

Assesment of Variety of Tomato for Growth Parameters under Cover and Open Field Conditon

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ABSTRACT

*The present investigation entitled “Assesment of varities of tomato (*Solanum lycopersicum*) for growth, yield & quality under cover & open field condition” was carried out in the naturally ventilated arched saw teeth type polyhouse and in open field in main campus of Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya during the year 2015-16. The objective of the experiments were to study fruit yield and quality parameters of different indeterminate variety of tomato under New Alluvial zone of West Bengal in open field and cover condition.*

The experiment consisted of eleven tomato varieties namely VL-642, Kundan, Karan, Karina, Kohinoor, DEB 2913, PAN 1286, Amlika, DEB 2912, Chiranjeev, Namdhari and two situation like protected condition and open field condition. The experiment was laid out in Randomized Block Design with three replications. Statistically significant variation found in different variety for most of the characters. Only number of primary branches was non-significant for the varieties in both poly house and open field situation. For growth parameter variety grown in poly house were show better result than variety grown in open field condition. Among different variety maximum height recorded in variety PAN 1286 (191.73) followed by variety Kundan (185.96 cm) grown in poly house condition while in open field condition highest plant height recorded in Karan (139.66 cm) followed by PAN 1286 (134.00 cm). The variety Amlika recorded highest inter-nodal length in both poly house condition (17.03 cm) and open filed condition (15.87 cm). While variety Kohinoor recorded early flowering (26.33 days) as well as early fruit set (39.00days) under poly house condition. Similarly in open field condition also Kohinoor (23.00 days) was early flowering as well as early fruit set (35.00 days). Variety, VL-642 recorded maximum number of flowers per cluster both in poly house(6.60) and open field(6.40) condition. While Kundan (13.00) recorded maximum number of clusters per plant followed by VL-642 (12.33) in polyhouse however, Karan produce maximum number of clusters per plant (11.33) followed by VL-642 and PAN 1286 (11.00) in open field condition.

Key words: *Solanum lycopersicum, Amlika, Vegetable crop, Sweet potato*

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INTRODUCTION

Tomato (*Solanum lycopersicum* L. Syn. *Lycopersicon esculentum* Mill., $2n=2x=24$) is one of the most world's largest grown vegetable crop after potato and sweet potato, occupying an area of 4.81 million hectare with an annual global production of 163.02 million tonnes (FAO, 2014). It is also popular in India and occupies an area of 8.82 lakh hectares with a production of 18.74 million metric tonnes with an average yield of 21.2 metric tonne per hectare (NHB 2013-2014). It belongs to the family Solanaceae and is native of Andean region that includes parts of Colombia, Ecuador, Peru, Bolivia and Chile. Tomato is a warm season crop and requires a relatively long growing season and moderately high temperature (20-28°C). It ensures that the optimum fruit setting is at night temperature and the optimum range is 15°-20°C¹. Recently, to overcome these environmental conditions and pesticide residue problem protected cultivation of vegetables, like tomato, brinjal and capsicum has been recommended. Protected cultivation of tomato offers distinct advantages of earliness, higher productivity and quality particularly pesticide residue free produce, besides higher returns to growers. Tomato can be grown successfully in the off-season under cover for obtaining higher fruit yield. Occurrence of frost coupled with low temperature during the month of December and January cause death of tomato plant when grown in open field conditions, but under protected environment, the yield loss can be minimized. In recent days protected technology become popularizing to the farmer for commercial cultivation of Horticultural crop. In the northern plain of India farmer are adapting this technology by cultivating some high value vegetable for fetching higher yield and quality of the crop. Under protected cultivation yield and quality of crop are higher than open field condition. Under protected cover off season cultivation can be done, which is not possible in open field condition. Due to versatile uses of tomato, now its demand is increasing day by day. So, productivity should be increased to meet this increasing demand of tomato with low land availability and ever increasing population.

Now, it is become imperative to bring high yielding and suitable varieties under cultivation under different agro-climatic conditions. In west Bengal the ideal time for producing tomato is in grown winter season in open field condition. In West Bengal condition tomato does not grow all around the year in open field condition due to high temperature and rainfall. The some progressive farmer of this state are recently adapting to grow tomato under poly house even in the winter season for getting supreme quality of fruit for fetching good price in the market. Considering the importance of this crop, there is a need for improvement and development of varieties suitable for different agro-ecological conditions with specific end use. A thorough knowledge about the tomato hybrid grown in different condition like open field and protected condition is essential for farmers for production good crops for high yield and for off season production to fetching higher price. Keeping in view the facts mentioned above, the present investigation was undertaken.

MATERIAL AND METHODS

The present experiment entitled “Assesment of varities of tomato (*solanum lycopersicum*) for growth, yield & quality under cover & open field condition” was carried out in the naturally ventilated arched saw teeth type polyhouse and at open field in main campus of Bidhan Chandra Krishi Viswavidyalaya Mohanpur, Nadia (West Bengal) during the year 2015-16. The experimental site is situated on warm subtropical humid climate just south of tropic of cancer. The average temperature ranges from 25-36.5⁰ C during summer months and 12-25⁰ C during winter months. The average rainfall is about 1500 mm. Topographic situation of the experimental site is under Gangetic new alluvial plains of West Bengal. Broadly the season of this area are classified into – a) dry and cool season (November – February), b) dry and hot season (Mar – May) and c) hot and humid season (June–September).The experiment was laid out in a Randomized Block Design with eleven treatments and each replicated thrice during 2015-16. The treatment factors

included eleven open pollinated tomato varieties namely viz., VL-642, Kundan, Karan, Karina, Kohinoor, DEB 2913, PAN 1286, Amlika, DEB 2912, Chiranjeev, Namdhari and two situation like protected condition and open field condition. The aim of the experiment was to select the best performing variety(s) in these two situation. The height of five randomly selected individual plants was measured at final harvesting stage from ground level to the tip of the plant and mean values were expressed in cm and replication wise the average plant height of each treatment was recorded. Primary branches those emerged out from the main stem of the plant were counted for randomly selected five plants of every treatment at the maturity stage and means were computed. Average distance between two nodes was taken from the middle portion of the stem at five places in ten randomly

selected plants and averaged. The number of days was counted from the date of transplanting to the date of first flowering. Based on this, the days taken to first flowering were worked out for each treatment. For calculating the number of flowers per cluster total number of flowers in five tagged clusters on each of the randomly selected five plants of every treatment was counted. Then the number of flowers per cluster was calculated by taking mean of these values. Similarly number of flower clusters per plant was counted from the randomly selected five plants for each treatment from the day of first flowering to a period of 15 days and mean values were expressed. While to calculate days to first fruit set number of days was counted from the date of transplanting to the date of first flowering. Based on this, the days taken to first fruit were worked out for each treatment.

Table 1: Meteorological parameters during the crop season

Months	Poly house		Open field		Poly house		Open field		Average Sunshine hours
	Monthly average temperature (°C)		Monthly average temperature (°C)		Monthly average Humidity (%)		Monthly average Humidity (%)		
	Max.	Min.	Max.	Min.	Max	Min	Max	Min	
September, 2015	35.43	26.02	33.38	23.52	90	65	91	51	5.67
October, 2015	33.25	23.55	30.32	22.63	91	69	93	54	6.98
November, 2015	30.48	18.37	29.07	15.92	93	72	94	59	8.6
December, 2015	26.72	17.82	24.52	15.93	95	77	96	64	7.19
January, 2016	25.64	18.41	23.61	16.14	95	73	95	61	6.65
February, 2016	30.64	20.35	27.06	17.26	94	60	95	52	8.03
March, 2016	35.67	22.16	32.73	18.48	93	55	93	48	8.86

Source: Dept. of Agro-Meteorology and Physics, B.C.K.V., Mohanpur, Nadia, West Bengal and self taken through scientific instruments.

Table 2: Brief description of tomato variety

Sl. No.	Varieties	Source	Characters
1.	VL-642 (V ₁)	Seminis	Red colour indeterminate hybrid, high yielding, big size & oval shape fruit, high TSS.
2.	Kundan (V ₂)	Chia Tai Co. LTD	Oblong shape big size reddish fruit, high yielding variety, high Vit-C.
3.	Karan (V ₃)	Chia Tai Co. LTD	Early variety, medium size, Oval shaped shiny red fruit
4.	Karina (V ₄)	Chia Tai Co. LTD	Early variety, Oval shaped medium in size
5.	Kohinoor (V ₅)	Chia Tai Co. Limited	Very early variety, Oval shaped small in size
6.	DEB 2913 (V ₆)	Debgiri seed	Round shape, small size fruit large number of seed per fruit.
7.	PAN 1286 (V ₇)	Pan Seed Pvt. Limited	High yielding, big size, oblong shaped dark red fruit.
8.	Amlika (V ₈)	Syngenta India Limited	Late variety big size, round shaped red colour fruit.
9.	DEB 2912(V ₉)	Debgiri seed	Small oblong shaped fruit, less number of seed per fruit, high lycopene content.
10.	Chiranjeevi (V ₁₀)	Seminis	Late variety, medium size, oval shaped dark red fruit.
11.	Namdhari (V ₁₁)	Namdhari seed	Late variety, small size, oblong shaped fruit

RESULTS AND DISCUSSION

There was a significant difference among the tomato variety for plant height. In open field condition data ranged from 73.33 to 139.66 in different variety but in poly house condition its value varies from 147.06 to 191.73 (**Table no. 3**). Among different variety maximum height recorded in variety PAN 1286 (191.73) grown in poly house condition but when it grown in open field condition it plant height was 134.00. In poly house condition highest plant height observed in variety PAN 1286 (191.73 cm) followed by variety Kundan (185.96 cm), Karina (185.70 cm) and VL-642 (184.70 cm). In open field condition highest plant height recorded in Karan (139.66 cm) followed by PAN 1286 (134.00 cm), Kundan (128.33 cm) and VL-642 (114.00 cm). Minimum plant height observed in Namdhari (151.20 cm) followed by Chiranjeevi (164.43 cm) in poly house condition, where as in open field

condition variety DEB 2913 (73.33 cm) followed by Namdhari (82.00 cm) show minimum plant height. In general, the plants grown under protected condition were taller than in open field. This may be due to long internodal lengths, thinner stems of the plants and enhanced photosynthesis and respiration due to the favorable micro-climatic conditions in the poly house. These results are in conformity with those obtained by Nagoata *et al*², Thangam *et al*³. No significant difference was observed in number of primary branches in tomato variety grown in poly house and open field condition. The average number of primary branches per plant under poly house was varying from 3.33 to 4.33 whereas in open field it was varying from 2.66 to 3.66 (Table no. 3). Maximum no of primary branches observed in VL-642, Karina and PAN 1286 i.e. (4.33) under poly house. In open field condition variety VL-642 (3.66) exhibited

maximum number of primary branches followed by PAN 1286 and Amlika (3.33). In polyhouse number of primary branches more than variety grown in open field condition. Polyhouse permits easy entrance of short-wave radiation but traps the outgoing long-wave radiation. As a result the air temperature inside

the polyhouse gradually increased due to the greenhouse effect. Number of branches per tomato plant was positively favored due to the warmer environment inside the polyhouse^{4,5,6} in spite of lower amount of PAR. The same was reported by Sharma and Tiwari⁷ and Thangam *et al*³.

Table 3: Mean performance of some tomato varieties for plant height and number of primary branches

Treatment	Plant height (cm)		No of primary branches	
	Poly house	Open field	Poly house	Open field
VL-642	184.70	114.00	4.33	3.66
Kundan	185.96	128.33	3.66	3.33
Karan	182.80	139.66	3.33	2.66
Karina	185.70	103.66	4.33	3.33
Kohinoor	176.90	88.66	3.66	2.66
DEB 2913	148.40	73.33	3.33	2.66
PAN 1286	191.73	134.00	4.33	3.66
Amlika	147.06	91.00	3.66	3.33
DEB 2912	175.60	108.00	3.33	3.00
Chiranjeevi	164.43	97.00	4.00	3.33
Namdhari	151.20	82.00	3.33	2.66
S.Em (±)	4.60	3.90	0.33	0.37
C.D. at(5%)	13.87	11.605	N/A	N/A

Significant variation was observed among the variety for inter-nodal length. Its value ranged from 17.00-10.03 cm in polyhouse condition and 15.87-7.67 cm in open field condition (Table no. 4). The variety Amlika recorded highest inter-nodal length in both poly house condition (17.03 cm) and open filed condition (15.87 cm) followed by Namdhari (16.20 cm) and DEB 2912 (16.03 cm) in poly house

condition. DEB 2913 recorded lowest inter-nodal length in both poly house condition (10.03 cm) and open field condition (7.67 cm). From this data it was observed that tomato variety grown in poly house condition having more inter-nodal length than variety grown in open field condition. The same result was reported by Muthiah.G⁸.

Table 4: Mean performance of some tomato varieties for inter nodal distance (cm)

Treatment	Inter nodal distance (cm)	
	Poly house	Open field
VL-642	11.24	9.84
Kundan	10.54	8.23
Karan	10.88	8.60
Karina	11.21	8.87
Kohinoor	10.35	8.56
DEB 2913	10.03	7.67
PAN 1286	11.33	10.15
Anlika	17.00	15.87
DEB 2912	16.03	14.16
Chiranjeevi	15.96	14.36
Namdhari	16.20	14.70
S.Em (±)	0.972	0.64
C.D. at(5%)	2.88	1.92

There was a significant difference in the days to first flowering in different tomato variety grown under poly house and open field conditions. Its data ranged from 26.33 to 38.00 days in variety grown in poly house condition and 23.00 to 34.66 days in variety grown in open field condition (**Table no. 5**). The results indicated that under the poly house conditions tomato variety, Kohinoor (26.33 days) recorded early flowering followed by Karan and Karina (30.00 days). In open field condition Kohinoor (23.00 days) was early followed by Kundan (26.66 days) and PAN 1286 (28.33 days). The days to first flowering were delays both in poly house and open condition from variety Namdhari and Chiranjeevi. Variety grown in poly house produce late flowering than variety grown in open field condition. Earlier flowering in open field might be due to the congenial growing environment in plastic house as compared to open field condition so in poly house vegetative growth takes more time due to this late flowering occur. The same was reported by Nasiruddin *et al*⁹ and Thangam *et al*.

There was Significant variation was observed among the variety for days to first fruit set in poly house and open field condition. The range varies from 39.66- 51.00 days in tomato variety grown in poly house and 35.00- 48.00 days in open field condition (**Table no. 5**). Kohinoor (39.00 days) set fruit early followed by Karan and Karina (39.66 days) in poly house condition. Tomato variety Namdhari (51.00 days) takes maximum days to set fruit in poly house condition followed by Anlika, DEB2912 and Chiranjeevi (48.33 days). In open field condition Kohinoor (35.00 days) set fruit early followed by kundan (35.33 days) and VL-642 (38.33 days) and Namdhari (48.00 days) take maximum days followed by Chiranjeevi (45.33 days) and DEB 2913 (42.66 days) to set flower. It was observed that variety grown in open field set fruit earlier than variety grown in poly house. In open field condition early flowering occur due to this, fruit set was earlier in open field. It represent that shading prolonged the days of fruit set and the first harvest delayed. Nasiruddin *et al*⁹ and Thangam *et al*³.

Table 5: Mean performance of some tomato varieties for Days to first flowering and Days to first fruit set

Treatment	Days to first flowering		Days to first fruit set	
	Poly house	Open field	Poly house	Open field
VL-642	32.00	29.66	42.00	38.33
Kundan	31.00	26.66	41.66	35.33
Karan	30.00	30.33	39.66	39.00
Karina	30.00	30.66	39.66	40.00
Kohinoor	26.33	23.00	39.00	35.00
DEB 2913	34.66	33.00	46.33	44.00
PAN 1286	32.66	28.33	43.33	40.00
Anlika	37.66	32.33	48.33	42.66
DEB 2912	36.00	30.00	48.33	40.66
Chiranjeevi	38.00	32.66	48.33	45.33
Namdhari	38.00	34.66	51.00	48.00
S.Em (±)	0.79	0.78	0.92	1.01
C.D. at(5%)	2.37	2.32	3.59	3.01

There was a significant difference in the number of flowers per cluster in different tomato variety grown under poly house and open field conditions. Number of flower per cluster in variety grown in polyhouse varies from 4.86-6.60 and in open field it varies from 4.66-6.40 (**Table no. 6**). The results indicated

that under the poly house conditions tomato variety, VL-642 (6.60) recorded maximum number of flowers per cluster followed by PAN 1286 (6.20) and DEB 2912 (5.86). In open field condition variety VL-642 (6.40) recorded maximum number of flowering per cluster followed by PAN 1286 (6.00) and DEB

2912 (5.66). Chiranjeevi show minimum number of flower per cluster in both poly house as well as open field condition. Tomato crop grown under poly house conditions were produced higher number of flowers per cluster than in the open field conditions. It was due to congenial environment for flowering in poly house as compare to open field because average temperature more in open field condition which cause flower drop. Similar results were revealed by Nasiruddin *et al*⁹, Gavrish *et al*¹⁰ and Thangam *et al*³. Similarly for number of clusters per plant (**Table no. 6**) significant different observed in variety grown in open field as well as poly house. Its range varies from 8.33 to 13.00 in poly house and 8.00 to 11.33 in open field condition. Kundan

(13.00) recorded maximum number of clusters per plant followed by VL-642 (12.33) and Karan (12.00) whereas, minimum number of cluster per plant (9.00) was recorded in DEB 2913 (9.00) and Amlika (8.33) in poly house .However, Karan produce maximum number of clusters per plant (11.33) followed by VL-642 and PAN 1286 (11.00), while minimum number of clusters per plant (8.00) were recorded in DEB 2913 and Amlika in open field conditions. Number of cluster per plant was more in variety grown in poly house condition as compare to variety grown in open field. The results are corroborated with the findings of Gavrish *et al.*¹⁰ and Singh *et al*¹¹ in tomato.

Table 6: Mean performance of some tomato varieties for number of flower per cluster and number of cluster per plant

Treatment	No. of flower per cluster		No. of cluster per plant	
	Poly house	Open field	Poly house	Open field
VL-642	6.60	6.40	12.33	11.00
Kundan	5.73	5.47	13.00	10.00
Karan	5.30	5.10	12.00	11.33
Karina	5.80	5.46	10.00	9.66
Kohinoor	5.66	5.26	10.33	9.33
DEB 2913	5.20	5.06	9.00	8.00
PAN 1286	6.20	6.00	12.00	11.00
Anlika	5.13	5.06	8.33	8.00
DEB 2912	5.86	5.66	10.00	9.33
Chiranjeevi	4.86	4.66	9.33	8.33
Namdhari	5.20	5.13	9.00	8.00
S.Em (±)	0.13	0.13	0.83	0.71
C.D. at(5%)	0.39	0.41	2.48	2.12

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