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Effect of different sources of nutrient and hormones on growth and yield of tomato

Md. Mizanur Rahman[a], Md. Eakramul Haque[b], Khaleda Parveen[c], Mohammad Monirul Hasan Tipu[a] and Md. Shahidul Islam[d]

[a]RARS, Bangladesh Agricultural Research Institute, Jamalpur
[b]On-Farm Research Division, Bangladesh Agricultural Research Institute, Alamnagar, Rangpur
[c]CASR, Bangladesh Agricultural University, Mymensingh
[d]Upazila Agriculture Office, DAE, Teknaf, Bangladesh

✉ For any information: ask.author@journalbinet.com, Available online: 14 November 2016

ABSTRACT

The experiment was conducted to find out the effect of different sources of nutrient and hormones on the growth and yield of tomato. The study consisted of Factor A: different nutrient sources viz. N_0: Control; N_1: Cowdung (60 tha^{-1}); N_2: Vermicompost (7 tha^{-1}) and N_3: Recommended dose (10 ton Cowdung + 550 kg Urea + 450 kg TSP + 250 kg MPha^{-1}) and Factor B: different hormones viz. H_0: Control; H_1: NAA (30 ppm) and H_2: GA_3 (30 ppm). The minimum days (32d) required from transplanting to 1st flowering from N_3H_2 and the maximum (39d) was needed from N_0H_0. The treatment N_3H_2 performed better than other treatments and produced maximum (59.11) number of fruits per plant, maximum (95.82 g) weight of individual fruit and maximum (83.87 ton) yield per hectare. Treatment combination, N_3H_2, enhanced fruit production by about three times over control (20 fruits plant^{-1}) and individual fruit weight by 1.6 times compared to control (59 g plant^{-1}) resulting maximum fruit yield (83.87t ha^{-1}) which is 2.4 times higher than that of control, N_0H_0. It appears that the recommended fertilizer dose along with GA_3 application may be recommended for tomato production.

Key Words: *Tomato, Hormone, Nutrient source, Dry matter and Yield*

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I. Introduction

Tomato (*Lycopersicon esculentum* Mill) is the most important and popular vegetable crop grown commercially throughout the country. Its food value is very rich because of higher contents of vitamins A, B and C and also minerals like calcium (Bose and Som, 1990). It has versatile uses as soups, conserves, pickles, ketchup, sauces, juices etc. In spite of its wide cultivation in Bangladesh, the average yield is not satisfactory in comparison with other tomato growing countries of the World (Aditya *et al*., 1997). Low yield of tomato in Bangladesh may be attributed to a number of reasons viz.

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unavailability of quality seeds, and varieties, fertilizer management, disease and insect infestation and improper irrigation facilities. The cultivation of tomato requires proper supply of plant nutrient. This requirement can be provided by applying inorganic fertilizer or organic manure or both. Organic manure helps conserve soil moisture and availability of soil nutrients for the plants. The chemical fertilizers give immediate boost required by young plants; organic fertilizers provide nutrients slowly and uniformly throughout the season; and mulch keeps the soil more evenly moist and the nutrients more uniformly available (Sam and Frank, 2006). Plant growth regulators play an important role in flowering, fruit setting, and ripening and physiochemical changes in plants. Gibberelic acid (GA_3) plays an important role on controlling pre-harvest fruit drop, extending self-life, fruit setting and changing sex expression in plants. Fruit setting in tomato was successfully improved by application of NAA (Mukherji and Roy, 1966). In fact the use of growth regulators had improved the production of tomato including other vegetables in respect of better growth and quality, which ultimately led to good harvest. Aim of this study was to evaluate the effects different nutrient sources and hormones on growth and yield of tomato.

II. Materials and Methods

The study was conducted in the winter of 2007-08 at the experimental field of Sher-e-Bangla Agricultural University, Dhaka. The location of the experimental site is $23^0 74'$N latitude and $90^0 35'$E longitude and at an elevation of 8.2 m from sea level (Anon, 1989). The soil of the experimental area belongs to the Modhupur Tract (UNDP, 1988) under AEZ No. 28. The experiment was designed as RCB factorial with three replications comprising factor A: different nutrient sources *viz.* N_0: Control (no fertilizers or manure), N_1: Cowdung (60 tha^{-1}), N_2: Vermicompost (7 tha^{-1}), N_3: Recommended dose (Cowdung 10 tha^{-1} + Urea 550 $kgha^{-1}$ + TSP 450 $kgha^{-1}$ + MOP 250 $kgha^{-1}$) and factor B: hormones *viz.* H_0: Control, H_1: NAA (30 ppm) and H_2: GA_3 (30 ppm). Thirty days old seedlings of BARI Tomato-3 were transplanted on 30 November in each experimental plot of 2.4 × 2.5 m size maintaining the spacing 60 x 50 cm. Well-rotten Cowdung, Vermicompost, TSP and MP was applied during final land preparation as per treatments and layout of the individual plot. Urea was applied in three equal installments at 15, 30 and 45 days after seedling transplanting. Intercultural operations such as irrigation, weeding and sticking, etc. were accomplished as and when necessary. Hormones spray was done at 30 and 45 days after seedling transplanting. Harvesting was started from February 26, 2008 and was continued up to April 2, 2008. Data were recorded on Days required to 1st flowering, Number of flowers per plant, Number of fruits per plant, Weight of individual fruit and Yield per hectare. Recorded data were analyzed following MSTAT-C software package.

III. Results and Discussion

Effect of different sources of nutrients

Days required to 1st flowering significantly varied due to different sources of nutrients. The minimum (33) days required for 1st flowering was recorded for N_3 treatment while the maximum (38) days for the same from control, N_0 (Table 01). Recommended doses of fertilizers (N_3) might ensure easy availability of nutrients for the tomato plants compared to cowdung/vermicompost treated or control plots. The number of flowers per plant was found highest (69.96) in N_3 treatment which was followed by N_2 (66) and N_1 (60.85). The control (N_0) plot gave the lowest number of flowers per plant (39.44). The maximum (51) number of fruits per plant was harvested from N_3 treated plants which was statistically identical (49) with N_2 (Vermincompost: 7 tha^{-1}), while the minimum (26) number of fruits per plant was found from N_0 i.e. control plants (Table 01). Mohd *et al.* (2002) reported that the readymade organic manures were inferior to traditional organic manures *viz.*, FYM and Vermicompost in consideration of fruits per plant. Statistically significant variation for weight of individual fruit was recorded for different sources of nutrients. The maximum (83.59 g) weight of individual fruit was observed from N_3 which was statistically similar (78.69 g) with N_2 and the minimum (64.72 g) weight of individual fruit was found from N_0 i.e. control condition (Table 01). Pansare *et al.* (1994) reported that the maximum yield of high quality tomatoes was obtained when straight fertilizers was added in the N, P, K ratio of 3:1:2.

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Table 01. Main effect of different sources of nutrients on yield contributing characters of tomato

Treatment(s)	Days required to 1st flowering	Number of flowers per plant	Number of fruits per plant	Weight of individual fruit (g)
N_0	37.89	39.44	26.04	64.72
N_1	35.56	60.85	44.00	76.68
N_2	35.96	66.00	49.05	78.69
N_3	33.74	69.96	51.37	83.59
$LSD_{(0.05)}$	*1.069*	*3.697*	*2.919*	*6.003*

N_0: Control, N_1: Cowdung (60 tha^{-1}), N_2: Vermicompost (7 tha^{-1}), N_3: Recommended dose (10 ton Cowdung + 550 kg Urea + 450 kg TSP + 250 kg $MPha^{-1}$)

Yield per hectare was varied significantly for different sources of nutrients. The maximum (71.58 ton) yield per hectare was recorded from N_3 which was statistically similar (66.36 ton) with N_2 and the minimum (38.48 ton) yield per hectare was found from N_0 i.e. control condition (Figure 01). Silva and Vizzotto (1990) found that the highest yields (53 tha^{-1}) were obtained by applying N: P_2O_5: K_2O at 104: 259: 140 kgha-1 plus poultry manure at 20 tha^{-1}.

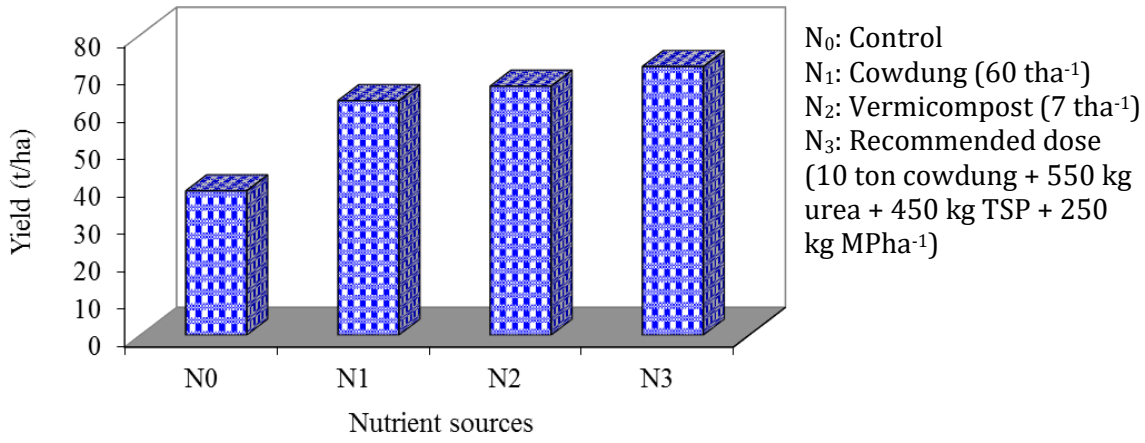

Figure 01. Effect of nutrient sources on yield of tomato.

Effect of different hormone spray

Application of different hormone had an immense effect on different parameters. Days required to 1st flowering of tomato showed statistically significant variations. The minimum (34.17) days required to 1st flowering was recorded from H_2 (GA_3: 30 ppm) which was closely followed (36.00) by H_1 (NAA: 30 ppm), while the maximum days (37.19) required to 1st flowering was observed from H_0 i.e. control (Table 02). Swaroop *et al.* (1998) reported that growth regulator treatments had no significant effect on days to flowering. Rahul *et al.* (2005) and Anon (1992) reported that the initiation time of first flowering and first fruiting was significantly and highly increased by the interaction NAA. Application of different hormone showed significant variation for number of flowers per plant of tomato (Table 02). The maximum (66.75) number of flowers per plant was observed from H_2 which was followed (60.81) by H_1 and the minimum (49.64) number of flowers per plant was observed from H_0. Onofeghara (1983) observed that GA_3 promoted flower primodia production but Saleh and Abdul (1980) reported that GA_3 decreased the total number of flowers per plant. The maximum (48.17) number of fruits per plant was recorded from H_2 which was followed (43.90) by H_1 and the minimum (35.78) number of fruits per plant was found from control (Table 02). Gibberelic acid (GA_3) plays role on controlling fruit setting. These results are supported by the findings of Hossain (1974). He reported that GA_3 had increased fruit set. This findings are also supported by Adlakha and Verma (1965). The maximum (83.43 g) weight of individual fruit was recorded from H_2 (GA_3: 30 ppm) which was closely followed (76.87 g) with H_1 and the minimum (67.46 g) weight of individual fruit was found from control (Table 02). Kaushik *et al.* (1974) applied GA_3 at vegetative stage which increased the fruit weight per plant. But Sanyal *et al.* (1995) found that foliar application was more effective than root

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soaking of seedlings. Gupta *et al.* (2003) recorded the largest fruit size with NAA + Multiplex micronutrient mixture at the maturity stage.

Table 02. Main effect of source of different hormones on yield contributing characters of tomato

Treatment(s)	Days required to 1st flowering	Number of flowers per plant	Number of fruits per plant	Weight of individual fruit (g)
H_0	37.19	49.64	35.78	67.46
H_1	36.00	60.81	43.90	76.87
H_2	34.17	66.75	48.17	83.43
$LSD_{(0.05)}$	0.926	3.202	2.528	5.199

H_0: Control, H_1: NAA (30 ppm), H_2: GA_3 (30 ppm)

Due to the application of different hormone yield per hectare of tomato varied significantly under the present trial. The treatment H_2 performed better and produced maximum (65.89 ton) yield per hectare which was statistically similar (61.27 ton) with H_1 and the minimum (52.03 ton) yield per hectare was observed from H_0 (Figure 02). Rai *et al.* (2002) reported that application of IAA at 75 ppm along with Multiplex at 2500 ppm resulted in the highest yield. These findings supported by the findings of Saleh and Abdul (1980) and they reported that GA_3 increased hectare yield of tomato. Gupta *et al.* (2003) recorded the highest yield (63.61 tha^{-1}) with NAA + Multiplex micronutrient mixture at the maturity stage.

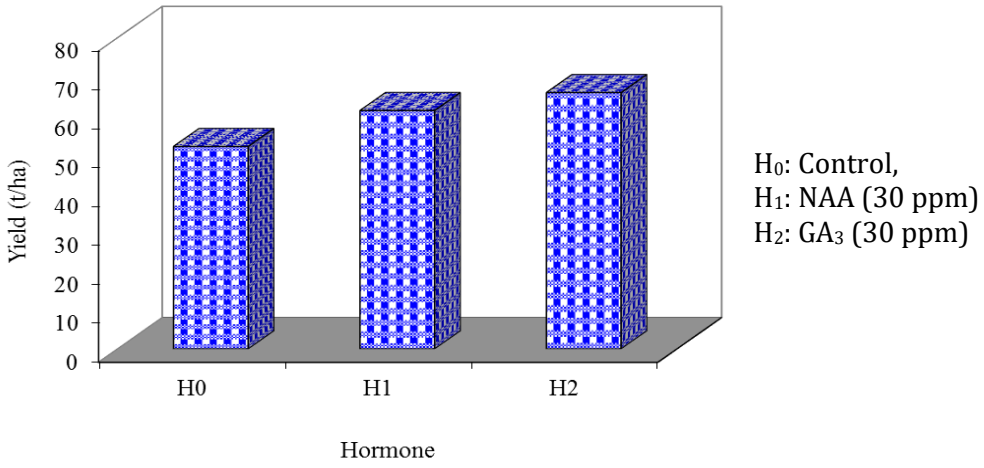

Figure 02. Effect of different hormone on yield of tomato.

Combined effect of sources of nutrient and different hormone

Combined effect of sources of nutrient and different hormones showed statistically significant variation for days from transplanting to 1st flowering. The minimum (32.89) days from transplanting to 1st flowering was found from N_3H_2 and the maximum (39.67) days from transplanting to 1st flowering was recorded from N_0H_0 (Table 03). Combined effect of sources of nutrient and different hormone showed statistically significant variations on number of flowers per plant (Table 03). The maximum (79.89) number of flowers per plant was recorded from N_3H_2 and the minimum (29.11) number of flowers per plant was found from N_0H_0 (Table 03). The maximum (59.11) number of fruits per plant was found from N_3H_2 and the minimum (20.67) number of fruits per plant was recorded from N_0H_0 (Table 03). The maximum (95.82 g) weight of individual fruit was recorded from N_3H_2 and the minimum (59.59 g) weight of individual fruit was recorded from N_0H_0 (Table 03). Yield per hectare showed statistically significant differences due to the combined effect of sources of nutrient and different hormone. The maximum (83.87 ton) yield per hectare was observed from N_3H_2 and the minimum (34.36 ton) yield per hectare was recorded from N_0H_0 (Figure 03).

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Table 03. Combined effect of source of nutrients and different hormones on yield contributing characters of tomato

Treatment(s)	Days required to 1st flowering	Number of flowers per plant	Number of fruits per plant	Weight of individual fruit (g)
N_0H_0	39.67	29.11	20.67	59.59
N_0H_1	38.44	43.44	27.89	65.35
N_0H_2	35.55	45.78	29.55	69.21
N_1H_0	37.11	54.11	38.56	67.50
N_1H_1	34.89	57.89	41.44	73.97
N_1H_2	34.67	70.56	52.00	88.57
N_2H_0	38.45	58.55	43.44	77.21
N_2H_1	35.89	68.66	51.69	78.73
N_2H_2	33.56	70.78	52.00	80.14
N_3H_0	33.56	56.78	40.44	65.54
N_3H_1	34.78	73.22	54.56	89.42
N_3H_2	32.89	79.89	59.11	95.82
$LSD_{(0.05)}$	*1.851*	*6.404*	*5.056*	*10.40*

N_0: Control, N_1: Cowdung (60 tha-1), N_2: Vermicompost (7 tha-1), N_3: Recommended dose (10 ton Cowdung + 550 kg Urea + 450 kg TSP + 250 kg MPha-1), H_0: Control, H_1: NAA (30 ppm), H_2: GA_3 (30 ppm)

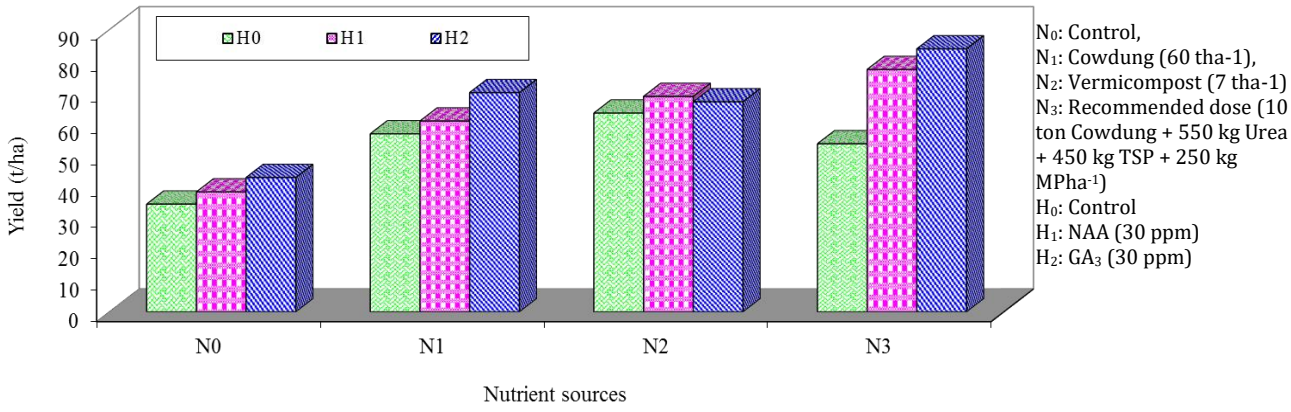

Figure 03. Combined effect of different nutrient sources and hormone on yield of tomato.

IV. Conclusion

Recommended dose of fertilizers (N_3) along with GA_3 (30ppm) application performed better than the other treatments. Thus farmers can adopt this combination for production of quality tomato along with higher yield.

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