

EVALUATION OF TOMATO HYBRIDS FOR YIELD ATTRIBUTES UNDER KHUMALTAR CONDITION

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ABSTRACT

An experiment was conducted to evaluate hybrid genotypes of tomato for fruit yield and fruit quality in Horticulture Research Division, NARC, Khumaltar, Lalitpur, Nepal during March to August, 2014 in open field condition. Eleven hybrid genotypes developed from the crosses between HRA and HRD lines, selected as good performer under late blight condition and 'Srijana' as a local check were taken for the evaluation. Design of experiment was single factorial RCBD with three replications. Observation on traits related to plant morphology, maturity and yield component were recorded to develop, evaluate, identify and recommend high yielding hybrids of tomato. The fruit yield per hectare ranged from 80.83 t/ha (HRA 14 × HRD 7) to 45.89 ton/ha (HRA 15 × HRD 6). Fruit yields of the genotypes HRA 14 × HRD 7, HRA 13 × HRD 7, HRA 20 × HRD 1, HRA 20 × HRD 2, HRA 20 × HRD 6 and HRA 16 × HRD 1 had 80.83 ton/ha, 78.50 ton/ha, 73.75 ton/ha, 70.44 ton/ha, 68.72 ton/ha, 64.64 ton/ha were higher than the yield of 'Srijana' (62.33 ton/ha). Based on overall performance, genotypes HRA 14 × HRD 7, HRA 13 × HRD 7, HRA 20 × HRD 1 and HRA 20 × HRD 6 were observed as good performer than Srijana (Check) and selected as high yielder with good fruit quality.

Key words: Evaluation, Hybrid, Tomato, Yield

INTRODUCTION

Tomato is recognized as important commercial and dietary vegetable crops (Singh *et al.*, 2014). The area under tomato in Nepal is about 19728 ha with a production of 298594 metric ton. Among 75 districts of Nepal, 22 districts are considered as potential district for tomato production (NARC, 2013). Productivity of tomato in Nepal is less, 15.14 ton/ ha (VDD, 2013) as compare to India i.e. 25 mt/ ha. Low productivity of tomato in Nepal is due to the lack of suitable high yielding variety (Shrestha & Sah, 2014). Some constraints such as pest, diseases, expensive inputs and difficulties associated with breeding techniques have also contributed to lower productivity of tomato in Nepal. Exotic varieties of tomato may not give stable and good performance under Nepalese condition. Srijana, hybrid tomato developed by HRD, NARC is becoming poor performer although it is popular among Nepalese farmers. Gradual varietal deterioration of Srijana hybrid is also reported. Continuous inflow of exotic hybrid varieties and risk of getting appropriate variety at desired time created dilemma among the farmers while selecting suitable tomato varieties. Uncertainty in timely availability of hybrid seeds can be reduced by cultivation of suitable hybrid cultivar developed in the country (Shrestha and Sah, 2014). Development of hybrid tomato varieties having desirable characters has proven to be an effective strategy to increase tomato production (Islam *et al.*, 2012). According to Choudhary and Khanna (1972) yield of hybrid tomato is 20 to 25 % more as compared to open pollinated (Islam *et al.*, 2012). Continuous varietal evaluation is needed for providing sufficient varietal options for the farmers (Chapagain *et al.*, 2014). Therefore research should be oriented towards tomato variety improvement through hybridization, selection, varietal evaluation and release of disease resistant, high yielding and consumer preferable hybrid varieties of tomato with high productivity.

METHODOLOGY

The experiment was conducted in Horticultural Research Division of Nepal Agricultural Research Council, Khumaltar, Lalitpur in open field condition from January to August, 2014. Experimental design was RCBD with 12 treatment and 3 replications having 36 number of plots. Srijana and eleven other hybrids (F_1), developed by crossing HRD and HRA lines that showed field level resistance to late blight disease and superior yield performance were selected as treatments for the experiment. There were altogether 12 F_1 hybrids of tomato. Each plot contained six number of tomato plants with the spacing of 60 cm for rows and plants. Transplanting of 25 days old seedling was done in the month of April, 2014. NPK dose was applied at the rate of 200:150:150 kg per ha and 15 ton FYM. Full dose of FYM, DAP and MOP were used as basal dose. Urea was applied 5 gram as a basal dose and 5.5 gram as split dose per plant. Pericarp thickness of fruits from different hybrid were recorded from randomly selected five fruits per plot by using Vernier caliper. Fruit set percentage was calculated by the ratio of total number of fruit set to the total number of flowers in a truss. On the basis of yield per plot, calculation of yield per hectare was done. Multiple manual harvesting of fruit was done at 2 to 3 days interval. All the collected data were subjected to analysis of variance and Duncan's Multiple Range test (DMRT) for mean separation using MSTAT-C (version 1.2).

RESULTS AND DISCUSSION

Effect on reproductive characters

Number of flowers per cluster in tomato plant showed statistically significant due to differences among hybrids. The maximum number of flowers was recorded in genotype 'Srijana' (7.267) which was at par with HRA13× HRD7, HRA14 × HRD7, HRA20× HRD1, while the minimum number of flowers was recorded in genotype HRA 17 X HRD 1 (4.90) and HRA 18 X HRD 2 (4.90) which was at par with HRA 16× HRD 1, HRA 16× HRD4, HRA17× HRD1, HRA15 × HRD6 and HRA20× HRD2, HRA20× HRD4 and HRA20 × HRD6 (Table 1).

Number of fruits per cluster

Number of fruits per cluster of tomato plant varied significantly among the hybrids (Table 1). The maximum number of fruits per cluster was recorded from Srijana (5.40), while the minimum number of fruits per cluster was recorded from HRA16 X HRD 4 (3.267).

Fruit set percentage

The estimates of fruit setting rates of twelve tested hybrids were observed significant maximum fruit set percentage was observed in HRA 15 X HRD 6 (88.12%) and minimum fruit set percentage was observed in HRA 16 X HRD 4 (67.40 %).

Table 1: Number of flowers per cluster, number of fruits per cluster and fruit set percentage of tomato hybrids , Khumaltar, Lalitpur, 2014

Hybrids	Numbers of flowers per cluster	Numbers of fruits per cluster	Fruit Set(%)
HRA 13 X HRD 7	6.267 ^{ab}	4.833 ^{ab}	77.50 ^{ab}
HRA 14 X HRD 7	6.433 ^{ab}	4.867 ^{ab}	75.70 ^{ab}
HRA 15 X HRD 6	5.500 ^{bc}	4.567 ^{abc}	82.94 ^{ab}
HRA 16 X HRD 1	5.000 ^c	3.833 ^{bcd}	77.22 ^{ab}
HRA 16 X HRD 4	4.933 ^c	3.267 ^d	67.40 ^b
HRA 17 X HRD 1	4.900 ^c	3.567 ^{cd}	73.95 ^{ab}
HRA 18 X HRD 2	4.900 ^c	4.267 ^{bcd}	88.12 ^a
HRA 20 X HRD 2	6.000 ^{bc}	4.467 ^{abc}	74.23 ^{ab}
HRA 20 X HRD 4	5.933 ^{bc}	4.433 ^{abc}	74.53 ^{ab}
HRA 20 X HRD 6	5.900 ^{bc}	4.167 ^{bcd}	70.77 ^{ab}
HRA 20 X HRD 1	6.333 ^{ab}	4.667 ^{ab}	73.76 ^{ab}
SRIJANA	7.267 ^a	5.400 ^a	75.70 ^{ab}
Grand mean	5.781	4.361	75.985
LSD	0.9874*	0.9504*	17.44*
SEM	0.3366	0.3239	5.9477
CV (%)	10.09	12.86	13.56

Note: Means in the column followed by same letter in each treatment do not differ significantly at ($p = 0.05$) by DMRT. SEM= Standard error of mean, LSD = Least significant difference and CV = Coefficient of variation

Effects on fruit characteristic

The longest fruit was found from HRA 16 X HRD 4 (57.43 mm) at par with HRA16 × HRD1 while the shortest from HRA 20 X HRD 4 (40.17 mm). The maximum fruit diameter was found from HRA 16 X HRD 4 (66.14) followed by HRA 16 X HRD 1 (55.59 mm) while minimum from Srijana (41.20 mm). Five numbers of locules were recorded in HRA 16 X HRD 4, being followed by HRA 16 X HRD 1 having 4 locules. The minimum two locules was recorded in Srijana. The maximum pericarp thickness 6.267 mm was recorded in HRA 16 X HRD 4 while HRA 15 X HRD 6 Showed minimum pericarp thickness value 4.947 mm (Table 2).

Table 2: Fruit characters of tomato hybrids, Khumaltar, Lalitpur, 2014

Hybrids	Fruit characters			
	Length (mm)	Diameter (mm)	Pericarp thickness (mm)	Number of locules
HRA 13 X HRD 7	44.25 ^b	50.06 ^{bc}	5.073 ^b	3.533 ^{bc}
HRA 14 X HRD 7	41.87 ^b	45.53 ^c	5.513 ^{ab}	2.933 ^{bc}
HRA 15 X HRD 6	41.77 ^b	47.14 ^{bc}	4.947 ^b	3.067 ^{bc}
HRA 16 X HRD 1	52.45 ^a	55.59 ^b	5.373 ^{ab}	4.233 ^{ab}
HRA 16 X HRD 4	57.43 ^a	66.14 ^a	6.267 ^a	5.200 ^a
HRA 17 X HRD 1	40.79 ^b	48.09 ^{bc}	5.793 ^{ab}	3.967 ^b
HRA 18 X HRD 2	42.36 ^b	43.83 ^c	5.173 ^{ab}	3.067 ^{bc}
HRA 20 X HRD 2	44.29 ^b	46.31 ^{bc}	5.693 ^{ab}	3.000 ^{bc}
HRA 20 X HRD 4	40.17 ^b	46.75 ^{bc}	5.287 ^{ab}	3.400 ^{bc}
HRA 20 X HRD 6	43.35 ^b	49.91 ^{bc}	5.987 ^{ab}	3.333 ^{bc}
HRA 20 X HRD 1	41.34 ^b	44.98 ^c	5.347 ^{ab}	3.200 ^{bc}
SRIJANA	42.17 ^b	41.20 ^c	5.242 ^{ab}	2.267 ^c
Grand mean	44.854	48.794	5.475	3.433
LSD	6.467**	8.411**	1.013*	1.124**
SEM	2.2051	2.8678	0.3453	0.2836
CV (%)	8.61	10.18	10.92	19.35

Note: Means in the column followed by same letter in each treatment do not differ significantly at ($p = 0.05$) by DMRT. SEM= Standard error of mean, LSD = Least significant difference and CV = Coefficient of variance.

Effect on yield parameter

Hybrids varied significantly with their fruit size in weight. The tested hybrids produced fruits ranging their weight from HRA 16 X HRD 4 (154.6 gm) to Srijana (45.2 g). There was a significant difference in number of marketable fruits per plant among all hybrids. The maximum number of fruits per plant (69.83) was exhibited by HRA 14 X HRD 7 which was statistically similar to HRA 20× HRD1, HRA20× HRD 4, HRA14× HRD7, HRA13× HRD7 and ‘Sirjana’ (Table 3). While minimum (17.06 fruits per plant was recorded in HRA 16 X HRD 1 (Table 3). Other hybrids ranged between this limits. Similar type of experiment conducted by Shrestha and shah (2014) recorded 73 number of fruits per plant of Srijana hybrid in Parawanipur. Tiwari (2013), Bhurtyal (2000) and Shrestha (2006) also found significant differences in number of fruits among cultivars of tomato.

The maximum fruit yield per plant was found in HRA 14 × HRD 7 (2910 gm) which was statistically at par with all other hybrids except HRA 17 × HRD 1 and HRA 15 × HRD 6 whereas minimum yield per plant was observed in HRA 15 × HRD 6 (1652 gm) which .is at par with HRA 16 × HRD 1, Srijana, HRA 18 × HRD 2, HRA 20 × HRD 4, HRA 16 × HRD 4, HRA 17 × HRD 1, and HRA 15 × HRD 6 in decreasing order (Table 3). Whereas Chapagain *et al.*, (2014) observed 53.3 gm of fruit weight of Srijana hybrid in a trial conducted in Lumle, Kaski. According to Chapagain *et al.*, (2011) fruit yield of tomato might be vary due to the varietal diversity as well as growing condition. They reported significant variation on fruit yield from different varieties of tomato. In a study conducted in Regional Agriculture Research Station (RARS), Parawanipur of Nepal Agriculture Research Council (NARC), 1697 gm of fruit yield per plant was observed from Srijana hybrid (Shrestha and Shah, 2014). Significant differences were observed among hybrids in tomato yield computed in ton per hectare. The fruit yield per hectare ranged from 80.83 ton/ha (HRA 14 × HRD 7) to 45.89 ton/ha (HRA 15 × HRD 6). Hybrids HRA 13 × HRD 7, HRA 13 × HRD 7, HRA 20 × HRD 1, HRA 20 × HRD 2, HRA 20 × HRD 6 and HRA 16 × HRD 1 had 78.50 ton/ha, 73.75 ton/ha, 70.44 ton/ha, 68.72 ton/ha , 64.64 ton/ha yield respectively which were superior to Srijana (62.33 ton/ha). Rest of the hybrids showed yield lower than Srijana (Table 3).

Table 3: Means of fruit yield characters of tomato hybrids, Khumaltar, Lalitpur, 2014

Hybrids	Marketable fruits per plant	Individual Fruit weight (gm)	Yield /plant (gm)	Yield (Ton/ha)
HRA 13 X HRD 7	51.39 ^{ab}	64.17 ^{bc}	2826 ^a	78.50 ^a
HRA 14 X HRD 7	69.83 ^a	55.23 ^c	2910 ^a	80.83 ^a
HRA 15 X HRD 6	27.61 ^c	53.39 ^c	1652 ^c	45.89 ^c
HRA 16 X HRD 1	17.06 ^c	96.80 ^b	2327 ^{abc}	64.64 ^{abc}
HRA 16 X HRD 4	17.44 ^c	154.6 ^a	2163 ^{abc}	60.08 ^{abc}
HRA 17 X HRD 1	35.72 ^{bc}	57.15 ^c	1958 ^{bc}	54.39 ^{bc}
HRA 18 X HRD 2	29.28 ^c	53.63 ^c	2225 ^{abc}	61.81 ^{abc}
HRA 20 X HRD 2	55.94 ^{ab}	55.51 ^c	2536 ^{ab}	70.44 ^{ab}
HRA 20 X HRD 4	58.61 ^a	49.65 ^c	2202 ^{abc}	61.17 ^{abc}
HRA 20 X HRD 6	36.50 ^{bc}	62.78 ^{bc}	2474 ^{ab}	68.72 ^{ab}
HRA 20 X HRD 1	57.44 ^a	49.14 ^c	2655 ^{ab}	73.75 ^{ab}
Srijana	62.22 ^a	45.72 ^c	2244 ^{abc}	62.33 ^{abc}
Grand mean	43.255	66.481	2347.667	65.213
LSD	19.29	35.21 ^{**}	712.6 [*]	19.80 [*]
SEM	6.578	12.0042	242.979	6.7494
CV (%)	26.34	31.28	17.93	17.93

Note: Means in the column followed by same letter in each treatment do not differ significantly at ($p = 0.05$) by DMRT. SEM= Standard error of mean, LSD = Least significant difference and CV = Coefficient of variance.

CONCLUSION

In this experiment eleven hybrids developed by crossing HRA and HRD lines, selected as good performer under late blight condition and Srijana a recommended variety as check were taken for the evaluation. Based on overall performance, genotypes HRA 14 × HRD 7, HRA 13 × HRD 7, HRA 20 × HRD 1 and HRA 20 × HRD 6 were observed as good performer than Srijana (Check) in term of yield fruit quality. HRA 14 × HRD 7, HRA 13 × HRD 7, HRA 20 × HRD 1 and HRA 20 × HRD 6 hybrids should be evaluated on multi location trial. Based on their performance, good performer among these hybrids can be recommended to the farmers for commercial production after variety registration.

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