STRAWBERRY CULTURE IN ILLINOIS

By A. S. Colby

Circular 453

UNIVERSITY OF ILLINOIS - COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION AND EXTENSION
SERVICE IN AGRICULTURE AND HOME ECONOMICS
CONTENTS

CHOICE OF LOCATION FOR COMMERCIAL PRODUCTION.............. 1
SELECTING THE SITE FOR THE PATCH.................................. 2
THE SOIL AND ITS PREPARATION......................................... 4
CHOOSING THE VARIETY TO GROW.......................................... 10
SELECTING AND CARING FOR THE PLANTS............................... 16
WHEN AND HOW TO PLANT.................................................. 18
MANAGING THE PATCH THE FIRST SUMMER............................. 24
WINTER TREATMENT OF PATCH............................................ 28
SPRING TREATMENT THE SECOND SEASON............................... 31
IRRIGATION NEEDED DURING DRY PERIODS.............................. 32
CARING FOR THE CROP..................................................... 35
RENEWING THE PATCH..................................................... 39
SPECIAL CULTURAL DIRECTIONS FOR EVERBEARING
VARIEDIES........................................................................ 41
MARKETING PROBLEMS....................................................... 43
YIELDS, COSTS, AND PROFITS.............................................. 45
CONTROLLING COMMON INSECTS AND DISEASES...................... 46

Urbana, Illinois
Printed in furtherance of the Agricultural Extension Act approved by Congress May 8, 1914.
H. W. MUMFORD, Director, Extension Service in Agriculture and
Home Economics, University of Illinois
Strawberry Culture in Illinois

By A. S. Colby, Chief in Small Fruit Culture

ADAPTED to the home garden as well as to commercial production, strawberries take high rank among Illinois fruits. A small area of standard varieties properly cared for will furnish an abundant supply of fresh, well-ripened fruit over a long period in the second summer following planting. If everbearers are used, fruit will be available the season the plants are set out. An occasional surplus may be canned or otherwise preserved or may be turned into ready cash. Under careful treatment strawberries bring good and quick returns at a comparatively small outlay of time and money.

Commercial plantings of strawberries in Illinois are usually limited to 5 acres, tho a few plantings contain 10 acres or more. The heaviest concentration is near the larger towns and cities and in other areas where favorable transportation facilities are combined with soil and climatic conditions particularly suited to certain market varieties. During the past few years commercial strawberry production has been profitable for those growers who set varieties adapted to the locality, gave their plantations good care, and paid particular attention to marketing a quality pack.

Whether one is growing berries on a small scale for home consumption or plans to go into commercial growing on a large scale, he will have to observe the same general principles and practices if he is to get the best returns for his efforts.

CHOICE OF LOCATION FOR COMMERCIAL PRODUCTION

When choosing a locality for commercial strawberry production, one must keep in mind several important factors; namely, nearness to market, good hard roads or railroad facilities, availability of varieties adapted to the locality, favorable climate, good sites, proper soils, and an adequate supply of intelligent labor. The disadvantages of a locality may, however, be partially or wholly offset by its advantages. For instance, land in a certain district near a city, altho high in price, was ideally located with respect to marketing advantages.

1 Apples and peaches are the only Illinois fruits whose commercial value exceeds that of strawberries. Some 7,800 acres were devoted to commercial strawberry culture in 1929, according to the 1930 Census. From this area there were marketed more than 9,700,000 quarts valued at approximately $1,143,000. Home plantings would add considerably to these totals.
The owner paid nearly all the original cost of the tract from the returns of his strawberry crop within a short period. He then turned the property into a city subdivision and the lots were sold.

Many districts, including those in southern Illinois, are not located near good local markets. Compensating advantages include relatively low-priced land, soils generally within the range of acidity suitable for strawberries, nearness to sources of supply of plants and packages, excellent transportation facilities, a harvesting season about midway between those of the southern and northern areas of commercial production, relatively cheap labor, and a sufficient acreage already in production to attract brokers, commission men, and truckers. Scattered groups of growers skilled in handling the crop to advantage have built up a reputation for a quality product in some of these districts.

There are many excellent possibilities for the establishment of strawberry patches within easy trucking distance of the larger Illinois towns and cities. During the last few years more and more of the crop is being transported by trucks. In many sections the roadside market offers a certain and profitable means of disposing of a quality crop. Should extensive plantings develop in any locality which is near a good railroad shipping point, it may be profitable to ship in carlots. To load a car daily during the shipping season usually requires a minimum area of 100 acres conveniently located about the shipping point.

SELECTING THE SITE FOR THE PATCH

Whether strawberries are grown on a small scale for home consumption or on a commercial scale, the choice of a site needs careful attention. The best care will not give satisfactory results unless the site meets most of the requirements for strawberry culture. If commercial production is being considered, much time and expense will be saved later if only the best available piece of ground is chosen for planting. For a small home planting certain desirable features may be sacrificed in order to have the patch close to the house or perhaps in connection with the vegetable garden.

Some Elevation Is Desirable

The site should lie somewhat above the surrounding area. While it should be fairly level so that the soil will not wash, it should have a gentle slope, so that air drainage will be satisfactory. A slope of about 3 feet in 100 is usually enough for air drainage. With this
slope, the cold air will usually settle into a lower place beyond the site during the period in the early spring when there is danger of frost injury.

Where other conditions are especially favorable but the slope appears so steep that the soil may wash, the plants should be set in rows following the contour of the hill.

**FIG. 1.—GOOD SITES FOR STRAWBERRY GROWING IN SOUTHERN ILLINOIS**

Even in a locality favorable for strawberry growing, the site for the patch must be carefully selected. Note here the excellent natural air and water drainage provided partly by the gentle slopes, with correct moisture, and partly by the shelter belts of trees which protect the beds from drying winds.

**Good Water Drainage Essential**

Good underdrainage for water, as well as good surface drainage, must be provided. The strawberry plant cannot stand flooding for even a few hours at any time without damage to its root system. Sufficient slope and freedom from “basins” are necessary to take care of surplus water in late winter and early spring when snow is melting and the ground may be frozen.

Compact, impervious soil types of either surface or subsoil are unfavorable for soil water movement and detrimental to root growth. To determine subsoil conditions it may be necessary either to bore into the subsoil with a soil auger or to dig holes at frequent intervals over the field. Poor water drainage in certain impervious soil types, such as fine yellow clay, is partly responsible for the root troubles that have appeared in strawberry plantations in various sections of
some sites, if otherwise ideal, may be tiled and additional surface drainage provided by leaving occasional dead furrows. When the only land available is low and the drainage often poor, it may be advisable to set the plants a few inches above the furrows which separate the rows.

Merits of Different Slopes

The seasons of blossoming, growth, and ripening are affected by the direction of the slope on which strawberries are grown. If the ground slopes to the south, the plants start to grow earlier in the spring and may mature an earlier crop, which often is marketed to advantage at higher prices. However, in regions where late spring frosts are frequent, safety should not be sacrificed to earliness. An eastern or northern slope may be preferable, for on these slopes the soil will not warm up enough to cause much growth until weather conditions are favorable and there is less danger from frost.

Strawberries as an Intercrop in Orchards

Some growers have planted strawberries as an intercrop in a young orchard. The advantage in such a practice is that the strawberries bear the next year after planting and thus begin to furnish an early income while the orchard is growing. The objections are that (1) an intercrop makes orchard operations more difficult, since tillage and pest control requirements vary according to the season and kind of plant; (2) the mulch necessary in strawberry culture may constitute a fire hazard and may also harbor mice which may attack the trees; and (3) the strawberries may retard the growth of the trees.

THE SOIL AND ITS PREPARATION

Deep Sandy Loam Is Most Desirable

Strawberries can be grown on a variety of soil types. They do well on a soil that is neither extremely heavy nor too light, that is at least moderately fertile, contains a good supply of humus, and is well drained and well prepared. Soils hard to work, that “bake” easily, and that are slow to absorb water are not desirable.

Light soils may be worked earlier in the spring and are better than clay soils where plants are grown for nursery stock. Clay soils usually have a higher humus content, and thus hold moisture better than the light soils. Clay soils are often more fertile but may be poorly drained. A deep, fertile sandy loam with a subsoil that will hold moisture but that is not of a “hard pan” character is highly desirable.
A light sandy soil may be fitted for strawberry culture if heavy applications of barn manure or of green manure are plowed under some months before the plants are to be set. Heavy clay soils and muck land are more difficult to handle and should be avoided.

Newly cleared ground often can be used to advantage for growing strawberries, if it has an adequate supply of available nutrients, is in good physical condition, and contains no injurious pests, such as white grubs.

**Good Moisture Penetrating and Holding Ability Necessary**

The strawberry plant has a small, shallow root system. The roots spread out only a short distance, often for not more than a foot, and do not usually penetrate much below the surface 12 inches of soil. A continuous and even supply of moisture within reach of the roots is necessary if a heavy crop of fruit is to be produced. Moisture may be needed most at fruiting time, when so often there is not enough rain. The soil, therefore, should be capable of holding moisture from earlier in the season. A liberal amount of fresh organic matter worked into the soil several months before the plants are set increases the ability of the soil to absorb and retain water and, during its process of decay, helps to set free plant nutrients in the soil.
A Hoed Crop Is Good Preparation for Strawberries

Looking ahead a year in preparing the land for strawberry planting is decidedly worth while. The growing of a hoed crop at least one year before strawberries are planted is recommended, especially if a good coating of manure is applied and turned under for such a crop. If, however, a legume, such as lima beans, is used, it may be well to inoculate the seed in order to promote the growth of nitrifying bacteria and thus make it possible for the roots of the legume to add nitrogen to the soil rather than take it away. Some of these legumes are heavy nitrogen feeders and even tho crop residues are plowed back, the lack of available nitrogen in the soil may be reflected in poor growth of strawberry plants the next year. Under such conditions nitrogen fertilizers should be applied.

If the hoed crop preceding strawberries is well cared for, many troublesome weeds will be destroyed. The white grub, one of the most destructive pests of the strawberry plant, is also less likely to be found in ground that has been cultivated for one season than in sod land. Then, too, the soil after a year's cultivation will be in much better tilth, thereby insuring a more satisfactory plant growth.

Apply Generous Amounts of Barn Manure

Soils are seldom too rich for strawberries. Ten to 30 tons of barn manure an acre may well be applied to some soils during the fall before planting. If worked into the soil then, the manure will become somewhat decomposed before spring. Plowing or spading the soil again in the spring will bring the plant nutrients in the rotted manure nearer the surface of the ground, where the strawberry plant can use them to advantage. Weed seeds will also be turned up and the young weeds may be killed easily by early cultivation before they do any damage.

If little fertilizer has been added to the soil previously, and the bed is to be planted in the spring, a thick coat of well-rotted manure may be scattered broadcast at this time and worked in well before the strawberry plants are set.

Green-Manure Crops May Be Used

When barn manure is either hard to get or is so full of weed seed that its use is not recommended, green-manure crops may be used to supply humus and some of the necessary nitrogen to the soil. The legume crops—sweet clover, vetch, beans, peas, and, in the southern part of Illinois, Korean lespedeza—may be used for this purpose. Clover is especially desirable because of its deep-rooting tendency.
Approximately the following amounts of seed are suggested for use on an acre-basis: sweet clover, 10 to 12 pounds; vetch, 20 pounds; soybeans, 1 1/2 bushels, using a small-seeded variety when one is available which is adapted to the locality; cowpeas, 1 bushel; lespedeza, 15 to 20 pounds. A mixture of one of these legumes with a bushel of oats and a peck of buckwheat may also be used. One bushel of rye and 20 pounds of vetch make an excellent combination on a light sandy soil and can be sown as late as August. Little growth of rye and vetch may be made in fall, but good growth will begin in spring. The plants are plowed under when the vetch is in full bloom.

If the strawberry site is not subject to erosion, most of these green-manure crops may be plowed under in the fall after they mature. On sites subject to erosion, allow the crop to remain until spring, but plow under at least a month before the strawberry plants are to be set.

When and How to Use Commercial Fertilizers

If the soil is well supplied with humus, especially from plowing under either a leguminous green-manure crop or barn manure, and is in good physical condition, commercial fertilizers may not be profitable. Good soil texture has been shown to be of as great importance as nutrient content.

However, it may be wise in some soils to insure a greater supply of plant nutrients close to the plants by adding some commercial fertilizer as the ground is being prepared before spring planting. Superphosphate at the rate of 200 to 400 pounds an acre, muriate of potash at the rate of 50 to 100 pounds, or complete fertilizer up to 400 pounds may be applied if there are indications that these elements are needed. The fertilizer is usually drilled in with a grain drill.

During the first growing season the application of nitrogen is advisable if the plants grow poorly with few runners and show light foliage color. Apply 100 to 200 pounds an acre of a nitrogen fertilizer about a month after planting and a similar amount in late summer. This late application may be helpful in increasing the size and vigor of the young plants. It should be applied near the plants but not directly in contact with the foliage or crowns. Applications may be made either with a small drill or by hand.

Commercial fertilizers, however, cannot replace humus-forming

---

1For information concerning tests to determine the need for fertilizer and limestone consult your farm adviser.
barn or green manure, and the fertilizer question is in its last analysis a local one, which must be worked out by the individual grower.

When a heavy application of manure is made on good soil the year previous to strawberry planting and the land used for a hoed crop, the supply of nitrogen and other nutrients in the soil when the strawberries are set is sufficient to encourage maximum runner formation in the early part of the season. However, yields will usually be increased when a nitrate fertilizer is applied in August or September. This application is to aid in flower-bud formation in the crowns of the runners already set and not to induce more runners.

The use of commercial fertilizer in the spring of the fruiting year is now being tested in southern Illinois. Experimental evidence as to its value is not yet available. Observations indicate that the heavy foliage on fertilized plots tends to shade the fruit too much and promotes the development of fungous diseases. The conditions under which the plant crowns were formed during the growing period of the previous year—such as date of setting runners, amount and availability of nitrogen, temperature, and moisture—determine to a considerable extent the total yield of fruit in the first fruiting season.

When the plantation is being renewed after one year of fruiting, an application of 200 to 400 pounds an acre of a complete commercial fertilizer high in nitrogen will usually be beneficial.

Why and When to Use Lime

The use of lime in soil being prepared for strawberries is not usually advisable if the soil texture is good. If lime is needed to neutralize the soil, or make it "sweet," in order to promote the growth of a leguminous crop in the rotation, then it should be used. Experiments in Michigan,\(^1\) and observations in other states, bearing upon soil acidity and its importance in strawberry growing, show that the soil reaction alone, either acid or alkaline, does not materially affect strawberry growth or yield. While strawberry plants seem to do best on a somewhat acid soil, they will thrive on neutral and grow in slightly alkaline soils. Probably the best results are secured on soils within the pH range of 5 to 7.\(^2\)

Sometimes when the soil is in poor physical condition, its texture may be improved by applying finely ground limestone at the rate of


\(^2\)The pH scale is one used to measure the intensity of acidity or alkalinity in soils. Values from 7 down to zero include the acid range, while values from 7 to 14 cover the alkaline range.
500 pounds to the acre or about 2 pounds to 100 square feet. The application should be made on a crop preceding the strawberries. The lime also appears to act upon certain plant-food elements in the soil in a way to make them more readily available. If a legume is to be used as a manure crop, very fine limestone drilled in with the seed will cause the most immediate benefit.

**Rotation Plans for Large-Scale Growers**

Strawberries should not be grown continuously on the same site even tho the site is desirable from the standpoint of convenience, exposure, and air and water drainage. Rotation of crops is recommended in order to keep the humus content of the soil high and to improve its physical condition, to check weeds, and to aid in the control of insects and diseases. The other crops in the rotation should, under most conditions, occupy the land for at least as long a period as the strawberries.

The large-scale grower may find it possible to follow a definite rotation plan. The land might be kept in clover for one or two years, then given a deep plowing in the fall and planted the next spring to some hoed crop, such as potatoes or tomatoes. If these vegetables are harvested by August, a cover crop of oats or rye, or oats and soybeans, may be sown. This cover crop would then be plowed under late in the fall or very early in the spring before the ground is prepared for setting the strawberry plants. If corn should be the crop to precede the strawberries, the cover crop may be sown between the rows and the seed worked in at the last cultivation of the corn.

Another rotation which may be used is sweet clover, corn, and strawberries. Where the soil has been tested for acidity and the proper amounts of limestone applied, sweet clover can be sown in the early spring, allowed to grow for one season, and then plowed under in the following spring. Sweet corn or some other hoed or cultivated crop may be planted the year following the sweet clover. When the corn is cultivated for the last time, oats, soybeans, or cowpeas may be sown in the corn rows to serve as a green-manure crop. Late in the fall the patch may be plowed, or if the ground is rolling and likely to wash, the plowing can be delayed until spring.

Where corn is used in the rotation immediately preceding strawberries, there is some danger that the strawberries may be attacked by root lice. Sanitary measures that will help in the control of root lice are discussed on page 50.

An excellent rotation for a farmer who has a large vegetable gardening area
for strawberries, if the soil has been well manured over a period of years and is in good tilth.

**Steps in Preparing the Soil**

In order that the soil may be in a good state of tilth before strawberry plants are set, certain preparatory operations are necessary (Fig. 3). On a commercial plantation the soil may be pulverized by plowing, disking, and harrowing. Either a corrugated roller or a planker may then be used to compact the soil as a last important step before marking off the rows to set the plants (see page 21).

**Fig. 3.—Preparing the Soil on a Commercial Plantation**

If the ground is disked previous to plowing, all the soil will be uniformly broken up to a good depth. The disk should follow the plow immediately as the next step in breaking up the soil. The smoothing harrow helps to make the dirt fine and to level the ground. Using a corrugated roller further pulverizes and compacts the soil.

**CHOOSING THE VARIETY TO GROW**

**Keep Purpose in Mind**

The choice of a variety will depend upon its adaptability to soil and climatic conditions, its growth and fruiting habits, its susceptibility to injury from insects and fungi, and the purpose for which it is to be grown. The experience of successful growers in a community is usually a good guide in the selection of the best varieties for
further planting. However, several of the new varieties have been sufficiently tested under conditions similar to those prevailing in some of the representative strawberry growing areas in Illinois so that they may be safely planted there. Unless reliable information can be obtained as to the adaptability of new varieties for a certain locality, they should be tried out on a small scale before extensive plantings are made.

When the fruit is grown for home use or for fancy trade at a local market, the berries should be of high quality and rich in color, though they need not be especially firm. A variety may be chosen which ripens through a long season; or early, midseason, and late varieties may be used if a succession is desired.

If one intends to produce for a distant market, varieties should be grown which are in demand on that market and which ripen during the season when there is relatively little competition from other shipping sections, which are firm enough to stand shipment well, have an attractive appearance, are productive, easy to pick, and stand up well in the field under unfavorable weather conditions. If in addition to these qualifications a variety also has good dessert quality, it is all the more desirable for commercial culture. As a rule, it is advisable to concentrate on one or two varieties in any one large shipping region.

The yearly output of strawberry products each year in this country is estimated at many millions of dollars. Canning or otherwise preserving a portion of Illinois’ commercial strawberry crop may be advisable under some conditions. Fruit qualities desirable for canning include deep red color, a characteristic strawberry flavor, and a flesh firm enough to withstand cooking without breaking to pieces. The nearer the processing factory is to the producing area, the better, as a rule, will be the resulting product. The fruit should be picked while very firm and processed the same day.

Give Attention to Flower Type

In choosing a strawberry variety, the grower must consider the possible influence of flower type on yield. Some of the standard strawberry varieties have imperfect blossoms; that is, they have pistils but no stamens. Warfield (early) and Howard Supreme (midseason) are in this group. These varieties cannot bear fruit unless a perfect-flowering variety grows nearby to provide pollen, which is produced in the stamens. If imperfect varieties are planted, it is recommended that there should be one row of the perfect to every two rows of the imperfect variety. The plants with perfect blossoms
should bear an abundance of pollen and should bloom at the same time that the imperfect ones do. Planting varieties with perfect blossoms, on which are borne both pistils and stamens and which produce their own pollen, makes higher yields possible in unfavorable seasons.

Habit of Flowering Influences Yield

A knowledge of the flowering and fruiting habit of the strawberry is needed in order to understand why certain flowers in the cluster develop into large fruits, while the fruits from other flowers are either small or fail to develop.

A typical strawberry flower stalk or inflorescence is made up of a single main, or primary, branch from which originate two secondary branches. From each of these secondary branches two tertiary branches arise, and from each tertiary branch, two quaternary branches. Occasionally quaternary branches produce laterals, which are known as quinaries. At the terminals of each of the branches mentioned above, flowers are produced in succession, the primary blossoms opening first. These flowers are commonly designated as primary, secondary, tertiary, quaternary, and quinary, according to the branch from which they originate. With this definite order of blooming, the normal number of secondary blooms will be twice that of the primary ones, the number of tertiary blooms twice that of the secondaries, and so on. Varieties differ in their ability to form branches, flowers, and fruits beyond the secondary groups. Again, differences in cultural treatments will cause variations in the number of flowers produced on an inflorescence within a variety.

That a definite correlation exists between the position of the flower—whether, for example, it is of primary or quaternary origin—and the fertility of its pistils has been shown by Minnesota experiments. The number of seeds and the size of the fruits usually decrease with the later flowers because of pistil sterility. As a result, these later fruits are small or may be nubbins. Often the last flowers approach sterility. Failure of the flowers beyond the secondary groups to set may be due either to an inherent characteristic of the variety or to unfavorable soil or climate rather than to injury from insects or disease. Some of these varietal differences are noted under "Representative Strawberry Varieties," pages 13 to 16.

It has been found in Illinois experiments that good cultural methods—including cultivation, optimum soil fertility, and a suffi-
cient moisture supply—by encouraging the normal development of the plant and its pollen, pistils, and fruits, are important in increasing fruit production.

Representative Strawberry Varieties

ABERDEEN. Grown for some time in the eastern states, Aberdeen has recently shown promise under Illinois conditions because of its comparative resistance to brown stele root rot. The plants are vigorous and prolific but moderately susceptible to leaf spot. The blossoms are perfect. The fruit, ripening in midseason, is medium in size, cone-shaped, attractive but acid, with whitish core. The berries sometimes scald in the hot sun, and do not stand up well during wet periods. The fruit is sufficiently firm for local trade and short hauls, but must be marketed quickly after picking.

AROMA. When planted on the heavier types of soil, Aroma is one of the best late varieties for distant markets because of its attractive appearance, large size, and excellent shipping quality. The flowers are perfect. The first berries are very large to large, the size decreasing with later pickings. The berries are round-conic to blunt wedge shape; bright scarlet in color, with light red flesh; glossy and firm. The flavor is mildly subacid and the berries are of fair to good quality. The plants are healthy, medium in vigor, and fairly productive.

BLAKEYMORE. A recent introduction of the U. S. Department of Agriculture, Blakemore is especially recommended for the firmness of its fruit, its earliness, and its productivity. Its picking season is comparatively short, with the best fruit produced from primary and secondary flowers. It is an excellent plant-maker, with healthy foliage. A cross of Missionary and Premier, it is replacing Klondyke in southern
Illinois. On a good soil in a favorable season, the plants will set so many runners, if unchecked, that the fruit will be inferior in market value and of small average size and low yield. The number of new plants from runners must be restricted in the row. The flowers are perfect and the medium-sized, round-conic, red berries have good quality, although they are somewhat too acid for dessert. Because of its unusually firm fruit, Blakemore is promising for long-distance shipment and for preserving.

The so-called “yellows” disease, which sometimes affects the leaves of Blakemore and interferes with production, may be partially controlled by roguing out the infected plants as soon as noticed.

CHESAPEAKE. An old midseason to late variety of superior quality and attractive appearance, Chesapeake is not a vigorous grower, is only moderately productive, but is healthy, and perfect-flowered. The fruit is of medium to large size, round-conic in shape, and firm. Chesapeake seems to do best on the lighter soil types and is much benefited by irrigation. The plants usually escape frost as they bloom late.

DORSETT and FAIRFAX. These two new varieties, recently introduced by the U. S. Department of Agriculture, are similar in certain
respects and are therefore described together. They have been tested in different sections of Illinois and appear very promising. Both are probably of the same parentage—a cross of Premier and Royal Sovereign—and combine good characteristics from each parent. Both have perfect flowers, and the fruit ripens from early to midseason, Dorsett beginning perhaps a few days earlier than Fairfax. Dorsett is usually a heavier plant-maker under average conditions, and more productive than Fairfax. So far both appear resistant to leaf spot.

The fruit of Fairfax is darker red in color and somewhat firmer in texture and, some think, of higher dessert quality than Dorsett. Both bear very large conic to wedge-shaped fruit of superior flavor and attractiveness, which tends to hold its size well throughout most of the season.

The seeds of Fairfax protrude from the comparatively firm flesh, possibly resulting in better carrying quality than that of Dorsett.

For home use, where dark color is not objectionable, especially following a growing season favorable to good leaf and crown growth, Fairfax sometimes is superior to Dorsett. For local market and short hauls, Dorsett, even tho not so firm as Blakemore, may be profitable because of its large size, high quality, and attractive color. Both should be tried out, and the final choice of variety determined by home and market demand. So far both varieties have sold at a premium. Since both are of such general excellence, the choice may possibly hinge on color, that is, whether a medium-light or a dark berry is preferred.

DUNLAP. This variety is of especial interest because of its Illinois origin. Its hardiness, high quality, and attractive appearance made it
a great favorite for home and local market use over a large part of the northern states for many years. The plants are hardy, moderately healthy, and productive when runner plants are restricted. The flowers are perfect. The fruit ripens from early to midseason, is conic in shape, has excellent flavor and rich color, but is too tender to ship far and is inclined to run small after the first picking. Dunlap is now being replaced by Premier and Blakemore.

When introduced, Dunlap and Burrill varieties were plainly distinct, the fruit of the latter being characteristically wedge-shaped. Owing partly to the difficulty of separating these two varieties on the basis of plant characteristics, they are now generally mixed in the trade.

PREMIER. Premier is a leading early variety for home use, for marketing locally, and for shipping short distances. The flowers are perfect. The plants are healthy, medium in vigor, and productive. The first berries are large, but in later pickings lose size, especially in dry seasons, unless irrigation is practiced. The fruit is attractive, medium red in color, conic in shape, and moderately firm. When well grown and carefully handled, Premier berries may be safely "pan graded," altho they are more subject to injury from this procedure than are Aroma and Blakemore. Premier ranks well in quality with many varieties, but is surpassed by Chesapeake, Dorsett, Dunlap, and Fairfax.

EVERBEARING VARIETIES. During the last few years a group of everbearing, sometimes called fall-bearing, strawberry varieties has come into prominence. Most of the varieties have not proved worthy of the claims made for them in Illinois. Their chief advantages lie in the fact that a crop is possible from the plants the same year they are set, and since fruit is produced during the late summer and fall, the season for fresh strawberries is materially extended. (See directions for their culture, pages 41 to 43.)

Of the everbearing varieties offered by nurserymen, Mastodon is the most widely planted in this state. This variety makes a vigorous growth and produces heavy crops of large, handsome fruit of fair quality. Stock is now available of Rockhill and of Wayzata, two similar if not identical varieties. Both are said to be as good in plant characteristics and in the production of heavy crops of large berries as Mastodon, and superior in quality of fruit. Gem is promising for trial.

SELECTING AND CARING FOR THE PLANTS

Use Well-Grown, Healthy Stock

Only the best stock should be used for setting. Plants from old beds, which have fruited, are usually weak and often transfer insects and diseases to the new patch. If only a small number of plants are needed for starting a new home garden patch, they may be secured from the old bed if no crown borers or similar pests are present. The young plants may be dug with a spading fork. Small, weak, diseased stock should be discarded and the strong healthy plants reset immediately after they are dug.
It is recommended that stock be secured from a reputable nursery where special care is given to keep the different varieties separate and where the plants are not permitted to fruit but are grown in special nursery plots and the entire rows are dug as the plants are needed.

Pedigreed plants, so-called, are for sale by the trade. These plants are from stock which, it is claimed, has inherited certain desirable characteristics that have been “fixed” thru careful selection in the nursery. The experimental evidence thus far published does not support the belief that these plants are superior to other stock well grown and free from diseases and insects.

It is desirable that the stock be obtained from runners which have grown one previous season. Each plant should have a healthy top, a strong and vigorous crown, and a good root system, which is fresh and bright in appearance and usually white or straw-colored. If grown on a muck soil, the roots may be dark. Black crowns and roots indicate that the plant is either old or injured by disease or unfavorable weather conditions and is unfit for planting.

**Place Order With Nursery Early in Winter**

Most nurseries issue their catalogs soon after the first of the year. Varieties should be chosen and the order placed early in the winter with specifications for date of shipment. More careful attention is given early orders and a better choice of varieties is afforded. It matters little whether plants are northern- or southern-grown if healthy stock free from the strawberry nematode sometimes found in southern nurseries is secured, except that southern-grown stock may be too far advanced for successful planting when spring opens in northern sections.

Strawberry plants will stand shipment for some distance if properly packed. It is usually better, however, to order from a nearby nursery, in which case the plants are commonly dug a short time before they are needed for planting.

**Heel-In the Plants Until Ready to Set Them**

As the plants are received from the nursery, they should be carefully unpacked and heeled-in, or trenched (Fig. 7). If allowed to remain in the original package for a short time, even tho put in a cool place, they will heat and be seriously injured.

For heeling-in choose a well-drained spot protected from sun and wind, where the plants will not be disturbed. Spade up the soil, and pulverize it as for planting, making several V-shaped trenches 6 inches
deep and fairly close together. The plants come in compact bundles of 25 each, with a label in each bundle designating the variety. Open the bundles, separate the plants, and spread them out in the trenches, allowing the moist earth to come in contact with the roots as shown in Fig. 7. This precaution is highly important. Then firm the earth carefully about the plants, but do not allow the crowns to be covered. The variety label placed at the end of each trench prevents the mixing of varieties.

Water the plants well after heeling them in.

**WHEN AND HOW TO PLANT**

**Spring Planting Preferable**

All things considered, planting early in the spring as soon as the soil can be prepared is usually preferable to fall planting. Weather and soil conditions in the spring are more favorable for plant growth. Fall-set plants require extra care in weed control and mulching to
prevent winter injury. Pot-grown plants for fall planting may be purchased from nurseries which specialize in that type of stock, but they are expensive and the outlay may not be justified except under special conditions.

**Spaced-Row System of Training Recommended**

*Matted-Row System.*—The matted-row system in which the runners are allowed to grow and root at will, filling in the space between the original plants and even extending out into the row where cultivated, is most commonly used by growers. It is the least expensive to maintain and, with some of the weak-growing varieties such as Chesapeake, results in a fair crop of good fruit. However, on fertile soil during a favorable growing season, vigorous varieties such as Blakemore, Dunlap, and Dorsett throw great numbers of runners. If these runner plants are allowed to set at will, the row becomes so matted that serious crowding of plant crowns occurs. The young plants are deprived of necessary moisture and nutrients, and small weak crowns with too few leaves result. Most of the fruit crop the succeeding year will be small and of inferior quality.

*Spaced-Row System.*—A modification of the matted-row system known as the spaced-row system is recommended under most conditions for Illinois. It is based upon studies of the growth and fruit-bud development of the strawberry plant made by various experiment stations. The plants are set 18 to 36 inches apart in the rows, the exact distance depending upon their vigor. For example, Aroma is less vigorous than Blakemore and should therefore be set more closely. The rows are up to 4 feet apart. (See Figs. 13 and 14, page 27.)

Runners in the spaced-row system are allowed to grow and set crowns until the rows are of the desired width, but spacing is used to prevent the rows from becoming heavily matted. Experiments have shown that heavily matted rows produce low fruit yields. In England¹ plants taken from parents allowed to produce only three runners yielded more fruit than the progeny of plants with unrestricted runners. In Canada, Davis² found that new plants formed as late as October 20 produced, on the average, only 5 fruits the following year; that runners formed about the middle of August produced an average of 16 fruits; and that runners rooted in July produced only about 9 to 10 fruits. Apparently a matted row was formed, and the first runner plants became in turn the parents of

¹Ball, E. A note on strawberry "strains." Jour. Bath and West and South Counties Soc. 1926.
²Annual Report, Horticultural Division—Dominion of Canada, Dept. of Agr. 1921.
large numbers of new plants and were thus depleted of energy. In Illinois the yield as well as the quality of Blakemore berries was found to be inferior where "nature was allowed to take its course," and heavily matted rows were grown.

The number of runners to leave will vary according to the variety and the soil. Darrow\textsuperscript{1} of the U. S. Department of Agriculture, stated with reference to field observations of different varieties:

"At Willard, N. C., the yields of Blakemore plants grown under the various spacing systems, ranging from an average of over 30 plants to only two thirds of a single plant per square foot were strikingly different. The yields with 30, 4.0, 1.8, and 2/3 of a plant per square foot were, respectively, 42, 119, 131 and 99 bushel crates of marketable fruit per acre. Observations in fields of Dorsett, Fairfax, and other varieties in other strawberry sections indicated that the number of plants per given area is the chief, though not the sole, factor in determining adaptation.

" Apparently in varieties such as Blakemore and Dorsett, where vigor of plant may be expressed by the production of many runners, yields may be increased by restricting the number of runner plants to the optimum number per square foot. Runner restriction, conserving as it does the soil nutrients and moisture, tends toward more crowns, more fruit buds and more fruit per plant.

"... In testing seedlings or varieties a stand of 1 to 4 plants per square foot by July seems near the optimum. All later runners should be removed at frequent intervals. Culture should, of course, be such as to maintain in the greatest degree the vigor of the remaining plants."

In Ohio\textsuperscript{2} where a comparison was made of the yields from Premier runners rooted in different months during the season previous to fruiting, the yield was about fifteen times as great for a runner rooted in June than for one rooted in September or later, even tho there were more runners rooted late than early. In experiments in Maryland, under the supervision of the U. S. Department of Agriculture, plants allowed to set in a thickly matted row with only two or three leaves per plant yielded only about one-fifth as much fruit as those in spaced rows with ten or more leaves per plant.

From a practical standpoint, therefore, if the first runner plants are allowed to remain and the later runners are cut out, the plants set early will be more productive and profitable. The surplus plants are "strawberry weeds" and should not be allowed to rob the permanent plants of necessary moisture and nutrients.

With good soil and good culture in Illinois from four to eight runners may be allowed to take root to the square foot with the runner plants spaced up to 9 inches apart, the exact spacing depending

---

\textsuperscript{1}Darrow, G. M. Science 80, p. 315. October 5, 1934.
\textsuperscript{2}Shoemaker, J. S. The strawberry in Ohio. Ohio Exp. Sta. Bul. 444. 1929.
somewhat upon the vigor of the variety. Blakemore, for example, can well be spaced farther apart than Chesapeake.

**Hill System.**—In another method of training known as the hill system only the original plant is allowed to grow; all runners are removed as they appear. Some claim that larger fruit can be obtained from plants so trained, altho the total yield is less. Too much hand work is involved, however, in keeping plants trained to this system to make it practicable. The plants are set about 18 inches apart in rows about 30 inches apart. In a modification of this method the plants are set about $3\frac{1}{2}$ by $3\frac{1}{2}$ feet apart in squares. Cultivation is carried on in both directions early in the season. When the runners begin to form, they are trained lengthwise to the spaces between the plants in order to establish a row, and cultivation is continued in the middles between these rows.

**Set Plants in Rows Uniformly Distant**

The plants may be set in straight rows by being placed against a wire drawn taut across the patch, if the distance is short. A homemade marker, such as is shown in Fig. 8, may also be used to lay out the patch. This tool may be cheaply constructed of several pieces of 2-by-4-inch plank about 18 inches long rounded on the front ends like sled runners. These are laid on edge as far apart as the rows are to be. They are then fastened on a 4-inch board. Another strip at right angles to this board, and braced from end to end of the marker, serves as a tongue for drawing it over the ground. The
marker is first pulled across the patch to mark the rows and is then drawn at right angles to the rows, to make the intersections at which the plants are set. If the distance between plants is not to be the same as the distance between rows, the runners on the marker will need to be changed accordingly.

**Prune Plants Before Setting**

The plants should be pruned somewhat before being set; all the larger leaves should be removed in order to guard against excessive loss of moisture. Some growers recommend shortening the roots for convenience in planting, but this practice is of doubtful value except perhaps when a transplanting machine is used. The roots may be shortened quickly by placing the plants in bunches on a flat surface and using a large sharp knife to cut away the excessive root growth.

**Keep Roots Well Moistened**

The plants should not be allowed to dry out from exposure to sun or wind while being set. A basket lined with damp moss and covered with a wet sack or a bucket partially filled with water will insure proper conditions for the plants as they are carried about the field.

**Set Plants Firmly With Crowns at Ground Level**

A flat or corrugated dibble, a trowel, or a clean, shiny spade may be used to dig the holes for the plants. If a spade is used, as shown
(1) With the ground properly prepared and a corn wire marking the row, a shiny spade (to which the dirt will not stick) is inserted and pressed down to about half its length, making a flat opening. (2) As the spade is carefully removed so that no soil falls back into the opening, a plant is set with its roots spread out in fan shape and its crown a trifle above ground level. Next (3) the spade is inserted a short distance from the plant and the soil is pressed about it, completely filling the opening. Finally (4) the soil is pressed with the foot carefully but firmly about the plant, leaving its crown level with the ground.
in Fig. 10, insert it in the ground and press forward, making a narrow opening in which to place the plant. Take care that the roots are well spread out, not doubled up or wadded together. The crowns should be just above the level of the ground. Then press the soil firmly about the plant with the hands or feet, depressing the plant slightly in the operation, and leave it with the crown exactly at the ground level. If the crown is too high or too low, the plant will be severely injured or may even be killed.

Another mistake often made is in not firming the soil sufficiently about the plant roots. It is well to test the work by jerking a leaf of a plant just set; if properly planted, the leaf will come away, leaving the plant in the ground.

By the spade method a man and boy can set about 5,000 plants a day.

Using a Transplanting Machine

For those who are growing strawberries on a large scale, machines such as are often used in trucking sections for transplanting tomatoes, cabbages, and sweet potatoes, may also be used for setting strawberry plants. The land should be well prepared, and the soil must be fairly moist if planting is to be done with a machine.

About 30,000 plants, or 3 to 5 acres, can be set in a day with a planting machine, such a machine requiring three men to operate it. Difficulties in machine planting are that it is hard to set all the plants at the proper depth with their roots well spread out and to leave the soil sufficiently firmed about the roots. Considerable experience is necessary to use this method of planting successfully. It is usually necessary to have a man follow the machine to press the soil more firmly about the plants and reset those poorly planted.

Under favorable conditions of soil and with experienced and careful workmen, the cost of machine planting is comparatively low. An important advantage is that the work can be done quickly when the soil and weather conditions are most favorable.

MANAGING THE PATCH THE FIRST SUMMER

Cultivate Frequently Until Early Fall

Cultivation, frequent but shallow, should begin the day the plants are set and continue throughout the summer and early fall. The ground must be kept in good tilth to encourage runners to start and to allow them to root. Weeds must be kept down in order to conserve moisture and plant nutrients for the strawberry plants.

In a small patch a hoe and a rake or a wheel hoe may be used to
stir the soil and leave a dust mulch about the plants. In larger patches a 5-tooth cultivator with broad teeth is ordinarily used for the first cultivation. This cultivation may be somewhat deeper than the usual practice in order to loosen the soil which may have been packed in setting. From this time on, cultivate close to the plants until runners begin to start. A light 12-tooth cultivator is very satisfactory for this purpose. Do not leave the roots exposed at the edge of the rows.

The large-toothed cultivator uproots large weeds; the spike-toothed cultivator kills small weeds and leaves a good soil mulch. The disk may be used as a cultivator and for narrowing rows in renovation.

The runner plants should be saved, carefully spaced, and encouraged to root as soon as possible in order that they may develop the maximum number of leaves and vigorous fruiting crowns for the next year. Rooting may sometimes be encouraged by pulling loose soil over the runners.

The number of times it will be advisable to cultivate and hand-hoe will be governed by seasonal and soil conditions. Five to eight hand hoeings and eight to fourteen cultivations may be needed.

The width of the spaced row is controlled to a certain extent by the width of the cultivated strip. As the row becomes too wide—more than about 20 inches—surplus runners which encroach upon the middle space should be kept cut away with the hoe or by means of rolling cutters attached to the side of the cultivating tool.

Do not allow the runners to crowd each other in the row.

Cut out the surplus runners with a rake, a three-cornered hoe, or similar tool after four to eight good runner plants to the square foot have set. Space the plants up to about 9 inches apart. This involves
considerably more hand labor than has been thought advisable in the past, but only in this way can the grower be assured of the most profitable yield, with attractive fruit holding up well in size throughout a long period. It has often been observed that the best berries are found at the edge of a thickly matted row. Spacing the plants gives them necessary feeding area on all sides.

**Prevent Fruiting the First Season**

The production of fruits will retard the growth of newly set plants. Fruiting should therefore be prevented the first season. Carefully pinch off the flower stems as they appear, preferably before the blossoms open. For varieties such as Premier it may be advisable to go over the patch several times. Once or twice may suffice for Dunlap. Special directions for handling everbearing varieties are given on pages 41 to 43.
FIG. 13.—STARTING THE SPACED ROW
An attempt is being made in this row to space the runner plants about 7 inches apart. The arrows indicate runners recently set from the mother plant in the center. (Courtesy of W. F. Allen, Salisbury, Md.)

FIG. 14.—STRAWBERRY PLANTS GROWING UNDER THE SPACED-ROW SYSTEM
The plants in this patch are large and healthy with well-developed crowns, and promise a heavy crop of fruit. These productive rows are the result of good care during the previous growing season, including proper spacing of runner plants and removal of runners after the rows had been sufficiently filled. (Courtesy of U. S. Department of Agriculture)
Weed-Free Patch Means More Vigorous Plants

At the end of the growing season a well-kept patch will be absolutely free from weeds. The ordinary patch is too often a mass of chickweed, annual grasses, and other weeds. Such patches go into the dormant season handicapped because the strawberry plants were forced to compete with the weeds for moisture. Then too, in the spring the growth of the new crop of weeds will take moisture and plant materials needed by the strawberry plants.

There is little risk that late fall cultivation will affect the hardiness of the plants. Continuing the growth of the strawberry plant just as long as possible in the fall will cause no appreciable injury. The benefits resulting from maintaining good tilth and freedom from weeds will be demonstrated in the vigor and productivity of the patch the next season.

WINTER TREATMENT OF PATCH

Provide Protection With a Mulch

Extremes of winter temperature cause intermittent freezing and thawing where a patch is unprotected, and many plants are winter-killed by heaving. Proper mulching prevents this. It also protects the roots and crowns from the drying effect of winter winds.

If carefully handled, a mulch may sometimes be advantageous in keeping the plants from starting into growth too soon in an abnormally early spring. Weeds are less troublesome during the following fruiting season, moisture is conserved for the plants, and the berries are cleaner where a mulch is used. The value of a mulch in keeping fruit clean for picking and marketing is sufficient to warrant its use even if it served no other purpose.

Materials for Mulching

Among the materials used for mulching are strawy manure, straw of various kinds, wild or marsh hay, leaves, and pine needles. Cornstalks and rye straw and other coarse materials are not recommended. Wheat straw is one of the best mulches. When wheat is grown nearby, the supply of straw is usually adequate and reasonable in price. Some of the better growers who market clean fruit buy straw by the bale. Oat straw is often used but it may pack down rather tightly, an objection also found to the use of leaves.

If straw is used, care must be taken to see that it is as free from grain and weed seeds as possible, for the seeds will germinate in the spring and it will be hard to keep the plantation clean. If old straw
FIG. 15.—SPRING-TOOTH CULTIVATOR WITH ROLLING CUTTER
This homemade tool does very efficient work in cutting out surplus plants and weeds between the rows.

FIG. 16.—SPREADING A MULCH OF WHEAT STRAW ON A LARGE PLANTATION
The mulch is applied to a uniform depth of about 2 or 3 inches after the plants have become dormant.
can be obtained, it is to be preferred. By looking ahead, a supply may be secured a year before it is needed for use and exposed to sun and rain so that the seed will germinate and die. Baled straw should be torn apart; loose straw may be handled in wide flat-topped ricks. New straw should be shaken out before being used as a mulch. Do not use the chaff from the straw pile; it may contain weed seed and it has a tendency to pack.

On a windy site a loose mulch may be blown away unless special care is given to the time and manner of its application. Use somewhat moist material, apply it on a calm day, and firm it with the fork.

Apply Mulch Late in Fall

The mulch should usually be applied in November or December, depending upon the latitude, but after the plants have become dormant. Experimental work in Wisconsin\(^1\) indicates that plants should be mulched there before the temperature falls to about 20° F. or the plant crowns may be injured.

Spread the material uniformly over the patch, covering the plants about 2 inches deep. A heavier application may smother the plants. If mulching material is scarce, mulch only the rows. From 1 to 5 tons are sufficient for an acre, depending upon the material used and the latitude.

Mulching material is more effective when placed around the plants in a spaced rather than in a matted row, for in a spaced row it is of more help in winter protection, in conserving moisture, and in keeping the berries clean.

Growing a Mulching Crop

The benefits to be derived from the use of a mulch are so much worth while that it will pay to grow a crop especially for use as a mulch later, if one of the above materials is not obtainable. Sudan grass and some of the millets planted thickly have proved satisfactory. These crops should be sown early enough in the summer so that they can be cut and cured early in the fall before the seed heads begin to form. Since such a crop may be planted in the dry season, a moist soil should be chosen for planting, if possible. In some southern sections Korean lespedeza, cut before it comes into full bloom, has possibilities for use as a mulch. Approximately one acre of this crop, well grown, will produce 1 to 1 1/2 tons of cured hay, an amount sufficient to mulch an acre of strawberries in southern Illinois.

---

Some growers have tried a mulch crop of oats sown between the strawberry rows in early fall and allowed to mat down as it is killed by frost. This method is not recommended. The two crops compete with each other for moisture and nutrients, to the detriment of the strawberry plants. Such a mulch tends to rot during the winter and affords less satisfactory conditions for picking the following season than does straw.

**SPRING TREATMENT THE SECOND SEASON**

*Leave Mulch as Long as Possible*

The mulch should usually be allowed to remain on the patch as long as possible in the spring, the length of time being regulated by carefully watching the behavior of the plants. Under most conditions the mulch should be left as long as the plants remain dormant.

In the extreme southern part of Illinois, however, it may be desirable to remove the mulch earlier for an earlier crop of fruit. This will depend upon whether the danger from spring frosts is over.

The usual time for removing the mulch is indicated by the appearance of new leaf growth and a slightly yellowed foliage color. The calendar date for mulch removal has varied at Urbana from March 17
to April 17 over a period of years. At the proper time, as indicated by plant appearance, the mulch material should be shaken up, partially moved from the rows into the middles, and well tramped down. Some of the material may need to be removed from the patch. The plants should be allowed to grow up thru the remaining mulch. If frost threatens, they may be again covered with straw.

![Strawberry Patch Several Weeks After Mulch Removal](image)

The plants in this patch are making a vigorous growth thru the thin mulch left on the rows. The mulch pulled away from the plants is left in the space between the rows to prevent weed growth and conserve moisture, and to keep the berries clean.

**Cultivation Needed in Absence of Mulch**

It may be necessary to pull some weeds by hand as the season advances, but if the bed was properly cared for the year before and the mulch was free from weed seed, the patch should need comparatively little attention during the season, except perhaps to be sprayed for the control of certain insects and diseases. Where no mulch was applied, however, it is necessary to cultivate.

While cultivation helps to increase the crop, it is also likely to cover the berries with mud or dust, and to make picking conditions in the patch disagreeable after a slight rain.

**IRRIGATION NEEDED DURING DRY PERIODS**

Dry weather during the fruiting season often reduces the yield of fruit and injures its quality. Strawberry fruits contain nearly 90 percent water, and because the plant has a comparatively shallow root system it often suffers from short periods of drouth that do not affect larger plants. Watering or irrigating the plants thoroly even once or twice during a dry period may prevent considerable loss of
fruit and may even be the means of saving both crop and plants. Irrigation particularly improves the quality of the fruit obtained in the last two or three pickings.

The benefits from irrigation are distributed throughout the life of the plant. During the summer of the first growing season when the plants are not allowed to fruit, a good supply of moisture makes for greater leaf surface, the production of heavier plant crowns, and more vigorous fruit buds for the next season's crop.

Advantages of Overhead Irrigation

The profits from the use of an irrigation system will vary from one season to another according to the amount of rainfall during the critical periods. Over a series of years, however, an irrigation system may prove a good investment. It has been shown that the crop must be increased in value at least $50 an acre if spray irrigation is to be profitable. At the Illinois Experiment Station, overhead irrigation in a dry season increased the production of strawberries over 300 percent and the value of the crop more than $75 an acre.

In the overhead irrigation system the water is applied under pressure and broken up into a fine spray that does not pack the soil. A pressure of 25 to 40 pounds to the square inch is necessary for satisfactory operation. This pressure may be secured from the ordinary city or town water system or by connecting to an individual pumping plant. Either well water or river water may be used.

With the overhead system it is advisable, when possible, to irrigate at some time other than during the heat of the day. Some growers report that they protect their patches from frost injury at blossoming time by running their sprinkling system during the threatening weather.

Cost of Overhead System

If the work is done by specialists, the cost of installing an overhead irrigation system may amount to as much as $300 an acre. The grower may materially reduce this cost by using ordinary farm labor if he is a good mechanic and can personally supervise the installation. If it is not possible to install a permanent system, a temporary outfit may be rigged up by using one or more lines of pipe fitted with nozzles at 3-foot intervals and supported on wooden horses. Such an outfit can be moved from one part of the patch to another. Second-hand iron pipe may usually be purchased at a reasonable price and the nozzles may be secured from some irrigation supply companies for as low as ten cents apiece.
Small portable sprinkling outfits are also on the market which are quite satisfactory for the small patch, and may also be used for watering the lawn and the perennial border.

**Use of Surface Irrigation**

Surface or ditch irrigation can be employed in patches with gentle, fairly uniform slopes, rather heavy soil, and rows up to about 300 feet in length. One Illinois grower reports that he secures sufficient water supply for surface irrigation from a large artificial pond on elevated land near his strawberry patch. He has laid a 2-inch pipe line from the pond along the higher headland of the berry field at right angles to the rows of berry plants. The flow of water is regulated thru the use of discarded automobile drain cocks inserted along the pipe between each two rows. The soil is kept as damp as is necessary during the growing and fruiting seasons.

A second method of surface irrigation, new and promising, is canvas hose irrigation. By this method the foliage and fruit are not wet, which is an advantage over the overhead system, as wet foliage and fruit sometimes favor the spread of leaf and fruit diseases. The hose is laid on the ground along the row and carries water under pressure which oozes or seeps out thru the pores of the canvas. After the hose is filled with water, the pressure may be reduced to regulate the flow so that the soil may absorb the water quickly without puddling. When a row is sufficiently watered, the hose is moved on to the next row. The hose should be cleaned and dried after use to insure a reasonably long life.

Canvas hose is available commercially, it may be homemade, or made on order by a firm manufacturing awnings. Commercial hose is made of a heavy, specially woven canvas, usually treated with a water-proofing material to insure longer life. Quick-acting terminals and couplings are sold as a part of such equipment.

To make the hose at home, use canvas duck 27 or more inches in width, and cut into strips 9 to 10 inches wide. The weight of the canvas may vary from 8 to 24 ounces to the square yard. In hose 400 feet or more long it is advisable to use different weights of canvas to maintain an even pressure. With the first 50 feet made of heavy material to prevent excessive seeping, the rest of the line may be made up of 100- to 200-foot sections of 12-, 10-, and 8-ounce duck.

First sew the two edges of the strips together, using strong thread; then strengthen by turning back the edges and sewing again. The sections may be connected by using couplings from ordinary house down-spouting or by slipping one section into another a few inches.
Some growers preserve the hose by dipping it in a mixture of one gallon of paint, one pint of gasoline, and 1 pint of kerosene.

The entire cost of homemade hose need not be more than 9 cents a foot.

**CARING FOR THE CROP**

The strawberry harvesting season in Illinois begins about the middle of May in southern counties. The date varies with the season and to some extent with the variety grown, being earlier with varieties such as Blakemore than with later varieties such as Aroma. The harvesting season extends into the middle of July in northern counties. In a hot, dry year the picking season will be short but when the weather is cool with plenty of rainfall, picking may continue over a long period.

The strawberry is at its best as a dessert fruit, and if grown for home use or for fancy local trade, it should not be picked until thoroughly ripe. If the berries are left on the stems until needed and picked only for immediate use, they will be superior in quality and flavor. When picked for general marketing, berries will have to be less well ripened. The degree of ripeness is determined by the distance the berries are to be moved to market. They should be fairly well colored, however, even when they are to be shipped some distance, but they must always be firm. In general, berries one-quarter red are suitable for 24-hour shipment and with full color but firm for 12-hour shipment.

The fruit should be picked at regular intervals every day or every other day. *Early in the day while the berries are cool* is the best time. Fruit will not keep well if picked on a rainy day. Early morning dew on the berries does not seriously affect their keeping quality.

The fruit should be pinched rather than pulled from the stem, with each berry retaining the calyx and a short length of stem; it should then be placed, not thrown, into the basket. Careful handling insures longer keeping. Overripe or underripe berries sell at a lower price than the ones that are picked when they are just right.

Strawberries should never be allowed to remain in the sun after being picked, but should be put in a cool place immediately. Experiments by the U. S. Department of Agriculture have shown that for each rise of 15 degrees in temperature, the life of the berry is cut one-half.

Occasionally for some reason the patch may not be picked over

---

in the early morning and picking has to continue into the heat of the day. If these late-picked berries are to be kept over in the packing shed until the following day, as it is often necessary for the small grower to do, special precautions must be taken with them. The temperature of such fruit will be much higher than of that picked earlier. If boxes filled with these warm berries are placed in crates as they come from the patch, only the top layer will cool off sufficiently in a shed to prevent molding and serious damage to the fruit. It is advisable to allow the boxes to stand uncovered in the cool shade of the shed or a tree until the temperature of the fruit has more nearly approached the night temperature. Failure to follow some such procedure is frequently the cause of the two lower tiers of boxes in the crate arriving on the market in unsalable condition.

**Grading Is Necessary for Top Prices**

When the berries are not uniform in size and appearance, they must be graded if top prices are to be obtained. In a small patch the berries may be sorted as they are picked, the quality fruit and the less desirable fruit being placed in separate boxes. Pickers carry the boxes in the field in picking trays or carriers holding 4 to 8 boxes each, sometimes fitted with legs to keep the carriers away from the plants.

When it is not practical to sort in the field, some other way of grading is necessary before the berries are marketed. With firm varieties such as Aroma and Blakemore, “pan grading” the fruit as it comes to the shed is a generally increasing practice in some commercial strawberry sections. Premier may also be pan graded when special care is used. Each box of berries is carefully emptied into a triangular pan; the green-tipped, overripe, misshapen, undersized, or otherwise inferior berries are removed; and the quality fruit that remains is gently moved back into the box with as little handling

A satisfactory grading pan may be made of a good grade of tin by a tinsmith. The opening at the lower or narrow end of the grading pan is from 4 to 4½ inches wide. This opening is made smaller than the top of a berry box in order that the pan shall fit into the box. The pan is 10 to 11 inches long and widens toward the top to about 9 inches. The sides are about 1¾ inches high. In cutting out the piece of tin before it is shaped, allow an extra ¼ inch to be bent back to provide a smooth edge.

Some growers support the pan either on a block of wood or with metal strips in order to have both hands free for sorting the fruit. One grower used two pieces of tin as a support. One piece was cut 5 inches long and 3 inches wide, with ½ inch at each end turned back at a right angle. One end was riveted to the pan 2 inches back from the narrow end, forming a support 4 inches high. Two rivets were used. A second piece of tin cut 6½ inches long and 6 inches wide, with ½ inch on each end bent back, was riveted to the pan, 2 inches back from the wide end, forming a support 5½ inches high. With this elevation, only a slight jar is necessary to roll the quality berries down into the basket after sorting out the undesirable ones.
as possible (Fig. 19). The sides of the box may be pulled out slightly and the box shaken gently to allow the berries to settle. Do not bounce the box up and down.

Graded fruit sells at a sufficiently higher price than ungraded fruit from the same section to return a handsome premium even after subtracting the extra cost of grading. Experience in Illinois has demonstrated that graded fruit is in great demand. (See U. S.-Illinois grades under “Marketing Problems,” page 43.)

**FIG. 19.—STEPS IN PAN-GRADING OF STRAWBERRIES**

The individual boxes of berries are first emptied, one at a time, into the triangular shaped grading pan and all the injured and otherwise inferior fruit taken out. The remainder is then gently moved into another box.

**Management of Picking on Large Plantations**

When berries are raised on a large scale, they are usually picked by men, women, or children who are paid from 1 to 3 cents a quart. Some of this labor is transient labor and some is local. In some sections ½ cent per quart is retained until the harvest is over to hold the pickers thru the season. This bonus is returned to the pickers remaining at that time. On the average, from six to nine pickers are needed per acre, the exact number depending upon their efficiency, the seasonal conditions, and the yield of berries.

A competent foreman must be in charge of the picking crew in order to see that the rows are **picked clean** by the pickers assigned to
them and that the fruit is handled correctly and carefully. Detailed instructions should be given the pickers before they start work.

Some simple method of keeping records of the pickers by tickets or metal tags should be worked out. The carriers and boxes of the individual pickers may be identified by numbers assigned to them and a record kept in the shed, in order to check the performance of each picker.

When the fruit is not to be pan graded, it becomes even more important that only good fruit be picked. The foreman may carry

![Fig. 20.—Strawberry Grading and Packing Shed](image)

A cheaply constructed shed so arranged that the pickers may place the filled carriers on shelves just under the eaves is shown here. The fruit is graded and packed in the rear of the shed out of the sun and wind.

an empty box with him as he moves about the patch, occasionally taking a box from one of the picker's carriers and emptying it into his own box for critical examination. In this way a higher standard of performance is exacted.

**Give Careful Attention to Packing**

Boxes should be so packed that the berries come somewhat above the top and with the corners filled in to make a solid pack. The boxes should be carefully placed in the crates and none but strong, clean boxes and crates used. Use small nails for fastening the lids. Egg-crate nails are better than large boxing nails. The 24-quart ventilated slat crate is in general use in Illinois. Some of the improved types of crates have considerable promise and should be tried out.
The name of the grower and the variety grown stamped on each crate help to establish the grower's reputation with consumers. A fancy trade may be effectively built up and maintained by careful grading of the fruit, by filling the boxes full, and by arranging the top layer of berries in an attractive manner with no stems showing. However, the top layer should be representative of the size and quality of the remainder of the fruit. Boxes capped with cellophane have sold better on the roadside market than those left exposed to flies and dust.

RENEWING THE PATCH

The number of crops that can be taken from the strawberry bed depends upon the variety grown and the condition of the bed at the end of the first picking season. Poor soil fertility and the presence of weeds and injurious pests, such as the crown borer, sometimes make a second crop inadvisable. If a vigorous variety is grown and good care has been given the bed during the first season, it will usually pay to renovate it, and thus secure another good crop the next year. The older, unproductive plants should be thinned out and those that remain given the chance to produce new spaced rows of vigorous, healthy plants, from runners, just as soon as possible. Early-formed runner plants will make the most productive fruiting plants the next season.
Clean Up Bed Immediately After Fruiting

The best time to renew a strawberry bed is in early summer as soon as possible after the crop is harvested. If the mulch is heavy and has not rotted down, a portion of it may have to be removed. Clip off the foliage with a sickle or scythe or, if the patch is large, use a mowing machine with the cutter bar set fairly high.

After the leaves dry, rake them, with any mulch remaining, from the tops of the plants to the middles. The bed may then be burned over, a windy day, preferably after a rain when the ground is moist, being best for this job. *If there is no wind and the plant crowns are dry, a slow fire will injure them.* This practice of burning the bed over helps to keep down many diseases and insects that attack the strawberry plant but is *not recommended,* especially in southern Illinois, if the ground is dry or the mulch and leaves are damp. If conditions make burning unwise, rake up the leaves and mulch, and take from the patch and burn.

Thin Out Plants and Fertilize

After the bed has been cleaned up, the next step is to thin out the surplus plants. Thinning may be done either with a hoe or a plow, depending upon the size of the bed. If a hoe is used, cut away the surplus plants so that vigorous young plants are left from 12 to 24 inches apart, the exact space depending upon the variety. For example, Dorsett should be thinned more severely than Aroma.

In a large patch, or on a smaller area if the rows are long, either a disk or a turning plow may be used to narrow down the original row. If the plow is used, plow one or two furrows from one or both sides of each row until a narrow row of plants is left. Then cultivate the middle space between the rows *immediately,* smoothing down the ridges and working in fresh soil around the narrow strip of young plants. A spike-toothed harrow may be run across the patch with the teeth set with a back slant so as not to tear out too many plants. The object of this cross cultivation with a harrow is to level the soil and to thin out some of the excess plants. Complete the thinning with a hand hoe, leaving good plants evenly spaced.

Next hoe the plants well, spread a coat of well-rotted manure on the soil and cultivate it in around the plants that are left. *If manure is not available, commercial fertilizers may be added.* A commercial fertilizer may be drilled in or carefully applied by hand near the plants but it must not be allowed to come into direct contact with the foliage or crown as there is danger of its burning the plant. The kind and amount of fertilizer to use varies with the strawberry
variety grown and the soil. Beneficial results have been secured under different conditions from the use of 100 to 250 pounds of a nitrogen fertilizer; from superphosphate applied at the rate of 250 pounds an acre; from muriate of potash, 50 pounds; and from a high-grade complete fertilizer, 200 pounds and up.

![Figure 22: Strawberry Patch After Middles Were Cultivated](image)

When renovating a strawberry patch, the soil close to the plants should be left in friable condition to aid in setting new runner plants.

**Cultivate and Mulch the Patch as for Previous Year**

If good cultivation and plant spacing are practiced after thinning, a new row will be formed that usually is capable of producing a large crop the next year.

The treatment during the last fall and spring should be similar to that given during the previous year. It is seldom advisable to fruit a bed more than two years, but strawberries may again follow in a rotation after vegetable or farm crops.

**SPECIAL CULTURAL DIRECTIONS FOR EVERBEARING VARIETIES**

Everbearing, or fall-bearing, strawberries differ from the standard varieties in that they may be made to bear fruit more or less continuously throughout the summer and fall instead of maturing their whole crop in early summer and in that a crop is usually obtained the same season that the plants are set. They may be desirable for the home garden but they are not recommended for general com-
mercial planting. In the warmer months the berries are likely to be soft; in the cool fall months they may lack flavor. Growing and harvesting costs are greater and the attention to cultural needs is more exacting for everbearing than for the standard varieties. There may, however, be some satisfaction in having home-grown strawberries out of season and if the crop is sold the prices received may be higher, especially if the fruit is of good size and quality and a discriminating market is available.

The chief advantage of everbearing strawberries is that a crop is usually secured the same season that the plants are set. Again, on sites where spring frosts occur with injury to standard varieties, everbearers may be substituted because the killing of the first bloom does not mean the loss of an entire crop.

The growth and fruiting habits of the everbearing varieties, while varying somewhat among themselves, differ radically from those of the standard varieties. The standard bearing varieties form their fruit buds only during the short days of the fall preceding fruiting, while the everbearers can also form fruit buds during the long midsummer days. The shorter period between plant formation and fruit bud differentiation in the everbearing varieties calls for some special differences in their culture.

Everbearing plants may be grown either in rows spaced 3½ to 4 feet apart with the plants set 18 to 36 inches apart in the row, or in hills about 18 inches apart with the hills arranged in rows about 3 feet apart. About 50 plants should supply a small family with fruit during a season.

The plants are set early and kept well cultivated during the early part of the season. The blossoms must be kept picked until about the middle of July, or about a month before fruit is wanted. This is a time-consuming operation but is necessary if a good berry crop is to be had later in the season. From midsummer on, the blossoms are allowed to set, and fruit may be expected, if good care is given the patch, well into fall. A very fertile soil is required, and a continuous supply of moisture must be available during the whole season. A heavy application of barnyard manure worked into the soil the year previous to that in which the plants are set will take care of the urgent need for organic matter. Commercial fertilizers may be used to supplement manures if poor plant growth indicates their need. Unless everbearers are grown on rich moist bottom land, it may be necessary to use some means of irrigation for best results in growth and fruit production during a hot dry season.

Mulching the plants with straw, strawy manure, or similar
material as the bearing season begins is usually desirable in order to conserve moisture, restrain weed growth, and aid in keeping the berries clean. The use of a mulch, however, is less favorable for the growth of runner plants where the spaced row is being used and some extra attention is needed to assist the young runners to set. Since the bacteria present in the straw while it decays use nitrogen, a light application of a nitrogenous commercial fertilizer in early fall may be beneficial.

The treatment of the patch the second year may be similar to that for the June bearing varieties, and the crop may be allowed to ripen in May and June. Some of the older plants may need to be removed. The remaining plants should be well fertilized and the middles of the rows cultivated. With good care another fall crop may be obtained, after which the bed is usually plowed up.

The growth and fruiting habits of everbearers and the cultural practices followed are especially favorable to the growth and multiplication of certain diseases and insects. Additional treatment to that recommended for disease and insect control on standard varieties, page 46, is therefore necessary. Strawberry leaf spot may be fairly well controlled by spraying with bordeaux during the first growing season, previous to the time the blossoms are allowed to remain to form fruit. The strawberry leaf roller is checked by applications of lead arsenate at sufficiently frequent intervals to keep the new leaves protected from the time that growth starts in spring until the fruiting season. After the fruiting season begins, nonarsenicals, such as fresh pyrethrum powder or fresh powdered derris containing .4 to .75 percent rotenone, should be used. Either of these materials may be dusted on the plants or used at the rate of 1 ounce to 7 gallons of water.

MARKETING PROBLEMS

The production of good berries of varieties that are in demand and will stand up well is the first essential in solving marketing problems. The fruit must then be properly picked, graded, packed, and transported to market, if it is to reach the consumer in the best possible condition.

Adherence to standard strawberry grades is very desirable when packing berries for market. Standard grading not only helps in preparing the crop for market but also makes easier the work of the state and federal inspectors at the point of shipment or destination; it is an aid to buyers who purchase fruit in quantity and to the consumer who purchases by the box.
In the Illinois Standardization Law, now in force, certain grades have been adopted by the State Department of Agriculture governing the sale or offering for sale of strawberries in "closed packages," and the producer is liable for the fulfilment of this law. A crate of strawberries is a closed package in that all its contents cannot be seen readily or inspected after such a package is prepared for market. The United States grades have been adopted in Illinois and are known as the Illinois-U.S. Standards. Size and quality of fruit are important considerations. Complete information as to state requirements and some assistance in carrying out these regulations may be obtained by writing the Illinois State Department of Agriculture, Springfield, Illinois. It is to the grower's advantage to secure such information.

While a grower who raises and packs a high-class product does not as a rule need to fear competition on the local market, he may be at a distinct disadvantage on a distant market if he attempts to handle his own sales. Some growers sell to buyers at the loading point; others have found it advantageous to pool their offerings and market cooperatively. By this latter method, profitable distant markets may be developed and maintained.

Both growers and shipping associations that are building a reputation for carefully standardized grades will do well to use brand labels. The Federal Food and Drugs Act requires that all crates of berries be marked with a statement of the quantity of the contents; the addition of the variety, grade, and grower's name and address on the label constitutes good advertising and builds up good-will for the grower.

Some of the Illinois strawberry crop is moved to market in iced refrigerator cars, but trucks are being used to an increasing extent for this purpose. In carlot shipments moving to large centers of consumption, such as Chicago, it is advisable to have the fruit all of one variety. In the smaller markets carloads of mixed varieties or grades are more easily disposed of.

Adequate sheds for inspection and car loading are highly desirable. The fruit should be placed under refrigeration as soon as possible after picking. Precooling is rapidly becoming a commercial practice, and buyers for distant markets prefer cars so treated. For safe carriage the crates must be firmly loaded in the car and rigidly braced to prevent damage in transit thru backward or forward movement of the crates. However, provision must be made for ventilation around the crates.

Truck transportation to nearby markets, or to markets as far as
200 miles away, is becoming increasingly important because of the relatively low transportation costs and the ease and rapidity with which the crates are picked up and moved to market. Truckers load as late as possible in the day, seldom before 4 p.m., and plan to arrive on the market early the following morning. As the trucks travel at night, the cool night air is relied upon to cool the fruit. The trucks vary greatly in size and capacity. From 240 to 300 crates is an average load. As a rule, the load is made up of different varieties as well as different grades of fruit purchased from different growers, and may therefore meet the demands of the smaller markets.

YIELDS, COSTS, AND PROFITS

The average acre-yield of strawberries in Illinois, according to U.S. Census figures, ranges from 1,000 to 1,400 quarts. These yields are far below those that may be expected; in fact they may be more than trebled when good varieties are planted on favorable sites and correct cultural methods are practiced. Some of the best Illinois growers have reported yields of over 6,000 quarts an acre.

The cost of growing an acre of strawberries varies widely under differing conditions and especially with different growers. In general the cost, including development and production from the time the site is chosen thru the first picking and marketing season, may be up to about $300. With intelligent care many growers find the business a profitable one over a period of years. The best growers do not jump in and out of the game but stay with it. They have patches in bearing every year, with others newly planted for the next year’s crop. They do not make the mistake of overplanting, but grow only as large an acreage as they can handle well. In this way seasonal costs are kept down and net profit increased.

Several Illinois growers have realized a net profit of $100 or more an acre after all expenses connected with growing and marketing the crop were deducted from gross receipts. Prices during recent years have ranged from $1.50 to $3.00 per 24-quart case.

The introduction of improved varieties and the better cultural methods now possible justify moderate increases in planting at this time, especially of high quality varieties in quantities that will be absorbed by local markets.
CONTROLLING COMMON INSECTS AND DISEASES

Few growers attempt to control strawberry pests by spraying or dusting. The plantation is usually allowed to bear for two years only, and is then turned under before the pests become too numerous and destructive. Clean tillage, correct renovation, and the planting of healthy stock aid in checking insects and diseases. It is usually necessary, however, to spray or dust if these hazards are to be completely controlled. Damage from insects is caused mostly by white grubs, crown borers, leaf rollers, leaf beetles, and weevils. A common disease is leaf spot. Some varieties are more resistant to leaf spot than are others.

General Means of Control. A combination bordeaux and lead arsenate spray applied twice before the blooming period will usually control the various strawberry pests sufficiently for practical purposes if the planting is new and at a distance from established plantations. If insect pests are causing considerable damage, dusting may be necessary for the most effective control.

A number of satisfactory types of sprayers and dusters are on sale at hardware stores. The 3-gallon air-pressure sprayer, which the operator may carry on his shoulder or at his side, is well suited to the small patch. Small blowguns and hand dusters are quite efficient. On larger plantations a barrel pump mounted on a sled or set of low wheels, or a power sprayer or duster especially manufactured for use in small fruit and truck growing, should be employed. Sprayers must be carefully cleaned after use.

White Grub. The white grub is the immature, or larval, stage of the June bug or May beetle (Fig. 23). This insect lives and feeds in the ground for one to three years in the larval state. If the patch has been in sod just before planting, this grub may be in the soil and will attack the roots and crowns of the plants. Strawberry sites may be nearly cleared of white grubs either by growing a cultivated crop or a heavy green-manure crop on the ground at least two years before planting it to strawberries or by plowing it late in the spring and disking three or four times before setting out the plants. If possible, new plantings should be made at some distance from trees, especially from oak and poplar, on which the adult beetles feed and near which they lay their eggs.

Strawberry Leaf Roller. The strawberry leaf roller is a small greenish brown caterpillar with a brown head (Fig. 24). It is very active when disturbed. It rolls one portion of the leaf over upon the other and feeds within this protecting fold (Fig. 25).

1The material on insect control was prepared in cooperation with the Illinois State Natural History Survey. For the paragraphs on strawberry leaf spot and brown stele root rot the author is indebted to H. W. ANDERSON, Chief in Pomological Pathology.
Spraying or dusting for the control of this insect must be done before it has begun to protect itself within the leaves.

An application of lead arsenate before the young larvae begin to roll the leaves, just before blooming time, will be effective. The appli-

![Common Strawberry Insects and Insect Damage](image)

**FIG. 23.—COMMON STRAWBERRY INSECTS AND INSECT DAMAGE**

(1) Work of strawberry leaf beetle; (2) white grub; (3) grub of strawberry crown girdler or root weevil; (4) cutworm; (5) work of the strawberry weevil. (Courtesy Department of Agriculture, Canada)

cation may be made as a spray or as a dust. The spray should be applied under at least 100 pounds pressure, using 3 pounds lead arsenate in 50 gallons of solution. The dust is composed of 9 parts gypsum and 1 part lead arsenate and should thoroughly coat the leaves of the plants.

**Strawberry Leaf Beetle.** The strawberry leaf beetle is a small brown or black oval-shaped beetle about \(\frac{1}{8}\) inch long. Most of the damage is done by the mature form of the insect (Fig. 23). The adult leaf beetles
riddle the leaves with "shot holes," beginning their work as soon as growth commences in the spring. A second generation matures late in the summer and again injures the plants seriously.

Control is effected by spraying or dusting as for the leaf roller, when the first insects are noticed. Since the mature beetles hibernate in waste land, such cover near strawberry beds should be burned over during the winter or early spring. Old strawberry plantations nearby should be kept clean.

Strawberry Weevil. The strawberry weevil is a small reddish brown snout beetle, about \( \frac{1}{10} \) inch long, which appears just as the strawberry begins to blossom. The female beetle punctures the bud and deposits her egg within it. She then girdles the fruiting stalk below the injured bud, causing it to droop and fall (Fig. 23). Dusting the plants as suggested for control of leaf rollers will aid in combating the strawberry weevil.

Strawberry Crown Girdler or Root Weevil. Reports of damage from this insect have come in from southern and western Illinois. Injury is caused mostly by the small, white, legless grubs, which emerge from their hibernating places near the roots of the strawberry plants as warm weather approaches, and begin to feed on the crowns. At the same time the beetles gather in the patch, and egg laying begins on the roots of the plants. The beetles cannot fly, as their wing covers are grown together. The eggs soon hatch into grubs (Fig. 23). There may be two broods a year in Illinois.

Control measures, thru the use of arsenicals, are similar to those recommended for the strawberry...
leaf roller. Frequent crop rotation and the use of new, clean ground for new patches will help to combat this insect. A new patch should not be set out near an old infested plantation.

**Strawberry Crown Borer.** Outbreaks of the strawberry crown borer, an insect native to the upper Mississippi valley, occur occasionally in widely scattered sections of Illinois, and result in considerable damage. Most of the injury is caused by the white, thick-bodied grubs, which are about $\frac{1}{2}$ inch long when full grown. The adult is a reddish brown snout beetle about $\frac{3}{6}$ inch long, which hibernates in the soil or under litter in

![Damage Caused by Strawberry Crown Borer](image)

**FIG. 26.—DAMAGE CAUSED BY STRAWBERRY CROWN BORER**

These strawberry crowns have been seriously damaged by strawberry crown borers. (Courtesy Illinois State Natural History Survey)

or near the patch. In early spring, eggs are laid in the plant near the surface of the ground. Egg laying may continue up to nearly the end of June. Upon hatching, the grub works downward thru the crown, and by maturity it may have eaten out a large part of the contents; sometimes only the shell is left if several grubs are at work on one plant. After maturity in midsummer, the grubs transform to beetles, which remain in the burrows in the plant crown for several weeks before they eat their way out. The beetles go into hibernation when winter approaches. There is but one brood a year. Infested plants are so weakened that they either die or produce very little new runner growth.
Control measures are based chiefly upon short rotations and the use of new, clean ground for setting out new patches. It has been demonstrated in southern Illinois that the strawberry crown borer becomes a greater menace as the age of the patch increases. In southern Illinois it has been observed that in one-year fields 2.6 percent of the plants were infested, while in plantations three and four years old, the infestation jumped to 65.5 percent.\(^1\)

New beds should be located several hundred feet from infested fields and set with borer-free plants. These precautions prevent the spread of the beetles, which are unable to fly as their wing covers are grown together. New plants dug early in spring before the eggs are laid and well cleaned so that no hibernating beetles are carried over in soil about the roots should be free from infestation.

**Strawberry Root Louse.** These dark bluish green aphids hatch from shining black eggs on the leaves and stems of the strawberry plant early in the spring. They are often found by the brown cornfield ant and carried down to the strawberry roots, where they feed on the plant sap. Infested plants show a loss of vigor. The foliage may become pale yellow, and the fruit does not ripen properly.

While no very effective control measures are known, it is highly desirable that a regular rotation be followed in strawberry culture, so that the bed is not allowed to fruit more than twice. Clean plants should be used for setting, and the soil should be deeply plowed and frequently cultivated before the plants are set, in order to drive most of the ants away.

**Cutworms.** When strawberry plants have been cut off just at or below the surface of the ground early in spring, the damage may have been caused by cutworms. These insects are small, smooth, ground-colored caterpillars about an inch long (Fig. 23). They hide just below the surface of the ground during the day and forage at night. There are at least a hundred different species of cutworms in Illinois but most of these species can be killed thru the use of a poison bran bait.

**Poison Bran Bait.**—A formula for poison bran bait suitable for use on a small strawberry patch is 1 quart of bran or middlings, 1 teaspoonful of paris green, and 1 tablespoonful of cheap molasses, with sufficient water to moisten the bran. When injury from cutworms is severe, quicker results are possible if the poison mixture is made sweeter by doubling the amount of molasses. The bran should be scattered evenly over the patch just at dusk. It should not be put out in lumps or windrows, as it is much more effective if scattered thinly and evenly over the surface of the ground.

Directions for mixing and using this mixture on a large scale, as suggested by the Illinois Natural History Survey, are as follows: Stir 2 quarts of black strap or other cheap molasses into 3 gallons of water. Mix thoroly, stir in 1 pound of paris green and add 25 pounds of bran, mixing the bran thoroly with the water and molasses until all of it has been moistened. If the mash is sloppy, add more bran until it is just

\(^1\)Data gathered by S. C. Chandler, Illinois State Natural History Survey.
thick enough to hold together when tightly squeezed in the hand. This mixture should be scattered over the infested fields at the rate of about 8 to 10 pounds an acre.

An oil bait has recently been worked out that shows much promise as a substitute for the above bait. It may be prepared as follows:

<table>
<thead>
<tr>
<th>Large quantity</th>
<th>Small quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bran</td>
<td>25 pounds</td>
</tr>
<tr>
<td>Lubricating oil (medium heavy)</td>
<td>2 quarts</td>
</tr>
<tr>
<td>Paris green</td>
<td>1 pound</td>
</tr>
</tbody>
</table>

Mix bran and paris green and add oil as for the molasses and water above.

![Strawberry Leaf Spot](image)

FIG. 27.—STRAWBERRY LEAF SPOT

This is the most common disease of strawberry plants; it results in leaf injury and defoliation with loss of plant vigor. Spraying with bordeaux mixture is an effective means of control.

Strawberry Leaf Spot. Leaf spot, the most common strawberry disease, appears first as a small white area with a purplish border. Later the whole leaf may be affected, first becoming red or purplish in color, later having a dry and scorched appearance. Such diseased leaves seriously reduce the vigor of the plant. This disease may be held in check by spraying with bordeaux mixture as growth begins and again
just as the first blossoms are appearing. The formula for bordeaux is 3 pounds of copper sulfate and either 4 pounds of stone lime or 6 pounds of hydrated lime in 50 gallons of solution.

**Brown Stele Root Rot.** Recent investigations in Illinois have revealed the presence of a specific "stele" or "core" rot of strawberry plants, probably caused by a species of Phytophthora. The disease appears in

![Strawberry Patch Infected With Brown Stele Root Rot](image)

Brown stele root rot destroyed practically all the crop in the above patch. The infected area is poorly drained. Poor drainage contributes to the rapid spread of the disease in patches where susceptible varieties are grown. Infected plants become stunted and fail to mature a crop.

spring at blossoming time, but may not be noticeable until the first berries ripen. The plants show rolled and wilted leaves when the disease is mild. As the disease progresses, the plants become stunted and the fruits dry up. Infected roots show a browning of the stele, or core. The root tips are usually dead, and few rootlets develop. Heavily infected plants do not long survive. Premier is especially susceptible but other standard varieties, including Blakemore and Dunlap, are also attacked.

Tentative control measures recommended include the avoidance of poorly drained soils and the planting of the more resistant varieties. Aberdeen, Mastodon, and Redheart appear to be resistant under Illinois conditions.
PUBLICATIONS ON STRAWBERRY CULTURE

Books

A number of books have been published that deal wholly or in part with strawberry culture. Among these are—

- Orchard and Small Fruit Culture—Auchter and Knapp
- Strawberry Culture—Fletcher
- American Fruits—Fraser
- Productive Small Fruit Culture—Sears
- Small Fruit Culture—Shoemaker

Pamphlets

Many state experiment stations publish information on strawberry growing, available for free distribution upon request. A number of circulars and bulletins on the subject can be secured from the Division of Publications, U. S. Department of Agriculture, Washington, D. C. These include:

- The Blakemore Strawberry (Circ. 93)
- The Dorsett, Fairfax, and Narcissa Strawberries (Circ. 257)
- Everbearing Strawberries (Farmers' Bul. 901)
- Strawberry Culture, Eastern United States (Farmers' Bul. 1028)
- Strawberry Varieties (Farmers' Bul. 1043)
- Spray Irrigation in the Eastern States (Farmers' Bul. 1529)
- Preparing Strawberries for Market (Farmers' Bul. 1560)

A general discussion of strawberry culture is also included in the 1925 Yearbook of the U. S. Department of Agriculture.

The picture of the Dunlap berries shown on the cover of this circular was furnished thru the courtesy of O. A. D. Baldwin, Bridgman, Michigan.
STRAWBERRIES are the most commonly grown small fruit in Illinois. Among all Illinois fruits their value commercially is exceeded only by that of apples and peaches. Owing to the wide choice of varieties, this fruit is grown in nearly every part of the state. The principles and practices underlying successful strawberry culture in Illinois are explained in this circular.