PERFORMANCE OF HOUSEHOLD SOLID WASTE COMPOST ON THE GROWTH AND YIELD OF STEM AMARANTH (*Amaranthus cruentus* L.)

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CERTIFICATE

*This is to certify that thesis entitled, "**PERFORMANCE OF HOUSEHOLD SOLID WASTE COMPOST (HSWC) ON THE GROWTH AND THE YEILD OF STEM AMARANTH (Amaranthus cruentus** **L.)**" submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE** in **AGROFORESTRY AND ENVIRONMENTAL SCIENCE**, embodies the result of a piece of bona-fide research work carried out by **MD. SHAHADAT HOSSAIN, Registration No.14-06270** 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: June, 2021
Place: Dhaka, Bangladesh

Abdul Halim
Assistant Professor
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DEDICATED TO

MY BELOVED

PARENTS

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The Author

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ABSTRACT

Household solid waste (HSW) can be managed in an environmentally feasible way by preparing compost and using them to produce organic vegetables in kitchen yard or rooftop garden for family consumption. An experiment was conducted at the Agroforestry Farm of Sher-e-Bangla Agricultural University, Dhaka-1207 during the period of 27 March to 16 May, 2020 to study the performance of Household Solid Waste Compost (HSWC) with five levels viz., T_0 (no compost), T_1 (20% compost), T_2 (40% compost) and T_3 (50% compost) and also T_4 which was 100% RDF (Recommended Dose of Fertilizer) on the growth and yield of stem amaranth. The one factor experiment was laid out in Complete Randomized Design (CRD) with three replications. The maximum plant height 74.15 cm, plant diameter 1.89 cm, green yield per plant 166 gm were observed in T_4 at 50 DAS. The minimum plant height 21.67 cm, plant diameter 1.06 cm, green yield per plant 48.66 gm were obtained from T_0 at 50 DAS. The performance of HSW Compost was determined by the experiment among T_1, T_2 and T_3 where treatment T_2 produced maximum plant height by producing 71.33 cm of plant height, diameter 1.89 cm, leaves number 36.83 and green yield was 160gm. In cases of seed germination, stem diameter, leaf number, green weight and dry weight T_4 and T_2 were statistically similar and T_1, T_2 and T_3 showed significant positive effect compared to T_0. So treatment T_2 is preferable for organic cultivation in homestead or rooftop garden.

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Full Word	Abbreviation
Percentage	%
and others *(at elli)*	*et. al.,*
Agricultural	Agril.
Analysis of variance	ANOVA
Household solid waste compost	HSWC
Least significant difference	LSD
Centimeter	Cm
Percentage of Coefficient of Variation	CV%
Degrees of Freedom	Df
Sher-e-Bangla Agricultural University	SAU
Gram	G
Kilogram	Kg
Completely Randomized Design	CRD
Non-significant	NS
Parts per Million	Ppm
Agro Ecological Zone	AEZ

CHAPTER 1

INTRODUCTION

Amaranthus is cosmopolitan genus of annual or short-lived perennial plants collectively known as amaranths. The family of amaranth is Amaranthaceae which has 65 genera and 850 species and 50-60 species are edible. It is most common vegetable in South Asia as well as Bangladesh. As an agricultural country a huge diversities of vegetables is produced in Bangladesh and stem amaranth contributes large amount in it. The amaranth is being cultivated 11475 acres with a total production of 196500 metric tons and the average yield was 12.5−14.9 tons per acres. But at present the figure of cultivation is getting changed. 27200 acres are cultivated with production of 724000 tons and average yield is 24.4-27.8 tons per acre (BBS, 2016-2017). Near about 67% vegetables in Bangladesh are grown in Rabi season and only 33% are grown in Kharif season. So it is very helpful to people to get availability of vegetables in Kharif season by huge production of amaranths.

The amaranths is a crossed pollinated crop. It has chromosome number 2n=32 or 34; under the genus *Amaranthus* (Muthukrishanan *et al.* 1989). It was originated from South-East Asia and cultivated in different parts of the world including Bangladesh (Chakhartrakan, 2003). It was widely grown as a green vegetable in tropical and subtropical parts of Asia Africa and Central America (Hardwood1980). Bangladesh is rich source of land races of stem amaranth (Hossain *et al*.1997; Hamid *et al*.1989; Hossain and Hamid *et al*.1999).

Amaranth is considered one of the cheapest vegetable in the market. It is described as a “poor man’s vegetables” in Bangladesh ((Muthukrishanan *et al.* 1989). The leaves and tender stem are rich in protein, fat, calcium, phosphorus, P-carotene, riboflavin, niacin, sodium, iron and ascorbic acid. It also contains food energy of about 43 calorie per 100g edible portion which is higher than common vegetables except potato and taro leaf (Chowdhury, 1967). Amaranth protein is a valuable contribution to the diet when protein intake is marginal (Shanmugavelu, 1989). Its seed contain lysine,an amino acid . Its lysine is nearly three times higher than corn and nearly twice than that of wheat ((Muthukrishanan and Irulappan1989; Shanmugavelu, 1989). Amaranth has diverse health advantages such as therapeutic value on cardiovascular diseases (Martirosyan, *et al*. 2007), rich in phytosterols which reduce the cholesterol levels and also prevent cancer (Su *et al*., 2002). The leaves contain 17.5-38.3% dry matter protein in which 5% is lysine (Oliveira and De Cravalla, 1975). Vitamin A and C also found in significant level (Muloskozi *et al*, 2004).

Being a C4 plant amaranth has more efficiency to utilize nitrogen and photosynthesis (Megomedov *et al*.1997). Because of its cheapest price, quick growing character and higher yield potential; it is popular in Bangladesh. Additionally it is considered as a potential subsidiary food crop (Tutonic and knorr, 1995). A part of this, it is processed into table products like soup (Shanmugavelu, 1989). At present nutritional situation of Bangladesh is matter of great concern. The prime nutritional problems is that of vitamin, minerals and protein as energy for malnutrition. Most of our population suffers malnourishments. Mostly the children of our country die due to lack of proper nutritional diet (BBS 2016-17). Amaranth can play a vital role in elevating the existing nutritional problems of the country. Because of its high nutritious character it play a predominated role in nutrition as the cheapest source of minerals and vitamins.

Household solid waste (HSW) is the one of the constituents of Municipal Solid Waste (MSW), which accounts for the waste in developing countries (Ogedegbe, *et al* 2005). MSW generated in developing countries disposed of in the open dump is a threat to public and environment (Saravan, *et al* 2013). The decomposition of organic waste (OW) particularly, food waste in landfills and uncontrolled dump produce a greenhouse gas (methane gas) that affect environment .

Increasing Population, rapid urbanization, booming economy, and the rise in the standard of living in developing countries have greatly accelerated the rate, amount and quality of the Household Solid Waste (HSW) generation. Most of countries worldwide are facing a serious challenge to manage domestic food waste. It is wet, put in random way, and sometimes mixed with impurities of inorganic waste and metals. Primarily, the composition of such domestic food waste is very complex because it includes papers, water, oil, as well as spoiled and leftover foods from kitchen wastes and markets. All these waste substances are chemically comprised of fats, cellulose, starch, lipids, protein, and other organic matter. The moisture and salt contents lead to a rapid decomposition of the organic contents in the wastes thus produce unpleasant odors. This condition can attract bugs, and flies which are vectors for several diseases.

Composting provides an environmentally friendly method which not only compost mitigates problems of atmospheric pollution but also conserves soil fertility and biodiversity (Misra and Hiraoka.2003). This compost is used by many small-scale farmers in low-income countries as a soil conditioner because it is relatively cheaper compared to commercial mineral fertilizers and is more readily available than animal manure.The solid waste composition in such urban centers is largely organic in nature, and therefore, composting provides the most suitable form of recycling (Olobo, *et al* 2017). Composting of these organic wastes is however still small-scale and insignificant, often practiced by a few households and mostly for individual household gardens (Okot-Okumu *et al*, 2011).

Organic matter of Household can be recovered by HSW composting. This is low cost compared to other approaches including landfill disposal (Barreira *et al*., 2008). Low and middle-income countries have a higher percentage of organic matter in their solid waste (up to 88%) versus high-income countries (<56%); however these developed countries have a higher amount of organic waste destined to composting (Hoornweg and Bhada-Tata, 2012).

The use of inorganic fertilizers to sustain cropping was found to increase yield only for some few years but on long-term basic, it has not be effective (Ojeniyi, 2000). It often leads to decline in soil organic matter content, soil acidification and soil physical degradation, leading to increase soil erosion. On the other hand, inorganic fertilizers are beyond the reach of resource-poor farmers because of high cost and uncertain accessibility and Household Solid Waste (organic) inputs, which are often proposed as alternative to inorganic fertilizer.

A good soil should have an organic matter content of more than 3%. But in Bangladesh, most soils have less than 1.5%, some soils have less than 1% organic matter (BARC, 1997). In continuous cropping area, organic matter supply to the crop field through different manuring practices is made only to a minimum extent (Islam and Hossain, 1992).

Now-a-days gradual deficiencies in soil organic matter and reduced yield of crop are alarming problem in Bangladesh. The cost of inorganic fertilizers is very high and sometimes it is not available in the market for which the farmers fail to apply the inorganic fertilizers to the crop field in optimum time. On the other hand, the organic manure from Household Solid Waste (HSW) is easily available to the farmers and its cost is low compared to that of inorganic fertilizers. The crop production cost is more or less similar with organic and inorganic fertilizer (Haque, 2000).

To prevent the impact of synthetic fertilizer to fulfill the nutritional needs of the crop is by giving organic fertilizer. Organic fertilizer is the fertilizer that is largely or entirely composed of organic material derived from plants or animals that have been through the engineering process, in the form of solid or liquid that is used to supply organic matter to improve the physical, chemical, and biological soil (Permentan, 2006).

Disposal of organic wastes from various sources like domestic, agriculture and industries has caused serious environmental hazards and economic problems. In this regard, recycling of organic waste is feasible to produce useful organic manure for agricultural application. The biological treatment of these wastes is possible result into valuable nutrient source (Coker,2006). A possible way to utilize this waste is by composting and vermicomposting biotechnology (Benifez *et al*., 1999).Composting and vermicomposting are the appropriate biotechnological techniques for the degradation, converting waste to wealth resulting in stable nontoxic materials with good structure, with potentially high economic value as soil conditioner for the growth of the plants (Dhudat *et al*., 1997).

Dhaka and other megacities of Bangladesh are the most populated in the world and the population growth in this city is extremely high. To support growing food and vegetables demand of increasing population, food supply should be secure and sustainable. On the other hand, with the pace of urbanization built-up areas are increasing; hence supply of roof space is also increasing. Rooftop farming can provide solution to increased food demand and also can promote a sustainable and livable city. Local fresh and safe food and vegetables can be ensured through roof gardens in cities of Bangladesh. Since we have a huge densely population in city area, it produces a huge amount of household solid compost. Managing these waste is very complicated task and costly. If we can use these waste for growing food and vegetables, it returns both side end meet such as economic and environmental.

Objectives:

1. To compare the growth and yield performance of household solid waste compost with recommended dose of fertilizer

2. To identify the best dose of household solid waste compost in growth and yield of stem amaranth

CHAPTER 2

REVIEW OF LITERATURE

The review of literature includes reports of amaranth and household solid waste compost and other related crops studied by several investigators, which appears pertinent in understanding the problem and which may help in the explanation and interpretation of results of the present study. In this section, an attempt has been made to review the available information at home and abroad on adaptability,

2.1 Stem Amaranth

2.1.1 Cultivation Technique

Humid *et al*. (1989) reported that significant variation were present among 12 (Twelve) amaranth lines (4 exotic and 8 local) for plant height, number of leaves, stem diameter and yield. Height and stem diameter were positively correlated with yield.

Effects of six varieties and two row spacing (12.5 cm and 50.0 cm) on the yield, stand density, height have been studied by Jamriska (1998). Plainsman variety had the best yield (2.69 t/ha), on the other hand, the lowest yield (2.27 t/ha) was noted in K-369 variety. The stands with narrower row spacing produced higher yields than the stands with wider row spacing. Jaishree *et al*. (1996) conducted an experiment to study the effect of plant populations, nitrogen and phosphate on yield and quality of amaranth during kharif season of 1991 at densities of 111,000, 146,000 or 222,000 plants/ha and recorded the highest yield with 146,000 plants/ha.

Bansal *et al*. (1995) reported from an experiment than that the closer inter row (40 cm) and intra row spacing (10 cm) significantly reduced the dry matter accumulation, number of functional leaves and hence yield/plant. An experiment was conducted by Quasem and Hossain (1995) to evaluate 16 germplasms of local stem amaranth in summer. Spacing of 30 x 15 cm was maintained. Plant height at last harvest was found maximum in SAT 0034 (88.3 cm) and minimum in SAT 0062 (13.4 cm). The highest yield was recorded in SAT 0054 (54 t/ha) and the lowest in SAT 0024 (15.5 t/ha) only.

2.1.2 Cultivation Season

Dhanapal *et al*. (2009) studied optimization of sowing dates of two cultivars (Suvarna and K-432) on growth and yield of grain amaranth. The highest grain yield (944 kg/ha) obtained with Suvarna was significantly higher than K-432 (505 kg/ha). Maximum seed yield of 937 kg/ha recorded with July first fortnight sowing was superior to other sowing periods except the June second fortnight sowing (906 kg/ha). The Suvarna cultivar sown during first fortnight of July showed the highest seed yield of 1301 kg/ha which was significantly superior to other treatments except that which was sown at June second fortnight sowing.

Yarnia *et al*. (2010) studied on sowing dates and density evaluation of amaranth (cv. Koniz). The results showed that delay in sowing reduced plant height at least 13.02 up to 33.17%, the number of inflorescence per plant from 23.35 to 56.69%, number of seeds per plant from 22.75 to 71.44%, grain yield per plant from 5.09 to 92.78% and yield from 27.41 to 79.88%, plant biomass from 39.34 to 79.91%. Increasing plant density led to increase the number of inflorescence per plant up to 56.69% and reduced the number of seeds per plant up to 63.74% but the yield per area unit increased in low density and decreased in very high density (40 plant/ m2). Interaction between delay sowing and increasing plant density decreased leaf area at least 19.63 up to 97.15%, oil in seeds from 22.20 up to 98.26%, shoots oil from 34.38 to 93.81%, seed protein content from 2.99 to 92.23%, shoot protein from 3.74% up to 65.81%. Therefore, early sowing dates with low density increased growth period and reduced competition, so increased production potential of amaranth.

2.1.3 Fertilizer Application

Remison and Jombo (2011) made an experiment on effects of organic and inorganic fertilizer on the productivity of *Amaranthus cruentus* to evaluate the effect of palm oil mill effluent and NPK fertilizer on the performance of *Amaranthus cruentus*. Results revealed that the effluent and NPK fertilizer had positive effects on dry matter partitions, relative yield, relative agronomic effectiveness and chlorophyll content of *A. cruentus*. Integration of 5 t POME and 300 kg NPK ha-1 had the optimum total dry matter (9.65 t ha-1), relative yield (2.08), relative agronomic effectiveness (1.91) and total chlorophyll content (58.80 mg g-1).

Mazumdar (2004) reported that the optimum yield of amaranth was obtained from BARI Data-1 at Bangladesh Agricultural Research Institute, Gazipur. The highest yield was ranged from 30-40 t/ha as crops were sown between February to March and the fertilizer doses were 200 kg urea, 100 kg triple super phosphate and 200 kg murate of potash per ha respectively.

Ayodele *et al*. (2002) conducted a field experiment to evaluate the effect of N fertilizer 0. 50, 100 and 200 kg/ha on growth and yield of stem amaranth. Plant height, number of leaves produced, fresh and dry weights of plant parts increased with increased nitrogenous fertilizer application within a certain range. Application of fertilizer at 200 kg N/ha increased leaf production up to 75%, and the yield increased up to 114%. The unfertilized plants had yellowish green coloration as compared to the brighter green color observed in fertilized plants.

Das and Ghosh (1999) conducted a field experiment on amaranth during winter, summer and rainy seasons of 1996-1997 with 4 levels of nitrogenous fertilizer @0.40, 80 and 120 kg N/ha in Kalyani. India. From their experiment they reported that yield components and seed yield increased with increasing N up to 120 kg N/ha.

2.2 Household Solid Waste Compost (HSWC)

2.2.1 Composting

Melikoglu, Lin, C. Webb, Food Bioprod. Process. 95 (2015) reported that All these waste substances are chemically comprised of fats, cellulose, starch, lipids, protein, and other organic matter. The moisture and salt contents lead to a rapid decomposition of the organic contents in the wastes thus produce unpleasant odors. This condition can attract bugs, and flies which are vectors for several diseases. Apart from being perishable, these municipal solid wastes including household kitchen waste as well as the domestic food waste from restaurants and markets consist of high lignocellulosic materials that could be decomposed and exploited to produce valuable bio-products. These domestic food wastes including waste savory, bread, waste cakes, fruits, vegetables, onion and potato peel wastes and cafeteria waste, have been proved as being a suitable substrate for gluco amylase enzymes production by *Aspergillus awamori* via SSF technology

Hong *et al*.(1993) derived a household recycling choice model and a demand function for SWS and estimated these for a sample of households from the Portland, Oregon metropolitan area. Disposal fees are based on a block payment schedule for pickup of a specific volume at a given time interval. The demand for waste collection services is assumed to be a function of the incremental fee associated with contracting an additional bin for waste disposal and the opportunity cost of sorting waste into recyclables and non-recyclables, here equal to the female wage rate. The number of persons per household, education level, race and rent or ownership of their house was also assumed to influence the demand for SWS. The results indicate a positive but small relation between an increased payment difference and the demand for the quantity of waste collected. The effect of income is also positive and significant but the relationship is inelastic. Of the other variables only the value of time and the education level were found significant.

Potential and constraints of composting domestic solid waste in developing countries: f indings from a pilot study in Dar es Salaam, Tanzania S.E. Mbuligwe *, G.R. Kassenga, M.E. Kaseva, E.J. Chaggu reported that Field operations and pilot scale experimental work were carried out along with pertinent laboratory analyses. The carbon–nitrogen (C/N) ratio of raw organic waste, which accounts for over 78% of all household waste was 37–43. The C/N ratio of the f inal compost was between 6 and 21. Composting achieved a waste volume reduction of 49–70%. Thus the net reduction in volume of all the household waste was 38–55%. Field trials of the compost product improved yields of vegetable crops by more than 35% and extended their production period by more than a month. Also, the temperature developed during the waste composting process was high enough to kill pathogens, making the solid waste safer for soil application and disposal.

Composting is a controlled biological process that uses natural aerobic processes to increase the rate of biological decomposition of organic materials (Saherietal., 2012). The process of composting simply involves the piling of organic materials such as food waste, leaves and other under suitable moisture and temperature which allows the materials to decompose naturally into humus within short periods of weeks or months.

The application of solid waste recycling and composting has huge economic potentials in many developing countries (ADB, 2002; Ahmed & Ali; 2004 in Ezeah, 2010). In addition, organic materials constitute the largest fraction (about60%) of the municipal solid waste stream in developing countries and composting can largely reduce the quantity generated and lower the costs of collection, transport and disposal in the waste management. Many studies on solid wastes (Afon, 2007 and Kofoworola, 2007) also revealed numerous benefits of composting and recycling to the economy and the environment.

The composition of incoming organic materials must be appropriate to the composting process and desired end use. In order to optimize the composting process, the feedstock must have a certain makeup including a certain ratio of carbon to nitrogen and a moisture content of 50-55%, among other criteria. Broadly speaking, food waste, grass, manure and sludge are considered high nitrogen feed stocks and must be blended with much greater quantities of wood, leaves and branches, which are high in carbon, to create an optimal composting blend. Access to a carbon source may be a limiting factor when designing a composting facility, and in some cases, facility operators may be forced to purchase carbon feed stocks in the form of wood chips, straw or sawdust. When compost products fail to meet the nutrient requirements of the end market, operators may also be forced to augment their product with nitrogen, phosphorous or potassium additives, which may come at a cost.

2.2.2 Properties

The study of [Enayetullah I, Sinha AHMM, Khan SSA. Urban Solid Waste Management Scenario of Bangladesh, 2005) found that a substantial portion (69% to 77%) of solid waste in the urban areas is compostable. Average compostable content of the waste is 74% with the remaining 26% being non-compostable. The large quantity of organic contents present in urban solid waste composition indicates the necessity for frequent collection and removal. This also indicates good potentials for recycling of organic waste for resource recovery increased available water persisted for at least two years after the application of municipal solid waste, leaf, and food waste composts to a low-organic matter, eroded sandy loam soil (Gentilucci *et al*.2001)

Sullivan *et al*. (1998) evaluated six food waste composts with C: N ratios in the range of 20-25:1. The composts were incorporated into a sandy loam soil at a rate of 155 Mg/ha, and the site was planted with tall fescue for forage. Compost did not affect yield or N uptake in the establishment year, but yields and N up-take were greater in the compost-treated plots in sub-sequent years. Apparent N recovery in the harvested tall fescue was about 4% of compost N applied in the second and third years (Sullivan *et al*.1998). In the fourth through seventh years, apparent N recovery averaged 2% per year (Sullivan *et al*. 2003). A total of15 to 20% of the applied N was recovered in the crop during the seven-year period.

Mamo *et al*.(1999) found that municipal solid waste composts (mean C: N 20:1) applied at a rate of 90Mg/ha/yr provided half of the N needed for a corn crop in the first two years of applications. By the third year compost alone provided sufficient N for maxi-mum yield. Mamo *et al*.(1999) also made a one-time application of 270 Mg/ha of compost and grew corn for three years. They calculated a net N mineralization of about 4% each year from the single application.

Compost pH is generally near neutral to slightly alkaline. Composts containing alkaline feed stocks (such as alkaline stabilized bio solids or ash) have higher pH .Most research has shown a small effect of compost amendment on soil pH, typically increasing soil pH by0 to 1 unit (Sims 1990; Maynard 1994; Hornick 1988;Stamatiadis *et al*.1999; Epstein *et* *al*. 1976). Because com-posts can raise soil pH, Alexander (2001) suggests caution when adding compost (esp., alkaline compost) to soils where acid-loving plants will be grown.

Sullivan *et al*.(2002) compared food waste com-post applied at a rate of 155 Mg/ha with a zero-com-post control plus various rates of fertilizer N on tall fescue forage. The compost treatment had greater for-age yield and N uptake than the zero-compost treatment when no inorganic N was added, but the yield and N uptake difference disappeared as the inorganic N rate increased. This showed that the compost effect on tall fescue yield and N uptake was due to N supply. Other yield-enhancing benefits of the compost (e.g. water holding capacity, non-N nutrient supply, tilt) were not realized in the productive soil series (Puyallup fine sandy loam; coarse-loamy over sandy Vitrandic Haploxerolls) employed in this study.

2.3 Role of Compost on Stem amaranth

Sandra Ama Kaburi *et al*. (2015) showed in effect of three different rates of application of cattle dung on quality of two traditional leafy vegetables , *Amaranthus cruentus* and *Corchorus olitorius* are among such vegetables that could be widely cultivated but information on their fertility requirements is scanty. An experiment was conducted to study the effects of three different rates of application of cattle dung on growth parameters, proximate and mineral composition, weight loss and shelf life on *Amaranthus cruentus* and *Corchorus olitorius* on the experimental field of the Department of Horticulture, Faculty of Agriculture, Kwame Nkrumah University of Science and Technology. The treatments were cattle dung manure at rates of 0, 0.5. 0.8 and 1.1 t/ha. Application of (1.1 t/ha) in *Amaranthus cruentus* resulted in the highest plant height on the 20th day after transplanting. The 0.8 t/ha rate of application gave the highest number of leaves and shoots of *Amaranthus cruentus*. Higher rates of application produced biggest stem girth which varied significantly from those without manure application. the study showed that increased application of cattle dung produced positive outcomes on the growth parameter for *Amaranthus* *cruentus*. There were no significant (P > 0.05) changes in the proximate, mineral composition and shelf life of the two vegetables.

Ogedegbe, *et al*.(2012) , A field experiment conducted during the rainy season of 2011 and 2012 to evaluate the effect of organic fertilizers application on leaf and seed yields of three amaranth varieties. This experiment revealed the superiority of rabbit fertilizer over poultry and sheep fertilizers for amaranth production in Vom, Nigeria. Red seed amaranth yielded significantly more marketable leaves than black seed or white seed amaranths. Seed yield by white seed amaranth was greater than seed yields from black seed and red seed amaranths. It is recommended that further studies be carried out on seed yield of amaranth. Higher rates of rabbit and poultry fertilizers should be tested to establish the potential seed yield of white seed amaranth.

Kolawole Edomwonyi , Sarah OPeymi (2009) made a field trials were conducted in 2007 and 2008 to determine the influence of planting density and poultry manure application on the growth and yield of *Amaranthus cruentus*. This investigation revealed that a combination of planting and poultry manure application at a plant population of 62500 and 12 t ha-1 had positive effects on all growth parameters and so should be recommended to farmers and/ or leafy vegetable growers like amaranth because it is easily available, economical and it does not have the tendency of making the soil acidic since it is moderately available and improved the physical properties of the soil.

Anika et al. (2012) did the experiment on the effect of organic and inorganic fertilizer on the growth and edible yield of local vegetable amaranth (*Amaranthus caudatus* L. results obtained from this study showed that application of organic fertilizer (FYM) at 5 t ha-2 and inorganic fertilizer (NPK 20:10:10) at the rate of 300 kg ha-1 is recommended for farmers on upland soil in the Samara area of the Northern Guinea Savanna ecological zones of Nigeria.

Reza *et al*.(2016) made the experiment on the effect of organic and inorganic fertilizers on quality and quantity production of fodder Amaranth (*Amaranthus* spp. L.) a field experiment was conducted where they found that applying organic fertilizer methods will have good effective on quality and quantity of fodder production from Amaranth in Khuzestan.

The effect of compost (maize slover) and nitrogen fertilizers on the growth, shoot yield and nutrient uptake of amaranth was studied by Akanbi (2000) in Nigeria. Twelve treatments derived from a factorial combination of four levels of compost (0, 1.5, 3.0 and 4.5 t/ ha) and three levels of fertilizer (0, 30 and 60 kg N/ ha) were carried out on a sandy loam soil. The application of compost and N-fertilizer enhanced plant growth with respect to the control treatments. Plant height, plant diameter, number of leaves, leaf area per plant, dry matter and shoot fresh yield were all significantly affected by different levels of compost in combination with or without N-fertilizer.

An experiment carried out by Linkuietal. (2002) in Shanghi, China to investigated the effect of different bio-organic fertilizers on the yield and quality of 3-coloured amaranth. Fertilizers applied at the rate of 1.9 kg/plot. Amaranth receiving bio-fertilizers showed a yield increase of 15-38% compared to those receiving exclusive vegetable fertilizers.

A field trail was conducted to investigate the influence of P application method on the critical period of amaranth by Santos et al. (2004) with phosphorus fertilizer at rates of 125 or 250 kg/ha, respectively. Significant differences in respect of marketable yield, fresh yield and stem diameter were recorded at harvest. Fresh yield was 20% higher in 250 kg/ha compare with 125 kg/ha P in the method of broadcasting application.

Oyeyemi A., Francis Imade *et al*.(2017)said, The study was carried out to examine growth, shoot yield, dry matter and proximate composition of *Amaranthus cruentus* on poor soil augmented with compost or AMF either singly or in combination. The results revealed that the compost supplied sufficient plant nutrients needed for improving biological and economic yields of *Amaranthus cruentus*. Application of compost significantly (P B 0.05) influenced growth, dry matter and fresh shoot yield of *A. cruentus*. Applying of combination AMF and compost to nutrient limiting soil had no significant (P C 0.05) effect on yield and yield components of *A. cruentus*. Application of compost to nutrient deficient soil promoted growth, fresh shoot and dry matter yield of *A. cruentus*.

Islam, *et al*. (2017) made the experiment on the effect of organic manure and chemical fertilizers on vegetable crops and soil properties in the radish-stem amaranth-Indian spinach cropping pattern was studied in a homestead area of Gazipur district in Bangladesh. Among the treatments, the poultry manure 2.5 t ha-1 + reduced dose of recommended fertilizer and house hold waste 5 t ha-1 + reduced dose of recommended fertilizer were found suitable for achieving sustainable vegetable crop yield as well as for sustenance of soil health at homestead area.

Olowoake, *et al*.(2014) reported in Influence of Organic, mineral and organic mineral fertilizers on growth, yield, and soil properties in grain amaranth (*Amaranthus cruentus.L*) as organic mineral and unamend organic compost were found to have better residual effects on soil nutrients than NPK fertilizer and the integrated organic and mineral fertilizer and unamend organic compost showed promising potential for improving soil fertility and growth and yield performance of *Amarathus cruentus*.

Rahman and Akter (2019) found in Effect of kitchen waste compost and vermicompost in combination with chemical fertilizer on the production of Stem Amaranth, the growth performance of plant weight, height,stem girth showed that chemical fertilizers are more efficient than kitchen waste and vermicompost but the effect of kitchen waste and vermicompost are more favorable than chemical fertilizers.

CHAPTER 3

MATERIALS AND METHODS

3.1 Experimental Site

The experiment was conducted at the Agroforestry Farm in Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka 1207, Bangladesh. The experimental site is situated in 23°74/N latitude and 90°35/E longitude (Anon, 1989).

3.2 Characteristics of Soil

The soil of the experimental area belongs to the Modhupur Tract (UNDP, 1988) under AEZ No. 28 and was shallow red brown terrace soil. The selected experimental plot was medium high land and the soil series was Tejgaon (FAO, 1988). The characteristics of the soil under the experimental plot were analyzed in the Soil Testing Laboratory, SRDI, Khamarbari, Dhaka and presented in Appendix I. 3.3

3.3 Weather condition of the experimental Site

The climate of experimental site was subtropical, characterized by three distinct seasons, the monsoon or the rainy season from November to February and the pre-monsoon period or hot season from March to April and the monsoon period from May to October (Edris et al., 1979). Meteorological data related to the temperature, relative humidity and rainfalls during the period of the experiment was collected from the Bangladesh Meteorological Department (Climate Division), Sher-e-Bangla Nagar and presented in Dhaka.

3.4 Planting Materials

Seeds of stem amaranth (PANNA variety) were used as planting materials.

3.5 Treatment of the experiment

The experiment had one factor with five treatments

1. T_0: 0% compost
2. T_1: 20% compost of soil in pot
3. T_2: 40% compost of soil in pot
4. T_3: 50% compost of soil in pot
5. T_4: Recommended dose of fertilizer in pot

3.6 Experimental design and layout

The one factor experiment was done as pot experiment which considered as Completely Randomized Design (CRD) with three replications. As the five treatments with three replications experiment, the total unit of pot was 15. Each pot had four plants. The pot sized was 12 inch front diameter which covered as 0.073 m^2 each pot.

3.7 Soil preparation

The selected soil in agroforestry farm for conducting the experiment was prepared and fill the pot and opened for the 3rd week of March 2020. It was kept for 1 week so that it can released its nutrient. Weeds and stubbles were removed, and finally obtained a desirable pot of soil was obtained for sowing stem amaranth seeds. Compost is taken according to volume of pot. The sources of N, P_2O_5, K_2O were urea, TSP and MoP respectively. The entire amount of TSP and MoP and cow-dung comparing the area of pot were applied during the final soil preparation. Urea was applied in three equal interval at 15, 30 and 45 days after sowing seeds. It was done only for T_4.

3.8 Seed sowing

30 of seeds were sown in each pot in the fourth week of March.

3.9 Intercultural operation

When the seedlings started to emerge the bed was always kept under careful observation. After emergence of seedlings, various intercultural operations, thinning, weeding, top dressing was accomplished for better growth and development of stem amaranth seedlings.

3.9.1 Irrigation and drainage

Over-head irrigation was provided with a watering can to the pots once immediately after germination in every alternate day in the evening up to first thinning. Further irrigation was done as and when needed. Stagnant water was effectively drained out at the time of heavy rain.

3.9.2 Thinning

First thinning was done at 15 days after sowing 12April, 2nd thinning was done at 10 days after the first in 22 April and 3rd was done at 10 days after the second in 02 May for proper growth and development of stem amaranth seedlings kept four plants in each pot.

3.9.3 Weeding

Wedding was done to keep the pots free from weeds, easy aeration of soil, which ultimately ensured better growth and development. The newly emerged weeds were uprooted carefully after complete emergence of amaranth seedlings whenever it was necessary. Breaking the crust of the soil was done when needed.

3.9.4 Top Dressing

After basal dose, the remaining doses of urea were top-dressed in three equal installments .It was done only for T_4.

3.10 Plant Protection

For controlling leaf caterpillars Nogos @ 1 ml/1 water was applied two times at an interval of 10 days starting soon after the appearance of infestation. There was no remarkable attack of disease.

3.11 Harvesting

To evaluate the yield was harvested at final days after sowing at 50 DAS. The yield was carefully harvested and carefully weighted each of plant each of pot. Different yield contributing data were recorded from the mean of harvested sample plants which were selected at random from each unit pot.

3.12 Data collection

Data were recorded on the following parameters from the sample plants during the course of experiment. Such as seed germination rate, plant height, no. of leaves, stem diameter, green yield and dry weight of plant were taken for the study. Every parameter except fresh weight was taken in three times at 25 DAS, 40 DAS and finally 50 DAS. Weight of plant was taken only in harvesting days and the dry matter was taken by drying the plants.

3.12.1 Plant height

The height of plant was recorded in centimeter (cm) at 25, 40, 50 days after sowing (DAS) in the experimental pots. The height was measured from the ground level up to the tip of the growing point.

3.12.2 Stem diameter

Stem perimeter of amaranth plant was measured in centimeter (cm) with a thread and then in a meter scale as the outer surface of the stem . Diameter was determined by dividing pie value. Data were recorded as the average of middle of plants from each pot starting from 25 ,40 and 50 DAS.

3.12.3 Number of leaves per plant

The total number of leaves per plant was counted. Data were recorded from each plant from 25, 40 and 50 DAS.

3.12.4 Fresh weight of per plant

Fresh weight of per plant was taken after harvesting immediately of each plants. Every plant was calculated in gram.

3.12.5 Fresh weight of stem per plant

Fresh weight of stem was taken after cutting immediately the fresh leaves of plants. Weight was calculated in gram. Data were recorded at 50 DAS (harvesting time).

3.12.6 Fresh weight of leaves per plant

Fresh weight of leaves was taken after cutting immediately the fresh leaves. Weight was calculated in gram. Data were recorded at 50 DAS (harvesting time).

3.12.7 Green yield

Yield per hectare of stem amaranth was calculated by converting the weight of pot yield to hectare and was expressed in ton.

3.13 Statistical analysis

The data obtained for different parameters were statistically analyzed to find out the significance difference at different levels of compost on yield and yield contributing characters of stem amaranth. The mean values of all the characters were calculated and analysis of variance was performing by the ‘F’ (variance ratio) test. The significance of the difference among the treatment combinations means was estimated by the “Statistix 10 Trial” at 5% level of probability.

CHAPTER 4

RESULTS AND DISCUSSION

The experiment was conducted to investigate the performance Household Solid Waste Compost (HSWC) of yield production on stem amaranth. The analysis of variance for different characters has been presented in Appendix. Data on different parameters were analyzed statistically and the result have been presented in the Table 1 to 7 and Figures 1 to 13. The result of the present study have been presented and discussed in this chapter under the following headings.

4.1 Germination Percentage

The seed germination varied significantly due to the application of different levels of HSW compost (Figure 1). The highest (94.67%) seed germination rate was observed in T_4. At the same time T_0 produced lowest (72%) seed germination. The second highest seed germination was found 92% in T_1. The germination rate of T_2 (88%) was next to T_1 (92%). The T_3 germinated 81.33%. T_4 was significantly higher than T_0, T_1, T_2 and T_3. T_4 was statistically similar with T_2 and T_3.

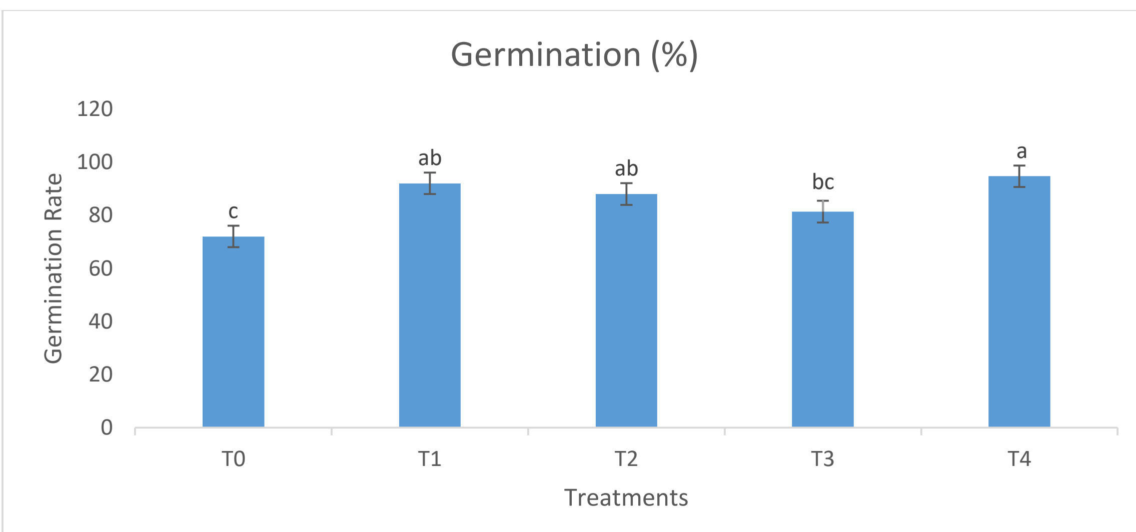

Figure 1: Effect of household waste compost on seed germination rate of stem amaranth

Among the T_1, T_2 and T_3 treatments the germination rate was high in T_1. T_1 was 10.67% higher than T_3 and 4% higher than T_2.

4.2 Plant Height

The plant height varied significantly due to the application of different levels of HSW compost (Table 1). The tallest plant height was observed in T_4 (17.5cm) in 25 DAS. At the same time the treatment T0 produced lowest height of plant (9 cm).The tallest plant was observed in T4 (53.5cm) at 40 DAS while the lowest plant height was observed from T0 (16cm). At 50 DAS the tallest plant observed in T4 (74.5cm) while the lowest plant height was observed from T0 (21.67cm).

The second tallest plant was observed 17.33 cm in 25 DAS from T2 and the plant was 16.17 cm from T1 while T3 produced 14.67 cm of plant. At 40 DAS T2 produced second tallest plant (51 cm) and the next to T2, T1 produced 43 cm where T3 produced plant of 35.67 cm respectively. The table shows the plant height how significantly differ at different days among treatments. T_4 was significantly higher than T_0, T_1, T_2 and T_3. The result of the study compared to Talukder (1999) who recorded the plant height of three amaranth cultivars at 30 DAS ranged from 32.5 to 39.88 cm, at 40 DAS ranged from 57.99 to 61.30 cm and at 45 DAS ranged 75.68 to 81.84 cm. Similar result was found by Hossain (1996).

Table 1: Effect of HSWC on Plant Height of Stem Amaranth at Different DAS

Treatments	Plant Height 25 DAS (cm)	Plant Height 40 DAS (cm)	Plant Height 50 DAS (cm)
T_0	9.00 d	16.00 d	21.67 e
T_1	16.17 b	43.00 b	66.83 c
T_2	17.33 a	51.00 a	71.33 b
T_3	14.67 c	35.67 c	48.17 d
T_4	17.5 a	53.50 a	74.5 a
CV (%)	3.96	3.86	1.99
$LSD_{(0.05)}$	2.8	1.08	2.05

Note: Means followed by common letters are not significantly different from each other by STATISTIX 10 TRIAL at 5% level.

At 50 DAS the time of harvesting the second tallest plant was observed 71.33 cm from T_2. The 66.83 cm of plant was observed from T_1 while the T_3 was far away by producing the plant of 48.17 cm. The T_2 produced only 4.26% less height than T_4. On the other hand T_2 shows great performance in comparing T_0. Here T_2 produced 69.62% more height than T_0. T_4 was significantly higher than T_0, T_1, T_2 and T_3. T_4 was statistically similar with T_2.

4.3 Stem Diameter

The plant diameter varied significantly due to the application of different levels of HSW compost at 25 DAS, 40 DAS, and 50 DAS (Table 2). The thickest plant diameter in T4 (1.02 cm) in 25DAS. At the same time the treatment (T0) produced 0.68cm which was the lowest diameter of plant. The thickest plant diameter was observed from T4 at 40 DAS (1.73 cm) while the lowest plant diameter was observed 0.75cm from T_0.At 50 DAS the thickest plant diameter observed 1.89 cm in both T4 and T2 while the lowest plant diameter was observed from T0 (1.06cm). The second thickest plant diameter was observed 0.97 cm in 25 DAS from T2 and the plant diameter was 0.95 cm from T1 while T3 produced 0.88 cm of plant diameter. At 40 DAS T_2 produced second thickest plant diameter was 1.69 cm and the next to T2, T1 produced 1.59 cm where T3 produced plant of 1.20 cm. So it can be cleared that performance of T2 was the best among the desired treatments in case of plant diameter. The result of the study compared to Talukder (1999) who recorded the diameter of plant of three amaranth cultivars at 30 DAS ranged from 1.22 to 1.5 cm, at 40 DAS ranged from 1.48 to 1.98 cm and at 45 DAS ranged 1.88 to 2.98 cm. Similar result was found by Hossain (1996).

Table 2: Effect of HSWC on Stem Diameter of Stem Amaranth at Different DAS

Treatments	Stem Diameter 25 DAS (cm)	Stem Diameter 40 DAS (cm)	Stem Diameter 50 DAS (cm)
T_0	0.68 d	0.75 d	1.06 d
T_1	0.95 b	1.59 b	1.73 b
T_2	0.97 b	1.69 ab	1.89 a
T_3	0.88 c	1.20 c	1.28 c
T_4	1.02 a	1.73 a	1.89 a
CV (%)	2.14	4.14	2.93
$LSD_{(0.05)}$	0.105	0.04	0.08

Note: Means followed by common letters are not significantly different from each other by STATISTIX 10 TRIAL at 5% level.

At 50 DAS; the time of harvesting the second thickest plant diameter was observed 1.73 cm from T_1 while the $T3_3$ was far away by producing the plant diameter of 1.28 cm. There are no significant change in case of plant diameter of T_3 and T_4 at harvesting time. T_2 and T_4 are 0.83 cm higher plant diameter than T_0 while T_1 is 0.67 cm. T_3 is 0.22 cm higher than T_0 and 0.61 cm lower plant diameter than T_2 and T_4. T_4 was significantly higher than T_0, T_1, T_2 and T_3. T_2 and T_4 are statistically similar.

4.4 Number of Leaves per Plant

The number of leaves per plant varied significantly due to the application of different levels of HSW compost at 25 DAS, 40 DAS, and 50 DAS (Table 3).The maximum number of leaves per plant was observed in T_2 at 25 DAS.T_4 produced 12 leaves per plant whereas T2 produced 12.16 leaves per plant in 25DAS. At the same time the treatment (T0) produced lowest number of leaves per plant (7.67). The maximum number of leaves per plant was observed 37 in T4 which was closed to T2 containing 36.67 leaves per plant at 40 DAS while the lowest number of leaves per plant was observed 14.67 from T0.At 50 DAS the time of harvesting the maximum number of leaves per plant observed 37.33 in T4 while the minimum number of leaves was observed 14.83 from T0. The second most containing leaves per plant was observed 12.00 in 25 DAS from T4 and T1.The number of leaves per plant was 10.33 from T3. At 40 DAS T4 produced second most number of leaves per plant was 37 which was closed to T2.T1 and T3 produced individually 33.67 and 33.53 leaves per plant respectively. At 50 DAS the time of harvesting the second most number of leaves per plant was observed 36.83 from T2 while the T3 produced 34.17 leaves per plant as the T1 produced. Statistically there are not any significant change among T1, T2 and T4 by producing leaves in 25 DAS. But T3 produced less than T1, T2, and T4.At 40 DAS no significant change can be found between T2 and T4.T1 and T3 contained next to first category levels and between them no statistically change remained. But T0 was far away by producing leaves which remain in last category. At 50 DAS which was harvesting time, no significant change can be observed between T2 andT4. T1 produced the leaves just next to first categories levels. On the other hand leaves of T0 was far away from T1, T2 and T4. The leaves of T3 was less than T1, T2 and T4. T3 higher than T0. The result of the study compared to Talukder (1999) who recorded the numbers of leaves plant of three amaranth cultivars at 45 DAS ranged 19.6 to 42.58. Similar result was found by Hossain (1996).

Table 3: Effect of HSWC on Number of Leaves per Plant of Stem Amaranth at Different DAS

Treatments	Number of Leaves/plant 25 DAS	Number of Leaves/plant 40 DAS	Number of Leaves/plant 50 DAS
T_0	7.67 c	14.67 c	14.83 c
T_1	12.00 a	33.67 b	34.17 b
T_2	12.16 a	36.67 a	36.83 a
T_3	10.33 b	33.53 b	34.17 b
T_4	12.00 a	37.00 a	37.33 a
CV (%)	3.58	3.36	3.10
$LSD_{(.05)}$	0.70	1.93	1.76

Note: Means followed by common letters are not significantly different from each other by STATISTIX 10 TRIAL at 5% level.

Among desire treatments T_1, T_2 and T_3 there were huge difference in case of numbers of leaves. Statistically T_2 was the first category. T_1 and T_3 were second category. The difference of performance of HSW compost from RDF and zero treatments were observed clearly. T_2 was only 0.5 number of leaf per plant less than T_4 but very much differ to T_0 with 22 number of leaves per plant. T_4 was significantly higher than T_0, T_1, T_2 and T_3.T_2 and T_4 were statistically similar.

4.5 Fresh Weight per Plant

The plant weight varied significantly due to the application of different levels of HSW compost (Figure 2). The highest plant weight was observed in T4 (166gm). At the same time the treatment T_0 produced lowest weight of plant (48.67gm). The second highest plant weight was observed 160gm from T2. The plant weight was 152.33gm from T1 while T3 produced 115.33gm weight of plant. They can be arranged by $T_4>T_2>T_1>T_3>T_0$ for producing green yield. The result of green yield of plant compared to Talukder (1999) who recorded the green plant weight of three amaranth cultivars at 45 DAS ranged 280gm to

119 gm. Miah M.Y, Roy P.K, Islam M.S and Fazal K.I (2013) Stem amaranth yield in response to organic manure; reported their findings as height 210 gm to 30 gm.

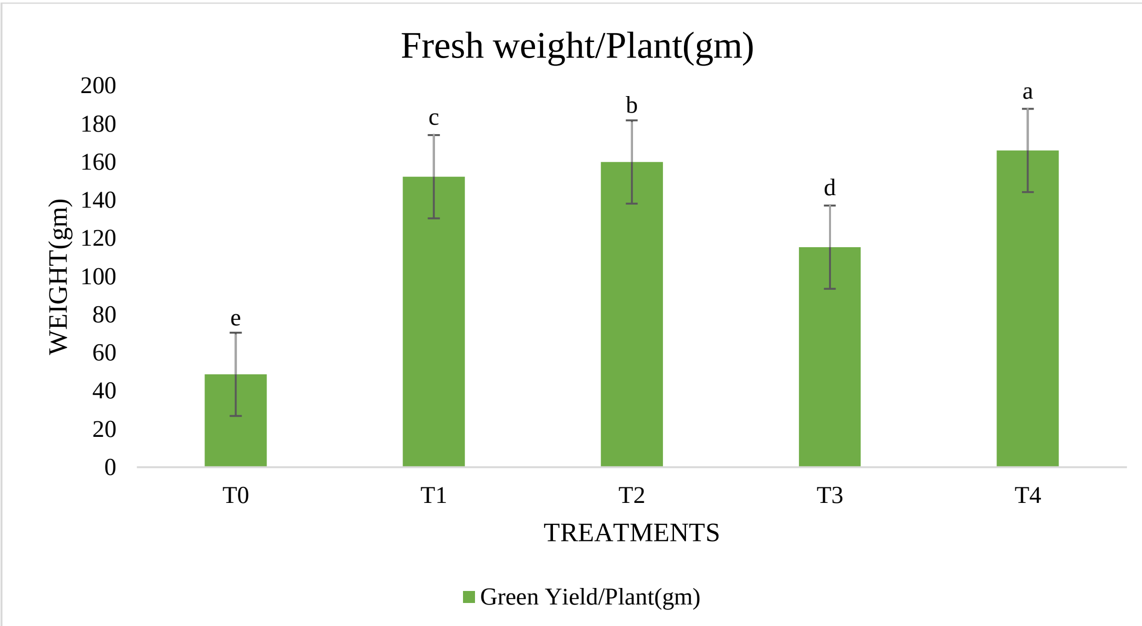

Figure 2: Effect of HSWC on fresh weight of per plant of stem amaranth at harvesting time

Among the treatments T_1, T_2 and $T_{3,}$ the T_2 is the best in case of weight which produced 5.03% higher production than T_1 and 38.84% higher than T_3. The T_2 produced 69.58% more than control (T_0) treatments. In these case T_2 was significant than T_0 and insignificant than T_4. From desired levels of HSW compost the T2 was the best in case of plant weight. The T_2 produced 3.61% less yield than $T_{4.}$ T_4 was significantly higher than T_0, T_1, T_2 and T_3. T_4 was statistically similar with T_2.

4.6 Dry Weight of Plant

Dry weight of plants were observed with a great variation due to the application of different levels of HSW compost (Table 4). The highest dry weight of plant was observed in T4

(33.98gm). At the same time the treatment (T0) produced lowest dry weight of plant (8.08 gm). The second highest dry weight of plant 32.11gm was observed from T2 which is statistically same as T4. T1 produced 30.22gm which was next to T2. Among the desired treatments T3 produced the lowest (22.71gm). The production of dry weight can be arranged in $T_4>T_2>T_1>T_3>T_0$.

Table 4: Effect of HSWC on Dry Weight/Plant of Stem Amaranth

Treatment	Dry Weight/Plant (gm)
T_0	8.08 d
T_1	30.22 b
T_2	32.11 ab
T_3	22.71 c
T_4	33.98 a
CV (%)	2.41
$LSD_{(0.05)}$	1.89

Note: Means followed by common letters are not significantly different from each other by STATISTIX 10 TRIAL at 5% level.

A noticeable difference can be observed in case dry weight among T_1, T_2 and T_3 treatments. Among these desirable treatments T_2 produced the highest (32.11gm) and T_1 produced the lowest (30.22gm). T_2 produced 1.89gm more than T_1 and 9.4 gm more than T_3. T_2 produced 24.03gm more than zero treatment (T_0) and only 1.87gm less than T_4. T_4 was significantly higher than T_0, T_1, T_2 and T_3. T_4 was statistically similar with T_2.

CHAPTER 5

SUMMARY AND CONCLUSION

SUMMARY

An experiment was conducted at the Agroforestry Farm of Sher-e-Bangla Agricultural University, Dhaka during the period of 27 March to 16 May 2020 to study the performance of Household Solid Waste Compost (HSWC) on yield of stem amaranth. The experiment consisted of 5 levels of compost viz., treatment (no compost), T1 (20% compost of pot), T2 (40% compost of pots) and T3 (50% compost of pot) and T4 (RDF) . One factor experiment was laid out in CRD with three replications. The amaranth seed of PANNA variety were sown on 27 March, 2020. Data were recorded on growth and yield contributing parameters and collected data were statistically analyzed for evaluation of the treatments effects. The mean differences were adjusted by Statistix 10 Trial. The entire amount of cowdung, TSP and MoP were applied as basal dose during soil preparation. Those were mixed with the soil of the individual pot 7 days before seed sowing. The full amount of urea was top dressed in three equal splits 15, 25 and 35 days after sowing (DAS). Most of the parameters like germination rate, plant height, number of leaves, plant diameter, weight of stem, weight of leaves, green yield per plant, dry weight and dry matter content of stem and dry matter content of leaves were significantly influenced by application of HSW Compost to comparatively zero treatment(T0) and RDF treatment (T4). The tallest plant (74.5 cm) was observed in the treatment applied at RDF pot (T4). Plant had better vegetative growth in this treatment. The highest green yield at all observation also obtained atT4. The maximum plant diameter (1.89 cm), green yield per plant (166 g), dry matter content of plant (20.46 %) were found from the pot receiving RDF(T4) at 50 DAS. Minimum data of all parameters were recorded from the zero treatment. The lowest plant height (21.67 cm), number of leaves (14.83), weight of per plant (48.67 g),dry matter content of plant (16.6 %) were found from the zero treatment at 50 DAS. Among the desired treatments (T1, T2 and T3) T2 showed its best performance. Among them the tallest plant (71.3 cm)

was observed in the treatment T2. Plant had better vegetative growth in this treatment. Among the desired treatments the highest green yield at all observation also obtained at T2 pot. The maximum plant diameter (1.89 cm), green yield per plant (160 g), dry matter content of plant (20.07%) were found from the T2 pot at 50 DAS. Minimum data of all parameters were recorded from the T3 treatment. The lowest plant height (48.17 cm), number of leaves (34.17/plant), weight of per plant (115.67 gm),dry weight(22.71gm), matter content of plant (19.69 %) were found from the T3 treatment. From all the analysis T4 was the best whether T2 was the statistically partner. In case of seed germination rate, plant diameter, no. of leaves, green yield, dry weight and dry matter content were statistically similar between T_2 and T_4.

CONCLUSION

Household solid waste compost (HSWC) influenced on the growth and yield of stem amaranth. In this study T_0, T_1, T_2, T_3 and T_4 treatments were evaluated. Among them T_0 showed significantly lower performance in all growth parameters and T_4 (RDF) performed the best, subsequently T_2, T_1, T_3. In case of following parameters like as seed germination, plant height, leaf number, plant diameter, plant weight and plant dry matter T_2 (40% compost) was statistically similar with T_4. So for organic farming, T_2 treatment can be used instead of chemical fertilizer.

RECOMMENDATIONS

Following suggestions and recommendations associated to this experiment should be followed for further research events related to alike topics-

- To produce organic Stem amaranth in pots/ rooftop, treatment T_2 (40% HSWC) will be preferable.
- Different doses of HSW compost for experiment should be undertaken for specific recommendation.
- Different vegetables or crops should be taken for research.
- On chemical composition and nutrient content more researches should be undertaken.
- More research should be carried out for accurate result.

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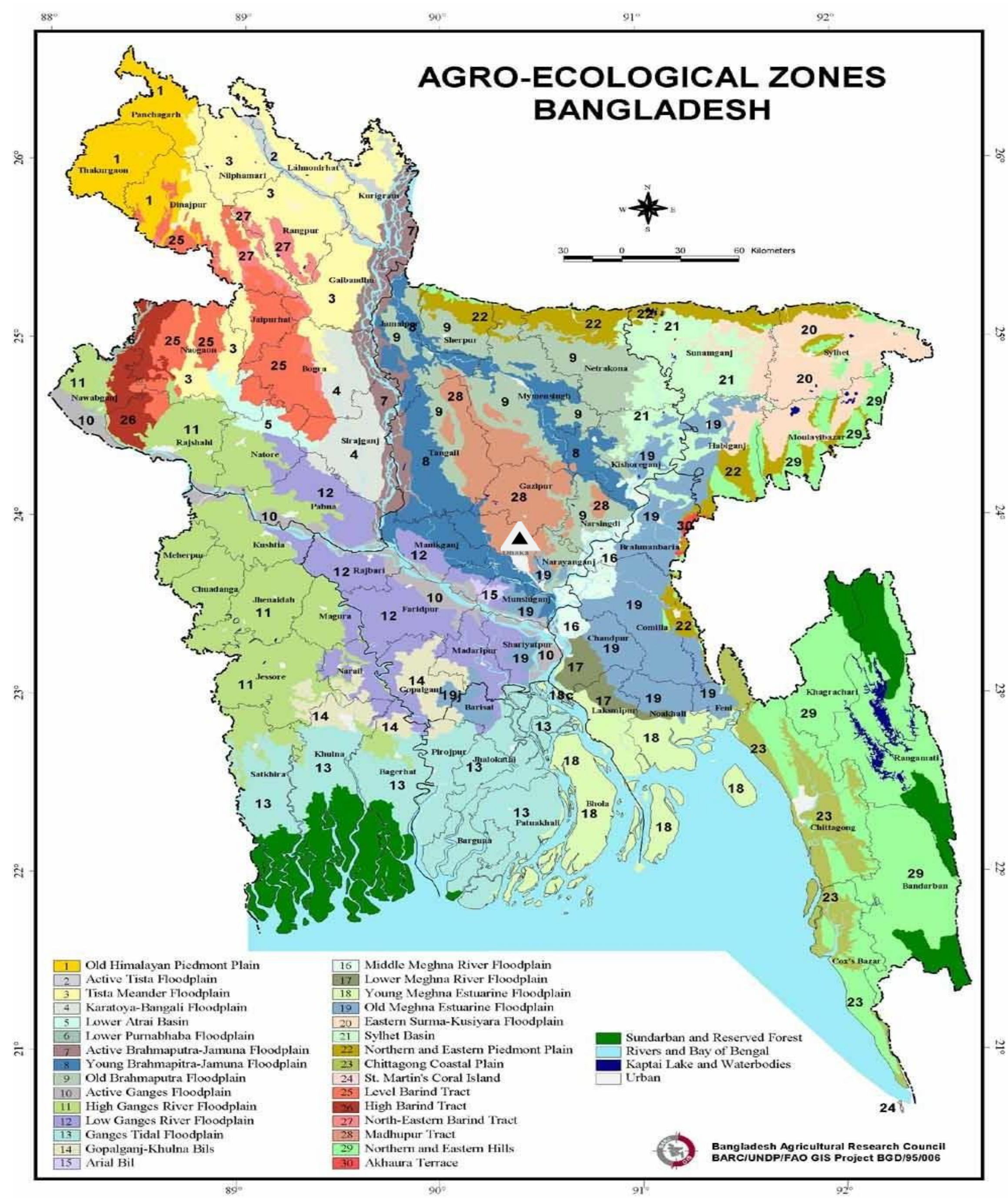
APPENDICES

Appendix 1. Map showing the experimental site under the study



▲ The experimental site under study

Appendix 2. The mechanical characteristics of soil of the experimentalsite as observed prior to experimentation (0 -15 cm depth).

Mechanical composition:

Particle size	**Constitution**
Texture	Loamy
Sand	40%
Silt	40%
Clay	20%

Appendix 3: Chemical composition of soil

Soil characters	**Value**
Organic matter	1.44 %
Potassium	0.15 meq/100 g soil
Phosphorus	22.08 µg/g soil
Magnesium	1.00 meq/100 g soil
Total nitrogen	0.072
Copper	3.54 µg/g soil
Sulphur	25.98 µg/g soil
Calcium	1.00 meq/100 g soil
Boron	0.48 µg/g soi
Zinc	3.32 µg/g soil
Iron	262.6 µg/g soil
Manganese	164 µg/gsoil

Source: Soil Resources Development Institute (SRDI), Khamarbari, Dhaka

Appendix 4. ANOVA of different growth and yield contributing attributes

Analysis of variance of Green Yield/Plant

Source	DF	SS	MS	F	P
treat	4	28539.7	7134.93	1240.86	0.0000
Error	10	57.5	5.75		
Total	14	28597.2			

Grand Mean 128.47
CV 1.87
$LSD_{0.05}$ 4.36

Analysis of variance of Dry Matter/Stem

Source	DF	SS	MS	F	P
Treatment	4	18.6056	4.65139	109.38	0.0000
Error	10	0.4253	0.04253		
Total	14	19.0308			

Grand Mean 5.6880
CV 3.63
$LSD_{0.05}$ 0.38

Analysis of variance of Dry Matter of Leaves/Plant

Source	DF	SS	MS	F	P
Treatment	4	4.96057	1.24014	9.26	0.0021
Error	10	1.33907	0.13391		
Total	14	6.29964			

Grand Mean 13.532
CV 2.70
$LSD_{0.05}$ 0.67

Analysis of variance of Leaves no. at 25DAS

Source	DF	SS	MS	F	P
Treatment	4	44.3333	11.0833	73.89	0.0000
Error	10	1.5000	0.1500		
Total	14	45.8333			

Grand Mean 10.833
CV 3.58
$LSD_{0.05}$ 0.70

Analysis of variance of Leaf no. at 40DAS

Source	DF	SS	MS	F	P
Treatment	4	1054.77	263.692	236.14	0.0000
Error	10	11.17	1.117		
Total	14	1065.93			

Grand Mean 31.433
CV 3.36
$LSD_{0.05}$ 1.93

Analysis of variance of Leaves no. at 50 DAS

Source	DF	SS	MS	F	P
Treatment	4	1054.40	263.600	282.43	0.0000
Error	10	9.33	0.933		
Total	14	1063.73			

Grand Mean 31.133
CV 3.10
$LSD_{0.05}$ 1.76

Analysis of variance of Plant Height /Plant at 25DAS

Source	DF	SS	MS	F	P
Treatment	4	147.433	36.8583	105.31	0.0000
Error	10	3.500	0.3500		
Total	14	150.933			

Grand Mean 14.933
CV 3.96
$LSD_{0.05}$ 2.8

Analysis of variance of Plant Height/Plant at 40DAS

Source	DF	SS	MS	F	P
Treatment	4	2720.67	680.167	287.39	0.0000
Error	10	23.67	2.367		
Total	14	2744.33			

Grand Mean 39.833
CV 3.86
$LSD_{0.05}$ 1.08

Analysis of variance of Plant Height at 50 DAS

Source	DF	SS	MS	F	P
Treatment	4	5800.83	1450.21	1144.90	0.0000
Error	10	12.67	1.27		
Total	14	5813.50			

Grand Mean 56.500
CV 1.99
$LSD_{0.05}$ 2.05

Analysis of variance of Diameter/Stem at 25DAS

Source	DF	SS	MS	F	P
Treatment	4	0.21083	0.05271	112.94	0.0000
Error	10	0.00467	0.00047		
Total	14	0.21549			

Grand Mean 0.8993
CV 2.14
$LSD_{0.05}$ 0.105

Analysis of variance of Diameter/Stem at 40DAS

Source	DF	SS	MS	F	P
Treatment	4	2.06644	0.51661	156.55	0.0000
Error	10	0.03300	0.00330		
Total	14	2.09944			

Grand Mean 1.3880
CV 4.14
$LSD_{0.05}$ 0.04

Analysis of variance of Diameter/Stem at 50DAS

Source	DF	SS	MS	F	P
Treatment	4	1.73469	0.43367	203.92	0.0000
Error	10	0.02127	0.00213		
Total	14	1.75596			

Grand Mean 1.5740
CV 2.93
$LSD_{0.05}$ 0.08

Completely Randomized AOV for Germination

Source	DF	SS	MS	F	P
Treatment	4	996.27	249.067	4.67	0.0219
Error	10	533.33	53.333		
Total	14	1529.60			

Grand Mean 85.600
CV 8.53
$LSD_{0.05}$ 13.28

Completely Randomized AOV for Dry Matter/Plant

Source	DF	SS	MS	F	P
Treatment	4	29.0012	7.25031	24.50	0.0000
Error	10	2.9590	0.29590		
Total	14	31.9602			

Grand Mean 19.332
CV 2.81
$LSD_{0.05}$ 0.9896