Factors Affecting Selection Of Strawberry Varieties For Oklahoma

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Strawberry production in Oklahoma has fluctuated widely during the past twenty years. Station strawberry variety tests from 1936 through 1940 indicated that this fluctuation is due to a group of factors rather than to any single cause. The factors involved were further studied in an experimental planting made in 1942. This bulletin reports the results of the 1942 test, together with pertinent data from some of the earlier variety tests.

Varieties recommended by the Experiment Station for commercial and home growing are listed in Bulletin B-304, *Strawberry Culture and Varieties,* published in February, 1947.

The characteristics considered in the Station's tests of factors influencing varietal adaptation to Oklahoma conditions were: (1) Runner development; (2) frost injury to blossoms; (3) summer hardiness; (4) size of berry; (5) firmness of berry; and (6) flavor or quality.

Test plantings were made in either one-tenth acre plots or 110-foot rows, and were handled as a regular commercial enterprise.

RUNNER DEVELOPMENT

The first limiting factor in strawberry production is the number of plants established in the patch. Some varieties have the capacity of producing a large number of runners, others very few. Table I shows the range in number of runners per mother plant was from 33.4 to 3.5 in 1942. It might be assumed that the varieties at the top of the list would produce the highest yield. However, production is affected not only by the number of runners but also by how early in the

season runners become established (Figure 1). For example, Ambrosia produced only 10.8 runners per mother plant but 81.8 percent of the plants were producing runners by June 8 while only 27 percent of the plants of Dresden were producing runners at that date (Table I). The production in 1943 of these two varieties was 134.5 crates per acre for Ambrosia and only 28.8 for Dresden.

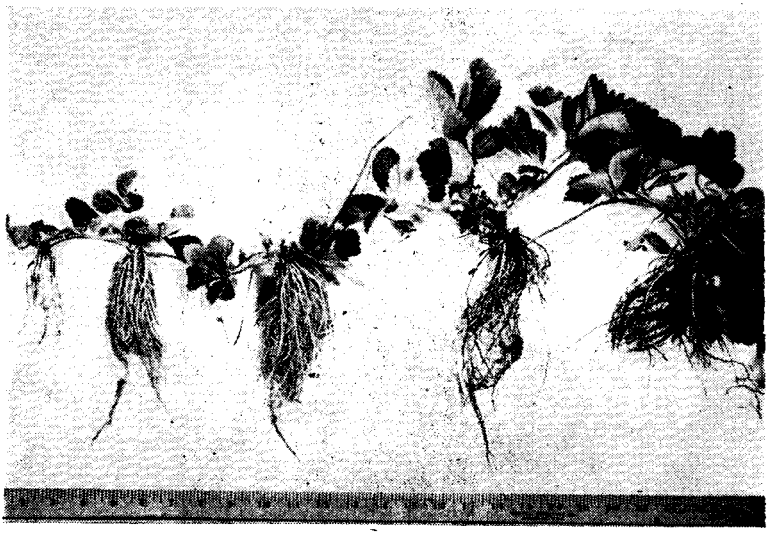

Fig. 1. Mother Plant (Right) With Runner Plants Attached.

The youngest plant (left), developed late in the season, will produce few if any berries. In a heavy stand of plants, however, such plants compete with the older plants (center) for both moisture and nutrients.

The fact that runner development is a definite varietal characteristic is shown in Table II which gives the ratio of runner plants to mother plants for 20 varieties all planted the same day in adjacent rows. It is generally assumed that varieties which produce few runners are unable to product a profitable first-year crop of fruit. Table III tends to confirm this assumption. A late frost in the spring of 1943 followed by an extremely wet harvest season adversely affected the production of some varieties; nevertheless, the tendency for varieties which produce few runner plants to be low in production is apparent in Table III.

FROST INJURY TO BLOSSOMS

The second important limiting factor in strawberry production is frost injury. This is governed by the length of the flower stalk, amount of foliage protecting the blossoms, the stage of flower development, and the degree of cold. Varieties like Fairmore having long flower stalks, exposing a high percentage of the flowers, are subject to more frequent injury

Table I—Strawberry Runner Plant Development and Drying by High Temperatures; by Varieties (1942).

Variety	No. of plants set	Stand 10/5/42	Pct. of plants showing runner development 6/8/42	Total no. runners 10/5/42	No. runners set per mother plant 10/5/42	Pct. plant loss during 1943 season 10/29/43
Blakemore	36	36	94.4	1204	33.4	10
Cooper	36	34	79.4	1115	32.8	10
Fairmore	36	35	99.0	1090	31.1	25
Jewell	36	33	94.0	838	25.3	20
Ranger	36	30	96.6	757	25.2	5
Extra Late Giant	36	35	91.4	880	25.1	30
Cresco	36	34	73.5	830	24.4	40
Virginia	36	32	81.2	771	24.1	10
Massey	36	34	88.8	751	22.1	45
Maytime	36	22	84.0	464	22.1	30
Flame	36	32	76.4	647	20.2	15
Daybreak	36	20	91.6	365	18.9	50
Konvoy	27	23	73.9	426	18.5	5
Grand Champion	36	22	33.3	402	18.2	60
Jumbo	36	30	75.7	396	13.2	60
Aroma	36	34	88.6	429	12.6	15
Neet	36	29	31.4	347	11.9	50
Tenn. Supreme	47	41	88.3	470	11.4	30
Ambrosia	36	31	81.8	336	10.8	30
Dresden	36	33	27.2	330	10.0	10
Catskill	36	36	44.4	309	8.5	20
Chesapeake	36	32	71.8	242	7.5	30
Starbright	36	24	50.0	160	6.6	60
Pathfinder	18	15	26.6	96	6.4	10
Pathfinder	36	22	15.4	128	5.8	10
Sparkle	18	15	43.7	52	3.5	90
U. S. D. A. Selections.						
27-300	24	23	100.0	612	26.6	5
3320	21	20	95.0	483	24.1	5
3378	24	24	83.3	411	17.1	10
2839	17	11	72.7	170	15.4	10
2839-350	24	22	68.2	322	14.6	10
2827	24	20	90.0	278	13.9	50
2796A	24	13	73.3	167	12.8	15
Midland	19	11	27.2	75	6.8	5

*Table II—Strawberry Runner Plant Development in Adjacent Row Plots.**

Row No.	PLOT I		PLOT II	
	Variety	RP/MP**	Variety	RP/MP**
33	Ambrosia	10.8	Chesapeake	7.5
34	Flame	20.2	Extra Late Giant	25.1
35	Massey	22.1	Starbright	6.6
36	Catskill	8.5	Cooper	32.8
37	Cresco	24.4	Dresden	10.0
38	Jewell	25.3	Jumbo	13.2
39	Pathfinder	5.8	Virginia	24.1
40	Daybreak	18.9	Grand Champion	18.2
41	Maytime	21.1	Neet	11.9
42	Ranger	25.2	Blakemore	33.4

* All planted March 18, 1942.
** Number of rooted runner plants per surviving mother plant on October 5, 1942.

Table III—Strawberry Runner Plant Production, Yield and Loss of Plants.

Variety	Runner Plants Set per Mother Plant 1942	Yield in Crates per Acre		Percent of Plant Loss from High Tempera-tures 1943
		1943	1944	
Blakemore	33.4	106.8	155.8	10
Fairmore	31.1	22.0*	36.5*	20
Ranger	25.2	26.7	110.8	5
Maytime	22.1	43.4	56.2	30
Konvoy	18.5	101.5	135.6	5
USDA 2839	15.4	56.0	107.1	10
Ambrosia	10.8	134.5	47.5*	30
Aroma	9.1	60.7	20.6*	25
Catskill	8.5	81.9	69.4	20
Chesapeake	7.5	83.3	22.9*	30
Midland	6.8	67.6	91.3	5
Starbright	6.6	38.5	----	50
Pathfinder	5.8	41.6	17.7*	10
Sparkle (N. J. 312)	3.5	19.6	----	90

* Blossoms severely injured by late frost.

than varieties whose blossoms are more or less protected by foliage. The stage of flower development when frost occurs varies from season to season. In 1943 Blakemore blossoms had passed beyond the stage of acute susceptibility to injury when frost occurred April 20—that is, a high percentage of blossoms had set fruit by that date. Ambrosia had not reached full bloom stage at that time; and the blossoms, being borne on short flower stalks, escaped serious injury. In 1944 a severe freeze

(16° F.) on March 29 injured a high percentage of the primary blossoms of the early blossoming varieties. Secondary blossoms, however, escaped serious injury on early varieties, due to slow plant development. A later frost on April 19 caught the late varieties in full bloom. Although the temperature was not severe (32° F.) it was sufficient to injure a high percentage of blossoms of the late varieties such as Ambrosia and Aroma, while the early varieties such as Blakemore and Konvoy were well advanced in fruit development.

Table IV shows blossoming date of varieties adapted or considered promising for growing in Oklahoma, and dates of killing frosts. The seasonal variability of killing frosts may be noted in Table IV, and the comparative resistance of varieties may be noted by comparing Tables IV, V, and VI. It is not to be assumed, however, that killing frosts are alone responsible for light production.

Table IV—First Blossom and Frost Dates.

Variety	YEAR				
	1938	1939	1940	1943	1944
			Dates of First Bloom		
Ambrosia				4-12	4-15
Aroma	3-21	4-10	4-10	4-16	4-13
Blakemore	3-16	3-27	4-3	4-2	4-1
Catskill	3-21	4-15	4-10	4-7	4-8
Chesapeake	3-28	4-18	4-19	4-16	4-10
Fairmore				4-7	4-5
Klondike		4-3	4-3		
Konvoy				4-2	4-3
Maytime				4-2	4-1
Midland				4-7	4-3
Ranger				4-2	4-3
Red Star				4-25	4-20
Tenn. 263				4-7	4-3
Tenn. Shipper				4-7	4-1
Tenn. Supreme				4-7	4-1
U. S. D. 8 2839				4-7	4-1
Gem	3-28	4-14	4-19		
Mastodon	3-23	4-10	4-19		
			Dates of Killing Frosts*		
Killing Frosts	4- 2(26°)	4- 7(27°) 4-19(32°)	4-12(25°)	4-20(30°)	3-29(16°)** 4- 5(31°) 4-18(32°)

* Temperatures in degrees Fahrenheit shown in parentheses following dates.

** The severe freeze of 16° F. on March 29 was preceded by a week of mild weather. Serious injury was caused to many blossom buds just emerging from the crown.

Table V.—Production of Strawberry Varieties in Commercial and Single-Row Plots; Stillwater, Okla., 1938-39-40.

Variety	Yield of Marketable Berries (Crates per acre)			Number of Berries per quart*		
	1st crop 1938	2nd crop 1939	3rd crop 1940	1st crop 1938	2nd crop 1939	3rd crop 1940
Commercial Plots**						
Bellmar	132.5	128.7	35.7	92	115	175
Blakemore	162.8	134.9	50.2	94	125	150
Dorsett	32.8	49.9	15.7	85	94	100
Fairfax	72.0	56.4	18.8	86	92	110
Aroma	52.3	86.0	42.9	66	79	84
Single-Row Plots†						
Bellmar	126.3	76.0		92	115	
Blakemore	299.4	128.3		94	112	
Dorsett	48.9	75.3		85	125	
Fairfax	125.8	78.6		86	129	
Aroma	53.0	99.6		66	79	
Howard 17	87.5	61.3		94	111	
Klondike	55.4	105.5		133	132	
Big Joe	114.0	66.5		77	92	
Jupiter	134.6	118.0		83	121	
Chesapeake	97.0	85.3		67	83	
Sample	141.6	96.6		70	87	
Mastodon	86.0	50.3		85	92	
Progressive	35.2	7.0		123	146	

* Number of berries per quart calculated at 1.2 lbs. per quart.
** 1/10 acre.
† 110-foot rows, except Blakemore, which was 55-foot row.

SUMMER HARDINESS

The adaptation of a variety to Oklahoma conditions is determined to a large extent by its ability to withstand prolonged high temperatures without injury. In the spring of 1936 the variety trials were extended to include a total of 46 varieties. During the prolonged drought of July and August, with no irrigation facilities available, all plants of all varieties were killed except a few plants of Blakemore. The prolonged resistance of this variety marked it as the most summer hardy introduced up to that time.

The summer of 1943 furnished additional data on plant survival. During June, July and August, rainfall amounted to 1.10, 0.60 and 1.68 inches respectively. Water applied by overhead irrigation during the same period was June, 3.0 inches, July, 4 inches, August, 6 inches. The area was cultivated as soon as possible after each application of water. Maximum air tem-

Table VI—Strawberry Production by Varieties, Stillwater, Okla., 1943 and 1944.

Variety	1943		1944		Fruit Character		Possibility for growing in Oklahoma
	No. berries per qt.*	Yield in Crates per A.**	No. berries per qt.*	Yield in Crates per A.**	Quality	Texture	
Blakemore	103	106.9	99	155.8	Good	Firm	Good
Aroma	78	60.7	82	20.6	Fair	Medium	Good
Fairmore	99	22.0†	101	36 **	Excellent	Medium	Poor
Ambrosia	60	134.5	76	47.5	Fair	Medium	Fair
Chesapeake	85	83.3	80	22.9	Good	Medium	Good
Flame	117	116.4	108	84.4	Good	Soft	Poor
Extra Late Giant	91	56.2	100	78.4	Fair	Soft	Poor
Massey	79	81.9	70	33.6†	Good	Soft	Poor
Starbright	82	38.5	--	--	Excellent	Medium	Poor
Catskill	78	81.9	76	69.4	Good	Medium	Fair
Cooper	117	68.7	120	112.5	Fair	Soft	Poor
Cresco	93	56.2	74	61.8	Good	Soft	Poor
Dresden	96	28.4	71	39.0	Good	Soft	Poor
Jewell	101	108.8	114	108.3	Fair	Soft	Poor
Pathfinder	85	41.6	87	17.7†	Good	Soft	Poor
Virginia	98	50.0	96	62.1	Fair	Soft	Poor
Daybreak	--	--	96	21.2	Good	Medium	Poor
Maytime	104	43.4	96	56.2	Good	Medium	Promising
Ranger	114	26.7†	108	110.8	Good	Medium	Promising
Blakemore	101	68.7	98	190.4	Good	Firm	Good
USDA 2796A	75	67.7	114	58.8	Fair	Soft	Poor
2827	112	42.4	86	31.8	Fair	Soft	Poor
2839-350	113	82.8	85	88.1	Fair	Medium	Promising
Midland	109	67.6	80	91.3	Good	Medium	Promising
USDA 2839	114	38.6	94	126.1	Fair	Medium	Promising
F. va. 27	--	--	180	100.0	Fair	Soft	None
Tennessee Supreme (a)	108	102.2	114	90.0	Fair	Medium	Fair
USDA 3378	114	70.8	81	51.2	Fair	Soft	Poor
3320	101	29.3	93	162.7	Fair	Soft	Poor
Konvoy	104	101.5	97	135.6	Good	Medium	Promising
Tennessee Beauty	103	36.9	89	31.66	Poor	Medium	Poor
Tennessee Supreme (b)	96	50.0	115	62.0	Fair	Medium	Fair
Tennessee Shipper	103	46.7	102	40.4	Poor	Firm	Poor

* Calculated at 1.2 lbs. per qt.
** Yields of Blakemore and Aroma are averages of 1/10th acre plots replicated five times. All others are from single rows 110 feet long.
† Severe frost injury to blossoms.

peratures of 100° F. or above were recorded for 12 days during the last two weeks of July and 21 days during August. Twelve days during the period 105° F. or above was recorded, the maximum being 107° on July 22 and 23 and August 2 and 3. During this 12-day period runner development ceased entirely and both newly established runner plants and plants held over for second-year production were observed to be dying. By October 15, new runners were beginning to develop in some varieties, most noticeable in Blakemore, Konvoy and Ranger. Counts of dead and living plants were made October 29 to determine the degree of loss, no attempt being made to separate young plants from those which had fruited. These data are recorded in Table I.

Commercial growers have frequently reported the first-year crop of Aroma to be lighter than the second-year crop due to light runner development the first season and a full stand of plants being secured the second season. In normal seasons this generally holds true (Table V). However, seasons like 1943 prove disastrous to second-year crops with varieties which produce few runner plants and are also susceptible to injury from high temperatures, while the more hardy varieties may still be able to produce a good second-year crop even though they have suffered some injury. This tendency may be noted in Table III.

SIZE OF BERRY

Seasonal average of berry size in these studies ranged from 60 to 180 berries per quart (Tables V and VI). Most markets prefer a medium to large berry; therefore varieties which produce small berries or tend to decrease in size as the season advances are not desirable for either home or commercial production. Large fruited varieties such as Aroma (66-84), Ambrosia (60-72), and Chesapeake (67-85) tended to produce a high percentage of marketable fruit throughout the season. Some medium fruited varieties such as Blakemore (94-125), Konvoy (97-104), and Midland (80-100) held up to a fair percentage of marketable sized fruit as the season advanced, while other varieties such as Klondike (132-133) and Cooper (117-120) produced an increasing percentage of berries too small for marketing as the season advanced.

The grower can influence the size of berries to some extent by control of (1) moisture supply, maintained by mulching and irrigation, and (2) density of stand. Plants too thickly crowded in the matted row compete for both moisture and nutrients which affect the size of the fruit. Therefore, runners which develop after a good stand is established should be removed.

FIRMNESS

Some varieties under trial became too soft before attaining full color (Table VI). A good commercial variety must be sufficiently firm to withstand the handling, incident to picking, packing and shipping without serious bruising. Some high quality varieties may be too soft for long distance shipping, yet sufficiently firm for local markets or home use. The grower may exercise some control, in addition to selecting good varieties, by (1) removing fruit from the patch into a shaded, cool packing shed as soon as possible after being picked, (2) avoiding picking during the heat of the day and (3) avoiding overfertilization with nitrogen which may tend to produce too rank foliage growth. Rank foliage causes too much shade and lack of air circulation over the berries.

QUALITY OR FLAVOR

Flavor or quality of the varieties tested varied considerably (Table VI.) Some of the higher quality varieties like Fairmore and Starbright were low in production, some good producers like Ambrosia and Tennessee Supreme were only fair or low in quality, while Blakemore is not only good in quality but also leads in production. Other good quality varieties with above average production in these trials were Chesapeake, Konvoy and Midland. Midland has the highest quality for freezing of any variety tested.

CONCLUSION

It appears that a strawberry variety to be adapted to Oklahoma conditions should be resistant to climatic conditions of high temperature and low moisture and should have good shipping, freezing and dessert qualities. In tests up to this time, Blakemore has shown the most satisfactory combination of these characteristics. Of the other varieties tested, Ambrosia, Aroma, Chesapeake, and Midland show the most promise for commercial planting. These varieties require closer planting than Blakemore, however, to secure a good crop the first year after planting.

10/47—3,500