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EVALUATION OF SUMMER TOMATO MUTANTS IN RESPECT BETTER YIELD AND BIOCHEMICAL PROPERTIES

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ABSTRACT

A pot experiment was conducted at the BARI sub Station, Pabna during the period of February to June, 2016 to evaluate the performance of six summer tomato mutants (CLN 2418, CLN 2443, CLN 2366, CLN 2413, CLN 2026 and J-5) in respect of yield and storage quality. The experiment was conducted in Completely Randomized Design with three replications. The collected data were analyzed statistically and means were adjudged by DMRT at 5% level of probability. Results revealed that mutants, CLN 2418 and CLN 2443 produced the higher fruit yield (1.50-1.55 kg plant^{-1}) with the highest being in CLN 2418 (1.55 kg plant^{-1}) due to its superiority in respect of all yield contributing characters. In contrast, CLN 2026 produced the lowest fruit yield (0.97 kg plant^{-1}). Further, harvesting duration was the highest in CLN 2418 (36 days) and the lowest was in CLN 2443 (30 days). Among the six genotypes, only one CLN 2026 had lesser NR activity (6.95 µmol g^{-1} fw). The highest reducing sugar (23.33 mg g^{-1}fw), total sugar (76.32 mg g^{-1} fw) and amino acid (9.92 mg g^{-1} fw) content in leaf was recorded in CLN 2418. The highest amount of content in leaf was observed in CLN 2418. The study also confirmed that CLN 2418 also showed seven days shelf life when stored in room temperatures without deteriorating the quality in summer season of Bangladesh.
Key words: Tomato, mutants, performance, bio-chemical properties.

Introduction

Tomato (*Lycopersicon esculentum* Mill.) belongs to the family *Solanaceae,* is one of the most important popular and nutritious vegetable crops in Bangladesh. It is cultivated in almost all home gardens and also in the field for its adaptability to wide range of soil and climate in Bangladesh. The crop performs better under an average monthly temperature of 20-23^{0}C. But commercially, it may grow at temperature ranging from 15-27^{0}C (Haque *et al.*, 1999). However, tomato is widely grown in Bangladesh usually in winter season. With the increase of population, the demand of tomato in our country is increasing day by day. The availability of quality summer vegetable in Bangladesh is very limited in number. Now-a-days, tomato is grown both in the winter and summer seasons in Bangladesh. But the production in the summer season is much less than that of winter. There is a great demand for tomato in summer. The present summer cultivated varieties are having low yield potentiality. So it is necessary to develop high yield variety for summer cultivation. In this regard, some research institutes (BARI, BINA and BAU) are trying to develop high yielding genotypes suitable for summer cultivation which need to be assessed morpho-physiologically for getting stable high yielding genotypes. Keeping the above views in mind, the present experiment was designed to evaluate the yield performances and biochemical properties of tomato mutants.

Materials and Methods

A pot experiment was carried out at the pot yard of Bangladesh Agricultural Research Institute substation, Poilanpur, Pabna during the period from February to June 2016. Geographically the experimental area is located at 24^{0}75 N latitude and 90^{0}50 E longitudes at the elevation of 18 m above the sea level. The soil of the experiment was collected from farm of BARI Substation, Pabna. The experiment consisted of six summer tomato mutants. They were CLN 2418, CLN 2443, CLN 2366, CLN 2026, CLN 2413 and J-5 (check). The experiment was laid out in a Completely Randomized Design (CRD)) with 3 replications. Two seedlings were sown in each pot on 15 March 2016. Finally, they were thinned to one seedling after 20 days of transplanting. Yield and yield contributing characters were recorded from the cultivated mutants of tomato. In addition some biochemical properties such as nitrate reductase activity, reducing sugar, total

sugar and amino acid were also estimated from the study. The collected data were analyzed statistically following the analysis of variance technique and the mean differences were adjudged by Duncan's Multiple Range Test (DMRT) using the statistical computer package program, MSTAT-C (Russel, 1986).

Results and Discussion

Some morpho-physiological and agronomic parameters

Plant height: Plant height differed significantly among the studied genotypes (Table 1). The tallest plant was recorded in J-5 (117.4 cm) which was significantly different from others. In contrast, the shortest plant was recorded in CLN 2026 (54.3 cm). These results were in agreement the result of Kabir (2004) who stated that plant height differed significantly among the studied genotypes in tomato.

Number of branches plant^{-1}: Number of branches plant^{-1} had shown high variability amongst the studied genotypes (Table 1). The highest number of branches plant^{-1} was recorded in J-5 (7.25). In contrast, the lowest number of branches plant^{-1} was recorded in CLN 2026 (1.83). Other genotypes had branches plant^{-1} in between 3.15 to 3.33. The differential response of branching in the genotypes could be attributed to its genetic potentiality. Further, most of the researchers reported that tomato fruit yield was significantly and positively correlated with branch number. In the present experiment, 3-5 produced the highest number of branches but performed lower yield because of most of the branches were inactive (profuse branching).

Table 1. Effect of genotypes on morpho-physiological and phenological characters in six summer tomato

Genotype	Plant height (cm)	Branches plant^{-1} (no.)	Total dry matter plant^{-1} (g)	Days to first fruiting	Days to first ripening	Picking duration (days)
CLN -2418	71.0 b	3.15 b	365.0 a	45.7 a	79.0 d	36.0 a
CLN- 2443	71.0 b	3.17 b	347.8 ab	44.7 ab	84.6 bc	30.0 c
CLN -2366	75.4 b	3.33 b	335.4 bc	44.7 ab	86.2 b	32.0 bc
CLN -2026	54.3 c	1.83 c	341.0 ab	40.8 c	81.6 c	34.0 ab
CLN -2413	70.0 b	3.25 b	355.0 ab	43.0 b	89.2 b	32.0 bc
J-5 - (Check)	117.4 a	7.25 a	321.8 c	44.5 ab	96 a	33.0 b
F-(test)	**	**	**	**	**	**
CV (%)	10.84	11.37	5.50	4.22	2.30	6.75

in a column same figure (s) do not differ significantly at $p \leq 0.05$ as per DMRT
** indicate significant at 1% level of probability.

Total dry matter production plant^{-1}: The development of total dry matter (TDM) production in tomato genotypes is presented In Table 1. CLN 2418, the high yielding genotype showed the highest TDM (365 g plant^{-1}) followed by CLN 2413 (355 g plant^{-1}), CLN 2443 (347.8 g plant^{-1}) and CLN 2026 (341 g plant^{-1}) with same statistical rank. On the other hand, J-5 showed the lowest TDM (321.8 g plant^{-1}). Increased TDM in CLN 2418 was possibly might be due to greater leaf area. The result was supported by the result of Kabir (2004) who reported that increased TDM was observed in high yielding genotypes compared to low yielding ones. Similar result was also observed by Hossain (2003).

Days to first fruiting: Days required to first fruiting ranged from 40.0 to 45.7 days among the genotypes (Table 1). Of the mutants, CLN 2026 had shown the earliest fruiting (40.8 days) and it was significantly different from the remainder. In contrast, the maximum days of fruiting occurred in CLN 2418 (45.7 days) followed by CLN 2443 (44.7 days) CLN 2366 (44.7 days) and J-5 (44.5 days) with same statistical rank. This result was in agreement with Karim (2005) and Kabir (2004) who reported flower opening between 35 and 45 days after transplanting in tomato.

Days to first ripening: Days required to first ripening had significant variability amongst the studied genotypes (Table 1). J-5 required the highest days to ripening (96 days). On the other hand, CLN 2418 required the lowest days to ripening (79.0 days).

Picking duration: Picking duration had significant variability amongst the studied genotypes (Table 1). The highest harvesting duration was recorded in CLN 2418 (36 days) followed by CLN 2026 (34.0 days) with same statistical rank. In contrast, the lowest harvesting duration was recorded in CLN 2443 (30 days).

Biochemical characters

Nitrate reductase activity: Nitrate reductase (NR) activity in leaf during flowering and fruiting stage varied significantly among the studied genotypes (Table 2). Among the six genotypes, only one (CLN 2026) had lesser NR activity (6.95µ mol g^{-1} fw).

Reducing sugar: Reducing sugar content in leaf of tomato mutants/genotypes varied significantly. The highest amount of reducing sugar content in leaf was recorded in CLN 2418 (23.33 mg g^{-1}fw). In contrast, CLN 2026 showed the lowest amount of reducing sugar (12.47 mg g^{-1} fw). Result further revealed that high yielding genotypes maintained higher amount of reducing sugar than low yielding ones.

Total sugar: Significant variation on total sugar content in leaf of tomato was observed. Four genotypes out of six were recorded greater amount of total sugar content in leaf (range 72.37 - 76.32 mg g^{-1} fw) than in CLN 2026 and J-5 (range 62.85- 69.65 mg g^{-1}fw). The highest amount of total sugar content in leaf was observed in CLN 2418 (76.32 mg g^{-1} fw), which was statistically similar to CLN 2443 (74.58 mg g^{-1}fw), CLN 2366 (75.40 mg g^{-1} fw) and CLN 2413 (72.37 mg g^{-1} fw).

Amino acid content: Amino acid content in leaf of tomato genotypes is presented in Table 2. The highest amino acid observed in CLN 2418 (9.92 mg g^{-1} fw).

Table 2. Effect of mutants on some biochemical parameters in six summer tomato mutants

Genotype	Nirate reductase activity (µ mol g^{-1} fw)	Reducing sugar (mg g^{-1} fw)	Total sugar (mg g^{-1} fw)	Amino acid (mg g^{-1} fw)
CLN -2418	10.7 a	23.33 a	76.32 a	9.92 a
CLN- 2443	9.95 a	19.66 b	74.58 ab	7.18 b
CLN -2366	9.86 a	19.64 b	75.40 a	6.51 bc
CLN -2026	6.95 b	12.47 c	62.85 c	5.64 c
CLN -2413	9.94 a	19.06 b	72.37 b	6.71 b
J-5 -(Check)	10.0 a	20.60 b	69.65 bc	6.74 b
F-(test)	**	**	**	**
CV (%)	10.98	7.77	9.98	10.98

In a column same figure (s) does not differ significantly at $p \leq 0.05$ per DMRT,
** indicate significant at 1% level of probability.

Yield contributing characters

Number of flower cluster plant^{-1}: The number of flower cluster plant^{-1} was significantly different among the genotypes. CLN 2413 produced the highest number of flower cluster plant^{-1} (12.8) followed by CLN 2418 (12.5), CLN 2443 (11.8) and CLN 2366 (12.3) with same statistical rank. CLN 2026 produced the lowest number of flower cluster plant^{-1} (9.75), which was statistically similar to J-5 (10.7). Result further revealed that high yielding genotypes also bad higher number of flower cluster plant^{-1} (Table 3).

Number of flowers cluster^{-1}: The number of flower production cluster^{-1} was also significantly different amongst the genotypes. The genotypes CLN 2418 and CLN 2443 had high yield and also possessed greater number of flowers cluster^{-1} with being the highest in CLN 2418 (3.01).

Single fruit weight: The genotype CLN 2418 produced the highest single fruit weight (72.41 g). The lowest single fruit weight was found in CLN 2366 (43.37 g).

Fruit diameter: CLN 2418 and CLN 2026 produced the heavier fruit (diameter 4.10 and 4.08 cm). The minimum fruit diameter was found in CLN 2366 (3.68 cm). Fruit diameter was significantly influenced by

the genotypes. CLN 2418 and CLN 2026 produced the heavier fruit (diameter 4.10 and 4.08 cm, respectively). The minimum fruit diameter was found in CLN 2366 (3.68 cm). Other three genotypes, CLN 2443, CLN 2413 and J-5 produced medium sized fruits (range 3.80 -3.91 cm).

Table 3. Effect of genotypes on yield attributes in six summer tomato mutants

Genotype	Number of flower cluster plant^{-1}	Number of fruit Cluster^{-1}	Single fruit weight (g)	Fruit diameter (cm)	Fruit yield (kg plant^{-1})	Keeping duration (days)
CLN -2418	12.5a	3.01 a	72.41 a	4.10 a	1.55 a	7 b
CLN- 2443	11.8b	2.67 b	57.60 ab	3.80 ab	1.50 a	9 a
CLN -2366	12.3 b	2.58 b	43.37 bc	3.68 ab	1.25 b	5 d
CLN -2026	9.75 d	2.31 c	58.3 ab	4.03 c	0.97 c	7 b
CLN -2413	12.8 a	2.45 b	52.82 ab	3.80 b	1.28 b	5 d
J-5 -(Check)	10.7 c	1.90 d	61.43a	3.91 ab	1.21 b	6 c
F-(test)	**	**	**	**	**	**
CV (%)	10.81	10.17	7.90	5.74	3.32	1.01

Fruit yield: There was a remarkable difference in respect of fruit yield plant^{-1}. The genotype CLN 2418 produced the highest fruit yield plant^{-1}. (1.55 kg) and it was similar to CLN 2443 (1.50 kg). The fruit yield was higher in CLN 2418 and CLN 2443 because of producing higher number of fruits plant^{-1} and larger fruit size. In contrast, CLN 2026 produced the lowest fruit yield (0.97 kg) due to the production of fewer number of fruits plant^{-1}. Most of the researchers reported that fruit yield in tomato mostly depend on fruit number and fruit size (Dutta *et al,*1995; Karim, 2005) that supported the present experimental results.

Keeping duration: The effect of genotypes on fruit keeping duration under room temperature during summer season was significant. Result revealed that the highest fruit keeping duration under natural room condition was observed in CLN 2443 (9 days) and the lowest keeping duration was observed in CLN 2413 and CLN 2366 (5 days). The fruits of CLN 2418 and CLN2028 were good till 7 days.

Conclusion

The study concluded that genotypes CLN 2418 and CLN 2443 performed best regarding biochemical, yield contributing characters and yield and these two genotypes could be stored in room temperature for 7-9 days without hampering the quality during summer season. However, more studies are needed to confirm their performance in field conditions.

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