Effects of Using 'Ultra Early' Tomato Lines as Seed Parent on the Earliness and Fruit Size of F^1 Hybrids

A.A. Boe
Professor and Chair
Department of Horticulture and Forestry

G.A. Tuskan
Assistant Professor
Department of Horticulture and Forestry

Tomatoes are grown as a vegetable crop in home gardens in virtually every corner of the United States and Canada. Harris (6) and Boe et al. (1-4) have released very early maturing cultivars that are able to set fruit and ripen at low temperatures and in areas of low summer heat accumulation. Boe et al. (4) have suggested that these be designated as "ultra early" cultivars to differentiate them from "early" cultivars. Gibrel et al. (5) have reported on the inheritance of earliness in a study that used "ultra early" cultivars as parents. The intro-duction of the "ultra early" characteristic into tomato cultivars extends the area where tomatoes can be grown. On a commercial basis this characteristic could lengthen the harvest season of processing and fresh market tomatoes.

"Ultra early" cultivars are small determinate plants that generally bear many small fruits. In the study reported here, the use of "ultra early" cultivars and lines as seed parents for "ultra early" F1 hybrid cultivars was examined.

Methods and Materials

Nineteen "ultra early" and "early" tomato cultivars and lines (Table 1) were crossed in the greenhouse with four large fruited "mid-season" cultivars (Golden Delight, Early Girl Hybrid, Campbell 1327 and Floramerica Hybrid) as pollen parents.

The 76 F1 hybrids and 23 parents were field grown in a randomized block design. Each plot contained five plants and each hybrid and parent was replicated in four blocks. The plants were transplanted to the field on June 2 and 3. Irrigation was performed as needed to establish the planting. Weed control was done by cultivation and hand weeding. A side dressing of nitrogen and phosphorus at 50 lbs per acre was made 14 days after transplanting. Earliness was determined by harvesting all ripe fruit after approximately 666 and 833 centigrade heat units between 10 and 32 C (1200 and 1500 Fahrenheit heat units between 50 and 90 F). The weight of the fruit from these two harvests was combined and is reported as the amount of early yield. Fruit size was determined by weighing and counting the number of fruit harvested and calculating average fruit weight.

Results

Several of the F1 hybrid families had early yields higher than their seed parents (Table 1). These yield increases ranged from 10 to 288 percent. Ten F1 hybrid families had early yields the same as or lower than their "ultra early" seed parent. The four highest yielding F1 families had yields the same as or slightly lower than their seed parent.

Fruit size was increased in all of the F1 hybrid families when compared to their seed parent (Table 2). Size increases ranged from 10 to 230 percent. The fruit size increase was greatest when the seed parent typically produced small fruit, such as Farthest North, ND 102, Gem State, IdaGold and Tiny Tim.

Table 1. Early yield of F1 hybrid tomato lines derived by using "ultra early" seed parents and large fruited, mid season pollen parents.

		Pollen Plant					
		Golden Delight	Early Girl	Campbell 1327	Floramerica		
	Self→	425	183	86	20		
Seed Parent	↓					Avg.	F1/SP
Gem State	1149[1]	1269	1118	1181	937	1124a[2]	0.98
ANI 63	1230	1226	907	928	554	904ab	0.73
Sub Arctic Plenty	857	464	NA	513	1620	866ab	1.01
Rocket	850	1025	1060	880	422	847a-c	1.00
Sub Arctic Midi	710	827	815	965	517	782a-d	1.10
ND 102	372	1090	1084	952	313	782a-d	2.10
IdaGold	485	612	873	754	610	712b-e	1.47
Shoshone	951	1041	219	810	716	697b-e	0.73
Farthest North	692	928	600	829	398	689b-e	1.00
Bonner	806	658	765	592	309	581c-f	0.72
Kootenai	409	805	558	353	344	515c-f	1.26
NDVDWF	252	423	912	430	181	487ef	1.98
Sandpoint	152	405	608	420	433	467ef	3.07
ANI45	725	291	419	660	369	417ef	0.58
Tiny Tim	100	NA	414	385	366	388f	3.88
ANI 68	720	417	265	450	176	327f	0.54
Nova	148	258	389	319	271	308f	2.08
Benewah	564	215	373	239	354	295f	0.52
Scotia	157	412	314	241	199	292f	1.86
Avg.	596	687	650	626	478	610	1.02
			Parents		F1 hybrids		
	C.V.		28.8		46.1		
	LSD .05		169.7		347.3		

[1]Grams per plot of 4 plants.
[2]Means not followed by the same letter are significantly different at the 5% level.

Increased early yield and increased fruit size were related in several of the F1 hybrid families in that the greatest yield increases were accompanied by a considerable increase in fruit size. In the case of Gem State no yield increase occurred but fruit size was 2.4 times larger in the F1 hybrids.

Several of the seed parents (Gem State, ND 102, Kootenai, VDWF, Sandpoint, and Tiny Tim) produce short internode dwarf plants. In most cases mating of these dwarfs to the large fruited, larger plant types resulted in large increases in both yield and fruit size in the F1 hybrids. Gem State was an exception to this and produced early yields similar to the seed parent but with much larger fruit.

Using the data collected from this study to estimate the narrow and broad sense heritability for early yield (.4347 and .9712 respectively) and fruit size (1.0 and 1.0 respectively) indicates that "ultra early" seed parents can be expected to produce F1 hybrids that are also very early. In this study some of the F1 hybrids produced early yields equal to or higher than their seed parent. Also indicated is the possibility of some of the seed parents being a better source of earliness and large fruit size than others.

Fruit size is a highly heritable characteristic in tomato and considerable gains can be made by using large fruited parents for F1 hybrids. In this study the greatest gains were made when the smaller fruited seed parents were mated with larger fruited pollen parents. Whether this size increase was also accompanied by a decrease in earliness was related to the seed parent.

Literature cited

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Table 2. Fruit size of F1 hybrid tomato lines derived by using "ultra early" seed parents and large fruited, mid season pollen parents.

Seed Parent	Self→ ↓	Pollen Plant: Golden Delight 111	Early Girl 111	Campbell 1327 244	Floramerica 320	Avg. 197	F1/SP
Benewah	76[1]	111	110	151	141	120a[2]	1.6
Kootenai	63	101	96	124	132	113a	1.8
Scotia	93	105	78	117	111	103b	1.1
ANI 68	52	89	89	75	108	90c	1.7
ANI 45	73	90	64	79	109	85cd	1.2
Sandpoint	48	70	87	93	87	84cd	1.8
NDVDF	45	69	78	86	103	84cd	1.9
Nova	59	87	67	73	88	79cd	1.3
Bonner	43	66	78	80	72	74de	1.7
Rocket	51	65	85	79	62	73de	1.4
Gem State	31	68	65	85	75	73de	2.4
IdaGold	34	67	68	81	72	72de	2.1
ND 102	28	65	61	70	77	68ef	2.4
Sub Arctic Midi	36	62	55	68	67	63ef	1.8
Sub Arctic Plenty	36	54	NA	62	66	61fg	1.7
ANI 63	32	62	51	60	63	59fg	1.8
Shoshone	30	57	60	38	60	54g	1.8
Farthest North	10	29	32	35	36	33h	3.3
Tiny Tim	13	NA	33	39	5	25i	1.9
Avg.	45	73	70	77	77	74	1.6
			Parents		F1 hybrids		
	C.V.		16.3		17.5		
	LSD.05		10.8		13.3		

[1]Fruit weight in grams (28.4g = 1 oz.)
[2]Means not followed by the same letter are significantly different at the 5% level.