

TEXAS DEPARTMENT OF AGRICULTURE BULLETIN

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STRAWBERRY, BLACKBERRY AND DEWBERRY CULTURE IN EAST TEXAS

By

G. J. SCHOLL
J. C. STEPHENS



GEO. B. TERRELL
Commissioner of Agriculture

Entered as second-class matter, May 8, 1909, at the postoffice at Austin,
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INTRODUCTION.

The possibilities for the future development of the berry industry in the State of Texas are very promising, taking into consideration the acreage adapted to the growing and the demand of these fruits, which are at the present time rather poorly supplied. The commercial plantings of these fruits in Texas are very limited, of which the majority are not given the proper attention, insofar as cultural methods and fertilization are concerned.

Wherever diversified agriculture is practiced, berries may be grown profitably. Practical methods employed in cultivation and soil preparation for these fruits are very essential, as it assists in producing good berries with a strong texture and good carrying qualities.

There are several drawbacks in the growing of berries, in that the berry plants are shallow rooted, subjecting them to injury from summer drouths. This obstacle may be overcome however, to a certain extent by loosening and aerating the soil by cultivation, thus building up the waterholding capacity and humus contents of the soil. Other drawbacks are insects and diseases which depredate on the plants, however these can be controlled by the proper applications of sprays and dusts that contain insecticidal and fungicidal properties.

The advantages of berry growing are that returns can be obtained within two or three years with large production from small acreage, which in fact can be handled by one man, except at picking time.

The information given in this bulletin applies to East and Northeast Texas, as well as to other section where the moist sandy-clay loam soils are to be found.

STRAWBERRY CULTURE.

Notwithstanding the fact that berries are grown generally throughout the State, many growers are not familiar with the best methods in producing the best berries for the market, therefore, in order to furnish more fully information of successful berry culture, a few brief directions are discussed in this bulletin.

STRAWBERRY SOILS.

East and northeast Texas soils may be roughly divided into two classes: white sand and red soils.

The white sand may be divided into two general classes: a very fine deep white sand, generally known as "blow sand" and a coarser more stable white or gray sand which does not "blow" so easily.

The "blow sand" is not of much value for strawberries. It dries out badly and in strong spring winds, blows so much as to damage the leaves and buds.

The red soils may be roughly divided into three classes. The very hard "tight" iron ore soils, the somewhat more open red gravel soils and the "red sand."

This "red sand" has just sufficient iron ore and sometimes a small mixture of clay in it to give it a fine red color. It works as easily as white sand, is somewhat "earlier" and is the best of all the red soils for strawberry culture.

The hard red soils are not recommended for strawberries. They do not hold moisture, are hard to work and usually contain very little humus.

In selecting land for strawberry planting, the soil should be at least twelve (12) inches deep on top of the clay, but eighteen (18) to twenty-four (24) inches is still better.

SELECTION OF A SITE.

The first thing to consider in selecting land for a strawberry field is to keep away from soil that has had tomatoes, sweet potatoes and vegetables grown on it. Do not use land with drainage across it from land which has been planted in the above crops. The reason for this is to keep the strawberry plants from becoming infested with nematodes (root-knot).

Also avoid land that has been recently sodded in grass, since such land is likely to be well filled with grub worms of June bugs or May beetles, which may destroy the plants.

The ground should have enough slope to drain well, but a too sharply sloping hillside is not desirable.

Wet or soggy land of any kind is not good for strawberry plants, and flat plats of ground such as bottoms, when surrounded by higher land are more likely to be visited by late frosts than sloping land where the cold air can drain off to lower levels.

PREPARATION OF LAND.

If the land selected for strawberry planting is not level enough to prevent washing, it should be thoroughly terraced. Between September 1st and December 1st the land should receive from five to fifteen tons per acre of stable manure. Fifteen tons should be used if possible. The manure should be spread as evenly as possible and plowed under about four inches deep. Following this, in the spring, the land should be planted to corn (fertilized with 400 pounds per acre of 10-3-6 commercial fertilizer) and iron (clay) peas, and given clean thorough shallow cultivation during the summer in order to kill as much of the grass and weed seed as possible, which are generally found in manure.

As soon as the corn is sufficiently ripe it should be gathered and the corn stalks cut off close to the ground and removed. The reason for the removal is, that being coarse, and slow to rot they are in the way of cultivation and hoeing, if plowed under, and are likely to be a nuisance.

The ground should then be plowed deeply, 8 to 10 inches if possible, turning under all the trash, leaves and peavines. This kind of material rotting in the ground makes humus. No soil ever contained too much humus for strawberries. It is better to turn under the peavines while they are still green, but fully matured, than to wait until they die.

TIME TO PLANT AND VARIETIES.

Strawberry plants are set successfully in northeast Texas in every month from October to March. Yet when everything is considered, December is perhaps as good a time as any to set plants.

Klondyke and Excelsior are old favorite varieties that do well. The Excelsior is very early and rather acid. The Klondyke is much larger than the Excelsior generally, and is mid-season or just following the Excelsior.

The Improved Lady Thompson is a variety which grows well and is very promising. Ripens with Klondyke.

SYSTEM OF GROWING.

The matted row system of planting is generally preferred and used in Texas and is used to the exclusion of all other systems of planting in northeast Texas.

To produce the matted row system the land is laid off in rows $3\frac{1}{2}$ feet, some prefer 4 feet, from center to center. The rows should be bedded up into wide flat beds and dragged off so that the beds or rows will be about 18 inches wide and 3 inches high.

The strawberry plants should be set two feet to three feet apart down the centers of the beds and allowed to make runners which root and fill in to make a "solid bed" or matted row.

This matted row should be kept about 16 inches in width and the plants should be from 4 inches to 6 inches apart in the row. Under no circumstances should the plants be allowed closer together than 4 inches if best fruit production is wanted. If they become thicker than this, thin with a hoe or trowel.

SYSTEM OF GROWING.

Modified Hill System.

This system was used some years ago in south Texas with gratifying results; and while it requires many more plants to

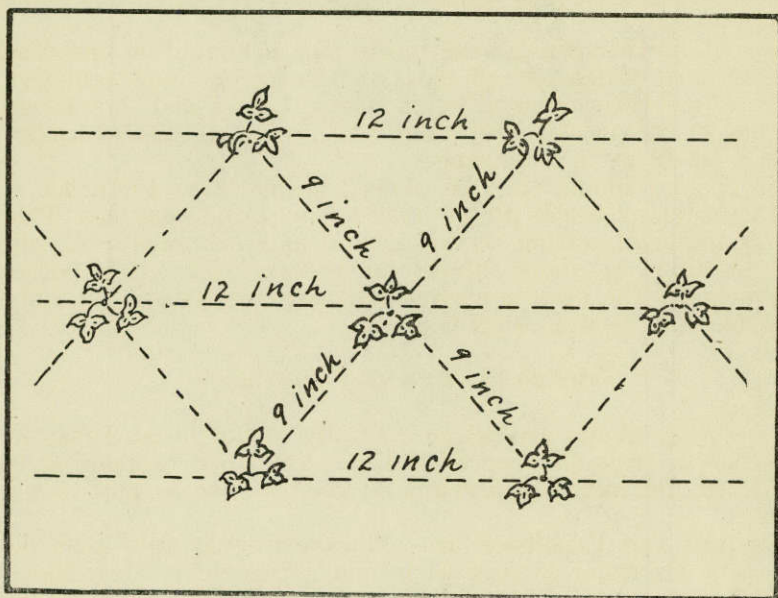


Fig. 1.—Modified Hill System. (Original.)

set an acre under this system and considerably more work at the start, its advantages claimed are: plants easier to work in summer, easier to mulch and berries larger and finer.

All runners are kept off the plants under this system during their bearing life, which is about 2 years after they come into full bearing, so that the original plants do not make any new plants during their bearing life.

The land is prepared and bedded as previously explained; but instead of one row of plants to each bed, 3 rows are used. The center row has the plants 12 inches apart in the row; the two side rows are "staggered" or set alternately, these plants being 12 inches apart in the rows and 9 inches distant from those in the center row. (See Figure 1.)

TOOLS AND PLANTING.

The best strawberry planting tool is made by taking a piece of scraper or saw steel about 5 inches by 6 inches and riveting down its center, on the narrow way, a piece of $\frac{1}{4}$ inch by $\frac{3}{4}$ inch iron or steel 8 inches long, allowing a 4 inch extension for a round wooden handle to be fastened to. This gives a tool with a 5 inch cutting width for opening the soil, pruning roots, etc.

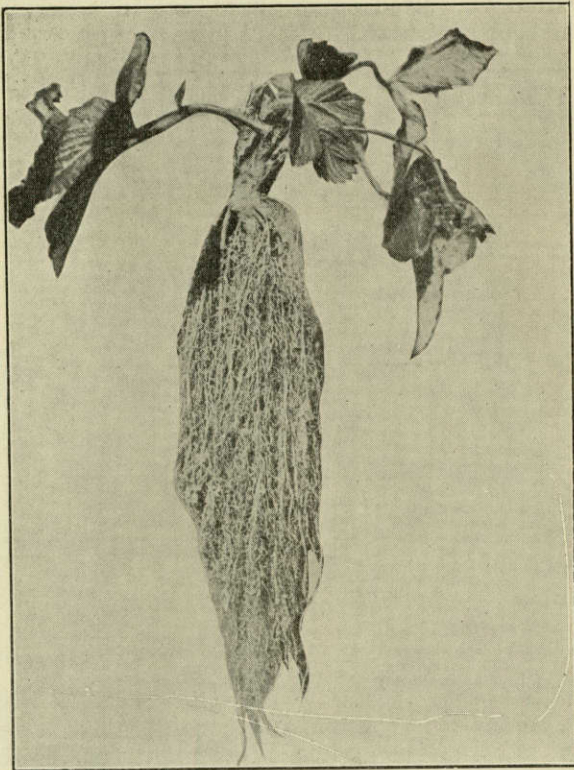


Fig. 2.—Good young strawberry plant as it comes from the nursery.
(Original.)

Never use old plants for new plantings. By old plants are those that have already grown a crop of berries. Old plants can be known by the old stub or stump $\frac{1}{2}$ inch to 2 inches long with the roots coming out around its top.

Figure 2 shows a fine healthy young plant as it comes from the nursery.

Plants should be leaf and root pruned before they are set out, that is they should have all but 2 leaves pinched off and the roots should be cut off about one-third with a sharp tool. (See Figure 3.)

A picking carrier filled with wet sawdust is about as good as anything to carry plants in for setting. The roots must be kept moist at all times.

There is just exactly one right way to "set out" a strawberry plant. It must be set neither too shallow nor too deep. About the best way to describe it, perhaps, is to say that the soil must come on the plant to a point half way between the top of the roots and the bud. The roots should be well covered and packed with soil, but the bud must not be covered.

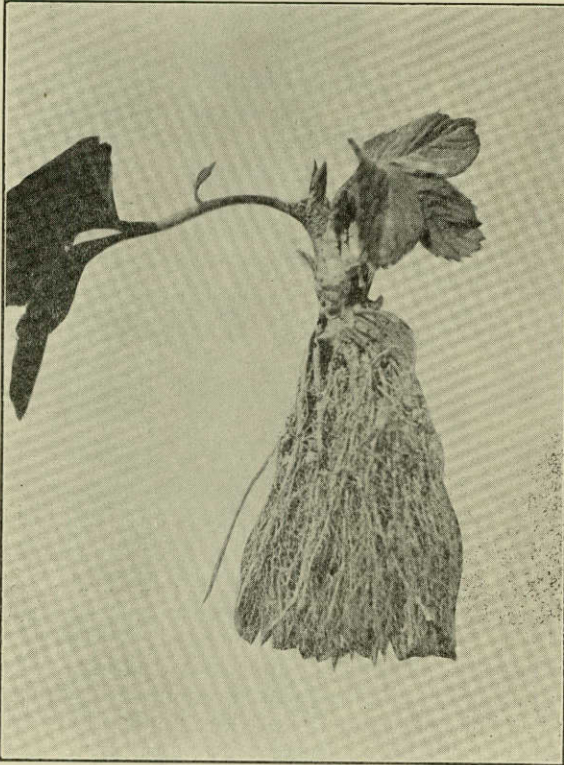


Fig. 3.—Plant properly root and leaf pruned, ready for setting.
(Original.)

Just as important as depth to set, is spreading the roots of the plant. The roots should be pruned as directed above and spread in a fan shape (see Figure 4) so that dirt will come in contact with every root. To complete setting the dirt must be packed firmly to the roots.

Figure 5 shows plant too deep, not leaf pruned and root system not spread.

Figure 6 shows plant too shallow, leaves not pruned, roots not pruned, roots not sufficiently spread.

CULTIVATION AND FERTILIZERS.

If the ground has been prepared as described, the plants will not need any fertilizer the first summer after setting. But as soon as spring opens up they should receive frequent shallow cultivations to keep down weeds and grass.

If the blooms which form the first season are kept "pinched out" it will add to the vigor of the plants and increase their plant raising capacity.

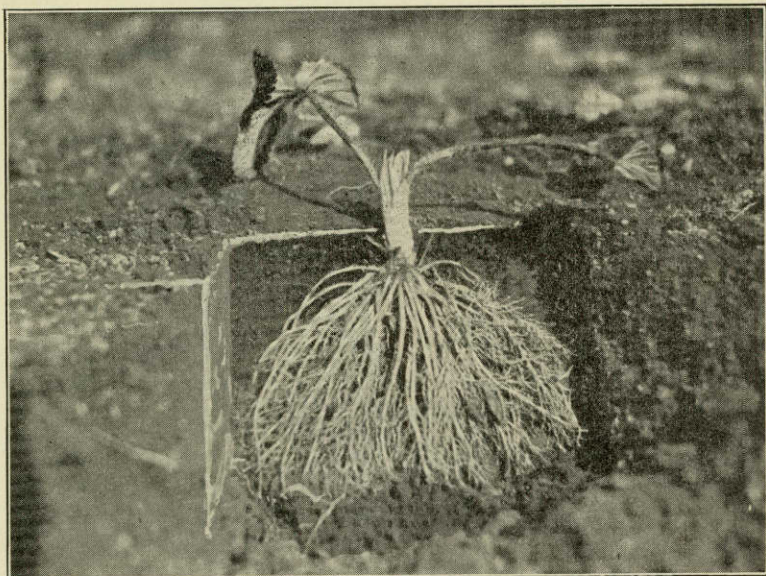


Fig. 4.—Plant properly root and leaf pruned, proper depth and roots properly spread to be covered with soil. (Original.)

By December or January, sometimes earlier, following the setting, the plants should have formed a solid "matted row." If they have been well tended and kept spaced as the runners root, no thinning will be necessary, but as stated before, plants must not be closer than 4 inches in the row; if thicker than this they should be thinned.

After the plants are thinned and the width of row reduced to about 16 inches to 18 inches, the plants should receive from 400 pounds to 600 pounds of Acid Phosphate distributed as evenly as possible among the vines and worked or scratched into the soil as much as possible. They are now ready for the mulch.

MULCHING.

Strawberries should always be mulched. It keeps the fruit clean, makes the early fruit ripen more evenly, makes the fruit easier gathered and helps to keep down weed and grass growth during the picking season.

Rice straw, clean prairie hay, pine needles, all make a good mulch. It should be put on 2 inches to 3 inches thick and well worked in among the plants. Where mulching is delayed till very late, as latter part of February or early March, it is sometimes necessary to place the mulch under the laves by hand to keep from covering the bloom stems.

When the picking season is over, if the mulch is in good enough condition to use again, and it is desired to save it, it can be raked in piles at the ends of the rows and kept, otherwise it can be plowed under.

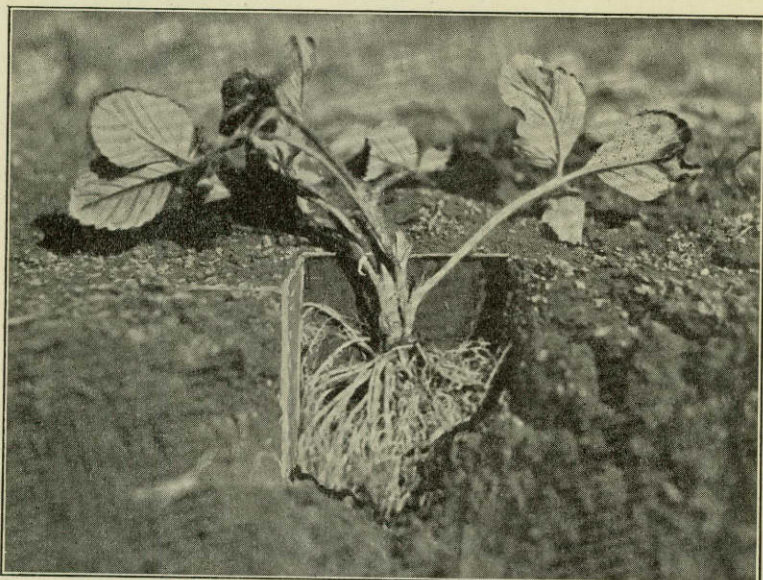


Fig. 5.—Plant not root and leaf pruned, set too deep and roots not properly spread. (Original.)

GENERAL CULTIVATION.

As soon as the strawberry plants are through bearing and the mulch removed, the middles should be run out with a sweep and all weeds and grass thoroughly cleaned out. The plants should be thinned out to 12 inches to 15 inches apart in the rows, to make hoeing easier, and the dirt well worked back to the plants. Sufficient shallow cultivation should be given to keep down weeds and grass and the plants allowed to runner and make new plants to bear next year's fruit, where the matted row system is used.

The old roots of strawberry plants die every year, while a new root system is forming above the old one. Since the formation of this new root system or crown of roots, which takes place, usually in June, is $\frac{1}{4}$ inch to $\frac{5}{8}$ inch above the old crown, if the dirt is not kept well worked to the plants new roots cannot form and the plants die.

HINTS ON IRRIGATION.

Where it is possible to obtain water, irrigation is of great value in carrying strawberry plants through a dry summer, but water must not be substituted for cultivation, which is as much of a necessity with irrigation as it is with rainfall.

To irrigate successfully the land should be as nearly free from stumps and obstructions as possible, and the rows should run in such a direction on the slopes as to make the distribution of water by furrow possible.

The head of water put in each row has to be governed by the nature of the soil and can only be determined by experiment. At no time should the water move rapidly enough to wash the soil in the furrow, nor must the water touch the plants,

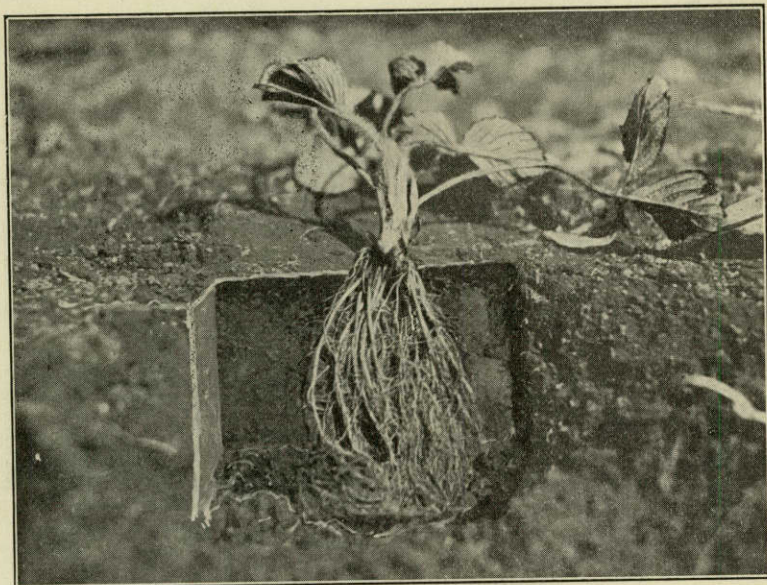


Fig. 6.—Plant not properly pruned, set too shallow and roots not spread. (Original.)

especially when there is hot sunshine. The water should reach the roots from the middles by soaking or seeping. The distribution of water into the middle furrows is best controlled by means of gates or dams. These are made of sheet iron 15 inches to 18 inches long and 8 inches or 10 inches deep. Find the center through the narrow width and cut a slot 2 inches wide and 4 or 5 inches deep.

The water can be run into a ditch across the ends of the rows, these gates "pushed" into the ground at the middles and the water allowed to flow through the slot. The gates can be raised or lowered so that an equal amount of water flows through each slot. Differences in the levels of the different furrows in which it is desired to run the water can thus be taken care of and an equalized amount of water can be distributed to every furrow.

STRAWBERRY INSECTS, SOME OF WHICH DO INJURY
TO STRAWBERRY PLANTS IN TEXAS.

STRAWBERRY WEEVIL.

(*Anthonomus signatus*, Say.)

The strawberry weevil is a small black or dull red colored snout-beetle which makes its appearance as soon as growth begins. Eggs are deposited by the females in the staminate buds and the bud stalk severed, which causes the bud to wilt and drop off.

The weevil passes the winter in the adult stage, usually in trash, rubbish and moss in the field or in adjacent woodlands. In the spring the beetles emerge, feed and oviposit on strawberry, blackberry and dewberry plants, attacking the buds in which the grub feeds and reaches maturity. It is essential, therefore, to use measures to control the strawberry weevil when the buds form.

Control—The lead-arsenate sulphur dust mixture is very effective when applied to the plants just as soon as the weevil begins to feed on the buds, and repeated in about 10 days later, or as soon as the dust of the first application has disappeared from the upper surface of the foliage.

Fourteen pounds of arsenate of lead and seventy pounds of finely powdered sulphur thoroughly mixed together is sufficient for an acre, and should be used for each treatment, and may be applied with a good hand dust-gun or machine duster.

Clean culture is also of vital importance in destroying hibernating haunts of the weevil.

STRAWBERRY CROWN BORER.

(*Tyloderma fragariae*, Riley.)

The larval stage of the strawberry crown borer is a white worm about $\frac{1}{4}$ inch in length which eats out the interior of the strawberry crown. The adult beetle also measures about $\frac{1}{4}$ inch long, the color of this beetle is black and has a short snout, and is practically wingless.

The adult beetle passes the winter under rubbish, leaves and in the strawberry beds. They emerge from their winter quarters in March and soon after begin to lay their eggs either at the base of the leaf stalk or within the crown just above the roots. One female is capable of laying about 100 eggs. The eggs hatch in about 14 days and the worm then works its way inside the crown, and becomes fully matured in about six weeks, after 12 more days the adult crown borer appears.

Control—Since the adult crown borer has such small wings that it is unable to fly to nearby fields, advantage should be taken of this fact and new fields planted away from the old patch at a distance of about 200 or 300 yards so that injury may be completely avoided. New patches should never be planted immediately adjacent to old infested fields.

New plants should be dug not later than March 1st and should be taken from young fields which are free from the crown borers. Young plants for planting should never be taken from old infested fields as there is danger of carrying adult crown borers in the soil adhering to the plants. In all cases it is advisable to free the young plants of all soil possible.

All old abandoned fields of strawberries should be plowed up in order to destroy all the borers by starvation, as the crown borers cannot exist longer than seven days without food.

Spraying with arsenate of lead (2½ pounds to 50 gallons of water) when the adults emerge and begin feeding in the spring will kill many of them and help to protect the bed.

STRAWBERRY ROOT-WEEVIL.

(*Otiorhynchus ovatus*, Linn.)

These strawberry root-weevil or crown-girdler are small, black snout-beetle, the larvae of which feed on the roots of strawberry and various other plants. They girdle the roots so that the plants can easily be lifted out of the ground with the slightest pull. When the infestation becomes heavy, severe injury may be done to a strawberry patch.

The adult beetles are general feeders of the foliage of various trees, shrubs and grasses, as well as flowers and vegetable plants. The beetles also have a habit in seeking shelter in houses.

Control—Spraying the plants with arsenate of lead, 2½ pounds to 50 gallons of water, or 2½ pounds of arsenate of lead to 50 gallons of bordeaux mixture, applied when the beetles make their appearance will give some relief. Canclum arsenate dusted on the plants thoroughly with a good dust gun may also be effective. Clean culture such as recommended for the control of the white-grub is one of the best preventatives.

STRAWBERRY LEAF-BEETLE OR ROOT WORM.

(*Typophorus canellus*, Fabr.)

This beetle is about ¼ inch in length and varies in color from chestnut to black, having black spots of various sizes showing on the wing covers.

The adult beetle hibernates through the winter under rubbish and emerge in the spring, which then feed on the leaves of the strawberry plants, eating small holes in them and sometimes the larger portion of the leaf surface is destroyed. The female beetles deposit their eggs on the plants near the surface of the ground during the months of April to June. The grubs or larvae hatched from these eggs feed upon the roots of the plants and become fully matured about June 15th to July 1st, when they change to pupae in earthen cells in the ground. In these cells they later change to adults and emerge and proceed to feed on the leaves again.

Control—Dusting with calcium arsenate or a mixture of hydrated lime 65%, ground bordeaux 20%, and arsenate of lead 15%, applied about June 15th to July 1st, and repeated three weeks later has given good results. In case of heavy rains following the applications, the plants should be redusted.

THE STRAWBERRY FLEA-BEETLE.

(*Haltica ignita*, Ill.)

The Flea-beetles attacking the foliage of the strawberry plant are about $\frac{1}{8}$ of an inch in length, varying considerably in color from purplish to bluish shining beetles somewhat elongate in shape. The adult beetles as well as the larvae or grubs are most injurious in the spring, eating large portions of the foliage, in some instances only the veins of the leaves remain.

The female beetles deposit eggs on parts of the plant in the spring which hatch in about three to four weeks, these larvae or grubs then too feed on the leaves.

Control—Arsenate of lead, at the rate of 2 pounds to 50 gallons of water to which is added two pounds of freshly slaked lime, usually gives relief. A good combination spray is the bordeaux mixture and arsenate of lead, two pounds of the latter to 50 gallons of bordeaux, will serve both as an insecticide and fungicide as well as a repellent. Dusting with calcium arsenate applied with a good dust-gun such as is ordinarily used in dusting cotton for the boll weevil, may also give good results to eliminate this insect.

Clean culture is very important in combating this insect, as the beetle in the adult stage passes the winter beneath dead leaves and rubbish, such should be destroyed by burning in the autumn, thus destroying the hibernating shelters of the beetles as well as reducing the number of beetles which are apt to make their appearance in the spring.

STRAWBERRY ROOT-LOUSE.

(*Aphis forbesi*, Weed.)

The strawberry root-louse is found upon the leaves of strawberries in the spring, but later in the season many of the wingless females are carried to the roots of the plants by ants, where their method of reproduction and their continuous sucking soon destroys many plants.

Winged migrants of these lice fly to new fields where new colonies are established, by this method of distribution field after field of strawberries soon become heavily infested and many of the plants soon die.

Control—Strawberry root-lice infested plants should not be sold or planted, unless they have undergone a severe treatment in a fumigatorium and fumigated with $\frac{3}{4}$ ounce of cyanide, $\frac{1}{2}$ ounce of sulphuric acid, and three ounces of water to 100 cubic feet of space, allowing the gas to act for about 20 minutes.

They may also be dipped in a nicotine and soap solution or in kerosene emulsion.

Strawberry plants should never be taken from an infested field for planting on new ground, nor should an infested field be replanted to strawberries.

Rotation of crops serves as a good method by which strawberry root-lice may be starved out.

WHITE GRUBS.

(*Lachnosterna*, *Spp.*)

The white grub is the larvae of different species of what is commonly called the May beetle or June bug. The grubs are white with brown head and are generally curled in a semicircle in the ground, where they feed upon roots of strawberry, field and garden crops, the injury being recognized by the sudden wilting and drying up of occasional plants. The adult female beetles lay their eggs in June, preferably in grass land, which hatch in about two weeks. The young grubs feed on the roots of plants, and in the fall they gradually burrow into the ground from 6 to 12 inches deep. When the grub is two or three years old it changes to white pupae, this stage lasts about three weeks before the adult beetle wiggles out of the pupal skin in August, but remains in the pupal cell until the following spring, when they emerge and feed upon the foliage of various trees and plants at night. Their work may be identified by the ragging of the foliage as if it had been torn.

Control—The simplest and most certain method of checking the injury on a small scale is to dig up the infested plants and destroy the grubs.

Deep plowing, especially cross-plowing is the most effective remedy for the destruction of white grub on a large scale. The ground should be disturbed often and kept free of weeds in order to eliminate the grubs.

Treating the land with gas lime after the crops have been harvested is very valuable. This lime is a refuse of gas manufacturing plants and is highly impregnated with gas and tarry substances when fresh, therefore it should be remembered that it will kill plant life as well as insects in the ground, and should be experimented with on a small scale before using it extensively.

STRAWBERRY LEAF-ROLLER.

(*Ancylis comptana*, *Frohlich.*)

The strawberry leaf-roller moths emerge from their pupae in April and early May, and as soon as mated the females lay their eggs upon the half-grown leaves of the strawberry plants. In about five to seven days the eggs begin to hatch and the small caterpillars then make their way to the upper side of the leaves and feed on the tender tissues of the leaves. They soon begin to draw the upper surface of the leaves together with fine silken

cords and form a silken mass within the folded leaf, in which they live. In about a month the caterpillars are full grown and immediately pupate within the folded leaf. About three generations of caterpillars may be produced in one year.

Control—It is very imperative that arsenical sprays be applied at time when the caterpillars are moving about the leaves just after hatching, as it is impossible to reach them with sprays after the leaf has been folded by them. Arsenate of lead at a rate of $1\frac{1}{2}$ pounds and an equal amount of fresh slaked lime to each 50 gallons of water, may be used effectively, however it is not safe to apply such arsenicals after the fruit has advanced.

Applications should be made about April 15th to May 1st and another about the 15th of May. This may be sufficient to kill most of the young caterpillars.

After the crop has been harvested the strawberry beds should be mowed, raked and burned, or old hay or straw covered over the beds and burned. This will destroy most of the remaining larvae and pupae of the pest.

STRAWBERRY SAW-FLY OR FALSE WORM.

(*Harpiphorus maculatus*, Norton.)

The larvae of the saw-fly is a greenish worm, one-half to three-quarters of an inch long when full grown. The adult of these larvae are approximately one-quarter of an inch in length, with blackish wings and black body, with a row of lighter spots on either side of the abdomen.

The flies emerge in the spring, about two to three weeks before the plants bloom freely, and the females soon begin to deposit their eggs beneath the epidermis of the leaves, these eggs hatch in about two weeks and the larvae then feeds on the foliage. Where numerous they will skeletonize the leaves to such an extent that the plants will be totally defoliated, causing great injury to the fruit crop, as well as killing a large number of the plants. These larvae when full grown enter the soil and go into hibernation in small cells until the next spring, when pupation takes place and shortly after the adult flies emerge.

Control—Hellebore, 1 pound to 3 gallons of water, dusting with pyrethrum, and spraying with arsenate of lead at the rate of $2\frac{1}{2}$ pounds to 50 gallons of water may be used with good effects, when applied when the blooming commences. The plants may be treated with these chemicals until the berries are about one-third grown without any danger of poisoning them.

STRAWBERRY WHITE-FLY.

(*Aleurodes packardi*, Morrell.)

These white-flies are very small four winged miniature moths which occur at intervals during the summer from May to September and deposit their small eggs on the underside of the

leaves. The eggs hatch in about ten days into active yellowish larvae which resemble the larvae of the scale insect. These larvae suck the plant juices from the leaves. The period of development from egg to adult under normal conditions, is from 30 to 35 days, and there may be three generations in one year. These insects rarely become so abundant as to cause severe injury on large plots, and usually is midsummer before they become abundant enough to attract attention.

Control—The larvae or nymphs of the white-fly succumbs readily to any contact insecticides of moderate strengths. Kerosene emulsion or oil emulsion applied with a bent nozzle so as to reach the underside of the foliage is very effective. If the spray is applied with great force through a fine nozzle, the air around the plants treated will be surrounded with a fine mist which will hit and disable many of the adult white-flies.

Whale-oil soap, 1 pound in 6 gallons of water has also been very effective.

Plants from white-fly infested patches, should first be fumigated with hydrocyanic acid gas before replanting to new beds. Formula given under control of the strawberry root-louse.

THE STRAWBERRY PAMERA.

(*Parmera vineta*, Say.)

This is a sucking insect with dark, almost black body and long yellow legs. The pamera feed upon the young fruit which prevents it from becoming of marketable size.

Control—Several applications of micible oil, kerosene emulsion or soap and nicotine are very effective. Dusting with nicotine-lime dust is also very effective.

Unslaked lime.....	1 pound
Slaked lime or other inert powder, as koalin.....	3 pounds
"Black leaf 40".....	4 ounces
Water.....	4 ounces

Beat up the unslaked lime into a powder and thoroughly mix the slaked lime with it. Add to the "black leaf 40" an equal volume of water, gradually pour this into the lime mixture and stir thoroughly. Then place in air-tight containers and let remain for three hours for lime to slake. Dust on the plants so that the material will settle on the insects and be destroyed. This substance will not keep unless sealed, hence it must be used immediately after opening or resealed after taking out the portion to be used.

RED SPIDCR.

(*Tetranychus telarius*, Linn.)

These spiders are very small and appear as minute red specks on the underside of the leaves. On strawberry plants they do injury not only by sucking the sap, but also by spinning a network of webs under the leaves, over the buds, blossoms and

fruit, which partly excludes air and light, thereby in a measure prevents the development of the berries.

Control—The sulphur caustic potash contact spray seems to have been the most effective in combating this pest. The formula is as follows:

STOCK SOLUTION.

Sulphur	20 pounds
Caustic potash or soda	10 pounds
Water	20 gallons
(14 pounds of concentrated lye may be substituted for the caustic potash or soda in case the latter cannot be obtained.)	

Make a paste of the sulphur by gradually adding 1 or 1½ gallons of water to the 20 pounds of sulphur and stir vigorously, then gradually add the caustic soda, potash or concentrated lye. A chemical reaction will take place and the mixture will boil violently. To prevent burning, a small amount of water should occasionally be added. When the boiling has stopped add enough water to make 20 gallons. This is the stock solution and should be strained to eliminate all lumps and other particles which might clog the nozzle. For red spiders on strawberries use one gallon of this stock solution to 25 gallons of water, and spray thoroughly on the plants, as well as under the leaves, as the spiders are mostly concealed there. The spray should be repeated in about a week or ten days, as a number of spiders and eggs usually escape the first application.

Dry or powdered sulphur is also very effective when applied mornings when the plants are moist with dew and when the temperature is about 75 degrees F. or over. The sulphur should be applied thoroughly and as evenly as possible with powder guns or shaken through a porous sack onto the plants.

STRAWBERRY THRIPS.

(*Thrips tritici*, Fitch; *Thrips tabaci*, Lind.)

Thrips are minute active or rather rasping insects about one twenty-fifth of an inch in length with delicate feather-like wings, and are of a yellowish color slightly tinged with black. The injury caused by these tiny insects is first noticeable when the blooms and parts of the plants begin to blight, afterwards these turn brown or black and die. The main injurious effects however, seem to be in preventing the fertilization of the ovules.

Dry weather seems to be very favorable for the thrips, but on the other hand is very unfavorable for the plants, in view of the fact that it renders them less able to resist the attacks of the insects.

Control—The best method of control seems to be by dusting the plants with a nicotine dust, as prescribed for controlling the strawberry pamera, which see.

Spraying with a nicotine solution has also been very effective. Prepare the solution by heating two gallons of water in which dissolve three pounds of whale-oil soap; while still warm (not hot) add one-half pint of nicotine sulphate (40%) and

stir well. This stock solution will be sufficient to be added to 50 gallons of water. In applying this solution high pressure should be used and the spray directed downward so that it will be forced into the crevices and between the stems and leaves of the plants where the insects are concealed.

The sulphur solution, as recommended for red-spiders has also given good results.

STRAWBERRY DISEASES.

LEAF SPOT OR BLIGHT.

(*Mycosphaerella fragariae*, [Schu] Lind.)

This is a fungus disease which appears on the leaves and blossoms of the strawberry plant in the spring as purple or red spots. In the fall these spots increase and frequently unite, forming large irregular blotches, which causes the leaves to dry up.

Control—The disease may be held in check to a certain extent by the selection of healthy plants and planting them on well drained land.

Spraying with standard bordeaux mixture every two weeks, beginning after the crop is harvested, until four to six applications have been applied is also very effective. Mowing the plants and burning after the berries have been harvested is frequently advantageous.

POWDERY MILDEW.

(*Sphaerotheca humuli* [Fries] Burr.)

This is another fungous disease which sometimes causes heavy losses. A white powdery fungous forms on the lower surface of the leaves, causing them to curl as though they were suffering from a severe drouth. Berries attacked by the fungous will be small and tasteless and of no value.

Control—Dusting the plants thoroughly with powdered sulphur mornings of clear sunshiny days, when the plants are still covered with dew, will generally arrest the trouble. Two or three applications of bordeaux mixture applied at intervals of ten days or two weeks will also prove very effective.

FRUIT ROTS.

Fruit rot fungi are the causes of heavy losses, especially during transportation. Fruit may leave the farm in apparently good condition but arrive at point of destination in a very bad condition. The two principal fungous diseases attacking fruit are the black-rot (*Rhizopus nigricans*) and the dry-rot (*Botrytis* spp).

Black-Rot causes the fruit to become soft and rotten and the juice to run freely.

Dry-Rot attacks both green and ripe fruit and sometimes the leaves and blossoms, and causes the berries to be firm and frequently discolored.

Control—Berries picked when cool and wet keep much better than when picked when warm and dry, hence should be picked early in the day before they become heated by the sun. As soon as picked they should be carried to the shade and covered with cheese cloth for transportation to shipping stations.

BLACKBERRY CULTURE.

SELECTION OF SOIL.

Though the blackberry grows well on a number of different kinds of soil, it probably reaches its greatest perfection on sandy soils.

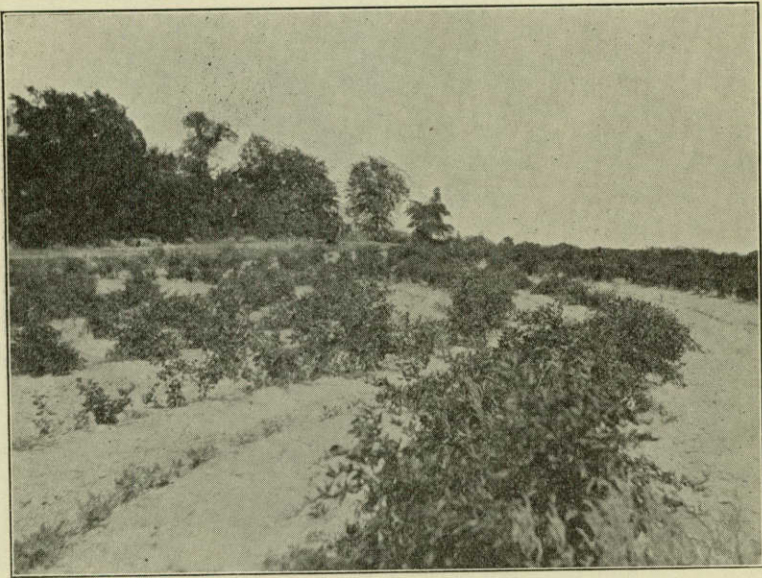


Fig. 7.—Lawton and McDonald Blackberries (alternate rows) with peas planted in between on terraced land. (Original.)

The gray sandy soils of east Texas are among the very best for blackberry culture.

The very white sand known locally as "blow sand" is not so well adapted naturally, to the blackberry as the somewhat closer bodied and richer sands, but if this white "blow sand" is well prepared and properly cared for after the berry plants are planted, the results will be very good indeed.

The site selected for planting blackberries should be well drained, and if sufficiently sloping for the soil to wash, the land should be terraced. There should be at least two feet of soil on top of the clay.

Figure 7 shows a well terraced hillside planted to Lawton and McDonald blackberries.

PREPARATION OF THE LAND.

A great many recommendations have been made concerning the preparation of land, intended to be planted to blackberries. Most of these methods advise the application of stable manure and the growing of cover crops, peas, etc., on the soil two or three years before planting the blackberry plants.

Fertile, well balanced soil, is necessary for all fruit bearing plants and there can be little objection to any practical method for enriching the soil.

The methods generally recommended for the preparation of land intended for blackberries, while of undoubted benefit to the soil, are generally not practical, except for small acreage and the

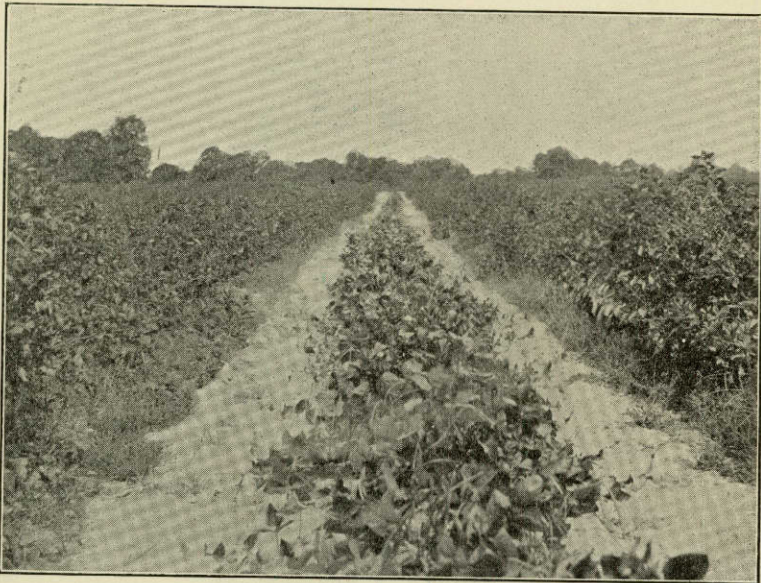


Fig. 8.—Peas growing between blackberries for soil improvement. (Original.)

amount of time and labor required, usually discourages the planter of large acreage from employing anything more than a moderate amount of commercial fertilizer, usually more or less unsuited to the purpose.

The following will enrich the soil, insure fine crops of fruit and is practical for a blackberry field of several hundred acres and easily used in a field of a few acres. The soil should be broken as deeply as possible, laid off in rows and planted as recommended under planting. As soon as the young plants start a good growth in the spring, about 500 pounds per acre of cottonseed meal, or its equivalent in a nitrogenous fertilizer, should be applied followed by frequent shallow cultivation to hold the moisture. One or two rows of peas, for preference iron or clay peas (fertilized with 300 pounds of commercial fertilizer

analyzing phosphoric acid 12%, potash 6% to 8%), should be planted between the rows of blackberry plants. When these peavines mature, but while still green, they should be plowed under to add humus to the soil.

Figures 8 and 9 show good growth of peavines in a blackberry field.

PLANTS AND PLANTING.

Blackberry plants are propagated in three ways, by rooted plants or suckers coming up in the blackberry fields, by rooted plants raised in nursery rows from root cuttings, and by root cuttings planted directly in the field where the plants are wanted to grow.

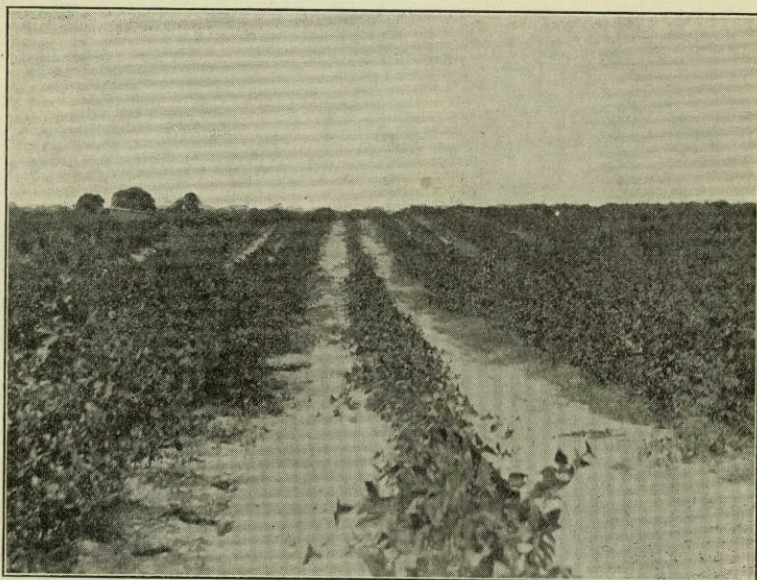


Fig. 9.—A fairly good growth of pea vines between blackberries on white sandy soil. Two rows of peas on such soil would be more satisfactory. (Original.)

Root cuttings are made from young roots $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter, cut up in pieces four to six inches long.

While rooted plants cost somewhat more than root cuttings, they are preferred by many, because with good rooted plants a "good stand" of plants can always be secured under favorable moisture conditions, which is sometimes not the case when root cuttings are planted in the open field. When rooted plants are used they should have all bruised or broken roots removed and the tips of remaining roots freshly trimmed before planting. The soil should be in good condition and the hole for planting should be large enough to prevent bending or cramping the roots and deep enough for the soil to cover the roots three or four inches when the hole is filled level. Spread the root sys-

tem as evenly as possible so that soil can come in contact with every root and pack the dirt firmly on the root system.

For the Lawton and like types of blackberries the rows should be about 12 feet apart and the plants set about three feet apart in the rows.

For the McDonald berry the rows should be 12 feet apart and the plants set 8 feet apart in the rows. Reasons for this setting will be given under "Pruning the McDonald."

The Lawton blackberry will fruit when planted alone, that is, without another variety of blackberries to pollinize its bloom.

The McDonald berry is a cross or hybrid and requires pollination of its bloom to produce perfect fruit. In east Texas

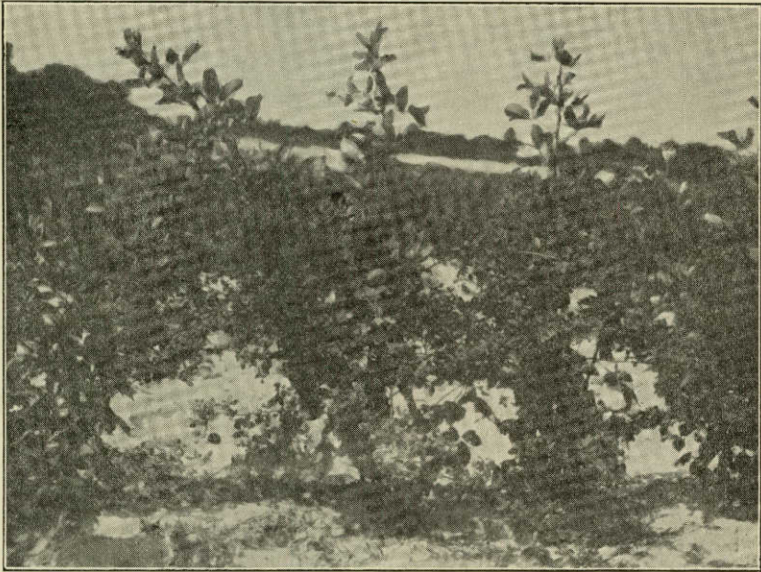


Fig. 10.—Lawton Berries with new growth coming through fruiting wood. Time to prune new growth. (Original.)

the Lawton seems to be the most satisfactory berry to use for pollination purposes, so where one intends planting McDonald berries it is recommended that every other row be planted to McDonalds and the intervening rows be Lawton. It is of course understood that in such mixed plantings the distance between the rows is kept at or near 12 feet from a row of McDonald berries to a row of Lawton; and from row to row of McDonald, or Lawton as the case may be, the distance is about 24 feet.

PRUNING THE LAWTON.

As soon as the canes of the Lawton are 24 to 30 inches high, they should have their tips cut off in order to force out the fruit bearing laterals. If the soil is poor and the growth small they should be "headed back" to 18 or 22 inches. Three to five canes to a hill are sufficient, others should be cut out.

Figure 10 shows a Lawton plant in full bearing with the new canes coming up through the fruiting wood. These new canes should be cut back at this stage.

As soon as the old canes are through fruiting they should be cut off as near the ground as possible, removed and burned. This helps get rid of borers which sometimes work in the canes and will help to prevent the spread of fungus diseases, especially the leaf rusts.

Before the plants start in the spring the lateral branches should have about one-third of their length cut off.

PRUNING THE McDONALD.

The McDonald berry being a blackberry-dewberry hybrid, has a somewhat different habit of growth to the pure blackberries,

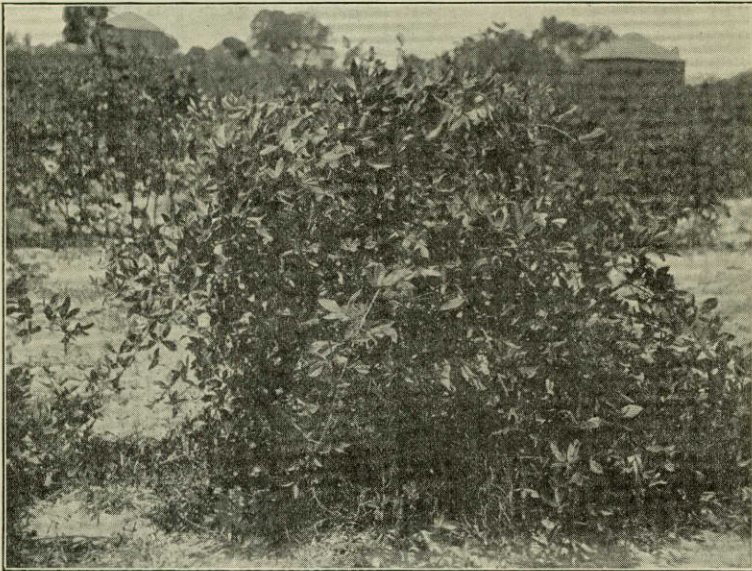


Fig. 11.—A good specimen of McDonald Berry plant in a well cultivated field. (Original.)

the method of treatment is therefore somewhat different.

The old canes of the McDonald are not cut out every year as with the Lawton blackberry, but the new growth coming up through the old growth is cut back or "headed" at 24 to 30 inches which produces a heavy growth of long laterals. The following year before growth starts, such of these laterals as trail on the ground are cut back short enough to prevent dragging in the dirt and getting the berries dirty. All other laterals should have at least one-third of their length cut off.

Every third year, as soon as the fruiting canes are through bearing, the whole plant should be cut off 6 to 8 inches above the ground to get rid of the accumulated brush. The reason for not cutting the plants closer than 6 inches from the ground is

to leave some support for the new canes as they come up and cause them to grow as upright as possible.

With the McDonald berry planted and pruned by this system the pickers can get all around each plant and the gathering of the berries is easy and rapid while securing a maximum yield.

Figure 11 shows a fine specimen of McDonald plant which has been headed at 30 inches. Notice the symmetry of the plant and the vigor of the laterals.

FERTILIZERS AND CULTIVATION.

Instruction for new plantings the first year will be found under "Preparation of Land." For the second year the blackberry plants should receive about 700 pounds per acre of 12-4-8 commercial fertilizer applied in February or March.

Peas should be planted the first year and the whole given clean cultivation by frequent shallow plowing during the growing season. This method of growing peas to be turned under should be kept up every year, however after the first year, it will not be necessary to fertilize peas. After two or three years the peas should begin to furnish sufficient nitrogen to produce satisfactory cane growth in the berries. The nitrogen in the fertilizer can then be discontinued and a fertilizer having 12% phosphoric acid and 6% to 8% potash used about 700 to 800 pounds per acre to produce satisfactory fruitage.

DEWBERRIES.

The treatment of dewberries as to fertilization and cultivation is no different from that of the blackberries. The methods of planting are also the same.

The distance for planting are somewhat less, dewberry plants being set about 4 feet distant in the rows and the rows about 8 feet apart.

Dewberries are propagated from plants or suckers which come up in the field from old plants, and by "tip plants" which are produced by covering the tips or ends of the vines with dirt in late summer and allowing them to take root.

If dewberries are not trained on stakes or trellis, but allowed to use the old canes for support, the whole plant should be cut off 4 to 6 inches from the ground every third year, as soon as the plants have finished fruiting, to remove the excessive accumulation of brush.

Where they are trained to stakes, a stake is driven by each plant so that its height is about 4 feet above the ground and the vines are gathered up in late winter, wound in a spiral around the stake and tied at the top where the ends are cut off. At the end of the bearing season the old canes are cut out and the same process repeated with the new canes the following year.

A wire trellis is sometimes used and is somewhat more economical than the staking system.

Posts are set up about 20 to 30 feet apart (depending on the

strength of the posts) in the rows and a strong wire stretched on them about 3½ feet above the ground. The dewberry canes are gathered up in the late winter (about February) and tied to this wire. At the end of the bearing season the old canes should be removed as in the stake system.

BLACKBERRY AND DEWBERRY INSECTS.

RED-NECKED RASPBERRY CANE BORER.

(*Agrilus ruficollis*, Fab.)

This borer is the larvae, or young, of a small short-horned beetle, which forms irregular swellings or galls from 1 to 3 inches in length on the canes, causing the bark to split.

The infested canes either die or become weakened so that the crop fails to develop.

The beetle of this borer can readily be distinguished by its reddish or golden neck by which it has been named. Its head is a bronze red and wing covers are velvety black. The presence of the beetles can be detected by scalloped edges and round holes cut in the leaves by them, leaving considerable excrement upon the leaves.

Control—The only method for the control of these borers seems to consist of pruning out all infested canes and burning them; this may be done any time during the winter and early spring. The infested canes may readily be detected by the galls or enlargements on them. Where wild canes are infested in or adjacent to the cultivated premises they should undergo the same pruning.

BLACKBERRY GALL-MAKER.

(*Diastrophus turgidus*, Bass.)

The gall-maker is the larvae of a small black fly. The larvae is about one-tenth of an inch in length, is white with reddish mouth parts.

The gall caused by this larvae is a pithy swelling from one to three inches long and about an inch in diameter, reddish-brown in color, with the outer surface divided into four or five ridges. The larvae passes the winter in these galls in which they pupate in the spring and appear as flies several days later.

Control—The affected canes should be pruned out and burned during the winter.

BLACKBERRY CROWN BORER.

(*Bembecia marginata*, Harris.)

The adult of this borer is a clear-winged moth, often mistaken for a wasp. The moths make their appearance in the field during the summer and by September begin ovipositing. The moths lay their eggs on the plants and the eggs hatch in late autumn.

The young larvae, when hatched, immediately proceeds to eat through the bark and burrow into the canes near the crowns and upper portions of the roots, where pupation takes place, and at the end of the second season adults again emerge.

Control—This pest, like the red-necked cane-borer, is very difficult to combat. The same methods employed for the latter may also be applied to the crown-borer. Since this insect sometimes bores into exposed roots, these should likewise be dug up and destroyed. In the spring when the plants have started to growing, the dead canes which are infested are readily noticeable and should be dug up and burned. When topping new growth, wilted shoots should be examined at the base and if found infested, should be destroyed.

BLACKBERRY AND DEWBERRY DISEASES.

CROWN GALL.

(*Bacterium tumefaciens*, S & T.)

Crown galls appear as soft, white roughened knots on the roots and sometimes 18 inches above the ground on the canes. These galls turn brown with age and decay. The disease varies with different varieties and with different soil conditions.

Control—The grower should secure his new plants for setting from only the most healthy plants possible.

Fertilization with heavy applications of nitrate of soda or poultry manure will aid in eliminating this trouble.

Individual diseased plants should be removed and burned as soon as detected. This disease spreads readily from berries to fruit trees, hence orchards should not be planted on old crown gall berry infested fields.

ANTHRACNOSE.

(*Plectodiscella venera*, [Speg] Burk.)

Anthracnose is especially severe on the canes of blackberries and also attacks other parts of the plants. It starts as small circular purplish spots on the young canes and becomes elliptical and the centers become grayish as the plant increases in age, causing irregular blotches and in severe cases the stems are cracked.

Control—The old canes should be cut out and burned during the winter and spray the plants thoroughly with bordeaux mixture before the leaf buds open. Spray the young canes again just as they appear above the ground. Repeat the application ten days or two weeks later and again just before the plants blossom.

ORANGE RUST.

(*Gymnoconia interstitialis*, [Schlt] Lagerh.)

Orange rust is a common disease which appears in early spring on the lower surface of the leaves, forming large bright orange-colored powdery areas which cause the leaves to curl up and become dwarfed. It is sometimes very destructive, as it also attacks the canes causing them to split, and also extends down into the roots.

Control—The only satisfactory remedy to eliminate this disease is by digging up and burning the infected plants as soon as the disease makes its appearance. It is also advisable to destroy old plants growing in the neighborhood, which may be a means of carrying the disease.

DOUBLE BLOSSOM.

(*Fusarium rubi*, Wint.)

Double blossom is a fungous disease which attacks dewberry and blackberry buds, in which the fungi remains through the winter. This fungi causes the buds to swell in advance of the healthy buds, giving rise to a number of weak deformed shoots which bear only a few worthless berries. The spores of this fungous disease are carried from the diseased blossoms by the wind to the young buds which are being formed on the vines for the next year.

Control—Since spraying is of little value in the control of this disease, hand picking the diseased buds just as the young leaves appear, when the diseased buds can be readily detected, seems to be the only method of control.

