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Screening of Tomato (Solanum lycopersicum Child) Genotypes for Yield and Yield Components under Foot Hills of Arunachal Pradesh

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ABSTRACT

The present study aimed to screen out fifty tomato genotypes with respect to growth and yield potential, under foot hill of Arunachal Pradesh at Vegetable Research Farm of College of Horticulture and Forestry, Central Agricultural University, Pasighat (Arunachal Pradesh) during *Rabi* season. The experiments were laid out in a Randomized Block Design with three replications under field condition. The present investigation revealed that the analysis of variance was highly significant for all the traits. Data were collected on growth parameters and yield components. Mean performance showed that genotype CHF-TOM-35 took minimum days to 50% flowering (35.33 days), 50% fruit setting (42.67 days) and days to first harvest (76.67). Genotype CHF-TOM-35 was also showed superior performance in result of yield contributing characters like Number of flower cluster per plant (10.37), Number of fruit per cluster (6.93), Number of fruit per plant (58.47), Fruit yield per plant (3.33 kg), Total fruit yield per plot (47.33 kg), and ultimately result in highest total fruit yield per hectare (788.77 q). The results of the present investigation clearly indicate that genotype CHF-TOM-35 were better in most of growth and yield parameters compared to other genotype. Hence it was recommended that farmer should grow tomato genotype CHF-TOM-35 for increased growth and yield in foot hill of Arunachal Pradesh.

Keywords: *Tomato genotypes, Growth parameters, Yield components.*

1. INTRODUCTION

Tomato (*Solanum lycopersicum* Child*)* is one of the most important vegetable crops of Peru-Ecuador origin (Rick, 1969), it belong to family Solanaceae. It is one of the most popular and widely cultivated vegetable throughout the world; it ranks third in world vegetable crop after potato and sweet potato (Rashid, 1983; FAO, 2010).

The leading tomato producing countries are China, India, USA, Italy, Turkey and Egypt. Because of its economic importance the area under cultivation is increasing every year. In world, total area under tomato was 4.82 million hectares with production of 163.03 million tonnes and productivity of 33.9 tonnes per hectare during the year 2013-14 (FAO, 2014). Tomato is widely grown in India as well as in Arunachal Pradesh usually in the winter season. The demand of tomato in the country as well as in Arunachal Pradesh is increasing day by-day with the increase in population and its preference for tomato In India, it rank second among vegetable next to potato with an area of 0.88 million hectare and production is 18.73 million tonnes with 21.2 tonnes per hectare productivity (Anonymous, 2014). In Arunachal Pradesh total tomato cultivation area was 0.0005 million hectare which produced 0.013 million tonnes in 2013-14 (Anonymous, 2015), which was very low compared to other leading tomato producing states.

Tomato cultivation in north eastern part of India, Arunachal Pradesh in particular is not practiced on a commercial scale because of several reasons, including the shortage of high yielding varieties and the lack of a recommendation packages regarding production. Realizing the economic importance of the crop, there is needed to isolate such genotypes having desirable/ marketable traits. Therefore, the main objective of this study was to find out suitable genotypes of tomato for growth parameter and yield component cultivated under foot hill of Arunachal Pradesh condition for future improvement programmes.

2. MATERIALS AND METHODS

This study was carried out during *Rabi* season at Vegetable Research Farm, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh. Vegetable Research Farm is situated in foot hills of Eastern Himalayan range at an altitude of 153 meters above the mean sea level, 28°04`N latitude and $95^{0}22$`E longitudes. The experimental material of present investigation was comprised of 50 genotypes of tomato collected from different parts of country and maintained at College of Horticulture and Forestry, Central Agricultural University, Pasighat (Arunachal Pradesh). The experiment was laid out in Randomized Block Design with three replications. The tomato genotype were planted in two row of 4 m length with inter and intra row spacing of 60 and 50 cm, respectively. The field was prepared by one deep ploughing, two harrowing followed by clod breaking, hoeing and levelling. The seedlings of 30 days old were transplanted to the main field for screening under natural condition. All the recommended agronomic practices were followed to raise a healthy crop (Choudhury, 2000).

Field data were collected in this experiment, including growth parameters and yield components of tomato plant viz., Plant height (cm), Number of primary branch per plant, Days to first flowering, Days to 50% flowering, Days to first fruit set, Days to 50% fruit set, Number of flower cluster per plant, Number of fruit per cluster, Fruit length (cm), Fruit girth (cm), Number of locule per fruit, Pericarp thickness (cm), Number of seed per fruit, Number of fruit per plant, Days to first harvest, Fruit weight per plant (kg), Average fruit weight (g), Total fruit yield per plot (kg), Total fruit yield per ha (q). The data collected was subjected analysis of variance (ANOVA) and means were separated according to the method outlined by Panse and Sukhatme (1985).

3. RESULTS AND DISCUSSION

Growth parameters and plant characters

Significant differences among the genotypes were observed from the analysis of variance for plant height. The significant varietal differences indicated a wide range of variation among the varieties for plant height ranging from 38.20 cm to 110.60 cm (Table 1). The average value for this character was 56.01 cm. The highest plant height (110.60) was observed in CHF-TOM-33 which was statistically significant and different from all other genotypes. The genotype CHF-TOM-42 showed lower value (38.20 cm) than average value for height of the plant (Table 1). The height of the plant is the result of the higher photosynthetic activity might be occurred in the genotypes production higher carbohydrate, resulting in higher growth of the plant (Bolibera *et al*. 2000). Norman (1974), Nsowah (1970), Nandpuri *et al*. (1974), Sharma and Rastogi (1993) and Ghosh *et al*. (1995) reported similar results for plant height.

Maximum number of primary branches was recorded in CHF-TOM-33 (27.67) while minimum branches recorded in CHF-TOM-52 (9.27) genotype. This finding was agreed with other researchers (Khokhar *et al.* 2001 and Eshteshabad *et al*. 2010). 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 present experiment most of the indeterminate type genotype produced the highest number of branch and also performed better regarding yield contributing characters.

Days to first flowering showed significant variations among the genotypes studied in the experiment. The mean values indicated that the genotype CHF-TOM-74 took maximum days (45.33) to first flower which was significantly different from the others. On the other hand, CHF-TOM-35 required the minimum number of days to first flowering (31.00). Georgieva (1969) reported, pre-flowering period ranging from 30-56 days among the varieties in his study. Sharma and Rastogi (1993) also observed significant variation for days to first flowering. The variation in day to flowering may be attributed to genetic makeup of genotypes. The minimum time taken to first fruit set was observed in genotype CHF-TOM-35 which was 37.67 days while maximum days recorded in genotype CHF-TOM-74 (53.33 days). The genotypes which have early flowering habit had also early maturity habit. The variety CHF-TOM-35 was early maturing took 76.67 days for first harvesting while genotype CHF-TOM-74 was late (120.33 days) among the genotype. Norman (1974) and Nsowah (1970) obtained significant differences for harvesting among the cultivars which is in agreement with this result.

CHF-TOM-35 produced the highest number of flower cluster per plant (10.27). CHF-TOM-53 produced the lowest number of flower cluster per plant (3.40). Result further revealed that high yielding genotypes also had higher number of flower cluster per plant. This result was in agreement with the result of Dutta *et al.* (1995) who stated that the yield was affected by number of flower cluster per plant. Further, Kabir (2004) reported that high yielding genotypes had higher number of flower cluster per plant compared to low yielding ones.

Yield contributing characters

Single fruit weight showed a very highly significant difference ($P<0.001$). The maximum fruit weight was obtained from the genotype CHF-TOM-74 (113.15 g) whereas; the minimum fruit weight was recorded from CHF-TOM-40 (56.83 g). This result of variability in single fruit weight agreed with the results of Kabir (2004) who observed a wide range of variability in fruit among the studied tomato genotype.

Total number of fruit per plant, the most important yield attribute, was showed very highly significant (P< 0.001) difference among the genotype. The genotype CHF-TOM-35 scored the highest number of fruits per plant (58.47) while, the genotype CHF-TOM-46 scored the minimum (14.13). This finding was agreed with other researchers (Khokhar *et al.* 2001 and Eshteshabad *et al.* 2010)**.** Result also revealed that high yielding genotype also had higher number of fruits per plant.

There was a remarkable difference in respect of fruit yield per plant (Table 2). The genotype CHF-TOM-35 produced the highest fruit yield per plant (3.33 kg) and it was followed by CHF-TOM-34 (3.17 kg), CHF-TOM -74 (3.00 kg), CHF-TOM-36 (2.81 kg), CHF-TOM-57 (2.70 kg) and CHF-TOM-31(2.61 kg). The yield being polygenic traits, it is a result of component characters like number of fruits per plant and fruit weight, showed the mean performance of yield and quality traits. The top ranked genotypes in terms of yield per plant was CHF-TOM-35 (3.33 kg). The fruit yield was highest in above genotype due to producing higher number fruits per plant and larger fruit size. In contrast, CHF-TOM-46 (0.83 kg) produce low yield due to the production of fewer numbers of fruit per plant.

Most of the researchers reported that fruit yield in tomato mostly depend on fruit numbers and fruit size (Dutta *et al.* 1995, Das *et al.* 1998, Islam *et al.* 1999 and Kabir 2004). The results of present findings are agreeable to those reports.

The average fruit length and fruit width in fifty genotypes was 3.42 cm (CHF-TOM-39) to 5.64 cm (CHF-TOM-58) and 3.73 cm (CHF-TOM-47) to 6.32 cm (CHF-TOM-44) respectively. The similar result was also reported by (Khokhar *et al*. 2001; and Eshteshabal *et al*. 2010). The analysis of variance for Number of locules per fruit due to genotype was statistically significant at 1% level indicated significant varietal difference among the genotypes of tomato. The highest number of locules per fruit (8.20) was recorded in the in CHF-TOM-34. Arora *et al.* (1982) studied 60 genotypes of tomato and reported maximum number of locules per fruit up to 12.

The results of the experiment indicated highly significant differences among fifty genotypes of tomato for all the characters studied. The different genotypes showed better values for the characters such as CHF-TOM-35 showed minimum scores in days to first flowering, days to 50% flowering, days to first fruit set, days to 50% fruit set, days to first harvest, it was also showed highest scores in number of flower clusters per plant, number of fruits per cluster, number of fruits per plant, fruit yield per plant and total fruit yield per hectare. Genotype CHF-TOM-33 showed highest scores in plant height, and number of primary branches per plant while average fruit weight highest in CHF-TOM-74. It was concluded that the Best genotype that produced maximum yield having potential growth and yield contributing characters was CHF-TOM-35.

Table 1:Mean performance of tomato genotypes for growth parameters

Genotypes	Plant height (cm)	Days to first flower	Days to 50% flowering	Days to first fruit set	Days to 50% fruit set	Days to first harvest	No. of primary branch /plant	No. of flower cluster /plant
CHF-T0M-31	92.73	31.67	36.67	39.33	44.00	77.67	11.60	6.27
CHF-T0M-32	94.80	33.00	40.33	41.33	47.00	84.67	22.87	4.47
CHF-T0M-33	110.60	33.67	37.67	40.67	43.67	79.67	27.67	7.93
CHF-T0M-34	106.73	36.67	42.67	44.33	51.00	85.00	17.20	6.20
CHF-T0M-35	90.60	31.00	35.33	37.67	42.67	76.67	18.13	10.27
CHF-T0M-36	63.00	33.00	38.67	40.00	45.00	81.67	19.07	9.13
CHF-T0M-37	57.07	32.67	36.00	38.67	44.00	80.00	17.87	5.87
CHF-T0M-38	56.90	31.00	36.33	38.33	44.67	79.33	10.87	7.87
CHF-T0M-39	58.87	31.67	37.67	39.00	44.00	80.00	17.67	5.07

CHF-T0M-40	54.60	32.33	38.00	41.67	45.00	83.00	11.93	7.73
CHF-T0M-41	59.47	31.33	37.33	40.67	43.67	81.00	12.87	8.20
CHF-T0M-42	38.20	31.67	38.67	40.67	46.00	82.67	12.67	4.40
CHF-T0M-43	46.87	32.00	39.00	42.67	47.00	86.33	18.67	4.20
CHF-T0M-44	46.87	33.67	37.67	40.33	44.67	79.67	17.73	4.67
CHF-T0M-45	56.53	34.33	40.33	42.00	48.00	84.00	12.87	3.47
CHF-T0M-46	43.00	32.33	40.33	41.00	46.33	82.67	12.17	3.80
CHF-T0M-47	54.00	38.33	44.00	45.00	51.00	89.67	12.87	4.40
CHF-T0M-48	61.27	34.33	41.67	43.00	48.33	89.00	10.13	5.73
CHF-T0M-49	55.00	36.67	42.00	43.00	49.00	86.00	11.47	4.20
CHF-T0M-50	51.87	42.33	47.67	47.67	54.00	95.00	11.40	4.13
CHF-T0M-51	59.87	40.33	45.33	46.00	51.33	98.67	10.33	5.07
CHF-T0M-52	55.60	44.33	51.00	52.00	57.33	105.67	9.27	3.60
CHF-T0M-53	54.53	37.67	43.00	44.00	51.00	84.67	12.07	3.40
CHF-T0M-54	53.47	44.67	48.33	49.33	54.33	95.33	10.60	3.93
CHF-T0M-55	46.80	39.33	44.33	47.33	52.00	95.33	10.27	3.73
CHF-T0M-56	38.87	42.67	48.00	50.33	55.00	100.33	12.13	4.00
CHF-T0M-57	50.13	41.00	47.00	48.00	54.33	98.33	11.80	7.87
CHF-T0M-58	42.40	44.33	51.00	51.33	58.33	107.33	11.20	4.27
CHF-T0M-59	42.13	41.33	45.00	47.00	51.33	90.00	11.27	3.20
CHF-T0M-60	59.53	40.67	45.33	46.00	53.00	88.00	11.60	5.60
CHF-T0M-61	54.73	42.33	47.67	50.00	54.00	103.33	11.53	5.33

CHF-T0M-62	68.20	43.67	50.00	51.00	57.00	107.00	11.07	5.40
CHF-T0M-63	49.40	40.00	46.00	47.00	53.00	98.00	11.60	4.73
CHF-T0M-64	57.20	41.67	46.00	48.33	53.67	98.33	11.67	5.87
CHF-T0M-65	48.47	43.00	49.00	50.00	56.00	97.00	10.60	6.27
CHF-T0M-66	48.20	39.00	47.00	46.00	53.67	93.33	10.87	5.07
CHF-T0M-67	48.47	42.00	46.00	49.00	54.33	100.67	11.27	5.60
CHF-T0M-68	51.53	44.00	50.00	51.00	57.00	102.67	11.73	9.53
CHF-T0M-69	45.40	44.33	49.33	52.33	56.00	109.33	10.93	4.20
CHF-T0M-70	62.67	43.00	48.00	50.00	56.33	101.33	11.47	7.87
CHF-T0M-71	56.27	42.33	47.00	48.33	55.33	87.33	11.47	6.73
CHF-T0M-72	42.73	40.67	46.00	47.00	52.67	91.00	11.07	4.67
CHF-T0M-73	50.60	44.33	50.00	51.33	57.33	104.67	11.20	4.73
CHF-T0M-74	47.67	45.33	51.33	53.33	59.00	120.33	9.93	9.07
CHF-T0M-75	44.00	44.33	50.00	52.33	57.00	108.00	11.60	5.33
CHF-T0M-76	46.07	42.67	49.33	50.67	56.67	105.67	10.40	4.80
CHF-T0M-77	42.27	41.67	47.33	49.00	52.33	99.33	11.40	6.07
CHF-T0M-78	47.47	42.00	47.00	50.67	55.00	104.00	9.43	5.40
CHF-T0M-79	40.00	41.33	46.00	46.67	54.00	97.00	9.87	8.93
CHF-T0M-80	46.73	42.00	49.00	50.00	56.33	105.33	10.60	4.93
Mean	56.01	38.79	44.37	46.05	51.47	93.22	12.76	5.66
CV %	14.23	9.98	9.20	8.00	8.06	8.22	11.71	18.35
SEm±	4.60	2.24	2.36	2.13	2.39	4.42	0.86	0.60
CD or LSD	12.91	6.27	6.61	5.97	6.72	12.41	2.42	1.68

Table 2: Mean performance of tomato genotypes for yield components

Genotypes	No. of fruit per cluster	No. of fruit per plant	Fruit length (cm)	Fruit girth (cm)	Pericarp thickness (cm)	Number of locule per fruit	Number of seed	Average fruit weight (g)	Fruit weight /plant (kg)	Total fruit yield per plot (kg)	Total fruit yield /ha (q)
CHF-T0M-31	5.53	35.45	4.79	5.29	0.63	4.13	138.06	81.62	2.61	36.67	611.11
CHF-T0M-32	5.47	19.87	4.63	4.91	0.50	3.87	141.41	86.98	1.80	23.53	392.22
CHF-T0M-33	6.13	48.40	4.34	5.45	0.44	3.47	216.63	88.87	2.10	28.63	477.22
CHF-T0M-34	6.53	39.80	5.34	6.30	0.52	8.20	164.16	94.42	3.17	45.47	757.89
CHF-T0M-35	6.93	58.47	4.95	4.25	0.53	3.60	128.89	86.33	3.33	47.33	788.77
CHF-T0M-36	5.27	44.33	4.27	5.35	0.53	3.33	164.48	78.41	2.81	39.70	661.66
CHF-T0M-37	4.87	29.60	4.30	5.33	0.58	3.67	138.53	90.22	2.26	31.38	523.00
CHF-T0M-38	5.60	33.00	5.46	5.13	0.54	3.27	131.02	68.32	2.02	28.57	476.11
CHF-T0M-39	4.53	20.53	5.64	5.54	0.50	3.40	132.73	79.28	1.58	21.57	359.44
CHF-T0M-40	5.40	36.47	5.55	4.85	0.59	3.87	131.82	56.83	2.49	34.22	570.39
CHF-T0M-41	4.00	34.73	4.88	5.21	0.55	3.00	149.48	76.12	2.35	32.50	541.66
CHF-T0M-42	3.80	19.13	4.57	4.93	0.48	3.20	156.98	62.07	1.24	15.50	258.33
CHF-T0M-43	4.67	17.53	5.16	5.62	0.56	4.00	233.58	82.85	1.15	14.62	243.67
CHF-T0M-44	3.47	18.13	5.37	6.32	0.53	3.67	126.32	64.62	1.14	14.53	242.22
CHF-T0M-45	4.33	19.33	5.20	5.79	0.64	4.20	166.84	77.72	1.48	18.51	308.50
CHF-T0M-46	3.73	14.13	3.59	3.98	0.35	5.07	167.79	75.63	0.83	9.50	158.33
CHF-T0M-47	5.13	16.40	4.44	3.72	0.44	3.60	91.97	82.83	1.22	14.37	239.44
CHF-T0M-48	4.73	24.73	3.73	4.91	0.38	3.33	138.10	83.63	1.93	25.55	425.89
CHF-T0M-49	4.80	16.6	3.8	4.4	0.42	3.67	173.99	100.1	1.46	19.81	330.17

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CHF-T0M-50	4.47	19.73	3.73	4.56	0.36	3.87	131.25	100.37	1.94	26.38	439.66
CHF-T0M-51	4.53	19.47	5.06	4.20	0.51	3.20	150.51	94.79	1.71	23.61	393.50
CHF-T0M-52	5.47	21.80	4.79	4.03	0.45	3.73	106.57	67.68	1.55	20.75	345.78
CHF-T0M-53	3.20	17.00	4.80	5.80	0.43	4.47	119.65	83.78	1.43	18.74	312.39
CHF-T0M-54	3.87	18.33	3.82	4.72	0.42	3.47	137.88	77.49	1.25	16.43	273.89
CHF-T0M-55	3.93	18.40	4.23	5.18	0.42	4.00	197.24	70.31	1.16	14.51	241.89
CHF-T0M-56	3.93	21.67	4.48	4.34	0.46	4.20	179.12	74.26	1.36	17.52	292.05
CHF-T0M-57	4.53	32.13	3.45	3.85	0.32	3.47	173.15	91.42	2.70	38.38	639.61
CHF-T0M-58	4.27	22.80	3.42	5.08	0.40	3.67	157.35	86.05	1.75	23.00	383.33
CHF-T0M-59	4.20	20.20	3.96	4.90	0.51	3.27	179.91	75.39	1.53	20.39	339.89
CHF-T0M-60	5.47	17.80	4.28	4.91	0.49	3.13	128.27	82.96	1.38	18.50	308.33
CHF-T0M-61	4.47	17.60	3.88	4.44	0.54	4.47	143.61	105.21	1.77	23.71	395.22
CHF-T0M-62	4.80	21.80	3.90	5.47	0.58	3.13	152.22	88.04	1.57	21.41	356.78
CHF-T0M-63	4.27	22.73	4.81	4.52	0.56	4.13	129.85	79.74	1.53	20.96	349.33
CHF-T0M-64	4.60	28.87	3.99	4.23	0.65	3.20	128.30	85.76	2.28	32.36	539.28
CHF-T0M-65	5.00	23.87	4.05	4.87	0.60	2.73	92.30	81.25	1.81	24.24	404.00
CHF-T0M-66	4.67	28.07	4.22	4.59	0.69	3.27	128.75	87.22	2.08	29.13	485.55
CHF-T0M-67	4.20	14.67	5.21	5.68	0.68	4.13	189.36	98.72	1.23	15.96	266.00
CHF-T0M-68	4.73	36.87	5.38	6.13	0.61	4.00	168.31	65.06	2.13	30.63	510.44
CHF-T0M-69	4.27	17.40	5.23	5.03	0.60	4.10	140.90	97.34	1.44	19.60	326.67
CHF-T0M-70	6.00	25.53	5.24	4.83	0.53	4.07	131.75	98.08	2.42	34.53	575.55
CHF-T0M-71	5.07	23.0	4.9	5.0	0.46	3.60	151.92	67.32	1.36	17.45	290.83

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CHF-T0M-72	5.33	18.47	4.91	4.56	0.58	3.53	159.42	94.44	1.58	21.11	351.78
CHF-T0M-73	5.93	12.87	5.05	5.07	0.44	3.53	134.46	91.27	0.92	10.13	168.89
CHF-T0M-74	4.13	34.60	4.21	5.27	0.47	4.07	166.78	113.15	3.00	44.23	737.16
CHF-T0M-75	4.27	18.07	4.93	5.17	0.52	3.40	152.37	93.03	1.47	19.32	322.00
CHF-T0M-76	4.27	14.13	4.11	4.90	0.57	4.13	143.41	82.66	1.04	12.23	203.89
CHF-T0M-77	4.00	26.33	5.01	5.52	0.47	4.00	186.82	85.89	2.13	30.53	508.78
CHF-T0M-78	4.00	18.93	4.50	5.13	0.65	3.60	181.47	82.06	1.41	18.46	307.67
CHF-T0M-79	3.93	30.73	4.82	4.76	0.49	3.33	185.97	85.65	2.13	30.76	512.66
CHF-T0M-80	4.00	14.67	4.55	4.91	0.51	4.07	161.01	82.62	1.02	12.31	205.11
Mean	4.69	24.50	4.58	4.98	0.51	3.79	151.65	83.72	1.78	24.18	403.08
CV %	11.05	19.58	8.77	10.20	10.27	15.63	17.73	16.37	28.20	17.33	17.33
SEm±	0.30	2.77	0.23	0.29	0.03	0.34	15.52	7.86	0.29	2.42	40.34
CD or LSD	0.84	7.77	0.65	0.82	0.09	0.95	43.57	22.06	0.81	6.79	113.21

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