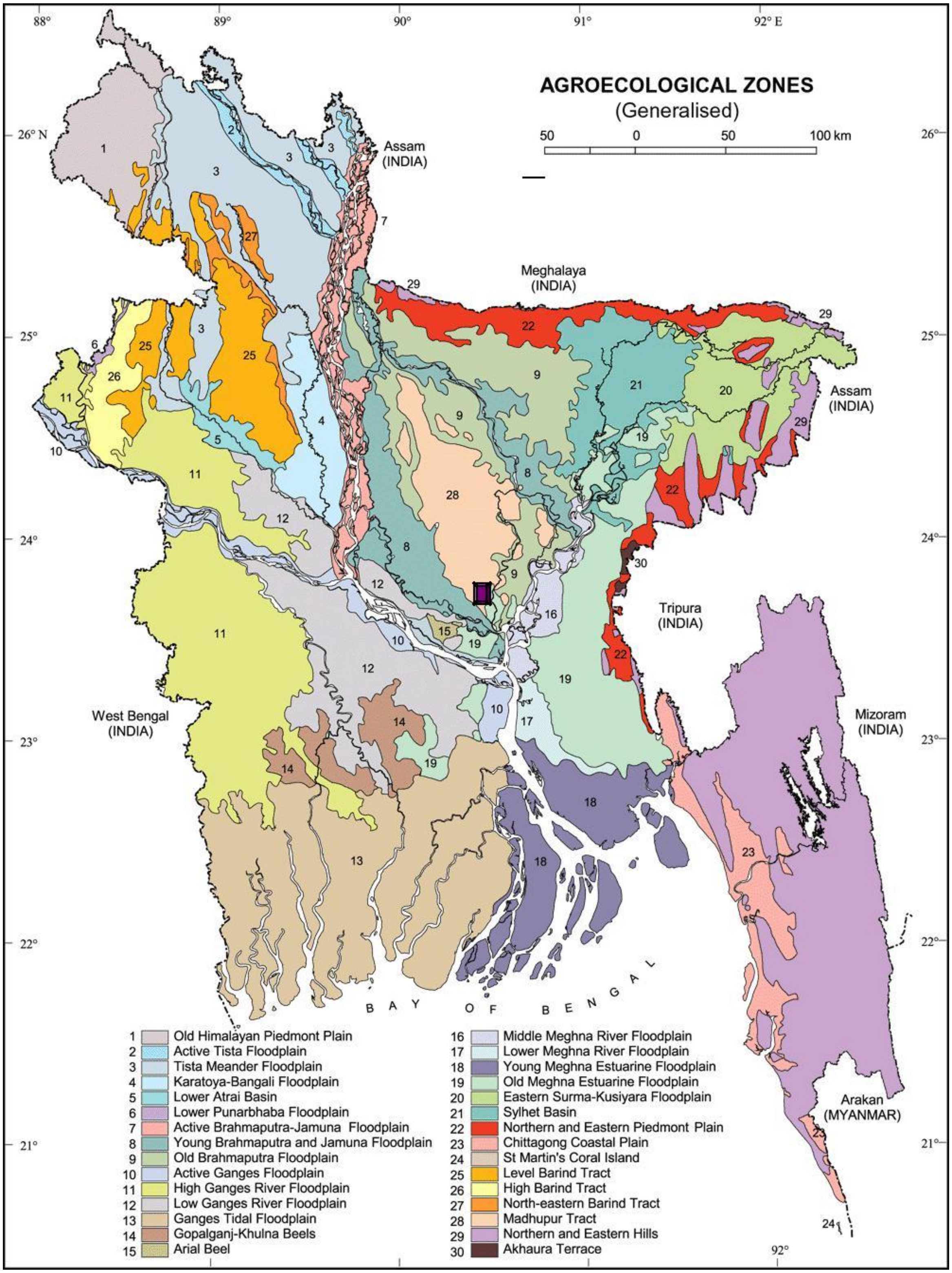
APPENDICES

Appendix I. Map showing the experimental sites under study



Appendix II: Monthly record of air temperature, rainfall, and relative humidity during the periodfrom July – December, 2018

Month	RH (%)	Air temperature (^{0}C)			Rainfall (mm)
		Max.	Min.	Mean	
July	82	33.4	25.8	29.6	532
August	83	32.7	26.0	29.3	365
September	82	32.2	26.0	29.1	501
October	81	31.5	24.3	27.9	520
November	74	30.0	19.8	24.9	10
December	68	28.0	15.6	21.8	3
Average	78.33	31.3	22.92	27.1	321.83

Source: Bangladesh Meterological Department (Climatic Division), Agargaon, Dhaka,2018

A**ppendix III. Morphophysiological and chemical characteristics of experimental soil**

A. Morphological characteristics of the experimental field

Morphological features	**Characteristics**
Location	Agronomy Farm, SAU, Dhaka
AEZ	Modhupur Tract (28)
General Soil Type	Shallow red brown terrace soil
Land type	High land
Soil series	Tejgaon
Topography	Fairly leveled
Flood level	Above flood level
Drainage	Well drained
Cropping pattern	Not Applicable

Source: Soil Resource Development Institute (SRDI), Farmgate, Dhaka.2018

B. Physical and chemical properties of the initial soil

Characteristics	Value
Partical size analysis % Sand	27
%Silt	43
% Clay	30
Textural class	Silty Clay Loam (ISSS)
pH	5.6
Organic carbon (%)	0.45
Organic matter (%)	0.78
Total N (%)	0.03
Available P (ppm)	20
Exchangeable K (me/100 g soil)	0.1
Available S (ppm)	45

Source: Soil Resource Development Institute (SRDI), Farmgate, Dhaka.2018

Appendix IV. Mean square values of plant height at different days after transplanting (DAT) and at harvest as influenced by poultry manure, weeding and their interaction

Sources of variation	Degrees of freedom	Mean square values			
		Plant height			
		25 DAT	50 DAT	75 DAT	At harvest
Replaction	2	3.2309	75.712	45.456	91.538
Poultry manure (P)	3	65.1036**	144.367**	167.639**	307.986*
Error of (Replication*Poultry manure)	6	4.5160	42.373	47.298	36.820
Weeding (W)	2	17.5104**	74.382*	101.799*	140.931*
P×M	6	3.7045*	16.358*	7.177*	20.611*
Error of (Replication*Poultry manure*weeding)	16	2.5720	24.606	27.298	22.894

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix V. Mean square values of total tiller number hill^{-1} at different days after transplanting (DAT) as influenced by poultry manure, weeding and their interaction

Sources of variation	Degrees of freedom	Mean square values			
		Plant tillers hill^{-1}			
		25 DAT	50 DAT	75 DAT	At harvest
Replaction	2	0.01841	3.2865	5.1244	0.0234
Poultry manure (P)	3	8.59709**	16.3236**	19.1175**	29.8360**
Error of (Replication*Poultry manure)	6	0.11576	1.2416	3.6090	2.2509
Weeding (W)	2	0.82698*	2.0669*	12.2460*	5.3472*
P×M	6	0.18844*	0.2641*	2.0672**	0.1422**
Error of (Replication*Poultry manure*weeding)	16	0.15708	0.7414	1.6040	1.2728

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix VI. Mean square values of plant dry weight hill^{-1} at different days after transplanting (DAT) and at harvest as influenced by poultry manure, weeding and their interaction

Sources of variation	Degrees of freedom	Mean square values			
		Plant height			
		25 DAT	50 DAT	75 DAT	At harvest
Replaction	2	0.15641	0.5250	3.0078	3.0078
Poultry manure (P)	3	2.99603**	17.2255**	44.4175**	44.4175**
Error of (Replication*Poultry manure)	6	0.02327	0.0691	0.2529	5.978
Weeding (W)	2	0.46630**	1.8608**	7.0864**	7.0864**
P×M	6	0.01710**	0.0683**	1.2500*	1.2500*
Error of (Replication*Poultry manure*weeding)	16	0.05026	0.1929	0.6769	1.867

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix VII. Mean square values on yield attributes of transplanted aman rice as influenced by poultry manure, weeding and their interaction

Sources of variation	Degrees of freedom	Mean square values				
		Effective tillers hill^{-1} (no.)	Non-effective tillers hill^{-1} (no.)	Panicle length (cm)	Filled grains panicle^{-1} (no.)	Unfilled grains panicle^{-1} (no.)
Replaction	2	5.0570	0.40390	5.0700	5.78	4.794
Poultry manure (P)	3	12.6155**	4.77780**	33.047**	1784.18*	731.356**
Error of (Replication* Poultry manure)	6	1.0991	0.34552	3.7892	46.49	36.218
Weeding (W)	2	2.2550*	1.12011**	8.1249**	222.80*	116.612**
P×M	6	0.5286*	0.15067*	1.3133**	16.38**	11.231*
Error of (Replication* Poultry manure*weeding)	16	0.8392	0.10281	1.3746	31.43	9.620

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix VIII. Mean square values on yields and harvest index of transplanted aman rice as influenced by poultry manure, weeding and their interaction

Sources of variation	Degrees of freedom	Mean square values				
		Weight of 1000-seed (g)	Grain Yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Replication	2	3.7141	0.26701	2.4980	3.9897	15.8387
Poultry manure (P)	3	21.2632**	3.15349*	12.9945*	28.6681*	8.5090 ^{NS}
Error of (Replication* Poultry manure)	6	4.6626	0.22194	1.2623	1.2573	27.1839
Weeding (W)	2	24.1200**	0.72670**	2.0719**	5.1551**	1.0774 ^{NS}
P×M	6	8.1219*	0.10097**	0.2937*	0.6993*	0.6833 ^{NS}
Error of (Replication*Poultry manure*weeding)	16	10.5651	0.14413	0.7523	1.2284	6.3394

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix IX. Some pictorial view of my research work

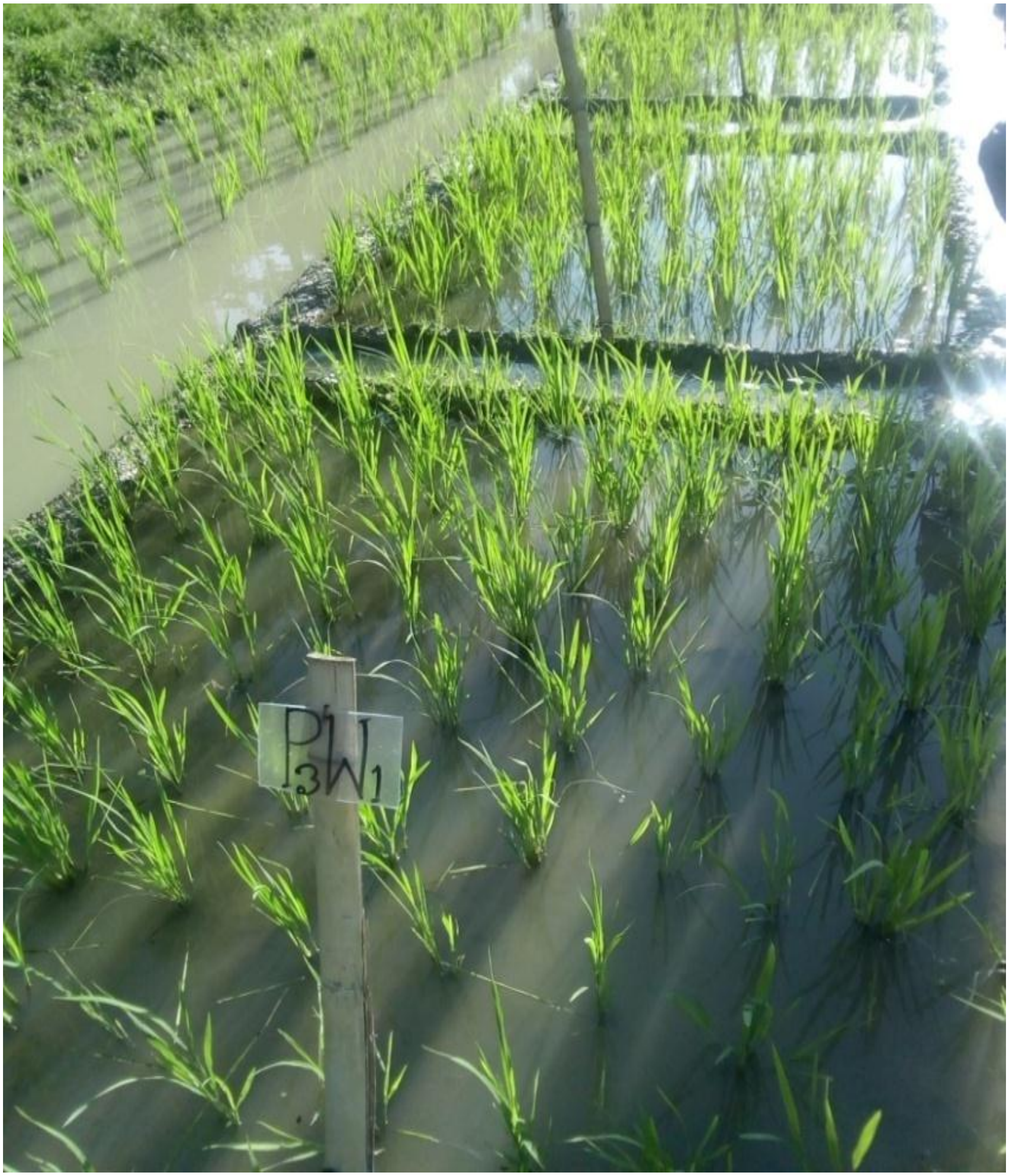


Plate-1: Growth stage

Plate-2: Urea top-dressing at 10 DAT

Plate-3: Weeding at 20 DAT

plate-4: Signboard setting

Plate-5: Harvesting stage

Plate-6: Data collection stage