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Evaluation of Tomato Hybrids and Cultivars for yield, Fruit Quality and Physiological Disorders

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Abstract: Yielding ability, fruit size, specific gravity, blosson-end-rot (BER) and cracking were investigated under plastic house conditions using six tomato hybrids and cultivars.

Highest and lowest early yields were obtained from Claudia "RAF" and AMC, respectively. Topas and Tropic gave best late yield. Topas, though not significantly different from most genetic sources tested, proved of greatest potential in terms of seasonal yields. This hybrid gave consistantly highest fruit counts and smallest fruits throughout the harvest season. Largest fruits were those of Tropic.

Cracking was highest and BER was lowest in the AMC. Claudia "RAF" gave the least incidence of cracked friuits. Specific gravity was least in AMC and Claudia "RAF" and almost similar in the other genetic sources.

Additional key words: Blossom - end - rot, cracking, disorders, specific gravity, tomato.

INTRODUCTION

Though considerable research has been carried out in Jordan including open field (Suwwam et al., 1986) and plastic house (Abubaker et al., 1986 and Rushdi et al., 1983) conditions to improve tomato yield and fruit quality, further improvements are still seeked through introduction

of new cultivars and hybrids. Gentic sources were reported to exhibit a wide range of variation in yield potentials (Abubaker et al., 1986; Larson, 1941, Rushdi et al., 1983 and Suwwam et al., 1963), earliness (Abubaker et al., 1986 and Suwwam and Hamayel, 1982), ability to set fruits (Abubaker and Suwwam, 1986 and Hewitt and Stevens, 1981) and fruit quality including fruit size (Dempsey and Boynton, 1965; Emery and Munger, 1970; Ibarbia and Lambetts, 1971 and Kasrawi et al., 1981), specific gravity (Suwwam and Abubaker, 1986), blossom-end-rot (Greenleaf and Adams, 1969 and Maynard et al., 1957), and cracking (Cotner et al., 1969 and Frazier, 1936). These variations depended on location and cultural practices adopted.

As new tomato genetic sources are continuously produced and since Claudia "RAF", AMC, Tropic, Carmello, Topas and Jet Star hybrids and cultivars were not tested previously under plastic house conditions of Jordan, this investigation was initiated to evaluate these genetic sources.

MATERIAL AND METHODS

Six tomato hybrids and cultivars (AMC 79/2, Tropic 77872, Claudia "RAF", Jet Star Hyb. 869, Carmello, Topas VFNF1 (R.S. 8180) were obtained from local dealers and evaluated under plastic house conditions of the Jordan Valley. Soil was thouroughly prepared and divided into 18 equal plots. A randomized complete block design was used. Each treatment consisted of four 4-m rows with 3 replicates.

One month old tomato seedlings were planted on January 7, 1981 at a distance of 0.4 m within rows 0.8 m part. Irrigation was performed using a drip irrigation system with laterals spaced at 0.8m provided with keyklib emmiters (6 L/hr) 0.4m apart to fit the distribution of plants within each treatment. Plants were irrigated uniformly at a soil moisture tension of 30 centibar.

Weeds, diseases and insects were kept under control. By the end of February, plant rows were side dressed with ammonium sulfate and monosuperphate at the rate of 2000 and 800 kg/ha, respectively.

The harvest season started May 3 and continued for 12 weeks; Fruits were harvested at the red ripe stage at 2-day intervals from the middle 16 plants. Early and late yields represented 4 and 8 weeks, respectively. During the production peak, representative fruit samples were collected and specific gravity determined using the platform method described by Mohsenin (1970).

At the end of the harvest season, 16 plants of each treatment were cut down to the soil surface and separated into leaves and stems. To determine the dry matter contents, representative samples were dried to a constant weight at 70°C.

All the data obtained were analyzed as for the randomized complete block design. Duncan's Multiple Range Test and correlations were also perfomed (Little and Hills, 1978).

RESULTS AND DISCUSSION

The tomato hybrids and cultivars varied in their yielding ability (Table 1), agrees with other findings under local conditions (Abubaker and Suwwan, 1986; Rushdi and Haddad, 1983 and Suwwan and Hamayel, 1982) and elsewhere (Larson, 1941). Earliness was significantly evident in the Claudia "RAF", Carmello, Topas and Jet Star. Tropic and AMC were the lowest early yielders. However, highest late yield increases were observed for Topas and Tropic. Significantly lowest late yields were obtained from Claudia "RAF" and Jet Star. Though Topas seasonal marketable yield was only significantly higher than that of AMC, it proved to be of highest potential among all tested genetic material relative to seasonal marketable yields (Table 1).

Ability to flower and set fruits early in the season (Table 2) followed a pattern similar to that of marketable early yields (Table 1). For the late and seasonal fruit numbers, Topas proved significantly superior to the other five hybrids and culticars. The seasonal capacity to produce fruits, however, was as follows: Topas > Carmello and Claudia "RAF"> Jet Star, AMC and Tropic. Abubaker and Suwwan (1986) reported a wide range of variation in eartliness of 9 hybrids and cultivars including Carmello and Claudia "RAF".

Table 1: Marketable yield distribution of six tomato hybrids and cultivars under plastic house conditins.

Hybrids and Cultivars	Marketable yield (ton/ha) Early	Late	Seasonal
Claudia "RAF"	54.7 a[1]	62.6 b	117.3 a
AMC 79/2	18.3 b	72.1 ab	90.4 b
Tropic 77872	27.9 b	83.5 a	111.4 ab
Carmello F1	50.6 a	69.7 ab	120.3 a
Topas VFN F1	45.2 a	85.2 a	130.49
Jet Star hyb. 869	53.5 a	63.9 b	1117.4 a

(1) Within each category, values having different letters are significantly different at the 5% level accoring to Duncan's Multiple Range Test (DMRT).

Table 2: Fruit number distribution of six tomato hybrids and cultivars under plastic house condition.

Hybrids and Cultivars	Marketable Fruit number (1000/ha) Early	Late	Seasonal
Claudia "RAF"	351.9 a[1]	524.3 b	876.2 b
AMC 79/2	116.9 b	533.8 b	670.7 c
Tropic 77872	142.4 b	500.6 b	643.0 c
Carmello F1	323.5 a	590.3 b	913.8 b
Topas VFNF1	340.3 a	891.4 a	1231.7 a
Jet Star hyb. 869	307.9 a	479.2 b	787.1 bc

(1) Within each fruit number category, values having different letters are significantly different at the 5% level According to Duncan's Multiple Range Test (DMRT).

Tomato cultivars and hybrids were reported to vary considerably in fruit counts produced (Abubaker and Suwwan, 1986) and concentration of fruit set (Hewitt and Stevens, 1981) thus contributing highly to yields obtained in all tested hybrids and cultivars except for late and seasonal yields in the AMC and the early yields of the Jet Star as indicated by the highly significant correlation coefficients presented (Table 3). These results confirm other findings under open field (Suwwan and Hamayel, 1982) and palstic house conditions (Abubaker and Suwwan, 1986)

Though all hybrids and cultivars gave significantly similar vegetative growth, Topas tended to give highest growth (7.72 t/ha) and Tropic gave the least (5.81) t/ha); respective vegetative growth values were 6.72, 6.66, 6.07 and 5.85 t/ha for AMC, Carmello, Claudia "RAF" and Jet Star. Better vegetative growth supports more flowers and fruits (R**) contributing to higher yields.

Table 3: Correlation coefficients (R) for yield and yield components of six tomato hybrids and cultivars under plastic house conditions.

Hybrids and Cultivars	Levels of significance for "R"		
	Dependant Marketable yield	Marketable No.	Independant Average fruit weight
Cladia "RAF"	Early	**(1)	-*
	Late	**	**
	Seasonal	**	**
AMC 79/2	Early	**	-ns
	Late	**	**
	Seasonal	**	-ns
Tropic 77872	Early	**	-ns
	Late	**	-ns
	Seasonal	**	-*
Carmello F1	Early	**	-ns
	Late	**	**
	Seasonal	**	**
Topas VFNF1	Early	**	**
	Late	**	**
	Seasonal	**	**
Jet Star hyb. 869	Early	ns	*
	Late	**	**
	Seasonal	**	**

(1) ns = not significant * = significant at 5% levle
** = significant at 1% level - = negative correlation

Among genetic materials tested, fruit size was significantly and consistantly the highest in the Tropic throughout the season (Table 4). In contrast, Topas gave consistantly the smallest fruits. Variation in fruit size among the six hybrids and cultivars agrees with other findings (Emery and Munger, 1970; Hernandez and Nassar, 1970; Ibarbia and Lambeth, 1971; Larson, 1941 and Suwwan and Hamayel, 1982). According to Emery and Munger (1970), average fruit weight obtained from the indeterminate tomato plants was higher than that ontained from the determinate plants. When testing 11 parental strains and two common parents, Ibarbia and Lambeth (1971) reported a wide range of variation in tomato fruit size (38 g to 265 g). Dempson and Boynton (1965) attributed about 80% of variation in average fruit weights of their cultivars to variation in seed numbers. However, contribution of fruit size in marketable yield of the hybrids and cultivars tested was not consistant (Table 3).While fruit size was highly related to early, late and seasonal marketable yields of Topas and Jet Star and late and seasonal yields of the Carmello and Claudia "RAF", the relationship was highly negative with the early yield of Claudia "RAF" and the seasonal yield of Tropic. Early and late yields of Tropic and the early and seasonal yields of AMC were negatively, but insignificantly correlated with fruit size (Table 3).

Though percentages of marketable and unmarketable fruit numbers were similar among the six tested hybrids and cultivars, considerable variations were detected in the cracked and blossom-end-rotted fruits (Table 5). While Clandia "RAF" showed the least % of cracked fruits, cracking incidence was highest in the AMC. Cracking has been reported to vary with cultivars (Dempsey and Boynton, 1965; Frazier, 1934 and Hernandez and Nassar, 1970), fruit skin characteristics (Batal et al., 1970 and Voisey et al., 1970) and irrigation (Frazier, 1934) and fertilization (Suwwan, 1963) regimes. According to Voisey et al. (1970) cracking resistance does not appear to be governed by skin thickness. Incidence of blossom end rot was least for the AMC and similar for all other gentic materials tested. BER incidence has been found to vary with cultivars (Hernandez and Nassar, 1970 and Little and Hills, 1978), Ca-metabolism (Hernandez and Nassar, 1970), Ca distribution (Taylor and Smith, 1957) and soil water stress (Pill and Lambeth, 1980). For

Table 4: Changes in average fruit weight of six tomato hybrids and cultivars.

Hybrids and Cultivars	Marketable fruit weight (g) Early	Late	Seasonal
Claudia "RAF"	155 bc[1]	119 b	134 c
AMC 79/2	155 bc	130 b	134 c
Tropic 77872	197 a	167 a	1173 a
Carmello F1	157 b	118 b	132 c
Topas VFN F1	133 c	96 c	106 d
Jet Star hyb. 869	175 ab	134 b	150 b

(1) Within each average fruit weight category, values having different letters are significantly different at the 5% level according to Duncan's Multiple Range Test (DMRT).

Table 5: Percentage of marketable and unmarketable fruits of six tomato hybrids and cultivars.

Hybrids and Cultivars	Percent (based or number) Marketable	Unmarketable Small	Cracked	BER	Total
Claudia "RAF"	90.15 a[1]	5.35 a	1.26 c	3.24 a	9.85 a
AMC 79/2	85.11 a	4.69 a	9.88 a	0.32	14.89 a
Tropic 77872	87.87 a	3.08 a	6.27 ab	2.79 ab	12.13 a
Carmello F1	88.54 a	3.92 a	3.77 bc	3.77 a	11.46 a
Topas VFN F1	88.04 a	5.79 a	4.86 bc	1.32 ab	11.96 a
Jet Star Hyb. 869	85.25 a	5.31 a	5.74 ab	3.69 a	14.75 a

(1) Within each fruit category, values having sifferent letters are significantly different at the 5% level according to Duncan's Multiple Range Test (DMRT).

both cracking and BER incidence, it is unlikely that these factors, other than the relative susceptibility of the tested hybrids and cultivars have affected variations in these disorders as all cultural practices were similar.

Specific gravity ranged from 0.978 to 0.996 which were recorded for the AMC and Carmello, respectively, Fruits of AMC and Claudia "RAF" were evidently lowest in specific gravity compared to other genetic materials which were almost similar (Fig. 1). In general agreement with present findings specific gravity has been reported to vary with tomato cultivars (Suwwan and Abubaker, 1986).

The present genetic variations, in terms of the different parameters tested, are of potential importance in breeding programs for superior tomato yields and better fruit quality. The present genetic sources could also serve as a tool to further investigate the basis for tomato physiological disorders which usually marr fruit quality and reduce marketable yields.

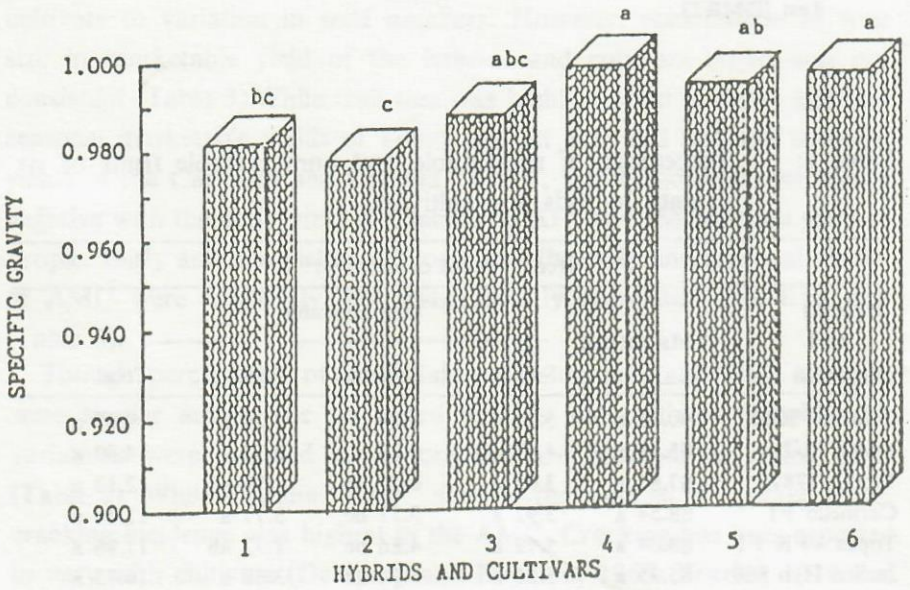

Fig. 1: Specific gravity in six tomato hybrids and cultivars: (1) Claudia "RAF" (2) AMC 79/2 (3) Tropic 77872 (4) Carmello F1 (5) Topas VFN F1 and (6) Jet star hyb. 869 under plastic house conditions. (columns having different letters are significantly different at the 5% level according to Duncan's Multiple Range Test).

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