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SHORT COMMUNICATION

Integrated Nutrient Management for Tomato in the Southern Region of Bangladesh

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ABSTRACT

A field experiment was conducted at Central Farm, Regional Agricultural Research Station, Rahmatpur, Barishal during the rabi season of 2016-2017 and 2017-2018 to evaluate the efficiency of cowdung and/or poultry manure on growth and yield of tomato. The crop variety was BARI Tomato-14. Cowdung and poultry manure were used with chemical fertilizers. A total of seven treatments were used viz. T_1:Control, T_2:100% recommended dose (RD) T_3:75% RD, T_4:100% RD + cowdung @ 5 tha^{-1}, T_5:100% RD + poultry manure @ 5 tha^{-1}, T_6:75% RD + cowdung @ 5 tha^{-1}, T_7:75% RD + poulty manure @ 5 tha^{-1} which were replicated for four times. Cowdung, poultry manure in combination with chemical fertilizers had significant influence on plant height (cm), no of flower clusters $plant^{-1}$, no of fruits $plant^{-1}$, fruit yield $plant^{-1}$(kg), fruit yield (t ha^{-1}) of tomato. In 2016-17 significantly higher fruit yield (65.20 t ha^{-1}) was recorded with 100% RD plus cowdung 5 t ha^{-1} followed by yield obtained from 100% RD + poultry manure @ 5 t ha^{-1}, 75% RD + cowdung @ 5 t ha^{-1}, 75% RD + poulty manure @ 5 t ha^{-1}. On the other hand, during 2017-18 maximum 95.46 t ha^{-1} tomato yield was recorded with 75% RD plus cowdung 5 tha^{-1}which was found identical with the result gathered from 100% RD + poultry manure @ 5 t ha^{-1}, 100% RD + cowdung @ 5 tha^{-1}, 75% RD + poulty manure @ 5 tha^{-1}. Therefore, only 75% of the recommended fertilizer could be used in integrated use of cowdung and/or poultry manure in tomato cultivation in southwestern region, Barishal (Non–calcareous Grey Floodplain Soils under AEZ 13).

Key words: Cowdung, poultry manure, chemical fertilizer, tomato, yield

Introduction

The tomato (*Lycopersicon esculentum* Mill.) belonging to the family Solanaceae is the most popular home garden and the third most consumed crop in the world. But due to lowering yield there is a prime need to increase the production and productivity of tomato in the country and the southern region as well. Among the various factors responsible for low production, improper cultural operation sand nutrient management are the important ones (Manohar *et al.*, 2013). Again, in today's agricultural sector sustainable production incorporates the idea that natural resources should be used to generate increased output and incomes, especially for low income groups without depleting the natural resource base. Integrated nutrient management (INM) integrates the use of all natural and man-made sources of plant nutrients, so that productivity and nutrient status of food increases in an efficient and environmentally benefiting manner without sacrificing soil productivity of future generations (Javaria and Khan, 2010). Again, application of chemical fertilizers provides a good yield but soil properties are badly affected. Keeping in mind the bad impact of sole chemical fertilizers, the concept of integrated nutrient management is taken under consideration to obtain a higher yield and good quality. Further, there is hardly any research accomplished in southern Bangladesh with integrated nutrient management in tomato. So an experiment has been conducted by combining different organic and inorganic fertilizers in a frame which is rare in the field of tomato research. The use of organic fertilizers and their proper management may reduce the need for chemical fertilizers thus allowing the small farmers to save in part the cost of production. In addition, organic fertilizers are generally decomposed slowly and nutrients remain available for longer period of time which helps to maintain soil nutrient status (Diacono and Montemurro, 2010). In the southern region of Bangladesh, the yield of tomato is not yet satisfactory as compared to other tomato growing area of the country. Organic manure (poultry manure, rice straw, cowdung), plant hormone and chemical fertilizers play an important role in increasing growth and yield of crops. That is why, it is necessary to adopt integrated nutrient management system through combined application of organic and inorganic fertilizers to boost up the crop growth and yield without affecting soil fertility for the southern region of Bangladesh.

Materials and Methods

A field experiment was carried out during the rabi season of 2016-2017 and 2017-2018 for tomato at Regional Agricultural Research Station (RARS), Rahmatpur, Barishal. The experiment was laid out in Randomized Complete Block Design (RCBD) with four replications. There were seven treatment combinations viz. T_1: Control, T_2: 100% recommended dose (RD), T_3: 75% RD, T_4: 100% RD + cowdung @ 5 t ha^{-1}, T_5: 100% RD + poultry manure @ 5 t ha^{-1}, T_6: 75% RD + cowdung @ 5 tha^{-1} and T_7: 75% RD + poulty manure @ 5 t ha^{-1}. The tested crop was tomato (cv. BARI Tomato-14). The unit plots measured 2.4 m × 2.4 m in size. Seeds were sown in seed bed and transplanted after 30 days in the experimental field. The physical and chemical properties of the initial soil samples from experimental fields at a depth of 0-15 cm were collected and analyzed following standard methods and presented in Tables 1.

Table 1. Initial fertility status of the soil samples of RARS, Rahmatpur, Barishal

Soil Properties	Texture	pH	EC	OM (%)	Total N (%)	K	P	S	B
						meq 100g^{-1}	µg g^{-1}		
Experiment field	Sandy clay loam	6.8	0.65	0.45	0.027	0.17	10.53	1.9	0.18
Interpretation	-	-		-	Very low	Medium	Low	Very low	Low

Nitrogen, phosphorus, potassium, sulphur, zinc and boron were used in the form of urea, TSP, MoP, gypsum, zinc sulphate and boric acid, respectively. Recommended fertilizer dose (BARC, 2012) for tomato (160 kg N, 90 kg P, 60 kg K, 30 kg S, 1.5 kg Zn and 0.5 kg B kg ha^{-1}) were used. All P, K, S, Zn, B and $^{1}/_{3}$rd amount urea were applied at the time of final land preparation and the remaining $^{2}/_{3}$rd amount of urea-N were applied in two equal installments at 25 and 45 days of transplanting. All the intercultural operations such as irrigation, sticking, weeding, insect control etc. were done as and when necessary. Data on yield and yield components were recorded at maturity. The tomato was harvested from 05 March to 08 April 2017 and 28 February to 04 April 2018.

Statistical analyses were conducted using standard statistical procedures (Gomez and Gomez, 1984) implemented in Statistics 10. The data were examined by analysis of variance (ANOVA). Differences between the treatments were determined by ANOVA, and Fisher's protected least significant difference (LSD) was calculated at the 0.05 probability level for treatment mean comparisons.

Result and Discussion

Plant height

Significant variation was found in case of plant height of tomato. At 50% fruiting stage of tomato, the highest plant height (136.3 cm) was recorded with 100% RD + cowdung (CD) 5 t ha^{-1} (T_4) in 2016-17 which was followed by 100% RD + poultry manure (PM) 5 t ha^{-1} (T_5) while in 2017-18 the highest plant height (132.90 cm) was recorded with 100% RD (T_2) having statistical similarity with 100% RD + poultry manure (PM) 5 t ha^{-1} (T_5). Plant height was recorded lowest in control treatment in both the research years, 103.80 cm and 116.60 cm, respectively (Table 2). Manures might have improved the physical condition of soil like structure, moisture holding capacity, aeration etc., These results are in close conformity with the finding of Samawat *et al.* (2001), Rao and Sankar (2001) and Hashemimajd *et al.* (2004).

Number of flower clusters plant^{-1}

Combined application of organic and inorganic fertilizers had a significant influence on number of cluster of flower clusters plant^{-1}. In 2016-17, the highest number of cluster of flower plant^{-1} was observed 8.80 in 100% RD + CD 5 t ha^{-1} treatment which was statistically similar to that in 100% RD + PM 5 t ha^{-1} and 75% RD and the lowest was recorded 6.50 in control treatment. Again in 2017-18, the maximum no. of cluster was observed 10.70 in75% RD + CD 5 t ha^{-1}having statistical similarity with 100% RD + PM 5 t ha^{-1}and 100% RD + CD 5 t ha^{-1} (Table 2). The reasons of obtaining comparatively higher flower cluster might be due to the contribution of integrated use of chemical fertilizers and poultry manure (Farhad*et al.*, 2009).

Yield contributing characters

Number of fruits plant^{-1}

The number of fruits plant^{-1} was significantly influenced by the application of different levels of organic manure with different doses of chemical fertilizers in 2017-18 but not in 2016-17. The highest number of fruits plant^{-1} (45.00) was produced in 100% RD + CD 5 tha^{-1}

treatment whereas lowest (33.80) was in control treatment. While in 2017-18, the highest no. of fruits plant^{-1} (36.58) was recorded in 75% RD + CD 5 tha^{-1} having statistical similarity with 100% RD + PM 5 tha^{-1} (36.38) and 100% RD + CD 5 tha^{-1} (35.54) and the lowest no. of fruits plant^{-1} was observed in control treatment (Table 2). The number of the fruits was higher in treatment where plants obtained nutrients when necessary in sufficient amount throughout the growth period. The increased supply of macro and micronutrients with increasing levels of manures stimulated the rate of various physiological processes in plant leading to increased growth and yield parameters and resulted in increased number of fruits in tomato. The results of present investigation are in line with those of Atiyeh *et al.* (2000), Anburani *et al.* (2003), Arancon *et al.* (2003) and Choudhary *et al.* (2003).

Fruit yield of tomato

Integrated application of chemical fertilizers, cowdung and poultry manures have shown significant variation in fruit yield of tomato. During 2016-17 fruit yield per hectare were recorded maximum 65.20 t in 100% RD + CD 5 t ha^{-1} which was statistically identical with 100% RD + PM 5 t ha^{-1}, 75% RD + CD 5 t ha^{-1}, 75% RD + PM 5 tha^{-1} treatments and differed from rest of the treatments. On the other hand, during 2017-18 the highest fruit yield (95.46 tha^{-1}) was recorded with the treatment 75% RD + CD 5 tha^{-1} which was statistically similar to the yield obtained from 100% RD + PM 5 tha^{-1}, 100% RD + CD 5 tha^{-1}, 100% RD + PM 5 tha^{-1} treatments (Table 3). In both the years, minimum yield was recorded in control treatment. Yongchung *et al*. (2004) also reported that the yield of tomato fruits from the organic-inorganic combined fertilized plants was significantly higher among all the treatments.

It was also observed that during 2016-17 100% RD + CD 5 tha^{-1} treatment increased yield by 203.10% while in 2017-18 75% RD + CD 5 tha^{-1} increased tomato yield by 162.15% over control. And this yield increase over control is higher in cowdung or poultry manure integrated treatments than that of sole chemical fertilizer treatments (Table 3). The significant increase in yield under the combined application of organic and inorganic fertilizers as basal dose was largely a function of improved growth and subsequent increase in number of clusters per plant, fruits per plant and other yield attributes as described earlier. Thus, the interactive advantages of combining organic and inorganic fertilization proved superior to the use of each component individually. Similar results were found in investigations of Reddy *et al.* (1998) and Patel *et al.* (2004).

Table 2. Effect of chemical fertilizers, cowdung and poultry manure on growth characteristics of tomato during 2016-2017 and 2017-2018

Treatment	Plant height (cm)		No of flower clusters plant^{-1}		No of fruits plant^{-1}	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
T_1: Control	103.80	116.60	6.50	7.89	33.8	23.95
T_2: 100% RD	116.80	132.90	7.45	10.35	41.7	34.27
T_3: 75% RD	123.80	130.55	7.60	9.86	38.9	31.98
T_4: 100% RD + CD 5 t ha^{-1}	136.30	129.65	8.80	10.07	45.0	35.54
T_5: 100% RD + PM 5 t ha^{-1}	135.70	132.75	7.60	10.65	42.8	36.38
T_6: 75% RD + CD 5 t ha^{-1}	133.00	130.45	7.35	10.70	43.5	36.58
T_7: 75% RD + PM 5 t ha^{-1}	131.40	127.95	7.55	9.86	43.2	34.91
CV (%)	7.92	3.77	15.50	6.47	18.40	6.30
Level of significance	**	*	*	*	NS	*

RD=Recommended dose of chemical fertilizers, CD=cowdung, PM= poultry manure

Table 3. Effect of chemical fertilizers, cowdung and poultry manure on yield characters of tomato during 2016-2017 and 2017-2018

Treatment	No of fruits plant^{-1}		Fruit yield (tha^{-1})		Fruit yield increase over control (%)	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
T_1: Control	33.8	23.95	32.1	58.87	-	-
T_2: 100% RD	41.7	34.27	54.3	89.75	169.2	152.45
T_3: 75% RD	38.9	31.98	51.9	86.30	161.7	146.59
T_4: 100% RD + CD 5 t ha^{-1}	45.0	35.54	65.2	94.93	203.1	161.25
T_5: 100% RD + PM 5 t ha^{-1}	42.8	36.38	62.5	89.65	194.7	152.28
T_6: 75% RD + CD 5 t ha^{-1}	43.5	36.58	60.9	95.46	189.7	162.15
T_7: 75% RD + PM 5 t ha^{-1}	43.2	34.91	57.1	91.02	177.8	154.61
CV (%)	18.40	6.30	11.40	8.43	-	-
Level of significance	NS	*	**	**	-	-

RD=Recommended dose of chemical fertilizers, CD=cowdung, PM= poultry manure

Conclusion

Application of 75% of recommended chemical fertilizers plus 5 t ha^{-1}cowdung (T_6) can improve plant growth and higher yield. But 100% RD + poultry manure @ 5 t ha^{-1}, (T_5) 100% RD + cowdung @ 5 t ha^{-1} (T_6), 75% RD + poulty manure @ 5 t ha^{-1}(T_7) were recorded identical fruit yield with full dose of chemical fertilizers plus 5 t ha^{-1}cowdung. Therefore, only 75% of the recommended fertilizer could be used in integrated use of cowdung and/or poultry manure. To improve soil health and to maintain it as well as to improve tomato production, we have to reduce the use of chemical fertilizer. As the yield was maximum in 75% chemical fertilizer plus cowdung or poultry manure, poor farmer can adopt these treatment for tomato cultivation in southwestern region, Barishal (Non–calcareous Grey Floodplain Soils under AEZ 13).

References

Anburani A, Manivannan K and Arumugam S (2003) Integrated nutrient management on quality parameters in brinjal (*Solanum melongena* L.) cv. ANNAMALAI. *Plant Archives* **3(2)**: 279-281.

Arancon NQ, Edwards CA, Bierman P and Metzger (2003) Effects of vermicomposts on growth and marketable fruits of field grown tomatoes, peppers and strawberries. 7th International Symposiumon *Earthworm Ecology*, Cardiff, Wales, 1-6 Sept., 2002. *Pedobiologia*, **47(5-6)**: 731-735.

Atiyeh RM, Arancon N, Edwards CA and Metzger JD (2000) Influence of earthworm-processed pig manure on the growth and yield of greenhouse tomatoes. Bioresour - technol Oxford, U.K. *Elsevier Sci. Lim.* **75(3)**: 175-180.

Choudhary RS, Anchal-Das, Patnaik US and Das A (2003) Organic farming for vegetable production using vermicompost and FYM in Kokriguda watershed of Orissa. *Indian J. Soil Conservation* **31(2)**: 203-206.

Diacono M and Montemurro F (2010) Long-term effects of organic amendments on soil fertility. A review. Agronomy for Sustainable Development, Springer Verlag/EDP Sciences/INRA, **30** **(2)**, ff10.1051/agro/2009040ff. ffhal-00886539

Farhad W, Saleem MF, Cheema MA and Hammad HM (2009) Effect of poultry manure levels on the productivity of spring maize. *J. Animal & Plant Sci.* **19(3)**: 122-125.

Hashemimajd K, Kalbari M, Golchin A and Shariatmadari H (2004) Comparison of vermicompost and composts as potting media for growth of tomatoes. *J. Plant Nutrition* **27(6)**: 1107-1123.

Javaria S and Khan MQ (2010) Impact of integrated nutrient management on tomato yield quality and soil environment. *Journal of Plant Nutrition* **34(1)**: 140-149.

Manohar SVS, Paliwal R, Matwa J and Leua HN (2013) Integrated nutrient management in tomato (*Lycopersicon* esculentum Mill) cv. ROCKY. *Asian Journal of Horticulture* **8(2)**: 414-417.

Patel MB, Mohammed RG and Ghadge PM (2004) Effect of organic and inorganic fertilizers on growth, yield and quality of tomato. *J. Maharashtra Agricultural University* **29(2)**: 124-127.

Rao TSSS and Sankar CR (2001) Effect of organic manures on growth and yield of brinjal. *South Indian J. Hort.* **49**: 288-291.

Reddy BN, Sinha MN and Rai RK (1998) Effect of irrigation, nitrogen and phosphorus on nitrogen and phosphorus uptake by mustard (*Brassica juncea*) at various stage of growth. *Ann. Agril. Res*. **9(1)**: 129-133.

Samawat S, Lakzian A and Zamirpour A (2001) The effect of vermicompost on growth characteristics of tomato. *Agric. Sci. & Technical* **15(2)**: 83-89.

Yongchung Z, Shen Q, Sun YL, Liu H, Ki Q, Xin H and Wang Z (2004) Effects of application of nitrogen fertilizers of different N forms on yields and quality at chinese cabbage. *Jiangsu J. Agril. Sci*. **20(3)**: 184-188.