Fruit Size of Strawberry Cultivars

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Fruit size is one of the important economic characters to be considered when evaluating strawberry cultivars, selections, or seedlings. Large fruit command the highest market prices. Fruit size is also becoming increasingly important in relation to harvesting cost. Large fruit size is now being emphasized in most strawberry breeding programs. The following study was conducted to determine fruit size characteristics of several strawberry cultivars and advanced selections that might be of value in breeding for large fruit size.

Materials and Methods

A planting including the 25 cultivars and selections listed in Table 1 was established at Fayetteville, Arkansas in April, 1964. Five replications of 10 foot plots were used for each cultivar. Plots were harvested in 1965, 1966, and 1967 on a 3-times-per-week schedule during ripening. At each picking, 25 random berries from each plot were weighed as a determination of fruit size. Following each season, the mean fruit weight of each cultivar was determined by the formula:

$$\text{Seasonal Mean Weight} = \frac{\Sigma \text{ Mean weight each picking} \times \text{yield each picking.}}{\text{Total yield for season}}$$

The seasonal data were broken down into mean sizes by weeks of harvest (Table 2) and percent of total yield in various size classes (Fig. 1).

Results and Discussion

Mean seasonal berry weights for each of 3 harvest years and average berry weight for the 3 year period are shown in Table 1. 'Md-US 3082' produced significantly larger fruit than any other clone in each of the 3 test years. Other genetic clones consistently producing large fruit were 'Md-US 2289', 'Md-US 2593', and 'NC 1768'. Among the named cultivars, 'Armore,' 'Citation,' 'Earlibelle,' 'Redglow,' 'Raritan,' and 'Sunrise' produced the largest fruit. The clones 'Bellmar,' 'Blakemore,' 'Stelemaster,' 'Tennessee Beauty,' and 'Md-US 2700' produced the smallest fruit in the 3-year period.

Considerable variability existed in fruit size from year to year (Table 1). However, the relative fruit size among clones was similar in each season.

It has been clearly established that strawberry fruit becomes progressively smaller in inferior blossom positions "down" the inflorescence (1, 2, 3, 5, 6). Since the succession of fruit ripening is from the primary berry "down" the cluster, mean berry size becomes smaller with successive pickings. Janick and co-workers (3, 4, 5) found that the rate of decrease in fruit size with later pickings was approximately the same in all cultivars studied. Valleau (6), however, presented data that showed that fruit size of the largest-fruited clones in his study decreased more than that of the smallest fruited clones in inferior positions on the inflorescence.

The mean berry size at weekly harvest intervals of 25 cultivars and selections for a 3-year period are given in Table 2. Significant decreases in fruit size occurred during the season for all clones. However, clones with

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Table 1. Mean fruit size and yields of 25 strawberry cultivars and selections for 3 harvest years, Fayetteville, Arkansas.*

Cultivar or Selection	Mean Fruit Size 1965	1966	1967	Mean	Mean Yield
		g	g	g	Lbs./A
Albritton		5.7	6.4	6.1 defgh	8517 ijkl
Armore		6.0	7.4	6.8 bcde	7897 kl
Bellmar		4.8	5.9	5.4 hi	8097 jkl
Blakemore		4.7	5.3	5.0 i	9919 hijk
Citation		6.4	7.5	6.9 bcd	15679 bcd
Dixieland		5.0	6.2	5.7 fghi	9903 hijk
Earlibelle		5.5	8.2	6.8 bcde	11434 fgh
Earlidawn		5.8	6.2	6.3 defg	10506 fghi
Midland		5.4	6.4	6.0 efgh	7541 l
Midway		4.9	6.2	5.7 fghi	14228 de
Raritan		6.0	7.2	6.6 cde	16976 bc
Redchief		5.5	6.6	6.0 efgh	12627 ef
Redglow		6.0	7.2	6.8 bcde	8765 ijkl
Stelemaster		5.2	6.2	5.6 gfhi	11712 efg
Sunrise		5.8	7.1	6.8 bcde	17323 b
Surecrop		5.5	6.8	6.3 defg	11646 fgh
Tenn. Beauty		4.4	6.0	5.5 ghi	20940 a
Md-US 2289		6.5	8.1	7.4 bc	15793 bcd
Md-US 2593		7.1	7.9	7.5 b	15113 bcd
Md-US 2700		5.1	5.9	5.5 ghi	14651 cde
Md-US 2713		6.6	5.8	6.4 def	10173 ghij
Md-US 2819		6.4	6.6	6.3 defg	11270 fgh
Md-US 3082		8.4	9.6	9.3 a	19659 a
Md-US 3107		6.0	6.6	6.2 defgh	11446 fgh
NC 1768		5.8	7.8	6.9 bcd	15553 bcd

*Means within columns followed by same letter are not statistically different at 5% level of significance (Duncans multiple range test).

the largest berries in the first week of harvest, such as 'Citation,' 'Earlibelle,' 'Raritan,' 'Sunrise,' Md-US 2289,' 'Md-US 2593,' 'Md-US 3082,' and 'NC 1768,' showed a greated percentage decrease during the season than clones with smaller primary berries. In general, there was no significant difference in fruit size among the clones in the fourth week of harvest. One exception was 'Md-US 3082' which still had larger fruit at the end of the season even though the rate of size decline was great.

The seasonal mean fruit weight (Table 1) and the mean weight at weekly intervals during the harvest season (Table 2) are good indices in evaluating fruit size in the strawberry. However, as Janick and Marshall (4) have pointed out, the horticultural value of a cultivar is not necessarily based on the ability to produce the largest fruit at a particular picking, but rather which cultivar will give the highest yields of large fruit. Figure 1 shows the percentage of fruit, by size classes, produced by 25 cultivars and selections in the three-year harvest period. These percentages can be compared with the yield data in Table 1 for an indication of actual

Table 2. Mean fruit size at weekly harvest intervals of 25 strawberry cultivars and selections at Fayetteville, Arkansas. (Means of 3 harvest years).

Cultivar or Selection	Week 1	2	3	4	Decrease During Season
	g	g	g	g	%
Albritton	8.0	6.2	4.5	4.0	50
Armore	8.8	7.3	5.8	4.3	51
Bellmar	5.9	5.6	5.0	4.6	22
Blakemore	6.5	5.3	4.6	3.6	45
Citation	9.8	7.7	5.6	3.7	62
Dixieland	7.1	6.0	4.8	3.9	45
Earlibelle	9.0	6.9	5.1	3.7	59
Earlidawn	7.0	6.4	5.6	4.6	34
Midland	7.4	5.9	4.9	3.9	47
Midway	7.5	6.7	4.9	3.6	52
Raritan	10.2	6.9	4.7	3.4	67
Redchief	7.4	6.1	5.1	4.1	45
Redglow	7.7	6.9	5.8	5.0	35
Stelemaster	6.9	5.5	4.5	3.7	46
Sunrise	10.9	6.6	4.6	3.7	66
Surecrop	7.8	6.5	5.3	4.5	42
Tenn. Beauty	8.1	6.5	4.5	3.2	60
Md-US 2289	10.1	7.2	5.9	4.1	59
Md-US 2593	10.5	7.6	6.2	4.7	55
Md-US 2700	7.0	6.2	5.6	4.3	
Md-US 2713	6.9	6.3	5.3	4.5	35
Md-US 2819	8.1	5.8	4.7	3.6	56
Md-US 3082	13.0	10.1	7.5	5.6	57
Md-US 3107	7.6	6.4	5.5	4.7	38
NC 1768	10.9	8.2	5.5	4.2	61

production in the various size classes.

The highest yield of large fruit was produced by 'Md-US 3082.' 'NC 1768' also produced a large proportion of fruit in the larger size classes. Some clones, such as 'Raritan,' 'Sunrise,' and 'Md-US 2289' produced very large primary berries, but the average size of later berries dropped markedly.

'Tennessee Beauty' was the highest yielding cultivar in the test (Table 1). However, a large proportion of fruit of 'Tennessee Beauty' was in the small size classes (Fig. 1). Some clones with lower total yields, such as 'Sunrise' and 'NC 1768' produced a greater quantity of large fruit than 'Tennessee Beauty.'

Conclusions

Strawberry cultivars with the largest primary berries tend to decrease in fruit size during the season to a greater extent than clones with smaller primary berries. Since high yields of large berries should be the strawberry breeder's objective, evaluation of primary fruit size alone is not an adequate selection procedure. The breeder must consider also the rapidity of size decline with later pickings. The selection of genetic material with the combination of large primary size and low percentage decrease "down" the inflorescence would result in high yields of large fruits. Some clones, such as 'Md-US 3082,' produce high yields of large fruit in spite of large

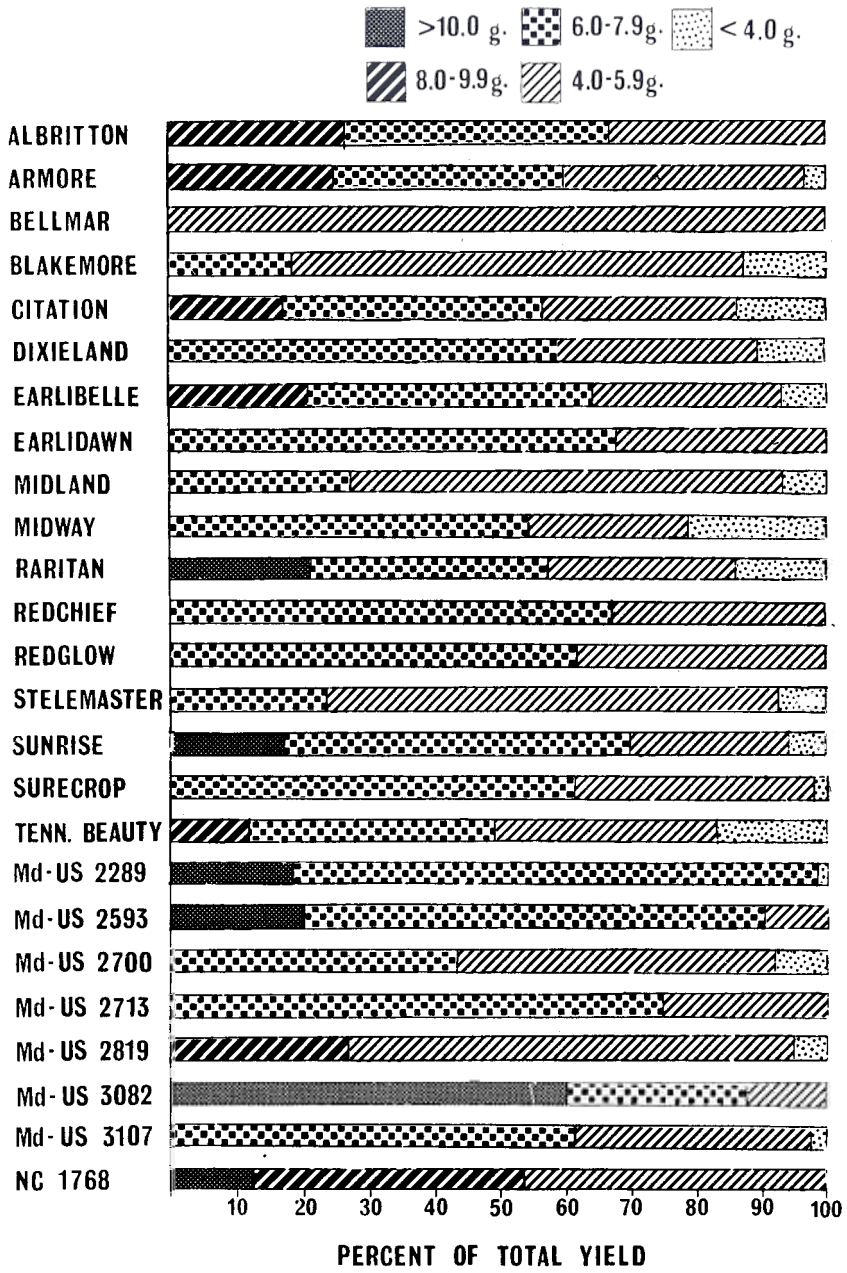

Fig. 1. Parentage of fruit in various size classes (mean berry weight) of 25 strawberry cultivars and selections at Fayetteville, Arkansas. (Means of 3 harvest seasons).

size decreases in late season pickings due to having extremely large fruit early in the season.

Yield evaluations of strawberry cultivars should consider production of the various size classes rather than total yield alone. In this study, for instance, the highest yielding cultivar, 'Tennessee Beauty,' did not produce the greatest amount of large fruit. Considering high yields of large fruit, the clones 'Md-US 3082,' 'NC 1768,' 'Md-US 2593,' 'Md-US 2289,' and 'Sunrise' appear to offer the most promise for use in breeding.

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Guardian, a New Root Rot Resistant Strawberry Variety[1]

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Guardian is a new strawberry variety notable for resistance to red stele (caused by *Phytophthora fragariae* Hickman) and verticillium wilt (caused by *Verticillium albo-atrum* Reinke & Berth.) root rots. The variety was originated in the cooperative strawberry breeding project of the Maryland Agricultural Experiment Station and the U.S. Department of Agriculture from a cross of NC 1768 × Surecrop made in 1958. The seedlings were grown at Salisbury, Md., in 1959, and selected as Md-US 3079 in the spring of 1960 by I. C. Haut and D. H. Scott. Guardian and Redchief originated from the same progeny (1).

Guardian ripens 4 to 5 days later than Redchief and Surecrop. Its berries are large with firm, glossy surfaces of uniform light red color (Tables 1, 3). The flesh is firm and has good flavor, but has a light red color that is not attractive in a frozen pack. The fresh berries retain an attractive appearance during harvesting and marketing. Primary berries have an irregular conic shape with a rather rough outline, but secondary and later berries are symmetrical and smooth with slight necks (Fig. 1).

Plants of Guardian are medium in size and produce runners so freely that it is a nurseryman's delight to propagate. The plants are highly resistant to red stele races A-1, A-2, A-4, and A-6 and intermediate in re-

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