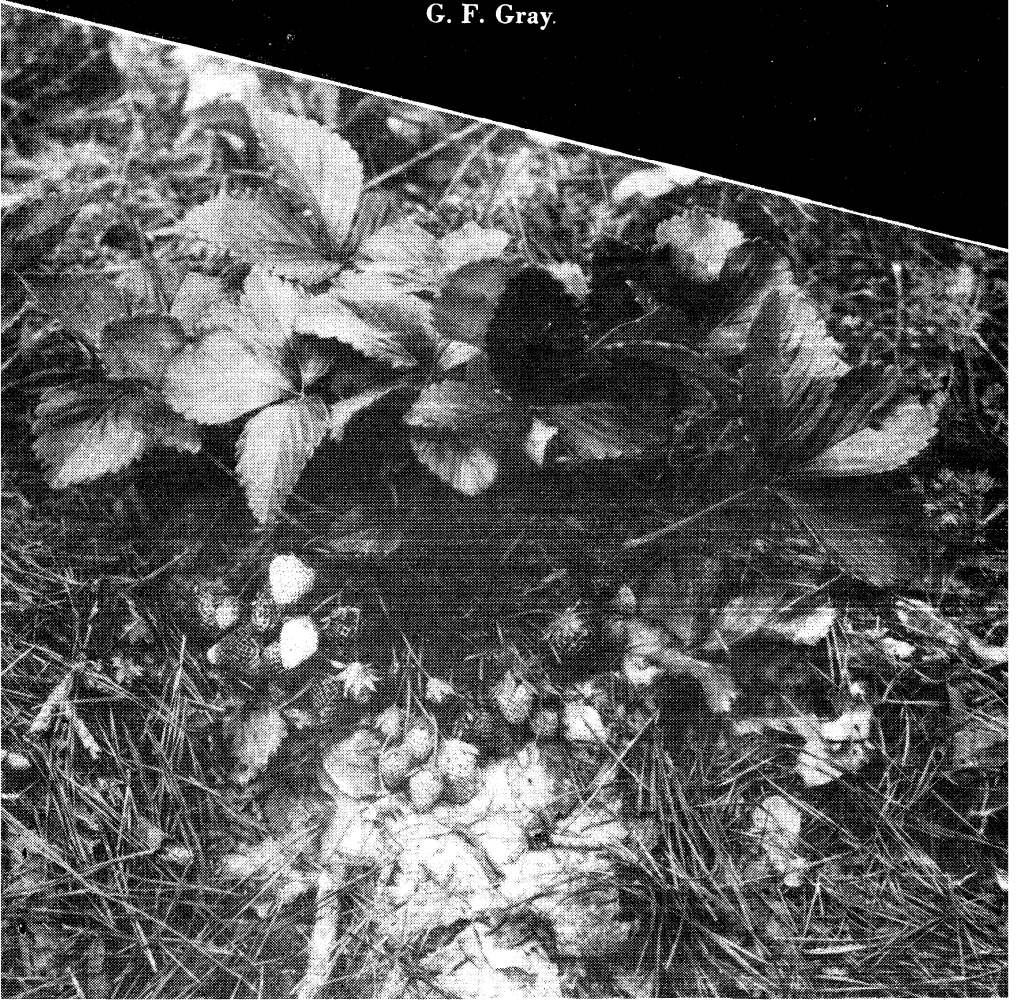


STRAWBERRY CULTURE AND VARIETIES

G. F. Gray.



OKLAHOMA AGRICULTURAL EXPERIMENT STATION
BULLETIN B-304

FEBRUARY, 1947

OKLAHOMA AGRICULTURAL EXPERIMENT STATION

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STRAWBERRY CULTURE AND VARIETIES

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The strawberry is one of the most attractive and highest quality fruits grown. In addition to its desirable flavor and attractive appearance, it has a higher Vitamin C content than any other cultivated fruit except black currants. It also far outranks all other fruits in the frozen pack industry.

Commercial strawberry production is confined largely to the eastern counties, but there are many other areas in the state where strawberries can be produced.

Strawberry varieties and cultural methods which succeed in states north and east of Oklahoma are not always satisfactory here. Therefore the Experiment Station for many years has conducted variety tests to find those best adapted to this state. More recently, various cultural methods have been compared to find those giving best results under Oklahoma conditions. This bulletin summarizes information derived from these tests and from observation of successful home and commercial plantings elsewhere in the state.

Production of strawberries in Oklahoma can be considerably increased by selection of adapted varieties and proper cultural methods. The State's 10 year average production 1936--45 was 52.4 crates, yet some areas report better than 125 crates per acre. (Figure 1.) Table II (page 15) shows how some varieties have yielded in Station tests.

SELECTING THE SITE

When strawberries are grown in the home garden, there may be little choice in location, but if a desirable spot can be selected it will add greatly to the success of the patch. In commercial plantings the selection of the site is very important.

The site should be higher than the surrounding area and have sufficient slope to provide good air drainage. Frost pockets should be avoided since strawberries bloom early and are frequently injured by late spring frosts in low, poorly drained areas.

COVER: Blakemore strawberries in full fruit. Picture courtesy of Dr. George M. Darrow, Senior Pomologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, USDA.

Strawberries succeed well on a wide range of soil types and may be grown on any soil adapted to general farm crops. In general they succeed best on a medium sandy loam. Heavier soils are usually more difficult to prepare and maintain in good condition. Soils that tend to bake and form a heavy crust after rains should be avoided. Very sandy soils as a rule are too low in fertility. Select soils that have good water drainage. Strawberry plants will not thrive in soils that are water-logged for any length of time.

Strawberries should never be planted on land that has been in sod the previous season. The white grubs always present in such areas will cause a heavy loss by eating off the roots beneath the crowns of the plants. Soils in nematode-infested areas should be tested the previous season by planting some highly susceptible crop.* The site should be selected one or two seasons in advance and planted to a well cultivated crop. Newly cleared land is frequently ideal but should be planted to a cultivated crop for at least one season before setting to strawberries.

Soils of medium fertility are desirable for strawberries. Too much nitrogen may prove harmful. In soils of low fertility a generous application of barnyard manure (10 to 15 tons per acre) may be turned under the fall previous to planting. Where manures are difficult to secure or likely to be contaminated with noxious weed seed, a green manure crop may be grown and turned under to advantage. The legume crops—vetch, beans, peas and Korean lespedeza—may be used for this purpose.

SOIL PREPARATION

The first important step in securing a good stand of plants is thorough preparation of the soil. As strawberry roots are very fibrous and reach to a depth of only ten or twelve inches, deep plowing is essential in most soils. The furrow slice should be well broken by disking. For spring planting and where the soil does not wash badly, fall plowing left rough is desirable. In any case plowing should precede planting time six to eight weeks.

* See Oklahoma Exp. Sta. Mimeo. Cir. M-44, "Root Knot."

Immediately prior to planting, best procedure involves through disking, harrowing with leveling harrow and compacting with soil pulverizer or cultipacker roller or plank drag. Work the soil into a firm, level seedbed. An uneven surface makes it difficult to set the plants at the proper depth.

SECURING AND CARING FOR PLANTS

Only the best young plants should be used for starting a new patch. The age of a plant can be determined by the length of the crown. Young plants seldom have a crown exceeding one-half to three-fourths inches in length, while the crown of old plants is usually more than an inch long with numerous old dead roots (see Figure 1). Old plants are slow in re-establishing themselves and generally fail to produce sufficient runners to make a good stand.

Plants should be secured from the nearest reliable nurseryman or plant grower. Unless the plants are properly packed, any delay in transit may cause heating or drying out, either of which will impair their quality. It is also desirable to order direct from the plant grower rather than from someone who handles plants. This avoids delay, rehandling, and possible injury from drying out. Direct shipment is especially important when large plantings are being made.

Few plant growers begin digging plants for fall shipment before October 1, and most growers do not begin fall shipments before November 1. For spring plantings order in the fall, specifying the approximate date the plants are to be shipped. This will avoid disappointment in not having the order filled as is often the case with late orders.

Upon arrival the plants should be examined immediately and if possible planted the same day. If the packing around the roots has dried out, it is advisable to immerse the roots (but not the crowns) in water several hours before planting. Plants can be held one or two days in a cool cellar without injury, provided the roots are kept moist (but not wet) and the tops well ventilated. If there is likely to be a longer delay in planting, the plant bundles should be opened and the plants spread out in a single layer in a trench, covering the roots with soil but leaving the tops exposed.

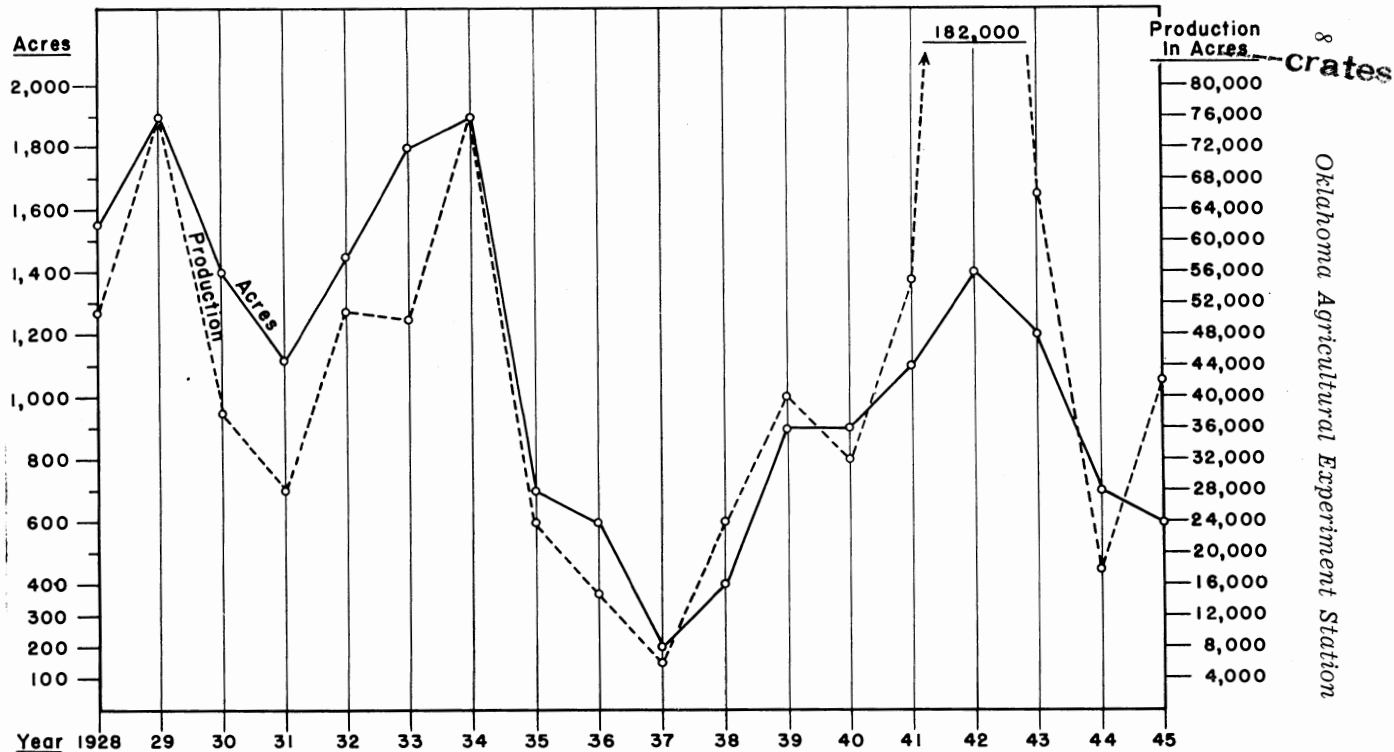


Fig. 1. Acreage and Production for Oklahoma 1928 to 1945, Inclusive.

The data were taken from Agriculture Statistics published by the U. S. Department of Agriculture. The comparative production scale is based on an average of 40 crates per acre. Thus it is seen that the state average yield per acre exceeded 40 crates in only six of the eighteen years for which figures were available.

TIME OF PLANTING

In the southern part of Oklahoma, strawberries may be planted throughout the fall and winter or early spring, whenever the soil is in good condition for working.

In the northern part of the state, fall plantings are satisfactory provided there is sufficient time to permit the plants to become re-established before the ground freezes. The principal advantages of fall planting are: (1) Availability of plants; (2) cool soil temperatures favorable for transplanting; (3) other farm work frequently is less pressing; and (4) well established plants begin growth earlier in the spring. The main disadvantages of fall planting are: (1) Weed control is generally more difficult than in spring planted patches; (2) there is danger of injury when ground freezes before plants become well established; and (3) mulching is necessary in the northern sections of the state for winter protection thus increasing the cost of establishing a good stand.

If plants are set out in the spring, every effort should be made to do it during February and before March 15.

METHOD OF PLANTING

Planting methods will vary with the acreage to be planted and type of soil. Very satisfactory results have been secured by large growers with a plant-setting machine. A common practice in some sections is to use a single-bitted ax for opening the holes for plants.

As a general rule best results will be secured by observing the following steps:

- (1) Trim the roots to approximately four inches in length;
- (2) Remove old and dead leaves;
- (3) Open hole by inserting spade or trowel vertically into the soil and pressing forward on handle.
- (4) Place plant into opening, making sure the crown is level with top of hole, spreading roots out fan shaped;
- (5) Remove spade and press soil firmly back against roots.

Regardless of the method used it is extremely important to have the crown set at the proper depth (Figure 2). If the crown is deep enough to become covered with soil, the young plant will be smothered before growth begins. If the plant is set too shallow, the base of the crown will dry out, retarding or completely preventing new root development.

Marking Rows

Where the ground is fairly level, straight rows are satisfactory. Under these conditions it is also possible to cross mark, indicating the location of each plant. By check marking in this way it is possible to cultivate in both directions before runners begin to develop, thus reducing the amount of hand hoeing necessary to control weeds.

On sloping areas, planting on the contour is preferable (Figure 3). This reduces erosion and conserves moisture.

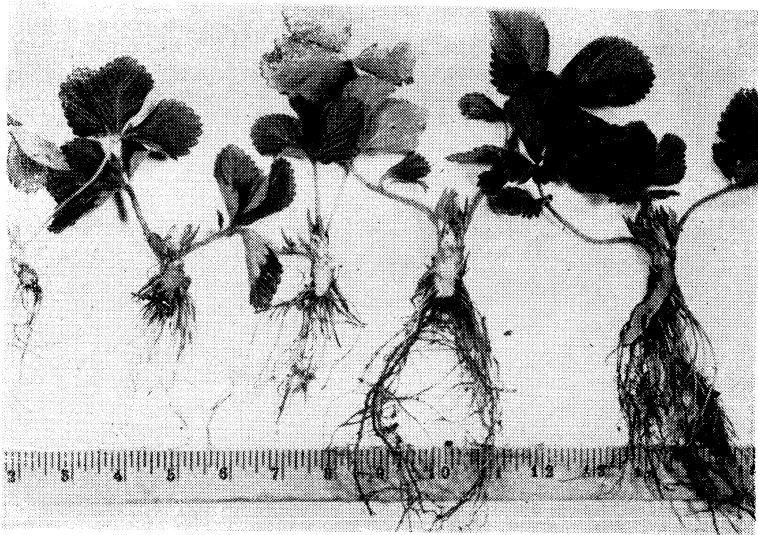


Fig. 2. Young and Old Plants Showing Length of Crown.

Reading from left to right, plants 1 and 2 developed late in the season and are so small they will be slow in developing new runners; plants 3 and 4 are vigorous plants that will produce new runners early in the season. The old mother plant on the extreme right is not suitable for transplanting as this type of plant is slow in becoming re-established and produces few runners.

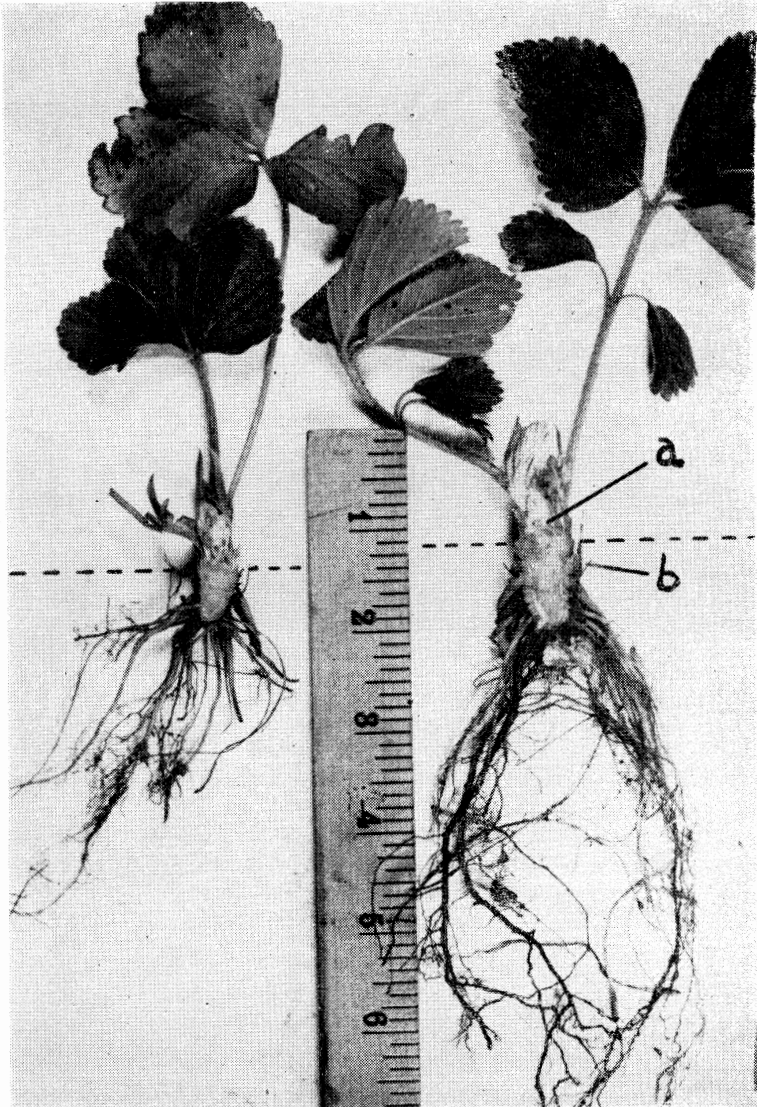


Fig. 3. Proper Depth of Setting Plants.

The proper depth to set plants is shown by dotted line. The growing point (a) must not be covered with soil. New roots arise from the upper part of the crown (b), therefore this should be covered with soil

Planting Distance

Planting distance will vary with the fertility of the soil, method of cultivation and variety. Spacing between rows should be 3½ to 4 feet, and 20 to 36 inches between plants. A commercial planting of Blakemore variety in Wagoner county set 4 x 4 feet with a plant setter in 1939 produced over 150 crates per acre in 1940.

SELECTION OF VARIETIES

Production of strawberries is determined to a large extent by the selection of adapted varieties. Most varieties of strawberries are very limited in geographical range of adaptation. For this reason the Oklahoma Agricultural Experiment Station has been conducting trials to determine what varieties are best adapted to Oklahoma climatic conditions.

As a result of these studies it has been found that many varieties having exceptionally high quality and yield in some other sections are not well adapted in Oklahoma. The reverse also holds true. Descriptions found in northern and eastern nursery catalogs cannot be relied upon in Oklahoma. This does not mean, however, that these same nurseries do not list varieties that are adapted to Oklahoma. For example, variety lists of five leading strawberry plant nurseries in 1944 offered from 13 to 29 varieties each. Among these, three to five varieties in each list were those which Station tests had shown were good or promising for Oklahoma (see Table I).

Factors Affecting Varietal Adaptation

In determining the suitability of a variety for growing in Oklahoma, several factors are important. They include:

(1) *Runner Development*.—A good variety should produce a large number of runner plants early enough to become established by midsummer. Runner plants established early will develop a large crown and produce more berries than runner plants which become established in the fall (see Figure 4).

(2) *Frost Injury to Blossoms*.—Varieties like Fairmore, having long flower stalks, expose a high percentage of the flowers and therefore are subject to more frequent injury than varieties like Blakemore, whose blossoms are more or less protected by foliage.

TABLE I.—Strawberry Variety Adaptability; Oklahoma.

The following varieties have been under trial for two or more seasons between 1937 and 1944. The possibilities of growing these varieties for either home gardens or commercial use are indicated as follows:

0—not suited; †—fair or promising; ††—good; †††—very good.

Variety	Home	Com- mer- cial	Variety	Home	Com- mer- cial
Aberdeen	0	0	New York	0	0
Ambrosia	††	†	N. J. 311 (Crimson Glow)	0	0
Aroma	††	††	N. J. 312 (Sparkle)	0	0
Beauty	0	0	341	0	0
Beaver	0	0	347 (Redwing)	0	0
Bellmar	†	0	364, 953	0	0
Belt	0	0	North Star	0	0
Big Joe	†	0	Pathfinder	0	0
Big Late	0	0	Pearl	0	0
Blakemore†			Ranger	††	†
Original strain	0	0	Red Heart	0	0
Yellow free strains	†††	†††	Red Star	0	0
Catskill	†	†	Sample	†	0
Champion K	0	0	Senator Dunlap	0	0
Chesapeake	†	†	Southland	0	0
Chermont	0	0	Starbright	0	0
Cooper	0	0	Tennessee Beauty	†	0
Cresco	0	0	Tennessee Shipper	0	†
Culver	0	0	Tennessee Supreme	†	†
Daybreak	0	0	Town King	0	0
Dorsett	0	0	Townsend's Big Late	0	0
Dresden	0	0	USDA selections		
Evening Star	0	0	321	0	0
Extra Late Giant	0	0	2183	0	0
Fairfax	†	0	1021	0	0
Fairmore	†	0	1557	0	0
Flame	0	0	1812 (Midland)	†	0
Ford	0	0	2796A	0	0
Gibson	0	0	2827	0	0
Grand Champion	0	0	2839	†	†
Haverland	0	0	3378	0	0
Howard 17	0	0	3320	0	0
Howard Supreme	0	0	F.v.a.-27	0	0
Jewel	0	0	Virginia	0	0
Jumbo	0	0	F. virginiana sp.	0	0
Jupiter	0	0	Worlds Wonder	0	0
Klondike	†	†	Xtra Late	0	0
Konvoy	††	††	Everbearing Varieties		
Lupton	0	0	Champion	0	0
Massey	0	0	Gem	†	0
Maytime	††	†	Mastodon	†	0
Nancy Lee	0	0	Progressive	0	0
Narcissa	0	0	Rockhill	0	0
Neet	0	0	(Wayzata)		



Fig. 4. Contour Planting

On sloping fields, contour planting conserves moisture and reduces erosion.

(3) *Summer Hardiness.*—Varieties that have shown considerable resistance to high summer temperatures are recommended for planting in Oklahoma. Blakemore is the leading variety in this respect.

(4) *Size of Berry.*—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. The grower can influence the size of berries to some extent by control of moisture supply and density of stand. Moisture can be maintained by mulching and irrigation. Too dense a stand can be avoided by removing runners which develop after a good stand is established. Plants too thickly crowded in the matted row compete for both moisture and nutrients, thus producing smaller berries.

(5) *Firmness.*—Some varieties under trial become soft before attaining full color. A good commercial variety must be sufficiently firm to withstand without serious bruising the handling incident to picking, packing, and shipping. Some high quality varieties may be too soft for long distance shipping, yet sufficiently firm for local markets or home use.

TABLE II.—Comparison of Strawberry Varieties Grown at Stillwater, 1943 and 1944.

Variety	1943		1944		Fruit Character	
	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
Aroma†	78	60.7	82	20.6	Fair	Medium
Fairmore	99	22. **	101	36. **	Excellent	Medium
Ambrosia	60	134.5	76	47.5	Fair	Medium
Chesapeake	85	83.3	80	22.9	Good	Medium
Flame	117	116.4	108	84.4	Good	Soft
Ex Late Giant	91	56.2	100	78.4	Fair	Soft
Massey	79	81.9	70	33.6**	Good	Soft
Starbright	82	38.5	—	—	Excellent	Medium
Catskill	78	81.9	76	69.4	Good	Medium
Cooper	117	68.7	120	112.5	Fair	Soft
Cresco	93	56.2	74	61.8	Good	Soft
Dresden	96	28.4	71	39.	Good	Soft
Jewell	101	108.8	114	108.3	Fair	Soft
Pathfinder	85	41.6	87	17.7**	Good	Soft
Virginia	98	50.	96	62.1	Fair	Soft
Daybreak	—	—	96	21.2	Good	Medium
Maytime	104	43.4	96	56.2	Good	Medium
Ranger	114	26.7**	108	110.8	Good	Medium
Blakemore	101	68.7	98	190.4	Good	Firm
USDA 2796A	75	67.7	114	58.8	Fair	Soft
2827	112	42.4	86	31.8	Fair	Soft
2839-350	113	82.8	85	88.1	Fair	Medium
1812	109	67.6	80	91.3	Good	Medium
2839	114	38.6	94	126.1	Fair	Medium
F. va. 27	—	—	180	100.	Fair	Soft
Tennessee Supreme	—	—	—	—	—	—
(a)	108	102.2	114	90.	Fair	Medium
USDA 3378	114	70.8	81	51.2	Fair	Soft
3320	101	29.3	93	162.7	Fair	Soft
Konvoy	104	101.5	97	135.6	Good	Medium
Tennessee Beauty	103	36.9	89	31.66	Poor	Medium
Tennessee Supreme	—	—	—	—	—	—
(b)	96	50.0	115	62.	Fair	Medium
Tennessee Shipper	103	46.7	102	40.4	Poor	Firm

* Calculated at 1.2 lbs. per quart.

** Severe frost injury to blossoms.

† Average of 1/10 acre plots replicated five times. All others from single rows 110 feet long.

(6) *Flavor or Quality* of the varieties tested varied considerably (Table II). 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. Blakemore is not only good in quality but leads in production. The cover picture shows a Blakemore plant in full fruit.

Description of Varieties

(Table I indicates varieties suitable for Oklahoma, as shown in Station tests. Table II shows actual yields obtained in tests.)

AMBROSIA.—A very late blooming, late maturing variety that frequently escapes injury from late frosts. Plants are medium in vigor, fairly drought resistant. Fruit similar to Aroma in size and shape, somewhat lighter in color. Although not a very good shipper, its productiveness, appearance and season of maturity make it a promising variety for home and local markets.

AROMA.—This variety has had a prominent place for many years as a dependable late variety. It is attractive in appearance, a good shipper, but only fair in quality. It has a tendency to produce a small number of runners the first season but this weakness can easily be overcome by spacing the plants 18 to 24 inches apart in the row at planting time.

BELLMAR.—This variety originated from the same cross as Blakemore and was introduced in 1931. It is very similar to Blakemore in plant characters, hardiness and shape of berry. The berry is dark red in color but tends to color more quickly on the side exposed to the sun. This character and a soft flesh make it objectionable as a commercial berry. However the dark color and high quality make it a good variety for home or local market.

BLAKEMORE.—This variety, a Missionary x Howard 17 cross, was introduced in 1929 by the U. S. Department of Agriculture. It has rapidly advanced in importance and at present is the leading commercial early variety. General acceptance was retarded at first by the presence of leaf yellows in the original strain. The discovery of a yellows free strain in

Tennessee stimulated increased plantings, and plants of this "yellows free" strain are now available from most of the leading nurseries. The outstanding qualities that have contributed to the popularity of this variety are its consistently high yields and resistance to adverse weather conditions. Runners are produced early and in abundance which permits wider spacing in the row (3 to 3½ feet). The foliage is highly resistant to leaf spot and leaf scorch, two of the worst strawberry diseases. The fruit is medium in size, regular in shape and light red in color. It is too acid to be considered a high quality dessert berry but has superior quality for preserving and good quality for freezing. It far outranks in production and summer hardiness any variety yet tested in Oklahoma. The plant pictured on the cover is of the Blakemore variety.

CATSKILL.—A Marshall x Howard 17 cross, introduced in 1933 by the New York Agricultural Experiment Station at Geneva. The plants are only moderate in vigor and should be spaced 18 to 24 inches in the row to secure a good stand, but are fairly hardy. This fruit is large, dark red, and of good quality. Although not firm enough for long distance shipping, the Catskill is a good berry for home and local markets in the northern part of Oklahoma.

CHESAPEAKE.—This is an old variety, introduced in 1904. The plants are vigorous but do not multiply rapidly, therefore should be set close in the row (18 to 20 inches). It blooms late, thus usually escaping late frost. The fruit is large, regular, very attractive and of good quality, rippening a few days earlier than Aroma.

FAIRFAX.—This variety, of unknown origin, was introduced in 1932. The berries are from medium to large in size, firm, very dark red in color, and very high in quality. The plants have heavy, dark green foliage, produce few runners, and are very susceptible to injury from high summer temperatures. It is not recommended for commercial plantings but is suited for limited planting for home gardens in the northern sections of Oklahoma.

FAIRMORE.—A Fairfax x Blakemore cross, introduced by the U. S. Department of Agriculture. It has quality almost equal to the Fairfax and plant growth habits similar to the

Blakemore. The fruit averages about the same size and shape as Blakemore but is much darker in color and richer in flavor. The principal weakness of the variety is the long flower stalks which expose a high percentage of the blossoms to injury from late frosts. However, due to its high quality and plant vigor, it is recommended for home garden plantings.

JUPITER.—A vigorous plant producer similar to Klondike in plant characters. The fruit is conical in shape, medium to small in size, dark red throughout, good in quality but very soft. Although it was one of the highest producers under trial it is too soft for commercial planting, but its quality and production make it a suitable home garden variety.

KLONDIKE.—This variety held first place for a number of years as an early southern commercial berry but is rapidly being replaced by Blakemore. Due to its dark color and rich flavor it is still favored by many. The plants are vigorous and produce runners in abundance; thus most beds become too thickly crowded, and this is largely responsible for the small size of the fruit.

KONVOY.—A Klondike x Fairmore cross introduced in 1943 by the Louisiana Experiment Station. This variety has shown remarkable plant vigor and summer hardiness. The fruit is medium in size, slightly more conical than Klondike, and dark red in color throughout. The flesh is not as firm as Blakemore but due to its vigor, quality and production is being recommended for home garden plantings and for limited trial as a commercial berry for local markets.

MAYTIME.—A Missionary x Fairfax cross, introduced by the U. S. Department of Agriculture. It has fruited two seasons at Stillwater and compared with Blakemore it has been three or four days earlier, much sweeter in flavor, deeper red in color, but not quite as firm nor as frost hardy. It is a good plant maker and fairly summer hardy. Its earliness, good quality and fair production during two seasons of heavy frost damage warrant its recommendation for limited trial as a home garden and commercial variety.

MIDLAND.—A new introduction from the U. S. Department of Agriculture sent to the Oklahoma Station for trial as No. 1812. It is a cross of Howard 17 x Redheart. Under trial at

Stillwater it was a shy producer of runner plants but was very summer hardy. The fruits are medium to large, regular in shape, bright red in color throughout, and of good quality. It is too soft for a good shipping berry but suitable for home use or local markets and excellent in quality for freezing. Production per plant is high but due to the few runner plants produced it should be set close in the row (18 to 20 inches) for best production.

RANGER.—A comparatively new variety. It is a vigorous plant maker and very summer hardy. Although the fruits are too soft for commercial production, its high quality and good production make it a promising variety for home use and local markets.

SAMPLE.—An old variety introduced in 1894 as a seedling of Leader. The blossoms are imperfect and the fruit is soft, which make it undesirable for commercial plantings. However, it is productive, fruit medium in size and of good quality, making it suitable for planting with other varieties in home gardens.

EVERBEARING VARIETIES.—The so-called everbearing or fall bearing varieties are not recommended for general planting in Oklahoma. They generally produce a lighter spring crop and are not dependable fall producers. Fall production is dependent upon cool temperatures during late summer. These conditions occasionally occur in the northeastern part of the state and a fair fall crop is produced in such years. The two most dependable varieties for the northeastern section of the state are Gem and Mastodon.

CARE AFTER PLANTING

After the plants are set, the blossoms should be kept clipped off to encourage earlier runner development (Figure 5). Frequent and shallow cultivation to control weeds is important. If the plants are set in check rows it is possible to cultivate in both directions—that is, with and across the row—until runners begin to develop. Cultivation as close to the row as possible serves a two-fold purpose. It reduces hand hoeing, and it establishes the early runners in the center of the row. When hand hoeing is necessary there is one common practice that should be guarded against, that is, do not scrape the weeds

away leaving a smooth hard surface (as is customary in hoeing cotton). Rather, loosen the surface of the soil between the plants to enable the runners to strike root more readily.

SYSTEMS OF TRAINING

Matted Row

The matted row is the popular system of growing strawberries in commercial producing areas of the state. This system permits the runner plants to root at will until a solid row of plants 12 to 14 inches wide has developed. Even distribution of runners can be encouraged by cultivating in the same direction along the row each time. This practice also lessens the danger of uprooting newly rooted plants.

Spaced Row

A more even stand of plants can be secured by spacing the new runner plants in the row approximately 6 inches apart until a row approximately 12 inches wide is completely filled with plants. After the stand is complete, all subsequent run-

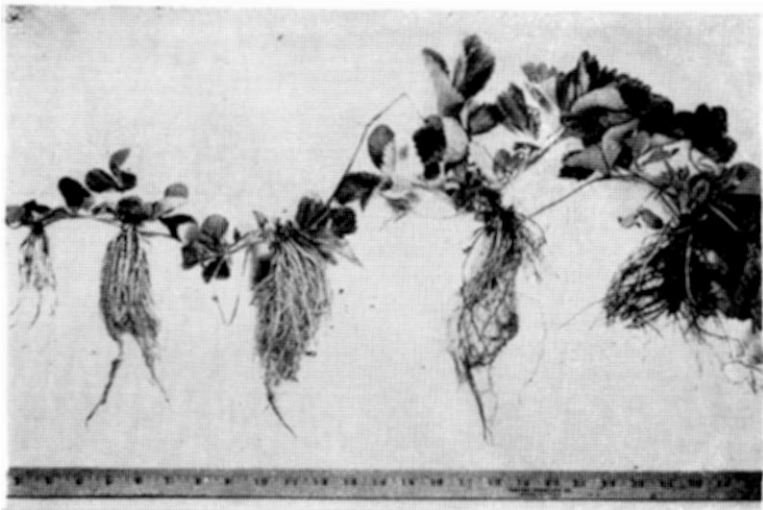


Fig. 5. Mother Plant (right) With Runner Plants Attached.

The youngest plant (left) is too small for transplanting and in a fruiting patch will produce few if any berries.

ners should be cut off. This method, although requiring more hand work, will pay dividends in greater yields of larger berries. This is due to the fact that both total production per plant and size of berry are influenced by the size of the crown. Competition in too thickly crowded matted rows results in smaller plants with fewer blossoms, and greater competition at harvest time results in smaller sized berries.

Hill System

The hill system is not advocated except for home gardens or small areas. Some varieties which produce few runner plants, such as Starbright and Midland, are adapted to this system. By planting in hills 12 to 14 inches apart it is possible to cultivate each way or mulch heavily to control weeds and conserve moisture.

IRRIGATION

Perhaps the most important cause of low strawberry yields in Oklahoma is lack of moisture. The effect of inadequate moisture is reflected in the decline of the total acreage in the state during the drought cycle of 1933 to 1938, as shown in Figure 6.

A new variety planting at Stillwater was completely killed during the summer of 1936 due to dry weather. An irrigation system was installed following the replanting of the area in 1937. The yield of Blakemore at Stillwater in crates per acre for 1938 and 1939 was 163 and 135 respectively, while the average for the state (including all varieties) was 60 and 44 crates per acre respectively.

Favorable growing seasons are reflected in increased yield per acre in commercial plantings. The favorable growing season of 1941 resulted in the highest average production on record, 130 crates per acre, in 1942. Conversely during the severe drought period of July and August 1943 many strawberry patches were killed out completely or so severely damaged they were unproductive, resulting in a reduction in harvested acreage and low yield per acre in 1944. The state average in 1944 was 25 crates per acre (Figure 6), while Blakemore in irrigated plots at Stillwater produced 155 crates per acre.



Fig. 6. Well Set Plant Showing Blossom Development.

These blossoms should be removed as they appear. This can be done most rapidly by clipping off the flower stalk with a pair of old scissors, thus removing the entire cluster in one operation. If allowed to remain they reduce the vigor of the young plant and retard runner formation.

The variety trial plots during this same period received sufficient water to maintain a fair moisture supply, although not enough for best plant growth as shown by the serious loss suffered by many varieties, yet several varieties produced over 100 crates per acre in 1944. Blakemore produced 155.8 crates; Konvoy, 135.6; U. S. D. A. 2839, 126.1; and Ranger, 110.8. An irrigated commercial planting of 2.5 acres located near Stillwater was equally productive in 1944.

In addition to securing and maintaining a good stand of plants irrigation is frequently advantageous during harvest. Prolonged dry weather during this period is reflected in small size berries which can be avoided by timely irrigation.

It seems entirely possible, therefore, for many growers to increase profits from strawberry plantings by installing irrigation systems.

MULCHING

Advantages of Mulching

Mulching is not generally practiced in commercial plantings, yet it does have several decided advantages. Growers who have mulched have profited from increased yields.

The principal advantages derived from mulching in Oklahoma are:

(1) *Clean Berries.* By protecting the berries from being coated with soil particles during rains and keeping them off the ground, the appearance and quality of the fruit is improved.

(2) *Moisture Conservation.*—Mulched patches do not suffer from dry weather during the harvest season as quickly as unmulched patches, therefore larger fruits and greater total yields are secured.

(3) *Weed Control.*—Adequate mulch retards weed growth, thus reducing competition for food supply as well as moisture.

(4) *Prevention of Winter Injury.* Unprotected strawberry crowns are subject to injury at temperatures lower than 5 degrees Fahrenheit. The blossoms for the spring crop are formed within the crown the preceding fall, and injury to the crown during the winter will reduce the number of blossoms and fruit the following spring.

Mulching Materials and Methods

A good mulching material is one which is free of weed seed, does not pack and is relatively easy to apply and remove. Cotton burrs are a good mulching material (Figure 7). The burrs may be spread over the row $1\frac{1}{2}$ to 2 inches deep.

In the northern part of the state the mulch should be applied between December 1 and 15. In the southern part of the state where winter injury is not likely to occur, application may be delayed until later. When a bed is mulched after mid-December, only enough burrs should be applied over the row to control weeds between the plants and to keep the berries clean. The covering over the plants should be thin enough to permit foliage and blossoms to grow through, but thick enough between the rows (at least 2 inches) to control weeds and conserve moisture.

After harvest the burrs can be worked into the soil without difficulty, thus improving the texture of the soil.

Clean, old wheat, oat, or other small-grain straw is an ideal mulching material. Prairie hay is also satisfactory. Fine, chaffy straw is not desirable. When straw or hay is used as a winter mulch it should be two to three inches deep after settling. In the spring most of the mulch should be raked off of the rows into the middle (Figure 8) leaving a thin layer through which the plants may grow, thus providing sufficient protection to keep the berries clean and conserve moisture. The cover picture shows a plant with sufficient mulch to keep the berries clean.

Such materials as corn stalks and sudan hay are too coarse, and tree leaves tend to become too compact. They should not be used.



Fig. 7. Cotton Burr Mulch.

Cotton burrs used as a mulch are applied about two inches deep over the rows. Mulches should be applied in December where necessary for winter protection.

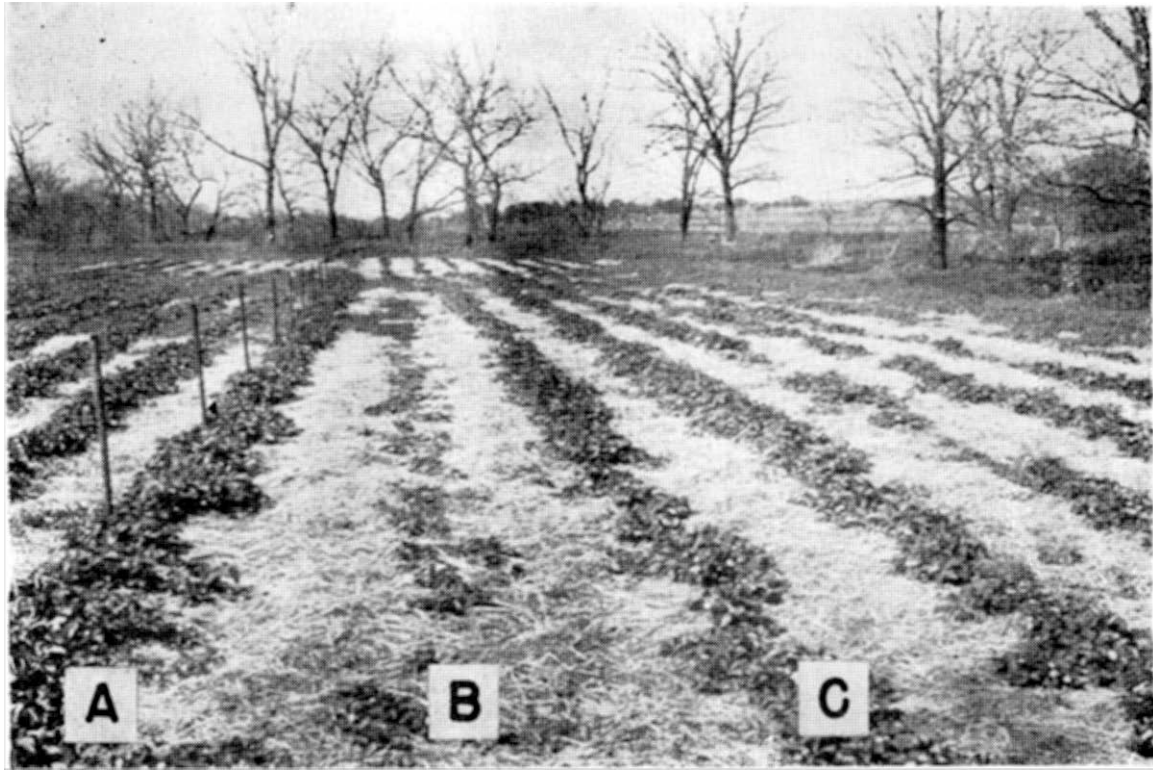


Fig. 8. Straw Mulch After Removal in Early Spring.
Note the slow growth of Aroma (b) in the spring as compared with Bellmar (a) and Blakemore (c).

HARVESTING

The most exacting phase of strawberry growing is proper and timely harvesting. Berries harvested before fully ripe are low in quality, while overripe berries are generally too soft to reach even nearby or local markets in good condition.

Proper instruction and supervision of picking crews is extremely important. Pickers should be carefully instructed as to the degree of color, denoting proper maturity, that should be observed. This will depend on the market destination of the berries. Variations in color between varieties must be considered.

Pickers should be cautioned against picking by taking hold of the fruit. Strawberries should be picked by grasping and pinching off the stem as close to the berry as possible. Long stems are objectionable.

For general market, and where the berries are fairly uniform in size, grading should be done by the pickers. This will avoid extra handling at the packing shed. The more strawberries are handled and bruised the lower will be their quality when they reach the consumer.

During periods of high temperature and intense sunshine, sufficient numbers of pickers should be on hand to complete the day's harvest by noon. Fruit picked during the heat of the day softens more rapidly than that picked at lower temperatures. Regardless of the time of picking, the filled carriers should be removed from the field to a shaded packing shed as soon as possible and packed in crates for market.

RENEWAL AFTER HARVEST

When the patch is being retained for another crop, renewal operations should begin immediately after harvest. If there is a very heavy weed growth the desirability of renewal may be questionable.

The purpose of renewal is to restore the patch to an active vegetative condition to build up vigorous crowns for next year's crop, therefore any operation must be directed toward that end. Most varieties are developing vigorous runners at harvest time,

and "mowing off" the patch, as advocated by some, will give the plants a serious set-back. Mowing removes the leaves and allows more rapid drying out of the soil around the crowns.

When straw or similar coarse material has been used as a mulch it should be raked off. Cotton burrs may be left and worked into the soil.

Better results generally will be secured if the rows are narrowed to 8 or 10 inches in width. This may be done with a light turning plow, or with a cultivator with a disc attachment or coulter disc to regulate width of the row. In a few days the patch should be cultivated again to destroy the remaining grass and weeds and work the soil back to the row. Plants in the row may be thinned slightly by harrowing across the row with a spike-toothed harrow or by hand hoeing. This will permit ample time and space for the re-establishment of new runner plants.

Subsequent care should be similar to that given the first season after planting, with greater attention to establishment of new runner plants to prevent too thick a stand. The so-called "running-out" of a strawberry patch is due primarily to the plants becoming too crowded.

The number of years a patch can be renewed without replanting will be determined by how well the weed control program is carried out. Generally, two or three crops is the customary practice; but at least one patch in Oklahoma (near Keystone), bore six successive crops without replanting.

CROP ROTATION

On many farms there are very few desirable sites for strawberries, especially when availability of water for irrigation is considered. Once a good site is developed it can be maintained by crop rotation. The site may be divided into three parts so that two thirds of it can be kept in production most of the time while the other third is being improved with soil building crops.

When one section is to be abandoned it is treated with a heavy application of barnyard manure (10 to 12 tons per acre) and turned under. As soon as possible the area should be

seeded to a cover crop, preferably one of the legumes such as cowpeas or Korean lespedeza. By turning this cover crop under in the fall the area is in excellent condition for replanting with the loss of only one year.

On poorer soils a two-year improvement program would be more desirable. Proceed as above, seed to vetch in the fall, and follow with a summer legume cover crop the next summer.

DISEASES AND INSECTS

Diseases and insects have not been a limiting factor in strawberry production in Oklahoma the past few years. The damage from leaf spot and scorch has been serious in the past, but the more productive varieties and those recommended are comparatively resistant to these diseases. Red-stele root rot has broken out at several places in Oklahoma, but care in selecting plants from reliable nurserymen has been effective in keeping this disease in check.

The white grub and crown borer have been troublesome in some fields allowed to stand more than three years, but they have not been serious in fields where strawberries have been planted following two or more years of cultivation.