

## EFFECT OF SEEDLING TYPES AND HORMONE APPLICATION ON YIELD OF TOMATO DURING SUMMER

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### Abstract

Three types of tomato seedlings viz., polybag raised seedlings (polybag seedling), seedbed raised seedlings (normal seedling) and grafted seedlings (tomato grafted on wild brinjal) of BARI hybrid tomato-4 were evaluated under with and without hormone application system during the summer season of 2014 at the experimental field of Sylhet Agricultural University with view to assessing the influence of grafting and hormone application on tomato yield during summer. Seedling types had significant influence on fruit yield and plant mortality. Only 3.5% plants were infected with bacterial wilt when grown from grafted seedling while it was 18% and 20% when the plants raised from normal and polybag grown seedling, respectively. Thus the higher survivability of plants in the grafted plot ensured much higher fruit yield acre<sup>-1</sup> (18 ton) than those of normal seedling (13.15 ton) and polybag grown seedling (12.80 ton). Application of paracholorophenoxy acetic acid had significant influence on higher tomato production. The plants applied with hormone produced 979.50 g of fruits plant<sup>-1</sup> while it was only 724.48 g in untreated plant. However, the highest fruit yield plant<sup>-1</sup> was recorded from the grafted tomato plants (1.06 kg) and normal seedling grown plant (1.08 kg) when treated with hormone while it was the lowest for normal types of seedling at without hormone application (0.59 kg plant<sup>-1</sup>). Results revealed that the high scope of improving tomato yield during summer using grafted seedling along with hormone application in Sylhet region.

**Keywords:** Production, grafted tomato seedlings and Sylhet region.

### Introduction

Tomato (*Lycopersicon esculentum* Mill.) is a winter crop belongs to the genus *Lycopersicon* of the family Solanaceae. It needs cool and dry weather for better growth and development (Rashid, 1990). At summer season flower and fruit setting of tomato are interrupted enormously due to high temperature and high humidity which result in poor pollination and fertilization. However, Bangladesh Agricultural Research Institute has developed some heat tolerant tomato varieties which are gaining popularity among the growers for summer season cultivation (Ahmad *et al.*, 2008). Production of tomato during summer is largely affected by adverse climatic condition which causes severe flower dropping and diseases especially bacterial wilt (Picken, 1984). In Sylhet region tomato production during summer season is severely affected due to attack of bacterial wilt disease caused by a bacterium (*Ralstonia solanacearum*). Plant growth regulators have been reported to enhance fruit set under both normal and adverse weather condition. Application of hormones in tomato production during hot summer was found very effective (Kuo, 1993; Ahmad *et al.*, 2011). Again, none of the heat tolerant varieties are resistant against bacterial wilt. Scientists proved that grafting tomato on wild eggplant as rootstock protect from this disease (Rashid *et al.*, 2007). Therefore, plant growth regulator and use of grafted seedling may improve this situation greatly for tomato production during summer. The experiment was, therefore, undertaken to observe the effect of seedling types and influences of hormone on fruit yield of tomato in summer season.

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## Materials and Methods

The experiment was carried out at the experimental field of Horticulture Department, Sylhet Agricultural University, Sylhet, Bangladesh during May to October 2014. The climate of the experimental area is characterized by high temperature, heavy rainfall and high humidity. It belongs to the “Khadimnagar” soil series of Eastern Surma-Kushira Floodplain under the Agro ecological Zones-20 (FAO, 1988). The pH of the soil is around 4.98, soil organic matter 1.79%. Two factors experiments consists of different seedlings types and hormone application were conducted in a Randomized Complete Block Design (RCBD) with three replications. Varied seedling types were transplanted in the main field on 26 May 2014. All plants were grown with and without hormone application. The unit plot size was 2.4 m × 2.4 m having four rows per bed and 6 plants row<sup>-1</sup> and 24 plants plot<sup>-1</sup>. Plants were transplanted with spacing at 60 cm × 40 cm. The each plots and blocks were separated by 50 cm and 75 cm, respectively. The land was acidic in nature hence, lime (Dolomite) was applied in the field @ 4 kg decimal<sup>-1</sup>. Each plot was fertilized with well decomposed cowdung 15 ton, urea 300 kg, TSP 200 kg, MoP 50 kg ha<sup>-1</sup>, respectively (Rashid and Singh, 2000). Half of the quantity of cowdung and the entire amount of TSP were applied during final land preparation. The remaining cowdung and half of MoP were applied 5 days before planting. The whole of urea and remained half of MoP were applied in 3 equal splits as top dressing at 15, 30 and 50 days after transplanting. The crop was protected from rain providing polythene tunnel. As per treatment combinations the growth regulator Tomatone (consisting of parachlorophenoxy acetic acid) at the rate of 2% was sprayed on plants having 4-5 flower clusters at full bloom stage. Plant received three sprays at 5-6 days interval, and only blooming flower clusters were sprayed. Two rows in each plot were kept unsprayed and which were considered as without hormone treated plants. Irrigation, pruning, mulching, weeding and other intercultural operations were done as and when necessary. Data were recorded on yield and yield attributing characters and statistically analyzed using MSTAT-C software.

## Results and Discussion

### *Effect of seedling types*

Types of seedling had significant influence on growth and yield of tomato during summer season (Table 1). Most of the characters were significantly affected due to seedling types. The polybag seedling took minimum days to first flowering (43.83), while maximum for grafted seedling type (57.50). Since the grafted seedlings were produced using 12-15 days old scion might be the reason of delayed flowering in grafted plants. Similar trend was also observed for days to first harvest of ripen fruits. The highest number of fruits plant<sup>-1</sup> (24.86) was produced in grafted seedling type whereas the lowest in normal seedling type (20.11) that was statistically similar to that of polybag seedling (20.99). No significant variation was observed in individual fruit weight although it was ranged from 37.46 g to 40.70 g. The highest fruit yield plant<sup>-1</sup> was recorded from grafted seedling (935.49 g) followed by normal seedling (835.02 g). This was attributed due to longer harvesting duration from grafted plants (39.33 days) compared to the other types of seedling. The highest TSS (5.35%) was recorded in the polybag seedling type whereas the lowest TSS (4.82%) was recorded from the fruits of grafted plants. Fruit yield was largely affected due to types of seedling. The highest fruit yield acre<sup>-1</sup> was recorded from the grafted plants (18 ton) while it was 12.80 ton acre<sup>-1</sup> for polybag grown seedling. This variation was attributed since the mortality of plants much higher in polybag seedling (18%) and normal seedling (20%) than that of grafted seedling (3.5). Similar better performance of BARI hybrid tomato 4 was found when grafted on BARI begun 8 during summer season of 2010 at BARI (Anon., 2011).

### *Effect of hormone*

Hormone application had significant influence on summer tomato production (Table 2). In the study hormone untreated plant produced the lowest number of fruits plant<sup>-1</sup> (20.88) indicating the untreated plants utilize most of the metabolites for their vegetative growth. Hormone treated plant produced significantly higher number of fruits plant<sup>-1</sup> (23.10) with heavier individual fruit weight (42.53 g) compared to that of untreated plants (34.72 g). From the study it was observed that hormone treated plants produced 979.50 g of fruits plant<sup>-1</sup> while untreated plants produced 724.48 g of fruits plant<sup>-1</sup>. However, plants that were not treated with growth regulator showed severe shedding of flowers, presumably because of high temperature and heavy rainfall. High day (above 32°C) and night (above 21°C) temperature usually accelerates the abscission of floral organ after anthesis (Iwahori, 1968; Picken, 1984). At higher temperatures, the level of endogenous auxin (IAA- like substance) becomes low which arrests the growth of the floral organs and causes abscission (Leopold and Kriedemann, 1975). Treating plants with tomatone (PCPA) reduced flower drop and increase total yield of tomato. Therefore, the treated plants produced 16.56 ton fruits acre<sup>-1</sup>, while it was only 12.73 ton fruits acre<sup>-1</sup> when untreated plants. Duration of harvest, fruit length, fruit breath, TSS% of treated plants were statistically identical with fruits of untreated plants. However, although hormone application is costly, but farmer can

earn more benefit by higher production compared to untreated control. This indicated that farmer can ensure higher fruit yield of tomato during summer through hormone application. Similar results were also reported by several workers (Patwary, 2009; Ahmad, 2011).

**Table 1. Effects of seedling type on yield and yield attributes of tomato in summer season**

Types of seedling	Days to first flower	Days to first harvest	Number of fruits plant <sup>-1</sup>	Individual fruit weight (g)	Fruit yield plant <sup>-1</sup> (g)	TSS (%)	Duration of harvest (days)	Bacterial wilt (%)	Fruit yield acre <sup>-1</sup> (ton)
Polybag	43.83b	80.50b	20.99b	37.70	785.45b	5.35a	29.16b	18	12.80
Normal	44.66b	81.83ab	20.11b	40.70	835.02b	5.06b	30.83b	20	13.15
Grafted	57.50a	87.16a	24.86a	37.46	935.49a	4.82c	39.33	3.5	18.00
F-test	**	**	**	NS	*	**	**	NA	NA
CV%	4.23	3.63	8.48	8.63	8.14	2.29	8.02	NA	NA

Means bearing the same letter(s) in a column do not differ significantly at 1% level of probability.

\*\*indicates significant at 1% level of probability, \* indicates significant at 5% level of probability, NS indicates non-significant, NA indicates not analyzed.

**Table 2. Effects of hormone on yield and yield attributes of tomato in summer season**

Hormone	Days to first flower	Days to first harvest	Number of fruits plant <sup>-1</sup>	Individual fruit weight (g)	Fruit yield plant <sup>-1</sup> (g)	TSS (%)	Duration of harvest (days)	Bacterial wilt (%)	Fruit yield acre <sup>-1</sup> (ton )
With hormone	47.33	81.22	23.10	42.53	979.50	5.08	35.00	15.33	16.56
Without hormone	50.00	85.11	20.88	34.72	724.48	5.07	31.22	12.33	12.73
F-test	NA	*	*	**	**	NS	*	NA	NA
CV%	-	3.63	8.48	8.63	8.14	2.29	8.02	NA	NA

Means bearing the same letter(s) in a column do not differ significantly at 1% level of probability.

\*\*indicates significant at 1% level of probability, \* indicates significant at 5% level of probability, NS indicates non-significant, NA indicates not analyzed.

### Interaction effect

Interaction effect between seedling type and hormone application is presented in Table 3. Some parameters viz., number of fruits plant<sup>-1</sup>, weight of fruit plant<sup>-1</sup>, breadth of fruit, total soluble solid etc were significantly affected due to interaction between seedling types and hormone. Number of fruits plant<sup>-1</sup> was the maximum for the grafted plants when applied with hormone (26.26). Ahmed *et al.* (2011) also recorded additional fruits plant<sup>-1</sup> when plants were treated with hormone. The maximum individual fruit weight was recorded from grafted plant with hormone application (40.45 g) while, minimum observed from normal seedling and without hormone application (34.30 g). The highest fruit yield plant<sup>-1</sup> was recorded from the grafted tomato plants (1059.53 g) and normal seedling plants (1080.40 g) when applied with hormone. The corresponding maximum fruit yield acre<sup>-1</sup> was also recorded from grafted seedling when treated with hormone (20.50 ton) while the lowest yield in normal seedling grown without hormone application (9.90 ton). The variation in fruit yield acre<sup>-1</sup> was attributed for lower mortality of plants due to bacterial wilt infection in the plants grown through grafted technique (3-4%). Yield potentiality of grafted seedling applied with hormone indicated that grafted seedling types produced much more yield during summer than other seedling or without hormone application. Plant growth regulator and use of grafted seedling have been reported very effective for tomato production during

summer (Ahmed *et al.*, 2011). The maximum TSS% was observed from normal seedling when treated without hormone (5.48%) which was statistically similar to other interaction.

From the above discussion it may concluded that the use of grafted seedling along with application of hormone can ensure successful tomato production during summer season in Sylhet region.

**Table 3. Interaction effects of seedling type and hormone on yield and yield attributes of tomato in summer season**

Interactions	Days to first flower	Days to first harvest	Number of fruits plant <sup>-1</sup>	Individual fruit weight (g)	Fruit yield plant <sup>-1</sup> (g)	TSS (%)	Duration of harvest (days)	Bacterial wilt (%)	Fruit yield acre <sup>-1</sup> (ton)
S1H1	42.66	79.00	20.06cd	40.03	798.18b	5.34a	31.66	19	12.80
S1H0	45.00	82.00	21.91bc	35.38	772.32b	5.36a	26.66	17	12.80
S2H1	44.00	80.66	22.96abc	47.10	1080.40a	4.63b	33.66	24	16.40
S2H0	45.33	83.00	17.27d	34.30	589.65c	5.48a	30.00	16	9.90
S3H1	55.33	84.00	26.26a	40.45	1059.53a	5.26a	41.66	3	20.50
S3H0	59.66	90.33	23.45ab	34.47	811.45b	4.38b	37.00	4	15.5
F-test	NS	NS	*	NS	**	**	NS	NA	NA
CV%	4.23	3.63	8.48	8.63	8.14	2.29	8.02	NA	NA

Means bearing the same letter(s) in a column do not differ significantly at 1% level of probability.

\*\*indicates significant at 1% level of probability, \* indicates significant at 5% level of probability, NS indicates non-significant, NA indicates not analyzed, S1 indicates polybag seedling, S2 indicates normal seedling, S3 indicates grafted seedling, H1 indicates with hormone application and H0 indicates without hormone application.

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