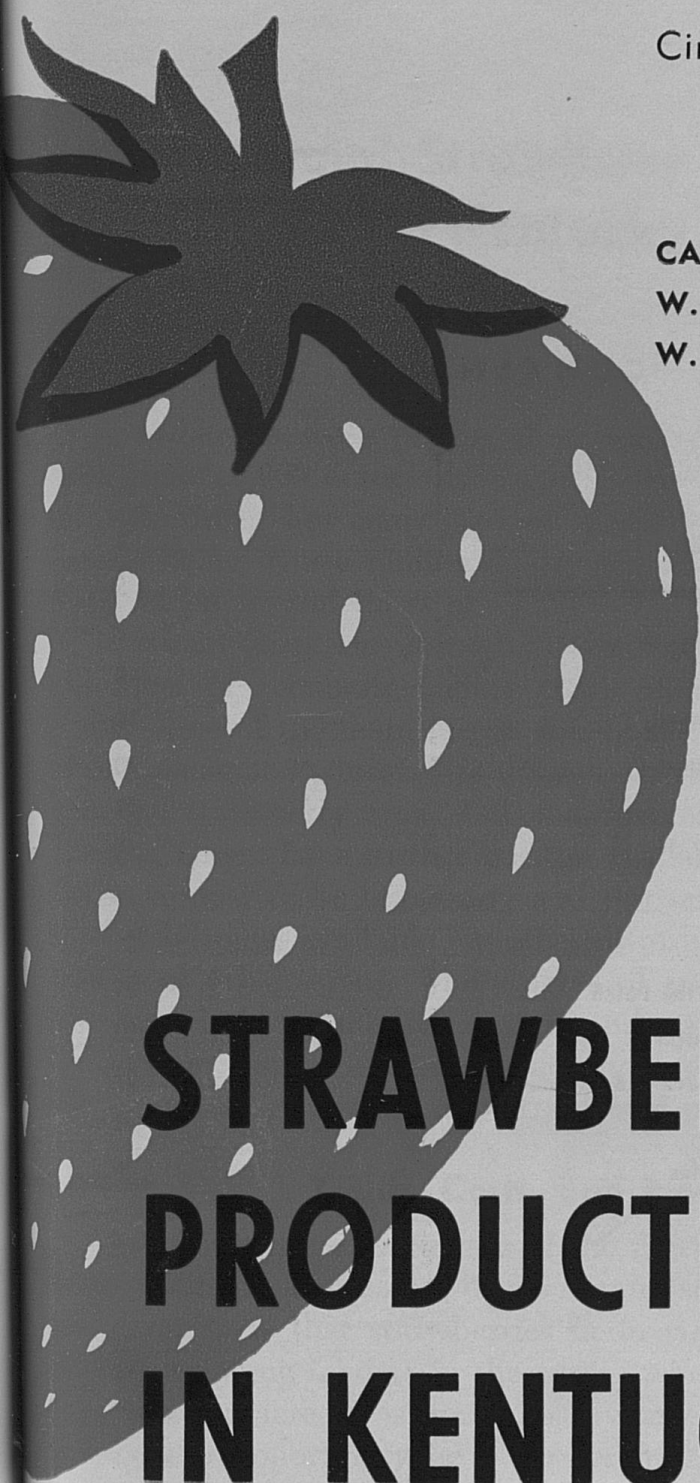


In
nd-
ela-
etail
ood

Circular 524

CARL CHAPLIN
W. W. MAGILL
W. D. ARMSTRONG



STRAWBERRY PRODUCTION IN KENTUCKY

UNIVERSITY OF KENTUCKY
College of Agriculture and Home Economics
Extension Division

FRANK J. WELCH, Dean and Director

CONTENTS

	Page
Yields, Costs and Profits	3
Requirements for Commercial Production	5
Varieties	6
Soil Management	8
Importance of Good Plants	10
Care of Plants on Arrival	10
Planting	11
Post-planting Care	13
Caring for the Crop	17
Marketing	21
After-harvest Care of the Patch	21
Insects and their Control	23
Efficiency of Insecticides and Precautions	31
Strawberry Diseases	33
Everbearing Strawberries	36

Commercial Strawberry Production In Kentucky

By C. E. Chaplin, W. W. Magill, and W. D. Armstrong

Strawberries were produced in Kentucky in the 1930's on more than 10,000 acres, placing the state among the leaders in this enterprise. For many growers, it was very profitable, the net income being over a million dollars annually. At present prices, it would be several times as much.

In recent years, the acreage has declined considerably due to a number of economic factors rather than to any decrease in profits. One of the main factors has been the labor supply. The atomic plant at Paducah has drained the labor supply from the principal strawberry area. Other industries near Louisville and Bowling Green have further cut the available labor. These conditions appear to be temporary and the acreage should increase as labor becomes available. Another disturbing factor is the rapid growth of urban areas. Many acres of former strawberry land have been used for subdivisions and industrial plant sites. Again, the acreage should increase as new growers farther out realize the opportunities and go into strawberry production.

Yields, Costs, and Profits

Most farmers are not aware of the fact that strawberries can be as profitable as tobacco, or even more so. Another important consideration is that strawberries fit in well with tobacco production, bringing income in the spring when it is badly needed. Since tobacco acreage is limited, strawberry production presents an excellent opportunity for a farmer to grow another high income crop.

Labor requirements for strawberry production are not as high as for tobacco, according to a study made by the Agricultural Economics Department of the University of Kentucky in 1951 on 32 farms selected at random from 150 growers in Trimble county. Based on a typical grower's first year of production,

230 man hours per acre are required for strawberries when sold to an association, and 250 man hours when sold to the processor, as compared to 388 for tobacco. The second year of strawberry production requires 93 hours for association berries and 106 hours for processor berries, while the labor for tobacco remains about the same, since it is an annual crop. Returns to labor and management per hour of man labor, according to this study, were \$1.51 for tobacco, \$1.29 for first year association berries, and \$1.07 for first year processing berries. The returns the second year were \$1.52 for association berries and \$1.93 for processing berries. Thus, tobacco returns per hour of labor were higher the first year of strawberry production, while strawberry returns per hour of labor were higher the second year.

The above figures are based on an average of 1,723 pounds of tobacco and 134.7 crates of strawberries per acre. The tobacco average is good, due to the best practices being used. The strawberry average falls far short of being as high as it might have been had the best practices been followed. For example, this study shows that growers who produced on an average of 200-215 crates per acre used 2,000 pounds of phosphate and 1,000 pounds of complete fertilizer per acre, while those averaging 120-130 crates per acre applied only 800 pounds of phosphate and 400 pounds of complete fertilizer per acre. (This is not a recommendation, but merely points out that good practices pay.)

Total costs per acre are naturally higher as production goes up, but the cost per crate is considerably lower on high-producing patches than on low producing ones, since many of the costs are fixed. The study mentioned above shows that the total production costs on berries sold through the association were \$5.34 per crate at the 120-crate level, and \$4.71 per crate at the 200-crate level. The same relationship holds true for berries sold to the processors. This fact should stimulate growers to follow the very best recommended practices so that the maximum profit may be realized. Many of the most successful individual growers consistently produce 250 or more crates per acre. Inasmuch as many of the costs are the same on low producing patches as on higher ones, it pays to do a good job of producing.

Requirements for Commercial Production

There are several important requirements that must be met in commercial strawberry production if the enterprise is to be successful.

THE PROSPECTIVE GROWER must be the type of man who will pay attention to detail. He must be timely in all of his operations. Soil preparation, fertilizing, ordering plants, planting, weeding, de-blooming, picking, and many other operations must be performed correctly and at the *right time*. By neglecting any one of these essentials, the grower may drastically cut his profits.

MARKET OUTLETS must be adequate. Growing a good crop of berries is of no avail if there is no market for them. Fortunately, most of Kentucky is in a good marketing location. There are cooperatives in the commercial areas to handle the marketing of the crop for fresh consumption, and other cooperatives could be formed if a sufficient acreage were planted to support them.

Most parts of Kentucky are within easy trucking and rail distances of large centers of population so that market outlets are available. One-third of the nation's population lives within a 500-mile radius of the boundaries of Kentucky. Processors and local sales are also important markets. Processing markets are more important each year.

THE LABOR SUPPLY is another factor to consider. Obviously, no more berries should be planted than can be cared for and harvested with the labor supply available. Ordinarily, five to seven pickers per acre will be adequate.

A WIDE VARIETY OF SOILS may be used for strawberries, but they do best in a deep, sandy loam that is well supplied with organic matter. Other soil types may be quite satisfactory if they are handled correctly and meet other requirements. For instance, a clay soil may grow good crops if it is well drained and has organic matter added in the form of animal or green manures, or preferably, both.

THE SITE plays an important part in a successful strawberry enterprise. The plot should be on higher ground than the immediate surrounding area and have a slight slope of 2 to 4 percent, if spring frosts are a hazard. Thus water and air drainage

are provided. Cold air is like water, it flows down hill and collects in low places. Therefore, it is undesirable to have strawberries in a low place where frost may kill the fruit buds in the spring or injure the plants during the winter. Good water drainage is also very important. Strawberry roots will not tolerate water-soaked soil for a very long period. Also, wet soils are conducive to the spread of various diseases.

Varieties

The selection of varieties may largely determine the measure of success of the strawberry grower. He should select varieties that do well under his own particular soil and climatic conditions. Many varieties are regional in their adaptation and will do well in one section and not at all well in another.

The grower should also keep in mind the purpose for which the berries are intended. If they are to be shipped, as most Kentucky berries are, the fruit must be firm enough to withstand the rigors of transportation. It must also be attractive and of good quality. If the fruit is to be processed it must have a bright red color throughout, be firm enough to hold its shape, and have a pronounced strawberry flavor. Fruits for processing should be easy to cap and be red throughout.

For local sales, the fruit need not be so firm. It should have good size, attractive appearance, and be of good quality.

The varieties listed for Kentucky are all-purpose, and may be used for any of the above markets.

Until 10 to 20 years ago, Aroma was the principal variety grown in Kentucky; then Blakemore was tried and found to be much more productive and desirable. It has been the foremost variety since then. However, Tennessee Beauty has been rapidly overtaking Blakemore in popularity. The two varieties go well together since Blakemore is early and the Tennessee Beauty is a late midseason variety.

Premier has been planted for local sales, and Tennessee Shipper is producing very profitable crops for some growers. However, it is not as reliable nor adapted as widely as Blakemore and Tennessee Beauty.

Red stele, a root-rot disease, is becoming more prevalent, and resistant varieties are recommended where this disease is present. (See Table 1.)

Table 1.—Recommended Varieties of Strawberries

Variety	Season	Section	Productiveness	Plant-making	Firmness	Purpose
Blakemore ²	.....Early	All ¹	Very good	Very good	Firm	All
Tennessee Shipper ²	.....Early	All ¹	Good	Good	Very firm	All
Tennessee Beauty ²	.....Midseason	All ¹	Very good	Good	Firm	All
Premier	.....Midseason	All ¹	Very good	Good	Soft	All
Temple	.....Early to midseason	Red-stele infected	Medium	Very good	Medium	All
Sparkle ²	.....Midseason	Red-stele infected	Medium	Medium	Medium	All
Vermillion ²	.....Midseason	Red-stele infected	Very good	Good	Soft	Local
Varieties for Trial						
Armore	.....Late	All ¹	Very good	Good	Firm	All
Vermillion ²	.....Midseason to late	All ¹	Very good	Good	Soft	Local
Albritton ²	.....Early	All ¹	Good	Medium	Firm	All
Pocahontas ²	.....Midseason	All ¹	Very good	Good	Firm	All
Dixieland ²	.....Early	All ¹	Very good	Good	Firm	All

¹ Except red-stele infected areas.

² Virus-free plants available from some nurseries.

Soil Management

The success of the crop depends largely upon the soil in which it grows. Therefore, the soil should be properly prepared for its task of producing large, profitable crops. There are several important things to consider in this respect.

A ROTATION PLAN is necessary if a grower is to be successful over a period of years. If strawberries are grown on the same land year after year, disease and insect problems are magnified to the point where profitable production is no longer possible. Rotations aid in the control of weeds and they also add organic matter and improve the physical properties of the soil. Strawberries are rather shallow rooted and require a soil that is capable of holding moisture. Green manure crops furnish much of the needed organic matter for moisture retention.

It is desirable to have a cultivated crop, such as corn or tobacco, preceding strawberries. The weed problem then is not so great and the soil is left in good physical condition. Potatoes and tomatoes should not be grown preceding strawberries because of the danger of contamination of the soil with the Verticillium wilt organism which may be very serious on strawberries. Rotations should include a legume such as clover, vetch with rye, alfalfa, soybeans, or cowpeas. The legume should be plowed under, then be followed by corn or tobacco or some other cultivated crop before the strawberries are planted.

Land that has been in sod within a three-year period before strawberries should be treated for grub worms. (See section on pest control.) If grubs are controlled, sod or new land may produce excellent crops.

BARNYARD MANURES are among the best fertilizers for strawberries. It is difficult to apply too much for this crop. Ten to 20 or more tons per acre may be applied before plowing in the fall preceding planting. The manure will decompose and furnish the much needed nutrients of nitrogen, phosphorus, and potash. Ten tons of manure is equal to approximately 1,000 pounds of 10-5-10 in nutrients. Manure is low in phosphorus, and if the soil is low in this nutrient it may need some superphosphate added. It will also add much organic matter and thus improve the physical structure and water-holding capacity of the soil.

COMMERCIAL FERTILIZERS should be applied in the spring before planting unless the soil has had unusually large manure applications, is high in organic matter, and soil tests show that it is high in phosphorus and potassium.

Strawberries require about the same nutrient level as many other farm crops. Soil tests should be made and the land fertilized accordingly. Six-hundred pounds to a ton of a complete fertilizer, such as 6-8-6, depending upon the needs shown by the soil test, should be applied. This may be broadcast and worked in or drilled before planting, or the rows may be side-dressed after planting. If nitrogen seems to be the limiting factor, more of this nutrient may be applied early in the first year of growth. Not over 150 pounds of ammonium nitrate or its equivalent should be used. Do not apply nitrogen fertilizers in the spring of the fruiting year. To do so will seriously cut yields.

Many growers in areas where the available phosphorus and potassium are low, or even medium, have had excellent results from the application of 800-1000 pounds of 0-20-20 or 0-14-14 per acre. The material should be broadcast over the rows in February or March of the fruiting year.

FALL PLOWING is recommended except where the slope is great enough to be conducive to excessive erosion. Strawberries should be planted as early as possible in the spring (March or early April) and often the soil is too wet for plowing until late in the spring. The alternate freezing and thawing during the winter puts the soil in excellent physical condition. It may need only to be smoothed with a harrow to prepare it for planting. Fall-plowed ground will absorb a lot of moisture during the winter and is less likely to be droughty.

SPRING PREPARATION of the soil for planting may consist of disking and harrowing the fall-plowed ground. The fertilizer may be broadcast and disked in, or it may be drilled. The soil may be rolled before marking if it is too loose. If the berries are to be planted on ground that is likely to be wet, the grower may want to plant on ridges. This may be done by throwing up small ridges with a lister.

Importance of Good Plants

An effort should be made to secure only the best plants. Much of the future usefulness of the planting may be determined by the condition of the mother plants. They should be free of disease, vigorous, and have an extensive, healthy, root system. Light-colored, fibrous roots indicate a healthy condition. Dark or spotted roots with few fibrous roots may indicate a diseased or unhealthy condition. Old plants have roots almost black in color.

One may be reasonably sure of getting good plants by ordering from a reputable nursery. Some growers select young plants from an old patch. This is permissible only when they do not show any evidence of crown borer or disease. The grower may want to plant a few rows of strawberries, especially for planting purposes. If he does, they should be some distance from the fruiting patch and never allowed to fruit. During a good year, a hundred feet of row may produce 2,000 to 3,000 plants.

Many nurseries now handle plants that have been dug in the fall and stored at 34° F. throughout the winter. This will permit earlier shipment in many cases. Properly stored plants may be better under some conditions than freshly dug ones. A possible explanation for this is that the stored plants are dormant when set and thus the shock is not so great as it is for freshly dug plants that have started some growth. They are particularly useful for late plantings.

Order plants early. Strawberries are planted in early spring in Kentucky. The grower should get his order in just as soon as the new catalogs are received. The latest date of shipment should be specified in the order, and this date should be made early enough to guarantee arrival in plenty of time for the earliest possible planting date. By getting the order in early the grower will have a much better chance of receiving his full order and of getting better plants.

Care of Plants on Arrival

Quite often the plants may arrive from the nursery at a time inconvenient for planting. If setting is contemplated within a day or so, the plants may not need to be heeled in. The package should be opened and the plants inspected for disease, insects,

and condition. The correctness of the order as to variety and number should be checked. The plants will be tied in bunches of 25 with a label in each bunch. Any discrepancy in the order, or any serious drying-out, heating, or disease should be reported to the nursery at once. The plants may be placed in a cool, sheltered place and kept moist for a day or so.

If the plants cannot be set for several days, they should be heeled in. Select a well-drained area that is protected from the sun and wind. Dig V-shaped trenches about 6 inches deep. Open the bunches and distribute the plants, one deep, along the trench. Cover the roots with fine, moist soil and firm well. The crowns should be just above ground as in planting. Water the plants well after heeling in unless the ground is quite moist.

Planting

Early spring is the best time to plant strawberries in Kentucky. Fall planting often is not satisfactory because of injury to the plants from heaving (alternate freezing and thawing). They should be planted as early as the ground can be worked in March or early April. This enables the plant to become established and make runners before hot, dry weather comes. Plants formed from early runners will produce several times as much fruit as those formed from later ones. If planting is delayed until late April or May, dry weather often slows the formation of runner plants until fall, and late-formed plants are low producers.

Planting distances in Kentucky vary with individuals, from rows 40 to 48 inches apart. Some varieties that make a profusion of plants, such as Blakemore, may be planted 3 feet apart while others, such as Tennessee Shipper, should be planted 2 feet apart in the row. A good rule is to plant most varieties in rows 4 feet apart, and 2 feet apart in the row. This is for the matted-row system of culture which is the only one used in Kentucky.

Marking off the ground is desirable for hand planting. This may be done with a marker. The runners are lengths of 2x4-inch oak spaced 4 feet apart. The marker is pulled across the patch to mark the rows. Another marker with the runners 2 feet apart may then be pulled at right angles across the patch if the grower desires to have the plants in checked rows. The plants are then planted in the intersections of the marks.

Pruning the plants before setting is a good practice. Most of the large, old leaves should be removed. This will reduce loss of moisture through transpiration. If the roots are too long, they may be cut back. This is especially helpful in machine planting. The roots may be easily pruned by placing bunches of plants on a board and cutting them off with a sharp knife so that the remaining roots are 5-6 inches long.

Correct planting will give the plants the necessary advantage for an early resumption of growth. Keep the roots moist at all times during the planting operation. This may be best accomplished by carrying the plants in a pail partly filled with water, or by keeping damp moss over the roots. Several methods may be used in hand setting. A dibble, trowel, or spade may be used. Whichever tool is used, there are several precautions that must be taken. The crown must be left exactly at ground level. If it is too deep or too shallow the plant will be injured and may even die. (See Fig. 1.) The roots must be spread out (not doubled up) and fine soil should be well firmed around the roots.

A spade is a handy tool for rapid setting. Press the spade to about half its length into the soil. Move it back and forth slightly to make a V-shaped opening. Insert the strawberry plant with the roots *fanned out*, with the crown at the surface of the ground. Next insert the spade a short distance from the plant and pry the soil against the plant's roots so that it is firmly anchored. Firm the soil around the plant with the foot.

Machine setting is practiced by many of the larger growers. It has the advantage of being much faster than hand planting. However, it has several disadvantages. It is difficult to get the plants at the proper depth with the roots spread out as they should be. A man should follow the transplanting machine to firm the soil around the plants and to reset improperly set plants.

A starter solution, although not used to any great extent, is thought to be helpful in getting the plants off to an early start. They are particularly useful in a transplanter. There are many fertilizer preparations on the market that can be used for this purpose. Directions on the package should be followed. You may make your own by following these instructions:

To 50 gallons of water, add 10 pounds of a complete fertilizer, such as 5-10-5 or 5-10-10. Stir it thoroughly and allow it to set

Fig. 1.-
will be
grow p
level. I

for se
sedim

TH
so tha
will a
hoeing
hoeing

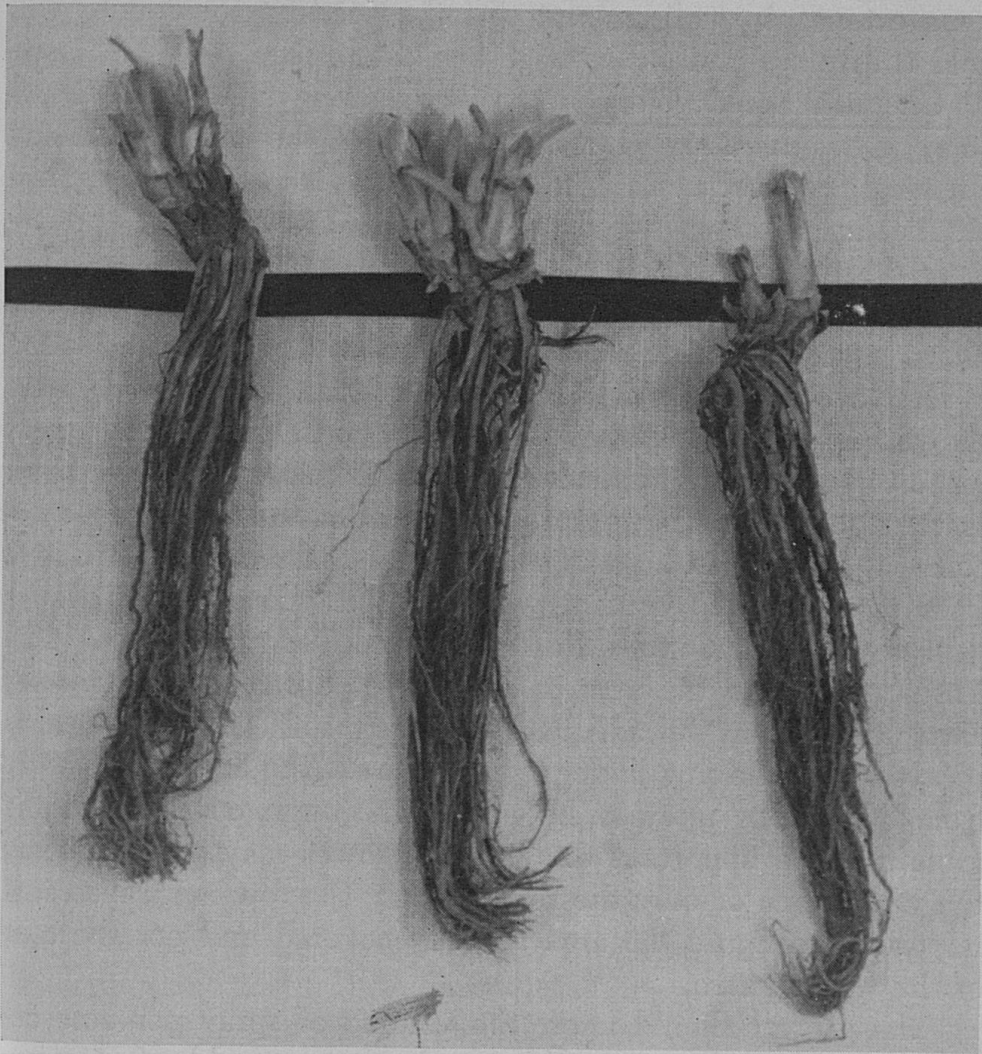


Fig. 1.— Correct planting pays. The plant on the left is not planted deep enough and will be damaged by drying out. The one on the right is planted too deep and will not grow properly. The plant in the center is properly planted, with the crown at ground level. It will start growth quickly and form runners early.

for several hours. Decant the clear liquid and throw away the sediment. Use about $\frac{1}{2}$ pint per plant.

Post-planting Care

The soil must be cultivated frequently to keep it loose so that runners may root easily, and to control weeds. Loose soil will absorb moisture more readily. A certain amount of hand hoeing is necessary for weeds the cultivator does not get. While hoeing, the runners may be pulled into the row and spaced to

some extent. A small amount of soil placed on the runner will hold it in place and aid it in getting established.

Chemical weed control is rapidly gaining favor with strawberry growers. *Crag Herbicide No. 1* is the most promising chemical for weed control in strawberries. It is effective against practically all annual weeds and grasses. Two to three applications during the first year seem to keep the weed population down about 80 percent with no malformation of the plants. There have been some reports of a slowing down of the rooting process of runner plants when the material was applied while the plants were runnering. The patch must be free of weeds when the material is applied, since the chemical kills weed seeds as they germinate and is not effective after the weeds have become $\frac{1}{4}$ - to $\frac{1}{2}$ -inch high. The chemical does not become active until it comes into contact with the soil where soil micro-organisms convert it into an active weed killer similar to 2, 4-D. Three pounds to the acre is the correct dosage on most soils. Two pounds may be adequate on sandy soils. The material is sprayed over the row under low pressure. Any amount of water from 30 gallons up may be used. Thorough coverage of the ground is the important thing. The grower may wish to spray the whole area or only the row. If only the row is sprayed it is important to figure the area actually covered and not the area of the whole patch.

The grower should know the volume of spray per acre delivered by his equipment. This may be determined by first spraying a measured area with water.

The first application may be made any time after 10 days of planting, but before or at the time weeds begin to germinate. It should not be used more often than once a month. A suggested schedule would be to make the first application about 10 days after planting and follow it with another a month to six weeks later. Other applications may be made after the row is established.

Crag Herbicide No. 1 does not present the drift hazard of some other weed killers, since it becomes active only when it comes into contact with the soil. The material has the further advantage of being easily washed out of the sprayer.

Use of geese as a means of controlling grass during the first

year of the strawberry planting has been a profitable practice for many years in Kentucky. Young geese seem best, and five to seven per acre are sufficient.

The planting must be surrounded by a 3-foot fence. Erect a shade and supply plenty of water at one end of the patch. Feed some grain, but do not overfeed as hungry geese are the best weeders. They prefer young, tender shoots, and do an especially good job on crab grass. During fruiting, remove them from the patch or they will eat the fruit.

Bloom removal is necessary the first season. The plants will bloom a short time after setting and if the fruit is allowed to develop, the plants will be seriously delayed in sending out runners. As mentioned before, it is very important that new plants be formed as early as possible. The blooms are borne on fruiting stalks and when they have grown out sufficiently, most of the blooms can be removed by pinching off the fruiting stalks. Going over the patch two times should be sufficient for bloom removal.

Irrigation is of special benefit to strawberry plants. They have relatively shallow root systems, hence, at critical drought periods during the first year, irrigation may insure a large crop the following spring. The additional water will stimulate more runner plants, which will have larger crowns and initiate more and stronger fruit buds. One or two irrigations while the fruit is developing and maturing may save the crop if a drought occurs.

Irrigation is especially helpful in the rejuvenation of old patches. This will be mentioned in more detail under rejuvenation. Irrigation may be helpful also in reducing damage from spring frosts. The water should be turned on when the temperature drops to freezing, and left on until the ice on the plants begins to melt the next morning. This method has prevented much blossom injury in some states.

Plant thinning is a good practice when too many plants are formed. Strawberries are like any other crop in that they do best when they are spaced properly. Four to eight plants per square foot is recommended.

Relatively few growers in Kentucky do any thinning. However, in years that are particularly conducive to plant-making, some varieties may need to be thinned. This is especially true of the Blakemore variety which makes many plants. Hand-thin-

ning is time consuming, and it is doubtful if it would be profitable under Kentucky conditions.

Some growers have found it satisfactory to pull a harrow over the patch in the fall. The harrow teeth will uproot many young plants that are not well established, yet will not harm the large plants with extensive root systems. These young, poorly established plants would have cropped only lightly, if at all, and would have been a drain on the other plants. The results of crowding are smaller size and lower quality fruit.

Another practice not used in Kentucky, but which could very profitably be tried, is the use of rolling coulters attached to the cultivator in front of the shovels to cut runner plants after the row has been sufficiently filled. Early in the season, the runners are pushed back into the row by the shovels. After the row is filled, the coulters could be installed, thus many unnecessary late-formed plants would be destroyed.

Winter protection for strawberry plants is essential. This is accomplished by a mulch of straw or other material. Unmulched plants may be seriously damaged by heaving and the crowns may be injured by cold weather.

A mulch serves many purposes. It retards growth during early springs, thus protecting blooms from spring frosts. It also aids in controlling weed growth, conserves moisture, makes picking more pleasant, and keeps fruit clean.

Wheat straw is the preferred mulch material for strawberries. Leaves tend to pack too much, sawdust may tie up nitrogen, and the various hays and pine needles are not plentiful. Straw should be piled loosely in early fall so that weed and grain seeds may germinate and thus save trouble in the spring. Baled straw should be distributed over the field and the ties clipped. About $1\frac{1}{2}$ to 2 tons per acre should be applied by hand or manure spreader when the temperature is expected to reach about 20° F. In Kentucky, this is usually in December. (Fig. 2.)

Many growers produce their own mulching material. Rye or other small grain or Sudan grass is allowed to head out and then is mowed before the grain forms. It is cured, then stacked until needed. One-half acre should produce enough mulching material for 1 acre of strawberries.

Mulch removal should not be hurried in the spring, in order



Fig.

that
usua
The
plant
yellow
rake
rema
tramp
his c

H
grow
perfo
ing s
three
If
so th
the fr
that t
picke
Tenne
have



Fig. 2.— Mulching strawberries is necessary for protection during the winter months.

that the strawberry fruit buds be protected. Unmulched plants usually bloom early and are frequently killed by spring frosts. The mulch should be removed when inspection reveals that plants have started new growth and the new leaves are slightly yellow in color. If the mulch is heavy enough to retard growth, rake part of it to the middles. The plants will grow through the remaining mulch, which should be packed around the plants by tramping. If a killing frost is predicted, the grower may save his crop by raking the straw over the plants again.

Caring for the Crop

Harvesting the crop is a very important phase of strawberry growing. This is the ultimate goal, and this operation must be performed correctly to realize the maximum profit. The harvesting season begins about the middle of May and lasts for two or three weeks in the principal strawberry regions of Kentucky.

If the fruit is picked for local sales, it should be fully mature so that the highest quality possible is retained. For shipment, the fruit may be picked less mature. A general rule to follow is that the berries should be three-fourths red. The fruit must be picked about every other day. Berries for processing (especially Tennessee Beauty, Tennessee Shipper, and Blakemore) may not have to be picked more often than every 3 to 5 days.

The best time for picking berries is early morning when they still retain the night coolness. Data of the U. S. Department of Agriculture show that for every 15-degree rise in temperature, the life of the fruit is reduced by half. Always keep the picked fruit in shade. Sometimes picking must be done during the heat of the day, and the berries held over night. When this is the case, do not place the boxes of berries in crates, or they will not cool out satisfactorily.

Teach proper picking to inexperienced pickers. Berries should be pinched off, not pulled. The calyx and a short length of stem should be retained with each berry. It then should be placed, not thrown, in the box. The pickers should be carefully supervised to see that they are not leaving fruit that should be picked. A careless picker who pulls fruit off, handles it roughly, and leaves fruit to become over-mature is actually losing you money because bruised and over-ripe fruit frequently molds and ruins the whole pack. The foreman should occasionally empty a box of fruit, picked at random from each picker's carrier, so that he may determine whether the worker is picking correctly.

A method of keeping individual picking records must be followed. The pickers may be issued tags showing the number of quarts picked, or some other method may be used. They are usually paid per quart about one-fifth the sale price of the fruit.

Graded fruit brings the best prices. All berries sold through an association must be inspected and a grade put on them. Since a pack of U. S. No. 1's brings a much better price than No. 2's or unclassified, it pays to grade the fruit.¹ Most associations are

¹ Grading standards:

U. S. No. 1 shall consist of strawberries of one variety, with the cap (calyx) attached, which are firm, not overripe, or undeveloped, and which are free from mold or decay and from damage caused by dirt, moisture, foreign matter, disease, insects, or mechanical or other means. Each strawberry shall have not less than three-fourths of its surface showing a pink or red color. *Unless otherwise specified*, the minimum size shall be not less than three-quarters of an inch in diameter.

In order to allow for variations other than size, incident to proper grading and handling, not more than a total of 10 percent by volume of the strawberries in any container may be below the requirements of this grade, but not more than 5 percent shall be allowed for defects causing serious damage, and not more than two-fifths of this amount, or 2 percent, shall be allowed for strawberries affected by decay.

In addition, not more than 5 percent, by volume, of the strawberries in any container may be below the specified minimum size.

U. S. No. 2 shall consist of strawberries which are free from decay and other serious damage caused by dirt, disease, insects, mechanical or other means. Each strawberry shall have not less than one-half of its surface showing a pink or red

inter
good
trade
their
best v
this r
the st
shed
the fr
Fig. 4
other
prop

color.
eights
In
and har
in any
more th
In
containe
Un
with eit



Fig. 3.— A portable grading and packing shed.

Photograph courtesy Department of Horticulture, University of Illinois.

interested in receiving well-graded fruit so they may build a good reputation with buyers. By doing this consistently, their trademark will become a symbol of quality and honesty. Thus, their fruit will sell readily. If competent help is available, the best way to grade the fruit is in the patch by the pickers. When this method is followed, close supervision is necessary so that the standards will be adhered to. Another method is to have a shed similar to the one in Fig. 3 for grading and packing. As the fruit comes in, it is graded by the use of a grading pan, as in Fig. 4, or the fruit may be carefully poured from one box to another and the berries below grade removed and put into the proper grade or discarded. (Fig. 3 and 4.)

color. *Unless otherwise specified* the minimum size shall be not less than five-eighths of an inch in diameter.

In order to allow for variations other than size, incident to proper grading and handling, not more than a total of 10 percent by volume of the strawberries in any container shall be allowed for defects causing serious damage, but not more than 3 percent shall be allowed for strawberries affected by decay.

In addition, not more than 5 percent by volume of the strawberries in any container may be below the specified minimum size.

Unclassified shall consist of strawberries which are not graded in conformity with either of the foregoing grades.



Fig. 4. (above) A grading pan operated by a foot treadle.

(Left) Use of a grading pan in the field for checking on proper grading.

Photographs courtesy Department of Horticulture, University of Illinois

The grading of berries sold to a processor need not be so rigid as to size. The fruit should be clean, well colored, and firm, with no rotten fruits.

Fruit for local markets may or may not be graded, but grading pays here, also. Many consumers will pay a premium for a high-quality, uniform pack. The individual's market will determine his policy in this case.

The roadside market should make an effort to keep the berries clean and protected from flies. Cellophane-covered boxes sell better than open ones.

Packing of fruit is done in 24-quart crates. Each box should be filled slightly rounded and with the corners well filled in. A grower who consistently packs high-quality fruit will find it advantageous to stamp his name and variety on the crate. By always having a high-quality pack, his reputation with buyers is established.

Marketing

There are three outlets for strawberries in Kentucky. Most important are associations and processors. The third is local sales.

In an association, a number of growers pool their offerings. Their volume of fruit makes it possible to develop good markets in large consuming areas that may be some distance away. The individual grower does not have enough volume to develop such markets. The association handles the refrigeration and shipping problems, and charges a certain commission for selling the fruit.

The next most important commercial outlet in Kentucky are the processors. Several million pounds of strawberries a year are sold to them. Net returns are about equal to those received for the fresh market through cooperatives. Processing is especially valuable in using the small berries near the end of the harvesting season. The grower usually caps the berries as they are picked unless the processor has a capping machine.

The third sales outlet is that of local consumers. Many growers are situated so that they can sell all or most of their crops locally. By producing high quality fruit, they frequently can command higher prices.

In recent years, some growers have instituted the practice of letting the consumer pick his own fruit. This has proved to be very satisfactory and may well open the way for more strawberry growers in areas where picking-labor is difficult to obtain.

After-harvest Care of the Patch

Most commercial fields in Kentucky are fruited two years and some even three years. The success of the second and subsequent fruitings depends largely upon its condition and care after harvest. The second-year production may be almost as good as the first if proper care is given the patch, and if it is relatively free of weeds, insects, and diseases.

As mentioned before, man-hours of labor per acre are considerably less than for the first year, and the returns per man-hour of labor are considerably higher. Therefore, each patch presents an individual problem each year. Some plantings may be in such condition that they should be plowed up after the first fruiting, but if the plantation is in a vigorous condition, has a well-developed fruiting row, and has no serious weed, insect, or disease problem, it is generally advisable to keep it over for a second year, and possibly a third or fourth year, if no troubles develop.

Renewing the patch consists first of mowing off the tops immediately after harvest. If the insect and disease problem is not serious, the leaves and mulch may be incorporated into the soil unless the mulch is too heavy. If it is, part of it may be raked off and the remainder cultivated in. If there is a disease or insect problem, the leaves and mulch should be burned in the alleys between the rows.

Until recently, the most popular method of treatment following clipping was to narrow the rows to 6 to 8 inches. Usually one entire side of the row, including the middle, was plowed up. This left only young plants on one side. The remaining plants were then further thinned by running a spike-toothed harrow or cultivator across the rows several times. This treatment tears out plants with weak root systems, and levels the ridges made by plowing.

Some growers use a hoe to further thin the plants to a clump every foot. This system has one great limitation. There is often a drouth at this time of year, and the remaining plants do not form sufficient early runner plants. However, *with irrigation*, this is probably the best renewal method.

A renewal method that has gained popularity recently consists of mowing the leaves, then narrowing the row to the desired width (about 18 inches) with a light plow or rototiller. The middles are then thoroughly torn up with a cultivator or other tool, and are cultivated the rest of the season to control weeds and keep the soil loose.

In recent years, many growers have used rototillers in renewing the patch. This tool thoroughly tears up the soil and incor-

porates all organic matter into it. The rototiller is also very efficient in narrowing the row to the desired width.

Irrigation is helpful after the patch has been worked. Drouths occur frequently at this time of year, just when the plants need water the most to recover from fruiting to re-establish themselves and make new plants for the next crop.

Fertilizing after rejuvenation should include a fairly heavy coat of well-rotted manure, if it is available. Nitrogen is needed to stimulate new growth and to aid in decomposing mulching materials and leaves; some growers use as much as 150 to 200 pounds of ammonium nitrate per acre if manure is not to be had. If phosphorus and potash are low, a complete fertilizer should be applied. As much as 500 pounds or more may be used. Fertilizer of the same analysis as was applied the first year may be used.

The fertilizer should not remain in contact with the foliage, but should be brushed off after applying. Irrigation at this time, if the season is dry, is especially helpful in getting the nutrients to the plants and stimulating new plant growth.

Post rejuvenation care includes the same practices used the first year. Since new plants are not formed until late (after harvest) the planting must be given the best possible growing conditions—frequent cultivation, weed control, and irrigation, if possible.

Insects and Their Control¹

There are several insects of considerable economic importance that attack strawberries. Some of these must be controlled every year and others only when they appear. Experimental work in recent years has demonstrated to growers that a regular insecticide program aimed at controlling all of the important insect pests is almost indispensable.

WHITE GRUBS. The white grub is the larval form of the May beetle. Most of our Kentucky species spend two years in the soil. They feed on strawberry roots and may burrow into the crown. They can be very destructive and ruin a planting (Fig. 5).

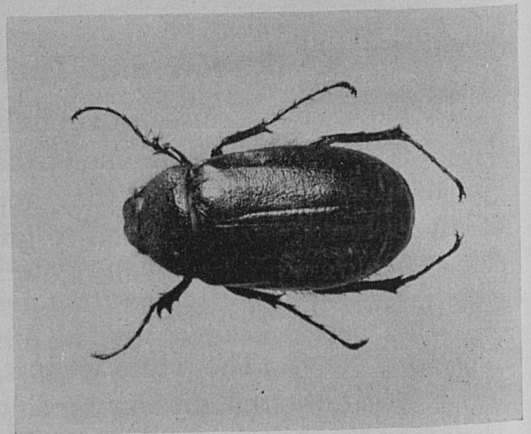
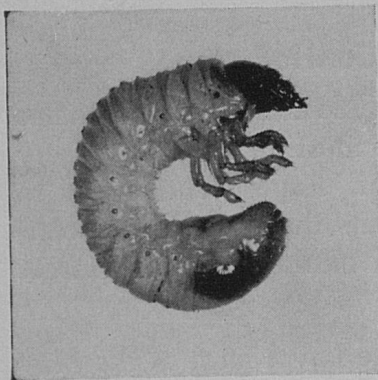
¹This section prepared by J. G. Rodriguez, Assistant Entomologist, Entomology and Botany Department.



Fig. 5. (above) Strawberry plants killed by white grubs, showing typical injury.

(Below, left) The white grub, the larva of the May beetle.

(Below, right) The adult of the May beetle.



cro
this
emo
me
dan
also
cult

bee
flye
larg
pru
ing
Com

mos
The
do
sam

S
plan
the
carr
ing
befo
by o
plan
l-pe
«

insec
berr
shap
insec
long
with
caus

Prevention of white grub damage lies in raising a cultivated crop for at least two years preceding the setting of strawberries; this allows time for the grubs present in the soil to pupate and emerge as adults. If grass sod or legumes are turned under immediately before strawberry setting, treating the soil with chlordane will give excellent control. (See Table 2.) Soil treatment also controls wireworms, which also may be a source of trouble to cultivated crops, and ants which spread the strawberry root aphid.

GREEN JUNE BEETLE. The adult of this insect is a large green beetle, with bronze on margins of the body. Beetles are strong flyers, and cluster on all kinds of ripening fruits. The grub is larger than the common white grub and crawls on its back, pruning off roots as it goes. Eggs are laid in soil rich with decaying vegetable matter, and the insect has a one-year life cycle. Control is the same as that specified for white grubs (See Table 2).

WIREWORMS. The larvae of the click beetle are wireworms, most Kentucky species completing their life cycle in one year. There is a great variation in size in the different species; some do more damage than others. They may be controlled in the same manner as the common white grub.

STRAWBERRY ROOT APHID. Eggs of this aphid are laid on the plants early in the spring. They hatch and are transported to the roots by ants, where they suck juice from the roots. Ants carry them about for their honey-dew secretions, hence, controlling the ants controls the root aphid. If the soil was not treated before setting, and an infestation develops, it may be checked by chlordane to control the ants, or parathion applied to the plants and soil will control both. Apply 5-percent chlordane or 1-percent parathion at 40 pounds per acre.

"CATFACING BUGS." There are a number of plant bugs or other insects that suck blossoms or buds of several fruits. On strawberries, they are responsible for most of the "buttons" or misshapen knotty berries. Probably the most important of these insects is the tarnished plant bug, the adult being about 1/5-inch long and inconspicuously colored a dull yellow or green mottled with reddish brown. This bug punctures the young fruit, and causes it to develop unevenly. Berries deformed in this way be-

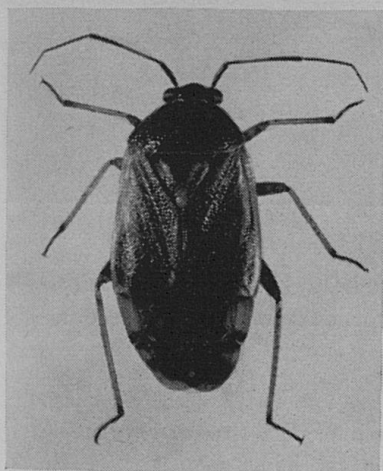
Table 2.—Insect Control

Insects*	Insecticide and amount per acre	When applied	What to look for
White Grubs, Green June Beetle, Wireworms, Strawberry Root Aphid	Chlordane, 8-10 lb actual Aldrin, 4-5 lb actual	Disked in about one week before planting.	Insects probably present if land has been in sod or legumes. Strawberry plants killed in early summer.
"Catfacing" bugs	1% Parathion, 30-40 lb, or 4% Malathion, 30-40 lb, or 5% Chlordane plus 5% DDT	Early bloom General bloom	Various sucking insects present during blooming cause "button" berries to develop.
Strawberry Crown Borer	1% Parathion, 30-40 lb, or 5% Chlordane plus 5% DDT 30-40 lb	Early bloom General bloom	Unthrifty plants with small legless grubs in crown of plant in summer, or tunnels apparent in dead plants in winter or spring.
Strawberry Weevil ("Clipper")	1% Parathion, 30-40 lb, or 5% Chlordane plus 5% DDT dust, 30-40 lb	Early bloom General bloom	Buds cut off before opening or left hanging by a mere thread.
Mites	1% Parathion, 30-40 lb, or 4% Malathion dust, 30-40 lb	When symptoms appear	Bronzing of foliage. Mites, hardly visible, feeding on undersides of leaves.
Aphids on foliage	1% Parathion, 30-40 lb, or 4% Malathion dust, 30-40 lb	When symptoms appear	Crinkled appearance of leaf and aphids present.
Strawberry Leaf Roller	1% Parathion dust, 30-40 lb	Before the worm rolls the leaf	Small, active, greenish brown caterpillar with brown head. Leaves rolled.
Leaf Beetles	1% Parathion, 30-40 lb, or 5% Chlordane plus 5% DDT dust, 30-40 lb	When symptoms appear	Small brown or black oval-shaped beetle present in early spring and late summer, causing shot-hole appearance of leaves.
Spittlebug	5% Chlordane and 5% DDT dust, 30-40 lb	When spittle masses are first seen	Stunted plants caused by bugs. Froth is almost a pure plant-sap.

* See discussion.



Fig. 6 (above, left) Fifty normal berries (1 full quart) and on the right fifty "catfaced" berries, barely covering the bottom of the container.



(Left) The tarnished plant bug is one of the chief insects causing "cat-faced" or "button" berries.

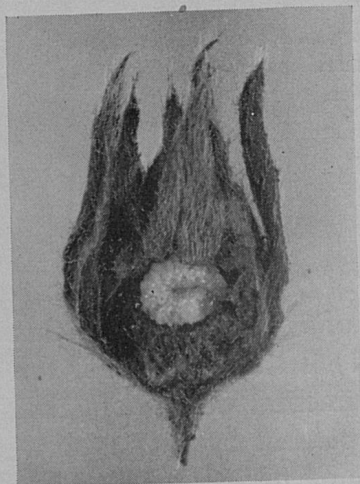
come almost unsaleable, and the lack of size decreases yields tremendously. The control (see Table 2) is the same as for the crown borer and weevil. Recent experimental data show that yields can be increased as much as 30 percent by two applications of parathion dust during the blooming period. (Fig. 6.)

STRAWBERRY WEEVIL. The strawberry weevil ("Clipper") is another insect that can cause considerable damage. The female adult is a reddish-brown snout beetle about 1/10-inch long that lays eggs in the flower bud and then girdles the fruit stalk just below the bud. This causes the bloom to hang or to fall to the ground, forming an incubator and providing food for the young weevil. Fortunately, the same control for crown borers and catfacing insects is very effective in controlling this insect. (Fig. 7.)

STRAWBERRY CROWN BORER. This can be one of the most



Fig. 7. (above) Injury from the strawberry weevil. Five cut buds are shown on this plant.



(Left) The larva of the strawberry weevil developing in a cut bud.

serious insects affecting strawberries unless preventive measures are taken. Infestations are more likely to occur where strawberries have been grown for some time, but may be scattered to new plantings by the use of infested plants. This is more likely to happen if plants from an old patch are used. Most of the damage is done by the larval stage of the crown borer. It is a white, thick-bodied, legless grub about $1/5$ -inch long when full grown. The adult, reddish-brown, snout beetle, about $1/6$ -inch long, overwinters in the soil, or in trash in or near the patch. In

earl
grou
cent
after
cide
tatin
men
(Ta
bore

M
the n
ish i
Thei
leav
injur
tatio
tates
Para
for c

A
folia
devit
trans
may
thion

Fig. 8.
open to
berry c

early spring, it lays its eggs in the plant near the surface of the ground. The larva then burrows into the crown and eats out the center. It pupates in mid-summer, the adult beetle emerging after several weeks. Before the advent of the organic insecticides, control measures consisted of using clean plants and rotating the patch to new ground every two years. Our experimental work shows that parathion or chlordane plus DDT dusts (Table 2) are very effective in controlling the strawberry crown borer. (Figs. 8 and 9.)

MITES. Eight-legged creatures which are hardly visible to the naked eye are mites, not insects. They are brownish or greenish in color, and injure the plant by sucking sap from the leaves. Their presence may be detected by a dusty appearance of the leaves or by bronzing of the foliage when the plants are severely injured. The use of DDT has caused an upsurge in mite infestations. It is thought that DDT kills their predators, and irritates the mites, causing them to scatter and start new colonies. Parathion or malathion dusts (Table 2) are excellent materials for control. (Fig. 10.)

APHIDS. There are several species of aphids that attack the foliage of strawberry plants. They suck sap from the plant and devitalize it. Certain species also are vectors of virus diseases and transmit them to healthy plants. (See Virus Diseases.) They may be controlled by 1-percent parathion dust or 4-percent malathion dust. (Table 2.)

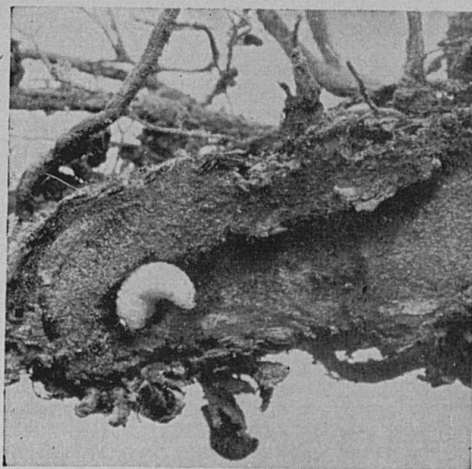


Fig. 8. (left) Strawberry crown cut open to show the grub of the strawberry crown borer and its injury.

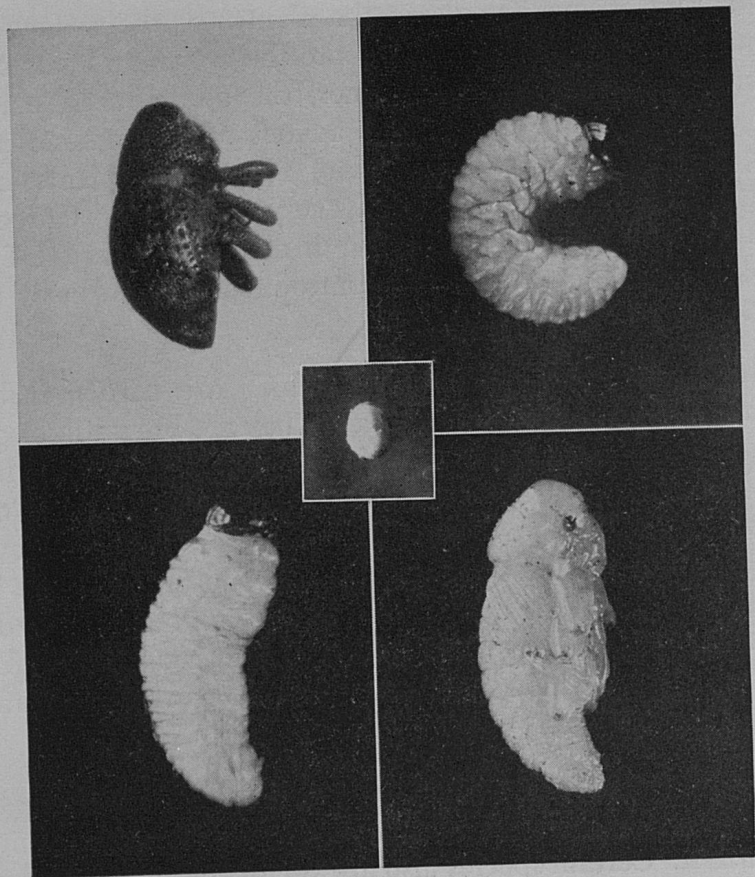


Fig. 9.—Life stages of the strawberry crown borer: (upper, left) adult; (upper, right) grub; (lower, left) prepupa; (lower, right) pupa.

STRAWBERRY LEAF ROLLER. This insect does its damage in the larval stage. It is a small, greenish-brown worm with a brown head. It rolls the leaflet and feeds upon it within the protecting fold. Eventually the entire leaflet turns brown and dies. Newly-set plantings and one-year-old plantings are particularly susceptible to injury. The insect may be controlled with parathion dust or wettable powder if it is applied when first signs of leaf folding are observed. (Table 2.)

LEAF BEETLES. There are several species of beetles which injure strawberry foliage. These are brown or black oval-shaped beetles about 1/8-inch long. They feed upon the leaves and give them a shot-hole appearance. The larvae feed upon the roots.

The
DD

incr
inse
pure
acts
of p
chlo

A
as s
more
E
all i
peric

Fig. 10
not att

The beetles may be controlled with parathion or chlordane-DDT dusts when they appear.

SPITTLEBUG. The meadow spittlebug has been observed in increasing numbers in northern Kentucky. It is a tiny sucking insect, which excretes fine droplets of a liquid which is almost pure plant sap. The froth resulting from the respiration process, acts as a barrier to natural enemies. Infestations cause stunting of plants; control may be obtained with the standard 5-percent chlordane plus 5-percent DDT dust. (Table 2.)

Efficiency of Insecticides and Precautions

All insecticides are poisonous materials and must be handled as such. However, some materials, such as parathion, require more careful handling than others mentioned in this circular.

Parathion is an excellent material, effective against practically all insects found on strawberries. In our tests, it has been superior to malathion or the standard chlordane-DDT mixture,



Fig. 10. (left) Two-spotted spider mite injury on bronzed strawberry leaflet, which did not attain full size. The leaflet on the right is free of mites.

which is not effective against aphids (foliage) or against any of the mites attacking strawberries. Inasmuch as strawberries are a low-growing crop, and most fields are relatively small, dusting with 1-percent parathion may be accomplished without undue hazard to the individual doing the dusting if he observes these precautions:

- (1) Choose a time when the breeze carries the drift across the path of the operator.
- (2) Wear a respirator.
- (3) Change clothes and bathe after treating.

There is much less hazard involved if a wettable powder is used, although it is not as effective against mites or aphids (which feed on the under side of the leaf) as a dust which covers better. Use 2 tablespoons of 15-percent parathion per gallon, or 2 pounds per 100 gallons of water.

Malathion, according to our preliminary results, is the next most efficient insecticide to use for control of "catfacing" insects, aphids and mites. This material may prove to be the most practical insecticide to use on strawberries, because treatment may be made within a few days of harvest. Data on crown borer and weevil control with malathion are not yet available. Malathion has low mammalian toxicity, being probably but little more dangerous than DDT to apply and less dangerous than any material mentioned in this circular from the standpoint of residue hazards on the fruit. Use the 4-percent dust, or the 25-percent wettable powder at 2 tablespoons per gallon or 2 pounds per 100 gallons of water.

Chlordane-DDT mixture is the next best insecticide. It does not control aphids on the foliage and the DDT encourages mite infestations. The 5-percent chlordane plus 5-percent DDT mixture is used as a dust; a 50-percent wettable powder of each chlordane and DDT may be used as a spray. Use 2 tablespoons of each powder per gallon of water, or 2 pounds of each per 100 gallons.

Apply any of the dusts mentioned above at 30-40 pounds per acre, or any of the wettable powders at about 100 gallons of spray mixture per acre (this is about 1 gallon per 100 feet of row).



Fig. 11.— Strawberry leaf spot.

Photograph courtesy Department of Horticulture, University of Tennessee.

Strawberry Diseases

LEAF SPOT. This is the most common strawberry disease. (Fig. 11.) Most commercial varieties have a certain amount of resistance and this disease usually is not serious enough to warrant control measures. However, when there is a serious outbreak, it can be controlled by following the Illinois recommendation of 30 pounds per acre of 10-percent captan or ferbam dust. In spraying, use 2 pounds of either 50-percent captan or 70-percent ferbam in 100 gallons of water.

RED STELE ROOT ROT. A fungus disease caused by a species of *Phytophthora* (Fig. 12). It attacks the stele or core of the roots and is becoming more serious in Kentucky. This disease appears in the spring about blooming time. The leaves roll and wilt and become very dull in color. As the disease progresses, the plant has a blasted, stunted appearance. A large percentage of the plants may die and the crop is ruined on the others. The infected roots show a browning or reddening of the stele and most of the small fibrous roots are absent which results in the roots having a rat-tail appearance. The disease is more likely to be most severe during a cold, wet spring. The symptoms appear only during the spring and are not present during the first growing



Fig. 12.— Strawberry roots showing symptoms of red stele disease. (Left) Diseased roots showing dead, discolored root tips. (Center) Diseased roots split lengthwise to show the reddened core extending into the white portion of the root. (Right) Normal roots split lengthwise to show the absence of the red center.

(Photograph courtesy Horticultural Crops Research Branch,
U. S. Department of Agriculture)

seas
by y
and
Tab
berr
10 y
to b

V
be c
York
and
pota
disea
to fo
strav

C
whic
jarre
is rat
(leak
deve
if the

K
mulc
contr
two c
capta
effect
mater
when

V
to be
in the
(Yell
in mo

¹ N

season. The disease may be spread by infected plants, tools, or by water.

The only controls known for this disease are to avoid infected and poorly drained soils, and to plant resistant varieties. (See Table 1.) It is not safe to plant susceptible varieties of strawberries on infected ground for several years. (Soil infected 8 to 10 years ago at the Experiment Station at Lexington is known to be highly infectious.)

VERTICILLIUM WILT. This disease has recently been found to be causing considerable trouble in strawberries in Indiana, New York, and other areas. The plants, when attacked, suddenly wilt and die. The disease is caused by the same organism that attacks potatoes and tomatoes. It is not known how much damage this disease may be causing in Kentucky, but it is good insurance not to follow potatoes or tomatoes, which may carry the disease, with strawberries.

GRAY MOLD (BOTRYTIS ROT). This rot is caused by a fungus which covers the infected fruit with a light gray mold. When jarred, the fungus spores rise in a white cloud. The rotted part is rather firm in comparison to the soft rot caused by *Rhizopus* (leak). Gray mold often attacks the bloom and spreads to the developing fruit. It is most serious during wet weather, especially if the plant growth is dense.

Keeping the rows from becoming too dense, and a good mulch to keep the fruit from contact with the soil, will help in controlling the disease. Illinois and Kentucky have found that two or three sprays at 10-day intervals of 2 pounds of 50-percent captan or 70-percent ferbam in 100 gallons of water, has been effective in controlling gray mold. A 10-percent dust of either material may be used. The first application should be made when the first blossoms open.

VIRUS DISEASES OF STRAWBERRIES. These diseases are reported to be present in 90 percent or more of the commercial plantings in the United States. There are two principal viruses, Virus 1 (Yellows¹) and Virus 2 (Crinkle). Either or both may be present in most strawberry plantings. They are thought to be causing

¹Not to be confused with Blakemore Yellows.

considerable reduction in yield, and much study is being given to this problem.

The United States Department of Agriculture has been searching for virus-free plants of all varieties, and has found them in about 25 varieties. These have been increased for foundation stock, which have been distributed to several nurseries for further increase. This program may be expected to grow so that eventually virus troubles will be affecting a comparatively small percentage of the plantings. Virus-free plants must be dusted regularly with some material, such as parathion, to control the aphid vectors of which there are seven species known. Virus-free plants are now available from several nurseries.

Everbearing Strawberries

Until recently, the Experiment Station has not recommended everbearing strawberries for Kentucky because they were not productive enough during the summer months; in fact, they were called "never bearers" by many people. A new method of culture, however, now makes everbearers very successful. It was reasoned that the everbearing plants had been unproductive because they used most of their food and energy in the production of new plants, and if the forming of runners were prevented, a larger crop should result. The new method, therefore, consists of close planting, no runners, mulching, and irrigation. First-year production records of 7,000 to 13,000 quarts per acre have been obtained with this system at The Agricultural Experiment Station at Lexington. Irrigation is essential. Directions are as follows:

Ground preparation. Apply manure, if available. Plow, preferably in fall. Prepare a good bed and set plants in early spring.

Planting. Plant with crown flush with surface of ground, hole large enough for roots to be fanned out. Firm soil around roots. Water if necessary.

Planting distance. Set in beds with plants 1 foot apart in each direction. Beds should be four rows wide with a two-foot alley between beds.

Culture.

A. Cultivate for approximately one month.

- B. Remove bloom until about the last of June, or until a strong, sturdy crown is developed. Then let fruit develop.
- C. *Remove all runners throughout the season.*
- D. Mulch with 1 to 1½ inches of sawdust of any kind about one month after planting. Plots should be entirely free of weeds at this time.
- E. Hand-weed as necessary.
- F. Pick every other day.
- G. *Irrigation* is necessary. During most summers, even the method of culture described above is not satisfactory unless irrigation is practiced. Irrigate often with a medium amount of water rather than soaking the soil less frequently. Morning or midday is the best time to water.

Size of plot. If moisture conditions are favorable, 200 plants should furnish enough fruit during July, August, September, and part of October, or until frost, for the average-size family.

Varieties. Gem, Superfection, Streamliner and Red Rich have been tried at the Experiment Station. The first two were superior. Brilliant and 20th Century have done exceptionally well in Ohio, and some other places.

Insect control. Use the same schedule as in Table 2 except use malathion instead of parathion within three weeks of harvest. Do not use malathion within one week of harvest.

The following is a list of the names of the
persons who have been appointed as members
of the Board of Directors of the
Company for the year ending 31st December 1921.
The names are given in the order in which
they were appointed, and the names of those
who have resigned are given in italics.
The names of those who have been re-elected
are given in bold type. The names of those
who have been appointed as members of the
Board of Directors for the first time are
given in plain type.

THE
ECONOMIC HISTORY OF
THE
UNITED STATES
FROM
1789 TO 1861

EDITED BY
J. H. COOPER
AND
J. H. COOPER

THE
MCMURDO PRESS
NEW YORK

THE
MCMURDO PRESS
NEW YORK

Cooperative Extension Work in Agriculture and Home Economics: College of Agriculture and Home Economics, University of Kentucky, and the United States Department of Agriculture, cooperating. Frank J. Welch, Director. Issued in furtherance of the Acts of May 8 and June 30, 1914.

Lexington, Kentucky
December, 1954

10M-12-54