

Fruit Size Inheritance in Highbush Blueberries, *Vaccinium australe* Small¹

A. D. Draper and D. H. Scott
U. S. Department of Agriculture, Beltsville, Md.

Abstract. Three blueberry progenies from crosses of large-fruited × large-fruited parents were significantly larger in fruit size than 3 progenies from crosses of large-fruited × small-fruited parents. Mean fruit sizes of the 3 large-fruited × small-fruited populations were equal to the fruit size of the smaller fruited parents in each cross, indicating that small fruit size is a dominant character. Large fruit size is not linked with low yield.

INTRODUCTION

LARGE fruit size has received much emphasis in the breeding program of tetraploid highbush blueberries. In addition to having greater consumer appeal, large berries are more easily and economically harvested by hand. The large fruit size of newer varieties has been attained by breeding and selection, but little is known about the inheritance of this character. Information on the inheritance of fruit size in blueberry is limited to early work by Darrow, Clark, and Morrow (1) and Johnston (2) prior to a time when large-fruited parents existed. In the breeding program, we have often crossed large-fruited types with large-, medium-, and small-fruited types, with the aim of combining large fruit size and other important characteristics. However, information was lacking on which type of cross would produce a population with satisfactory fruit size combined with other characteristics being sought. This study was an attempt to elucidate these relationships.

MATERIALS AND METHODS

Seven progenies were grown near Hammonton, New Jersey, on a St. Johns soil, in 10 randomized blocks, with 18 plants in each plot. Plants were spaced 2' × 9' and given clean cultivation, irrigated during prolonged dry periods, and dusted with insecticides for control of fruit worms. Fruit size was measured by weighing a random sample of 30 berries from each seedling. Each plant was given a subjective score for yield ranging from 10 for a full crop to 0 for no fruit. Four large fruited types (E-30, 'Darrow', M-23, and 11-93), one with medium-sized fruit, 'Lateblue', and one smaller fruited type, 'Bluetta', were used in crosses for this study. Fruit size of 'Darrow', E-30, M-23, and 11-93 is about 90 g, of 'Lateblue' about 66 g, and of 'Bluetta' about 55 g per 30 berries. 'Bluetta' is one of the smaller modern varieties used in the breeding program. There were 3 large × large crosses (E-30 × 11-93, E-30 × 'Darrow', 11-93 × M-23), one large × medium cross (E-30 × 'Lateblue'), and 3 large × smallest crosses (E-30 × 'Bluetta', 'Bluetta' × M-23, 'Bluetta' × 'Darrow'). The plants were 4 years old and in their second fruiting year when the data were taken.

RESULTS AND DISCUSSION

Progeny means and confidence intervals for fruit size of the three crosses of large × large parents were similar and not significantly different (Table 1). Mean fruit size of the large-fruited × medium-fruited progeny was lower

Table 1. Mean fruit size (g), confidence intervals, and productivity of 7 highbush blueberry progenies.

Fruit size of parents	Cross	Mean fruit size ^a	Confidence interval	Mean yield score ^b
Large × large.....	E-30 × 11-93	73.14	67.08-79.20	5.30 ^c
Large × large.....	E-30 × 'Darrow'	73.15	67.44-79.56	6.64
Large × large.....	11-93 × M-23	75.30	69.18-81.42	4.93
Large × medium.....	E-30 × 'Lateblue'	66.80	61.74-71.86	5.60
Large × smallest.....	'Bluetta' × M-23	57.30	51.52-63.08	5.78
Large × smallest.....	E-30 × 'Bluetta'	55.10	49.16-61.04	5.43
Large × smallest.....	'Bluetta' × 'Darrow'	55.70	50.51-60.89	5.95

^aWeight of 30 berries per seedling.
^b10 indicates full crop, 5 a half crop, 0 no crop.
^cNo significant difference among means.

than the large-fruited × large-fruited crosses, but its confidence interval overlapped those of the 3 large-fruited × large-fruited progenies and thus was not significantly different. Progeny means for fruit size of the 3 crosses of large-fruited × smallest-fruited parents were almost identical, and were significantly smaller than those of the 3 progenies from large-fruited × large-fruited parents. The confidence intervals of the means of the 3 progenies from large-fruited × smallest-fruited parents were similar. Of these 3 crosses, the confidence interval of the 'Bluetta' × M-23 progeny was slightly larger and it overlapped that of the large-fruited × medium-fruited progeny and thus did not differ significantly. The within progeny variation of all 7 progenies was comparable, and this caused the confidence intervals of the means to be similar in size.

The mean scores for cropping ability of the 7 progenies did not differ statistically (Table 1). Cropping ability of seedlings in each progeny varied greatly. However, the mean fruit production of the large- and small-fruited progenies was similar, indicating that large fruit size is not linked with low yield.

Frequency distributions for the large-fruited × large-fruited progenies are shown in Fig. 1. The mean fruit size of these populations is lower than that of 4 large-fruited parents (E-30, 11-93, M-23, 'Darrow') which average about 90 g per 30 berries. The range in fruit size of these 3 populations was similar, from 45 to about 120 g and was greater than the range of fruit size of the other populations. In a population of the 3 combined large-fruited

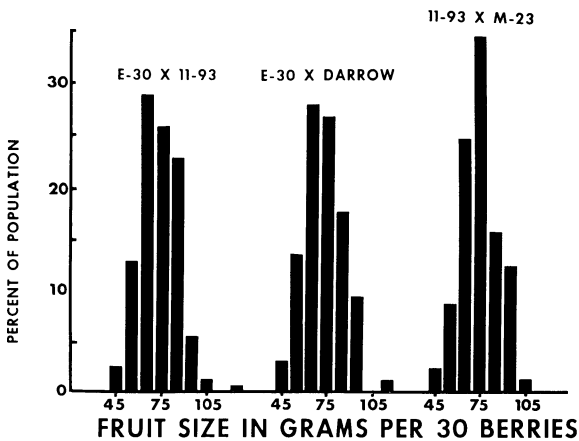


Fig. 1. Distribution of fruit size of 3 blueberry progenies of crosses of large-fruited by large-fruited parents.

¹Received for publication March 15, 1969. Geneticist and Horticulturist, respectively, Crops Research Division, Agricultural Research Service.

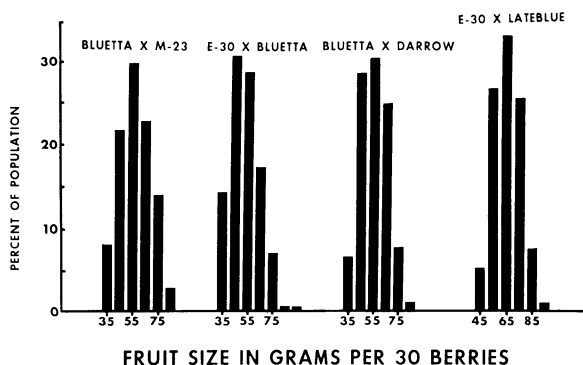


Fig. 2. Distribution of fruit size of 3 blueberry progenies of crosses of large-fruited by small-fruited parents and of 1 progeny of cross of a large-fruited parent by one with medium fruit size (E-30 \times Lateblue).

\times large-fruited progenies, approximately 19% of the seedlings were as large as the parents in fruit size. About 10% of the seedlings were larger than 90 g per 30 berries (Fig. 3).

'Lateblue' has medium-size fruit which weigh about 66 g per 30 berries. Mean fruit size of the large-fruited \times medium-fruited (E-30 \times 'Lateblue') progeny (Fig. 2) was equal to 'Lateblue', the smaller fruited parent. The range in fruit size was from 42 to 96 g. In this progeny none of the seedlings had smaller fruit size than the smaller fruited ones of the large-fruited \times large-fruited populations. None of these attained the large fruit size that some did in the large-fruited \times large-fruited population. About 8% of the population was as large as the large-fruited parents (90 g/30 berries) and only 1% of the population exceeded the large-fruited parent in fruit size (Fig. 3).

Mean fruit size for each of the 3 large-fruited \times small-fruited progenies ('Bluetta' \times M-23, E-30 \times 'Bluetta', 'Bluetta' \times 'Darrow') was equal to 'Bluetta', the smaller-fruited parent (Fig. 2). Fruit size of 'Bluetta', is about 55 g per 30 berries. The range of fruit size in these 3 populations is approximately 30 to 95 g. None of the plants of this population attained fruit size as large as the largest of the large-fruited \times large-fruited population.

A frequency distribution for the 3 combined large-fruited \times small-fruited populations has a mean of 56.0 g and 1.7% of the seedlings are equal to and 0.2% of the progeny exceed the large-fruited parent in fruit size (Fig. 3). This leads us to conclude that genes for small fruit size are dominant over those for large fruit size and are quantitatively inherited.

When all 7 progenies are considered as one population, the frequency distribution is very close to a normal curve

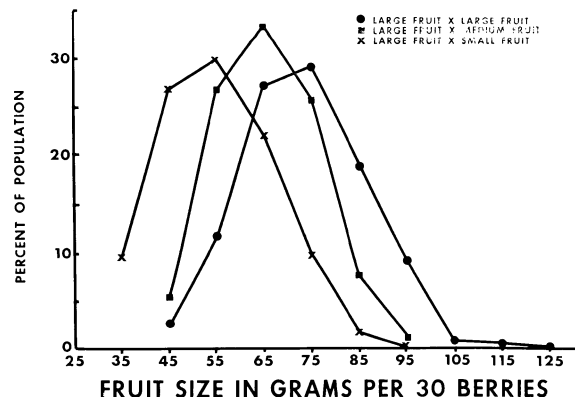


Fig. 3. Distribution of fruit size of blueberry progenies of large-fruited by large-fruited, large-fruited by medium-fruited, and large-fruited by small-fruited parents.

with a mean of 65.3 g which is equivalent to the mean of the large-fruited \times medium-fruited population.

If a fruit size of 90 g or larger is chosen as the minimum fruit size for selection, in the large-fruited \times large-fruited population, 11.7% of the seedlings are in the range of acceptable size (Fig. 3). In the large-fruited \times medium-fruited population the proportion of the population in the acceptable range is 2.4%, and for the large-fruited \times small-fruited population it is 0.4%. This indicates that when a small-fruited parent is used in combination with a large-fruited one, selection must be done in large populations to maximize the probability of recovering an individual with fruit size equal to the large-fruited parent. When other fruit characteristics such as firmness, color, and flavor are considered along with fruit size, the proportion of the population in the acceptable range can be much less. We selected 2.5% of the 'Bluetta' \times 'Darrow' progeny, but only 0.5% of the 'Bluetta' \times M-23 progeny merited further testing because of inferior fruit characteristics. Most of these selections were smaller than the larger fruited parent, but a compromise had to be made on fruit size in order to get favorable combinations of the other fruit characters. Among the progenies of large-fruited \times large-fruited parentage, the E-30 \times 'Darrow' progeny was outstanding in the number of selections produced. Almost 4% of that progeny was selected as compared to 2.2% for E-30 \times 11-93 and 0.8% for 11-93 \times M-23.

LITERATURE CITED

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