Blackberries, Raspberries and Dewberries

A Packed Pint Box of Cumberland Raspberries.

COLUMBIA, MISSOURI
JANUARY, 1929
Agricultural Experiment Station

EXECUTIVE BOARD OF CURATORS.—F. M. McDAVID, Springfield; MERCER ARNOLD, Joplin; H. J. BLANTON, Paris

ADVISORY COUNCIL—THE MISSOURI STATE BOARD OF AGRICULTURE

STATION STAFF, JANUARY, 1929

STRATTON DULUTH BROOKS, A.M., LL.D., President
F. B. MUMFORD, M.S., D.Agr., Director
S. B. SHIRKY, A.M., Asst. to Director
MISS ELLA PAHMEIER, Secretary

AGRICULTURAL CHEMISTRY
A. G. HOGAN, Ph. D.
L. D. HAIGH, Ph. D.
W. S. RITCHIE, Ph. D.
A. R. HALL, B. S. in Agr.
L. E. HUNTER, Ph. D.
C. L. SHREWSBURY, Ph. D.
E. W. COWAN, A. M.
ROBERT BOUCHER, Jr., A. B.
L. V. TAYLOR, A. B.

AGRICULTURAL ECONOMICS
O. R. JOHNSON, A. M.
BET H. FRAME, A. M.
P. L. THOMSEN, Ph. D.
G. B. THORNE, A. M.
Preston Richards, B. S. in Agr.
ELGIN E. McLEAN, B. S. in Agr.

AGRICULTURAL ENGINEERING
J. C. WOOLEY, M. S.
M. M. JONES, M. S.
E. G. JOHNSON, M. S.

ANIMAL HUSBANDRY
E. A. TROWBRIDGE, B. S. in Agr.
F. A. WEAVER, B. S. in Agr.
A. G. HOGAN, Ph. D.
F. B. MUMFORD, M. S.
D. W. CUTHTENDEN, A. M.
M. T. FOSTER, A. M.
F. F. McKENZIE, Ph. D.
H. C. MOFFETT, B. S. in Agr.
THOMAS W. COMFORT, B. S. in Agr.
LESTER E. CARDA, A. M.

BOTANY AND PHYSIOLOGY
W. J. ROBBINS, Ph. D.†
I. T. SCOTT, Ph. D.

DAIRY HUSBANDRY
A. C. RAGDALE, M. S.
WM. H. E. REID, A. M.
SAMUEL BRODY, Ph. D.
C. W. TURNER, Ph. D.
E. C. ELTING, A. M.
WILLIAM GIFFORD, A. M.
E. R. GARRISON, A. M.
M. J. FOWLER, B. S. in Agr.

ENTOMOLOGY
LEONARD HASEMAN, Ph. D.
K. C. SULLIVAN, Ph. D.

FIELD CROPS
W. C. ETHERIDGE, Ph. D.
C. A. HELM, A. M.
L. J. STADLER, Ph. D.

R. T. KIRKPATRICE, A. M.
B. M. KING, A. M.
MISS CLARA FURR, M. S.*

HOME ECONOMICS
MISS MABEL CAMPBELL, A. M.
MISS JESSIE ALICE CLINE, A. M.
MISS BERTHA K. WHIPPLE, M. S.
MISS MARGARET C. HESSLER, Ph. D.
MISS ADALETTA EFFEL, M. S.
MISS EDNA AMIDON, M. S.

HORTICULTURE
T. J. TALBERT, A. M.
H. D. HOOKER, Ph. D.
H. G. SWARTWOUT, A. M.
J. T. QUINN, A. M.
A. E. MURNEEK, Ph. D.

POULTRY HUSBANDRY
H. L. KEMPSTER, M. S.
EARL W. HENDERSON, A. M.

RURAL SOCIOLOGY
E. L. MORGAN, A. M.
HENRY J. BURT, A. M.
MISS ELEANOR LATTMORE, Ph. D.
MISS ADA C. NIEDERMeyer, A. M.
RANDALL C. HILL, A. M.

SOILS
M. F. MILLER, M. S. A.
H. H. KRUSEKOFF, A. M.
W. A. ALBRECHT, Ph. D.
RICHARD BRADFIELD, Ph. D.
HANS JENNY, Ph. D.
R. E. UNLAND, A. M.
F. L. DAVIS, B. S. in Agr.
GEO. Z. DOOLAS, A. M.
ROY HOCKENSMITH, A. M.
LLOYD TURK, B. S. in Agr.

VETERINARY SCIENCE
J. W. CONNWAY, D. V. M., M. D.
O. S. CRISLER, D. V. M.
A. J. DURANT, D. V. M.
ANDREW UREN, D. V. M.

OTHER OFFICERS
R. B. PRICE, B. L., Treasurer
LESLEY COWAN, B. S., Sec'y of University
A. A. JEFFREY, A. B., Agricultural Editor
J. F. BARHAM, Photographer
MISS JANE FRODSHAM, Librarian
E. E. BROWN, Business Manager

*In service of U. S. Department of Agriculture
†On leave of absence
Blackberries, Raspberries, and Dewberries

H. G. Swartwout

Abstract.—Commercial plantings of the blackberry in Missouri are few but are slowly increasing in number. Black raspberry plantings have increased slightly. The purple raspberry is increasing in popularity. The liberal use of manures in preparing land for brambles is important. Definite fertilizer recommendations cannot be made except that stable or barnyard manure is generally beneficial. The laterals of the Cardinal raspberry should be cut longer than those of the black raspberries. The laterals of Early Harvest and other close-fruited varieties of blackberries should be cut shorter than those of Snyder, Eldorado, Taylor, Rathburn, and similar long-fruited varieties. A trellis is recommended for the black and purple raspberries. Red raspberries have been found unprofitable in Missouri because of the frequent winter killing of the canes. Cumberland has proved to be the best commercial variety of black raspberry. Early Harvest is the best early blackberry and Ward the highest yielding late variety. Pollination studies with Early Harvest, Blowers, Ward, Snyder, Ambrosia, Lagrange, Eldorado, and Ancient Briton blackberries, the Lucretia dewberry and Kansas, Pearl, Cumberland, Farmer, Gregg, Improved Gregg, Conrath and Cuthbert raspberries have shown all to be self-fruitful. McDonald, a blackberry-dewberry hybrid was the only variety studied that was self-unfruitful. Spray injury to raspberries can be avoided almost entirely by using lime-sulphur at the rate of 1 to 49 in the early summer sprays.

The blackberry is an important small fruit in Missouri, occupying at the time of the last census more than 5000 acres. It is found growing wild in every section of the state, on thin as well as fertile soils and endures exceedingly well the hot, dry weather so common to the summers of this section. It is also very hardy to cold, seldom showing more than mere traces of winter injury. The larger part of the blackberry crop of the state comes from the wild plants, but with the rapid disappearance of wild blackberries as more and more land is cleared and put under cultivation, commercial plantings will increase, since growers can successfully compete with the generally inferior wild fruit.

There are practically no commercial plantings near a large number of the smaller Missouri cities and towns, each one of which would consume locally all the fruit produced from several acres. There is arising a practice of setting and tending one or two acres of blackberries within easy distance of some town, advertising and selling the privilege of picking in a cultivated field. The practice is finding favor among those in the habit of picking wild berries, and in some instances is just as profitable to the grower who thus avoids the worries of harvesting and marketing the crop.
Of the raspberries the black-cap is the only one generally cultivated in Missouri, the total plantings of all varieties occupying about 1700 acres. Plantings have increased slowly because of difficulties encountered in the culture of raspberries this far south. The raspberry is intolerant, of hot, dry weather, suffers rather extensively at times from winter killing of the canes, and is ravaged by anthracnose. Nevertheless, with fertile soil, good tillage, special care in the control of anthracnose, and careful attention to other cultural practices it can be grown at a profit. The demand is great and the price is generally high.

Dewberries are grown only to a very limited extent, although wild vines are found quite generally in open fields and pastures throughout the state.

CULTURAL AND MARKETING PROBLEMS

There are several problems encountered in the production of brambles not met with in the growing of many of the tree fruits. The berries are a soft perishable product which must be handled carefully and quickly. The fruit ripens rapidly and in a comparatively short time, necessitating large picking crews. It moulds or sours quickly, making immediate disposal imperative. The plants have a comparatively short period of profitable production.

On the other hand, there are two distinct advantages in growing brambles: Profitable returns can be expected within two or three years, and large returns are possible from an acreage so small that one man can easily handle the entire plantation, except at picking time. These two advantages make it possible to conduct the enterprise upon high-priced land advantageously located for quick and easy disposal of the fruit.

KINDS OF BRAMBLES

Blackberries, raspberries, and dewberries belong to that group of plants known collectively as brambles. All varieties under general culture in this section have been derived from species native to this country and have been domesticated only within comparatively recent years. For this reason most horticultural varieties rather closely resemble the wild plants and not infrequently plants will be found in pastures and woodlands yielding berries as fine as those under cultivation. Selection and breeding will continue to develop still better varieties.

Blackberries and dewberries are generally grouped together, though dewberries differ from the true blackberries in several respects. Dewberries grow along the ground instead of upright, grow in clumps rather, than thickets, and take root at the tips of canes to produce new plants while the blackberry suckers from the roots. The fruit of the dewberry ripens earlier, is generally larger, less “seedy” and of more pleasing
Blackberries, Raspberries, and Dewberries

Blackberries, raspberries, and dewberries differ in flavor, and the clusters of flowers and berries much looser. Blackberries produce fruits of three colors, black, dark red, and white. The white-fruited varieties are of no economic importance, existing merely as curiosities. As a result of the natural crossing and recrossing of the various species, varieties show such a mixture of characters that they cannot be easily classified according to the species from which they came. Blackberries and dewberries hybridize easily and a number of blackberry-dewberry hybrids are now under cultivation. As is the rule among hybrids, they show characters that range from one parent to the other.

Raspberries differ from blackberries in that the cohering druplets separate from the receptacle which is rather dry and woody and remains attached to the plant. In the blackberry the receptacle or core comes off with the berry, is soft and edible. Raspberries appear in five colors, black, red, purple, yellow, and white. The black, red, and purple varieties are grown commercially in this country. The common black and red varieties represent different native species while the purple is a hybrid of the two. The black raspberry or blackcap is the most popular for commercial planting in Missouri. It is fairly abundant as a native plant, growing and fruiting well in or near open woodlands where decaying leaves and twigs provide abundance of humus and where the plants are protected from the hot sun. A yellow-fruited form of the black raspberry is also native, but is found less frequently.

Characteristics

Under favorable conditions for development the black raspberry produces strong, vigorous, arched, blackish-purple canes with stiff thorns and covered with bloom, a gray or whitish powder-like substance. The Cardinal and related varieties of purple raspberries make the same general type of growth as the black raspberries, but the canes are lighter in color and larger. Both produce their new shoots from underground buds on the old canes, near the crowns of the original plants. Purple raspberry varieties, however, show variations that range from black to red raspberries. As a group they are more vigorous, larger, and more prolific than either parent, and by many the fruit is considered of better flavor. These qualities are responsible for the increased interest in the purple raspberries and may result in varieties of this type superseding both the reds and blacks.

The red raspberry canes are light brown to reddish brown in color and generally rather slender and upright in habit of growth. The Cuthbert, as grown on the station grounds, often branches, producing long laterals, which do not have the stiff arched appearance of the black and purple raspberries, but are rather loose and straggly. The red raspberry produces new canes, both from buds near the bases of the old plants and
as suckers at various intervals from the main plant. This sucker-producing habit is undesirable, sometimes making it difficult to keep the plants within bounds.

The blackberry has the same sucker-producing habit as the red raspberry, and anyone who has tried to exterminate a blackberry patch knows with what tenacity it will hold on and continue to send up shoots from every root or piece of root left in the ground.

The blackberry canes have a decidedly upright habit of growth, while the dewberry trails on the ground. The hybrids between the blackberry and dewberry might be classed as semi-upright or semi-trailing. Some of these hybrids are rather upright with fairly long laterals; while others, like the McDonald, are only slightly upright with long trailing laterals, reaching in some cases the length of dewberry runners.

The blackberry is the only one of the brambles grown in Missouri to entirely escape winter killing of the canes. The dewberry is rather tender to cold, suffering some injury nearly every year. Were it not for the fact that the canes, being prostrate, are partly protected by leaves, vegetation, and snow, few would survive the winters. The red raspberry is naturally very hardy to cold, more so than the blackcap, but in Missouri it is frequently killed to the ground. The laterals of the blackcap are often killed or injured a third or half their length, but enough
wood will remain, if anthracnose has been controlled, to produce a good crop.

The brambles bear their fruit in terminal clusters on lateral shoots arising the same year the fruit is produced. These shoots arise from buds on the main canes and laterals which grew the year before. No further growth is made after the fruit is produced, and the canes die soon after the crop is matured. The ordinary varieties are perennial plants with biennial canes, a new crop of canes being produced each season to replace those which have fruited and died.

PROPAGATION

The black and common varieties of the purple raspberry naturally propagate themselves by means of plants produced at the tips of the canes; that is, by natural tip layerage. In order to secure new plants of such varieties it is only necessary to make sure the tips are covered with soil in early fall. This can be done most conveniently and easily by cultivating the bed thoroughly in August. A large percentage of the tips will be covered either during cultivation or through the action of subsequent rains. The rooted tips are generally left attached to the parent plants until the following spring, when the canes are cut several inches above the ground and the rooted tips lifted, packed and stored, or set directly in the field.

The red raspberry and such varieties of the blackberry as sucker freely are propagated by means of the suckers or shoots which grow from the roots. Shoots which are one year old are best, although young succulent sprouts can be used for late plantings if a portion of the mother root is removed with the shoots.

Varieties of blackberries which do not sucker freely are usually propagated by means of root cuttings. For this purpose roots about the size of a lead pencil are best. They are cut into lengths of three or four inches, packed in damp, not wet, sand or sawdust, and stored until spring where they will not freeze. They are then dropped 5 or 6 inches apart in shallow furrows and covered with about three inches of loose, sandy soil. No buds are on the roots when cut, but adventitious buds develop later, and by spring one or more of these buds can be seen. Generally, after one year the plants will have made enough growth that they can be dug and set in the field. Such plants usually have a better root system than sucker plants.

The dewberry may be propagated by several methods. Tip-rooted plants, however, have the best developed root system and are, therefore, preferable to plants propagated by other methods.
SOILS AND SITES

Soils.—The brambles do well on a wide range of soil types. In general, however, the land should be moderately fertile and well supplied with humus. If the soil is not already well supplied with humus, it can be added by plowing under green manure crops, or by the addition of barnyard manure. Although the brambles must be well supplied with water, the soil in which they grow must be well drained.

The black raspberry will do well on a greater variety of soils than any of the other raspberries, but it does best in a rich clay loam top-soil with a more clayey subsoil which is retentive of moisture. It will, however, do well on a rather sandy soil well supplied with manure and water. In fact, a better yield will be secured on such a soil well handled than on the ideal soil poorly managed.

The red raspberry thrives on a lighter and more sandy soil than the black, but does well on any soil from a sandy to a clayey loam, provided other conditions are suitable for its growth. The purple raspberry does best on a silty loam soil.

The blackberry prefers a rather clayey loam soil of moderate fertility. A sandy or gravelly soil, unless underlaid with a porous clay subsoil which is retentive of moisture, is not suited to the growing of the blackberry. Such a soil becomes too dry just at the time when the blackberry is maturing its crop and in need of a great amount of water.

The dewberry is found growing wild on rather sandy well-drained soils and it is on the more sandy types of soils such as the sandy loams that it will probably do its best under cultivation.

Sites.—The most important consideration in the selection of a site is drainage, both atmospheric and soil. Since the brambles usually bloom late enough to escape spring frosts, atmospheric drainage is not so important from the standpoint of spring frosts as from the standpoint of winter injury. If the plantation is located on a hillside high enough that the cold air can drain away to lower lands, the amount of winter injury to the canes will be found to be less than where the plants are located in "pockets" or on low lands. A location which has good atmospheric drainage generally has good soil drainage though this is not necessarily true. All wet spots should be avoided, as the canes are more liable to winter injury in such places.

If a northern exposure is available, it should be used, as such a slope is cooler and more moist than other slopes. This is, however, the least important factor in the selection of a site and should be the last insisted upon when it is impossible to find the ideal location.
PREPARATION OF THE SOIL

Preparatory to planting, blackberries, raspberries, or dewberries it is advisable to grow on the land some intensively cultivated or hoed crop to rid the land of weeds; or if the land is lacking in humus, better still to plant it to some crop to be turned under. Plowing may be done either in fall or early spring but preferably in the fall. Fall plowing will help to destroy insects that might become troublesome on young plants and the grower is more independent of the spring weather. Since the brambles, particularly the black and purple raspberries, should be set early in the spring, the fall plowed ground is especially favorable because it will dry out sooner and often permit planting earlier than when plowing is delayed until spring. The land should be deeply plowed, especially the heavier soils and well pulverized. Plowing to a depth of 6 to 8 inches, using a steep moldboard to pulverize the furrow slice, followed by a thorough disk ing and harrowing just before planting will put the land in good condition. If a cover crop is not turned under it is advisable to work in a liberal supply of manure, as the bed will probably stand five to ten years and humus producing materials can be more easily incorporated in the soil at this time than after planting.

NURSERY STOCK

Very often in putting out a new plantation a grower will select plants from his old one, or from his neighbor's. This may be done without danger, if the old plants are healthy, vigorous and practically free of disease; but generally it is better to buy nursery stock from reliable nurserymen who make it a practice to grow their plants from young and healthy stock.

Plants affected with crown gall should be discarded. Such plants are usually weakened and do not make as vigorous growth and are less productive than disease free plants. Crown gall can be recognized by the knots or warty swellings which appear on the roots or about the crowns of the plants.

If the plants are not to be set as soon as received they should be unpacked and heeled-in to prevent drying out or rotting. For heeling-in a trench is dug with the back side sloped at an angle of about 45 degrees and deep enough to permit the plants being covered as deeply as they stood in the nursery. The bundles should be opened and the plants spread one layer deep in the trench and covered with loose, moist soil worked well down among the roots and packed about them. If the plants are dry they should be allowed to stand in water for several hours before heeling-in.
SETTING THE PLANTS

Before setting, if the day is warm and sunny, the roots should be dipped in a puddle of clay and water to protect them from the drying effects of the sun and wind and, in the case of tip-rooted plants, the old canes should be cut back to 4 or 6 inches to lessen the number of flowering shoots that would appear and which would weaken the small and poorly established plants. No harm will result if the canes are cut shorter since their main purpose is to mark the rows after setting. In fact, if the canes are affected with anthracnose, it would be better to remove them entirely in order to remove the source of infection of this disease. The shoots of blackberry and red raspberry plants should be
Blackberries, Raspberries, and Dewberries

cut back to 6 or 8 inches. For protection against dry weather it is ad-
visable to set the plants a little deeper than they stood in the nursery. 
Care should be used, however, with the black and purple raspberry, not 
to set the crowns of the plants deeper than 3 inches unless the soil is 
quite sandy. The shoots of these plants are very tender and if set too 
deep in a heavy soil will not be able to push their way to the surface. 
Ordinarily, red raspberry and blackberry plants are set 3 to 4 inches 
below the surface of the ground. On land rolling enough to drain well, 
an excellent method of planting is to set the plants in the bottom of a 
4 or 6 inch trench, the plants at first being covered with only about 2 
inches of soil. As the new shoots grow the trench is gradually filled as the 
plants are cultivated. By planting in this manner deeply rooted plants 
are secured, with canes arising from crowns so deep that they are not 
easily broken down by winds. The depression can be filled by cultivation 
in two or three years. After the plants become older and the crowns of 
black and purple raspberries grow above ground slight ridging may be 
necessary to lessen injury from the hot sun and drought of summer and 
from the cold of winter.

The best time for setting plants is in the early spring, but they can 
be planted in the fall, if mulched with a layer of straw for protection 
during the winter. It is very important that they be set early in the 
spring before growth has started. If setting is delayed too long there is 
danger of breaking off the shoots or their tender tips. Furthermore, the 
roots which have started will be injured in moving and drought may set 
in before the plants become established.

The actual setting may be done, either by digging holes into which 
the plants are set; or by pushing a spade into the ground, then pushing 
it forward and dropping the plants into place, removing the spade and 
tamping the soil firmly about the plants, much as sweet potato slips are 
set. The method employed makes little difference so long as reasonable 
care is exercised to space the roots, to get the plants at the right depth, 
and to firm the soil well about the roots.

PLANTING DISTANCES

As grown in Missouri, raspberries and blackberries are generally 
set in rows 6 to 8 feet apart with the plants 3 to 4 feet apart in the rows. 
Distances of less than 6 feet between rows will usually result in crowding, 
while planting at distances greater than 8 feet generally involves a waste 
of land. Red raspberries and blackberries which are grown in hedge rows 
may be planted closer than 3 feet apart in the rows if plants are obtain-
able at a reasonable price, since the closer the plants are set the sooner 
will a solid row be formed. Black and purple raspberries, however, which 
grow in clumps are generally planted 4 feet and 5 feet apart, respectively,
in order to allow the individual plants sufficient room for full development. Some growers are following the practice of setting their black raspberries every 2 feet in the row with the intention of fruiting them early and heavily. After a few crops the plants are torn out and new fields set. By this means they claim to grow the blackcap at a profit where before this was impossible because of anthracnose. When grown in solid rows dewberries are generally set 3 feet apart in rows, 6 or 7 feet apart. When grown in hills, they are usually set 5 feet each way.

CULTIVATION AND MULCHING

The purple and black raspberries do not spread, but grow in clumps from the plants originally set. Consequently, it is no trouble to keep the plants within bounds and the rows as originally set. The red raspberry and blackberry, however, may send up shoots anywhere from the roots and with them it is sometimes quite a problem to keep the middles clean and the rows straight and of proper width. The best fruit is produced by the better developed outer canes with more sunshine and less competition. Harvesting is facilitated with narrow rows and there will be fewer overripe berries from lack of clean picking to lower the quality of the pack. Also, the field can be kept cleaner of grass and weeds with much less hand hoeing. The rows should not exceed 2 feet in width and 18 to 20 inches would probably be better. With blackberries and red raspberries more and narrower rows to give more outside canes are more desirable than fewer and wider rows. Canes that arise too far out, if few and scattering, may be cut away with the shears when pruning; otherwise reducing the row to the proper width with a brush hook is better. This may be followed by shallow plowing in the spring, throwing the soil away from the rows. Deep plowing is to be avoided. Plowing of black and purple raspberries when done must be shallow and not close to the plants. Deep stirring of the soil, cutting or disturbing the roots may decrease the crop one-half or more.

Cultivation with a spring-tooth cultivator or five-shovel cultivator should begin at once after the plowing, keeping up a constant and thorough stirring of the soil until picking time. If plowing is not practiced, the soil should first be worked with a double-shovel cultivator after which the spring-tooth or five-shovel cultivator is used. This should be done early enough to keep ahead of weeds and suckers.

It is desirable, to maintain a dust mulch, but cultivation should be shallow, especially near to the plants, as some of the roots are near the surface and will be injured by too deep cultivation. This is especially true of the black and purple raspberries. During the ripening season cultivation is sometimes discontinued. A better practice, however, is to cultivate a narrow strip between the rows after each picking.
Thorough cultivation and conservation of moisture in the case of the blackberry can hardly be over-emphasized as the blackberry is supporting and maturing a heavy crop of fruit when the weather is normally the hottest and driest.

To keep the weeds out of the rows at least two hoeings will be necessary, one in the spring and one in midsummer. If the ground is very weedy, one or two additional hoeings are advisable.

Cultivation should stop about the middle of August, since cultivation in the fall leads to the development of new growth and prevents the maturing of the canes. Some growth of grass and weeds will, of course, result, but this growth will aid in drying out the soil and in maturing the canes. If the growth of natural vegetation is insufficient or considered undesirable the use of a winter killing cover crop, as oats, sown in early fall will be found of advantage.

For the home garden the berry patch can be mulched to good advantage. Straw, hay, leaves or similar material applied to the depth of 4 to 6 inches will prove satisfactory. Such a mulch keeps down weeds, checks evaporation and takes the place of cultivation. On account of the cost, its use however, can not be recommended at present for large commercial plantings. A mulch, once it is applied, must be maintained as it brings the roots close to the surface where they will suffer injury if the mulch is allowed to disappear.

**FERTILIZER**

Definite recommendations for the use of fertilizer on brambles can not be made on account of the wide variation in the soils on which they are grown. It can be said, however, that practically all Missouri soils are well enough supplied with potassium that no response can be expected from applications of potash fertilizers. Commercial nitrogen fertilizers should first be tried in an experimental way and used with caution. On old or very poor land their use may be found safe and profitable. Phosphorus is often deficient in our soils and the use of superphosphate (acid phosphate) may prove profitable in some instances. Each grower must determine the needs of his particular soil by the application of fertilizers to small plots, noting the effect on cane growth, yield and quality of fruit.

Stable or barnyard manure is the best fertilizer for general use, supplying humus as well as the elements of plant food. Humus in most instances probably is as valuable, if not more so, than the plant food the manure contains. Manure is particularly valuable to the black raspberry. It is almost impossible to grow this plant at a profit except in very fertile soils, such as bottom lands or land that has been heavily
manured. Apply some time between late fall and early spring. On the poorer soils as much as 15 to 20 tons annually will be none too much but on moderately fertile soils 5 to 10 tons will be sufficient. If manure is not available to give a full application to the entire planting it is better to give the whole field a light dressing than to manure only a portion.

The use of large quantities of commercial nitrogen fertilizers or of manures high in nitrogen may prove injurious as they are likely to cause excessive vegetative growth at the expense of fruit production.

**INTERCROPS**

The growing of a cash crop between the rows of brambles is sometimes practiced the first year in order to partially compensate for the cost of cultivation. In general intercropping is not advisable. Too often more attention is given to the cash crop than the berries with the result that they may be permanently injured. In market gardening and trucking sections where intensive cultivation is practiced, and in the home garden where the soil is fertile and care is taken not to neglect or damage the berries, a single row in each middle may be planted to some such intensively cultivated crop as tomato, potato, cabbage, or beans. Large plants requiring little cultivation and late crops should be avoided.

**PRUNING AND TRAINING**

Every spring raspberries, blackberries, and dewberries send up new shoots from the crowns or from buds formed on the roots. These replace the fruiting canes which die soon after the crop is matured. The method of pruning and training these shoots varies with the kind of fruit and variety.

---

*Fig. 6.—Well developed black raspberry cane (left) produced by proper pinching. The pinching stopped length growth, caused a thickening and strengthening of the main canes and the production of several strong healthy laterals.*
Black and Purple Raspberries.—The black raspberries and most of the commercially grown varieties of the purple raspberries send up new shoots from buds near the bases of the previous year’s canes or from latent buds on older portions of the crowns. To prevent these shoots from developing into long, slender, weak canes which will bend

Fig. 7.—A black raspberry plant before pruning.

Fig. 8.—The same plant after pruning. The laterals have been thinned and shortened.
or break to the ground with a heavy crop, the tips are pinched out of the
new shoots as soon as they have reached a definite height. With black
raspberries the shoots are pinched when 18 to 20 inches high. With
purple raspberries, which usually grow more vigorously, the shoots are
not pinched until they have reached a height of 24 to 30 inches. Pinching
stops length growth, causes a thickening and strengthening of the shoots
and induces the production of laterals near the tops. On these laterals
the buds that are to produce next year's fruiting shoots develop. It is
important that the pinching be done as soon as the shoots reach the
proper height. If pinching is delayed and the shoots are cut back later,
the buds left will be comparatively inactive and laterals will be slow­
starting, weak, poorly developed and improperly matured at the end
of the season.

Many more fruit buds will be produced on the laterals than the
plants are capable of properly developing. To prevent overbearing,
these laterals must be shortened. This is done preferably in early spring
just after the buds have started into growth. At this time dead and
weakened buds can be detected easily, and only strong, vigorous ones
left.

The length to which the laterals should be shortened depends on
the fruiting habit of the variety. Cardinal as grown on the Station
grounds at Columbia produces fewer buds near the bases of the laterals
than do black raspberries. Averages of a number of counts show 6.1
buds on the basal 8 inches of Cardinal laterals as compared with 9.2
buds on black raspberries. Moreover, many of the buds near the bases of
vigorous Cardinal laterals are poorly developed and either fail to grow
or produce little or no fruit. Thus, the basal portion of vigorous Cardinal
laterals is relatively unproductive and, to insure a heavy crop, the laterals
must be fairly long. On small laterals, however, especially secondary
laterals, the buds are close together and well developed, the number
found on the basal portion of such laterals being practically identical
with the number found on black raspberry laterals. No great difference
was found in the fruiting habit of the different black raspberry varieties
studied. Though no hard and fast rules can be laid down as to how long
the laterals should be left, in general black raspberries should be shorten­
ed to 12 to 18 inches, while those of purple raspberries like Cardinal
should be left 18 to 24 inches long. These are only approximate lengths.
If the laterals are few, but vigorous and healthy, leave them longer.
When numerous they may be cut a little shorter and more of them left.

The object in shortening the laterals is to make the plants as
compact as possible and to reduce the fruiting wood to an amount the
plant can properly handle and at the same time produce good fruiting
wood for the next year. Under-pruning with subsequent over-production
weakens the plants and over-pruning unnecessarily reduces the crop. Each plant is an individual problem and should be treated accordingly.

Shortly after the fruit is produced the old canes die. To give the new shoots more room and sunlight and to check the spread of disease and insect pests, they should be removed as soon as the crop has been harvested. The new shoots should also be thinned at this time to leave only 4 or 5 long, vigorous, healthy shoots to each plant.

Ordinarily no method of trellising is used in growing raspberries in Missouri but it has been found advisable on the trial grounds at Columbia to support the canes of the black and purple raspberries with a horizontal trellis. If this is not done and the plantation is exposed to strong winds, many of the new shoots are likely to be broken down. This will have a decided effect on next year’s crop, as it is then too late for these shoots to be replaced by others.

The trellis is constructed by placing posts 24 to 30 inches in height at intervals of 20 to 30 feet in the rows. Cross arms of 2 x 4’s about 18 inches long are then nailed to the flat tops of the posts. No. 10 or No. 12 smooth galvanized wire is stretched along both sides of the row and fastened to the ends of the cross arms.

Such a trellis is easily constructed, permanent and of neat appearance. It prevents the new growth from being whipped about by the wind or bent over and broken, and it supports the fruiting canes, holding them out of the mud and dirt and out of the way of the cultivator.

**Red Raspberries.**—Red raspberries send up new shoots from the crowns of the old plants and as suckers produced at random in the row. Unlike the black and purple raspberries these shoots are not pinched. Pinching the shoots of red raspberries leads to greater winter killing of the canes and as they naturally suffer from winter killing in this section, pinching will generally result in a serious loss of fruiting wood.

In the spring, after growth commences, living and dead canes can be readily distinguished. Dead, injured and, weak canes are then removed and the remaining ones thinned to leave strong, vigorous canes 8 to 10 inches apart. The canes are not pruned unless very long and slender; when they should be cut back to one-fourth to one-third their length to prevent their bending or breaking to the ground with their crop. As soon as the crop has been harvested the old canes should be removed to make way for the new shoots.

**Blackberries.**—Blackberries, like red raspberries, send up new shoots both from buds at the crowns of old plants and from adventitious buds formed on the roots. These new shoots are pinched when they have reached a height of 20 to 30 inches, depending on the variety. The more vigorous the growth of the variety and the stockier the shoots, the greater
Fig. 9.—A section of a red raspberry row before pruning.

Fig. 10.—Same red raspberry row after pruning. The canes have been thinned and shortened.
Fig. 11.—Section of a blackberry row unpruned.

Fig. 12.—Same blackberry plants after pruning. The canes and laterals have been thinned and the remaining vigorous laterals shortened.
the height at which the shoots are pinched. As with the black and purple raspberries, the pinching should be done as soon as the shoots have reached the proper height and to do this it will be necessary to go over the plantation several times.

Early in the spring the smaller and weaker canes should be removed and the remainder thinned to stand on the average 8 to 10 inches apart. The smaller and weaker laterals also should be removed and the stronger ones shortened. The length to which they should be shortened depends on the fruiting habit of the variety. On the basal 8 inches of Early Harvest laterals an average of 8.6 buds has been found and almost as large a number on laterals of the Robinson. On the other hand, on Snyder, Eldorado, Taylor and Rathburn there were 4.5, 4.4, 3.9, and 5.4 buds respectively, or only about one-half the number of buds found in the same region on Early Harvest and Robinson. Farther out on the laterals the number of buds increased slightly, but approximately the same ratio was maintained between the two groups of varieties. With varieties of the second group it is therefore necessary to leave longer laterals or a greater number. Since these varieties produce comparatively few laterals it is usually necessary to leave the laterals rather long. In general, Early Harvest and Robinson laterals are shortened to 10 to 15 inches, while those of Snyder, Eldorado, Taylor and similar

Fig. 13.—A black raspberry plant of good growth after pruning. Note the trellis for supporting the canes.
varieties are left 18 to 24 inches long. As in raspberries the old canes should be removed after the crop has been harvested.

Dewberries.—The common method of handling dewberries in Missouri is to allow the canes to trail on the ground. The plants are set fairly close in rows and cultivation practiced in one direction only. The new shoots as they grow are pulled into the rows and some will take root at the tips, starting new plants which are usually left unless needed to start a new planting or for sale. In the spring the old dead canes are removed as cleanly as possible without greatly disturbing the new wood. A light covering of straw or leaves given in the late fall will help many of the canes to live through the winter. Cleaner berries will be secured if a portion of this material is allowed to remain on the ground beneath the canes.

**PRUNING CHART**

The pruning of the various brambles is in general the same, the differences existing being mostly differences in detail. To make clear these differences, the following chart has been constructed.

<table>
<thead>
<tr>
<th>Fruit Plant</th>
<th>Dormant Pruning (Done in late winter or early spring)</th>
<th>Spring Pruning (June)</th>
<th>Summer Pruning (July and August)</th>
<th>System of Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackberry</td>
<td>Remove dead and weak wood and shorten laterals</td>
<td>Pinch new shoots at about 20 inches</td>
<td>Remove fruiting canes and thin new shoots</td>
<td>Linear. Individual plants 3 to 4 feet apart</td>
</tr>
<tr>
<td>Purple Berry</td>
<td>Remove dead and weak wood and shorten laterals</td>
<td>Pinch new shoots at 24-30 in.</td>
<td>Remove fruiting canes and thin new shoots</td>
<td>Linear. Plants 4 to 5 feet apart</td>
</tr>
<tr>
<td>Red Berry</td>
<td>Remove dead and weak wood, thin and shorten canes</td>
<td>No pinching</td>
<td>Remove fruiting canes</td>
<td>Hedge row (a continuous filled row 2 feet wide)</td>
</tr>
<tr>
<td>Blackberry</td>
<td>Remove dead and weak wood, thin canes and shorten laterals</td>
<td>Pinch new shoots at about 24-30 inches</td>
<td>Remove fruiting wood</td>
<td>Hedge row 2 feet wide</td>
</tr>
<tr>
<td>Dewberry</td>
<td>Shorten if trained to stakes, otherwise no pruning</td>
<td>No pinching</td>
<td>Remove fruiting wood where possible</td>
<td>Tie to stakes in spring or prostrate in linear rows</td>
</tr>
</tbody>
</table>

**LIFE OF PLANTATION**

The length of time a plantation will remain profitable depends upon soil conditions, diseases, and care. If the moisture supply is inadequate or if the plants are allowed to overbear, few, if any, new canes are developed and the plants are weakened or killed. This is particularly true of the black raspberry. Under present conditions and cultural methods the commercial life of a plantation in Missouri is from five to ten years.
HARVESTING

Raspberries are ready to pick as soon as they will separate readily from the receptacle. At that time they are not easily bruised in picking and handling, will hold up better under shipment and are not so subject to the attack of fungi as when allowed to become fully ripe.

Blackberries do not reach their height of perfection until fully ripe and to be at their best must be eaten soon after picking. As the fruit colors before it is ripe, it should be allowed to become soft before picking for home use. For shipment the blackberry should be picked as soon as it separates fairly easily from the cluster.

Fig. 14.—Early Harvest blackberries packed in the American standard quart box.

In picking, three fingers should be used and but few berries should be held in the hand at one time. The fruit should be placed, not dropped into the containers. The berries should be picked directly into the pint or quart boxes in which they are to be marketed. Additional handling of these soft fruits will result in broken skins which detract from their appearance and hasten deterioration.

For picking, trays or carriers holding from four to six boxes should be used. The use of carriers holding more than six quarts is not to be recommended, as the berries first picked are exposed to the sun so long that the fruit becomes overheated and damaged. Blackberries when exposed to the sun for very long, turn red and develop a bitter taste.
All grading, except where the packer separates the boxes of fruit according to the picker or the appearance on top, is done by the picker. The picker should reserve one or two boxes in the carrier for the decayed over-ripe, green, misshapen and injured berries. The carriers when full should be placed in the shade under the plants, to be gathered up later by a person whose duty is to bring in the full trays, or they may be brought directly to the packing sheds by the pickers.

The best time for picking is in the morning as soon as the dew is off and while it is still cool. At this time the berries are cool, and the pickers do much better work than in the heat of the day. Not only are warm berries harder to cool, but the thin membranous covering is weaker and more easily broken in picking and handling.

**PAYING THE PICKERS**

Two general methods are used in paying pickers; one by the hour, the other by piece work. Both have their advantages and disadvantages. The chief disadvantages in piece work include the tendency of the pickers to fill their boxes as fast as they can with little regard to grading and careful handling and their fondness for picking where the berries are the thickest and leaving the scattering fruit. Most pickers must be watched constantly and checked to secure clean picking and careful handling. In order to hold pickers at the end of the season when the berries become scattering it is often necessary to give them more per quart or give a bonus to those who stay throughout the season. On the other hand, paying by the hour is expensive, as few if any of the pickers will work at a maximum speed.

There are three general methods of keeping a record of the number of berries gathered by each picker. The first and least satisfactory is the daybook system where the foreman merely enters the picker's name, the date and the number of quarts picked. The two better methods are the check system, and the punch card system. In the check system each picker is given a check for each quart or tray brought in. These checks are kept by the picker and turned in on pay day. They are best made of some metal such as aluminum and stamped with the design of the fruit being harvested; they are generally in denominations of one pint or one quart, and one tray (4 to 6 boxes). In the punch-card system each picker is given a card much like a shipping tag in outline. On this card is written the picker's name and the rate per quart he is to be paid, and around the margin are printed numbers which are punched according to the number of quarts brought in by the picker. In using this system the punch must be changed frequently to prevent the picker securing and using a punch of like design. Or cards in duplicate may be used punching both cards together giving one to the picker and retaining the other. This system
is used with various modifications as to arrangement, the length of time the card will last and the number of cards used.

With any system frequent pay days are necessary to prevent discontent and to guard against mistakes.

PACKAGES

The 24-quart crate as used for strawberries is perhaps the best in which to market dewberries and blackberries. When marketing locally a 32 or 48-quart crate might be used, but such crates are too large for shipping. The added weight of fruit above tends to crush the berries in the boxes near the bottom. Furthermore the 24-quart crate best meets the demands of customers buying in crate lots.

The American style one-quart box is one of the best and most popular of the quart boxes. They are made up at the factory and shipped nested, and there is no expense or inconvenience of making up at home. They fit into the American 24-quart crate in three tiers of eight boxes each, with a divider between each two tiers.

The purple and red raspberries are best marketed in shallow pint boxes. They are rarely marketed in quart boxes, except where the markets are conservative and demand the quart box. The weight of the extra berries in the quart box will crush those near the bottom; and generally, because of the high price of the red raspberry, the consumer prefers to buy in pints.

Black raspberries are sometimes marketed in quart boxes, sometimes in pint boxes, depending on the price and market demands.
To comply with the New Weight Amendment to the Food and Drugs Act, the shipper, when shipping to another state, must stamp plainly on the outside of the package the contents and number of open packages contained, in terms of the largest unit contained. For example, the 24-quart crate would be marked: "Contents 24 dry quarts," or "This crate contains 24 dry quarts." Further, the standardization of the berry box makes it illegal to ship from state to state berry boxes which do not contain in cubical contents one pint, one-half pint, one quart or multiples of one quart, all dry measure.

PACKING SHED

Some sort of packing shed is essential in the small fruit industry. It protects the fruit from the hot sun and rain, creates a central packing point and provides a storage place for packing material and equipment. It may be a very cheaply built affair, consisting only of a framework and roof that will keep out the sun and rain, or it may be more substantially constructed with a storage room or loft, thoroughly protected from the weather. Such a place provides a permanent storage place for packing material.

YIELDS

Yields vary considerably from year to year, with different soil and conditions, and with different varieties. Under ordinary conditions and with good care and good soil the black raspberry should yield from 1,200 to 1,800 quarts per acre. Under exceptional conditions the yield may be somewhat higher. The yield of the Cardinal, a purple raspberry, is about the same as that of the blackcap. The red raspberry under Missouri conditions may yield all the way from no fruit, or practically none, to about 800 quarts per acre. The low yields are due, very largely, to the winter killing of the canes and for the varieties tested by the Missouri College of Agriculture an average of 400 quarts per acre over a period of years may be considered a good yield. With the finding of a variety whose canes will survive the Missouri winters or a practical treatment which will increase their hardiness there is no reason why higher yields may not be attained. Blackberry varieties that will not average 1,200 quarts per acre when given good care are not adapted to commercial planting. Averages of 1,800 to 2,000 quarts per acre may be regarded as good yields.

VARIETIES

There is a large number of varieties of both raspberries and blackberries, most of which are of little or no commercial importance or are restricted to certain localities. New varieties are constantly being introduced in glowing terms. Some of these are promising, but must be care-
fully compared with the standard sorts over a period of years to definitely determine their commercial value.

Owing to the heat and drought of the summers raspberries do not succeed as well in Missouri as in the cooler and more humid sections. Only a few varieties, mostly those that originated in this section, are worthy of commercial planting. The canes of all varieties of red raspberries tested by this Station are so frequently injured or killed during the winter that varieties of this type are not recommended except for home plantings. The Cuthbert is the best red variety for home use.

Of black raspberries, Cumberland is the leading commercial variety. Kansas and Gregg are good commercial varieties and with Cumberland furnish a succession. The order of ripening is Kansas, Cumberland, Gregg. Farmer (Plum Farmer) and Pearl (Black Pearl) are also good early varieties.

The Cardinal is the best of the purple varieties. It is productive and is gaining in favor with commercial growers as a substitute for the red raspberry.

Blackberries may be divided into two groups, early and late maturing. In general the early varieties are to be preferred because they ripen before the wild plants and thus avoid competition with them and because they escape in part the hot dry weather that so often prevails during the ripening season of the later varieties. The best early variety is the Early Harvest, and in tests conducted by the Missouri College of Agriculture, it has out yielded all other varieties. Ward has proved the highest yielding late variety over a five-year period. Blowers, Snyder, and Eldorado have produced moderate yields while Ambrosia, Lagrange and Ancient Briton produced yields too low to be recommended for commercial planting.

The Lucretia is the leading dewberry variety, and is the only one recommended for planting in Missouri. The dewberry-blackberry hybrids involve too great a risk from winter injury to justify planting them except in the home garden.

POLLINATION

Certain varieties of blackberries and dewberries will not produce fruit when planted alone. Other varieties that produce an abundance of good pollen must be planted near them. Bees will carry the pollen a distance of several rows and for convenience in harvesting a number of rows of the self-unfruitful sorts may be placed together with alternating blocks of the pollen producing variety. Fortunately practically all varieties of blackberries that have not been derived from crossing with the dewberry are self-fruitful and the planting together of several varieties is seldom necessary. Experiments carried on by the Missouri
College of Agriculture have shown the following varieties of blackberries to be self-fruitful under Missouri conditions:

- Early Harvest
- Blowers
- Ward
- Snyder
- Ambrosia
- Lagrange
- Eldorado
- Ancient Briton
- Lucretia (dewberry)

McDonald, a dewberry-blackberry hybrid was found to be self-unfruitful.

All varieties of raspberries tested proved self-fruitful. The following varieties were used in the experiment:

- Kansas
- Pearl (Black Pearl)
- Cumberland
- Farmer (Plum Farmer)
- Gregg
- Improved Gregg
- Conrath
- Cuthbert

**INSECTS**

Insects seldom cause serious damage to these fruits in Missouri. Only occasionally do their attacks become serious enough to justify the use of special remedial measures.
DISEASES

Crown Gall.—Crown gall is of very common occurrence among the brambles, frequently causing serious losses, especially with raspberries. Affected plants are characterized by a gall or wart-like swelling which appears on the roots, at the crown, or on the canes. The galls most frequently appear near the crown, but may be found a foot or more above ground on the canes. The galls are at first small, light green or whitish, and soft, later becoming hard and dark brown. The disease greatly weakens the plants and may eventually cause their death.

Crown gall cannot be controlled after the plants have become infected, hence the importance of planting disease-free stock. Nursery stock should be carefully examined and all plants which show symptoms of the disease discarded. If possible land that has not been in brambles for a number of years should be selected for the new plantation. When diseased plants are found they should be dug up and burned and it is best not to set new plants in the place once occupied by a diseased one.

Fig. 16.—Crown gall on roots and canes of the black raspberry.
Anthracnose.—Anthracnose is the most common and serious disease of black and purple raspberries in Missouri. It has stopped entirely the growing of blackcaps in some sections. Red raspberries, blackberries, and dewberries, though subject to attack, are seldom severely injured. The disease affects all the above-ground parts of the plants, canes, leaves and fruit, but is most noticeable and most destructive on the canes. Badly infected canes are of sickly appearance and fail to mature their fruit which becomes dry and hard.

The disease first appears on the new shoots when about 8 inches high as small, purplish, slightly raised spots. As these increase in size, they assume a roundish and finally a more or less oval form with sunken gray centers, bordered with a narrow, blackish-purple, slightly raised border. As the spots increase in size they often split lengthwise of the stem. When abundant, the spots may run together to form large patches of diseased bark of irregular outline.

There are several treatments which are effective in reducing the amount of injury from anthracnose. The treatments refer particularly to black and purple raspberries.

1. Cut off the stubs of old canes before planting unless free of anthracnose.

2. Prepare the ground well by adding organic matter, add liberal quantities of manure to promote strong growth and cultivate to keep clean of weeds and grass and to conserve moisture.

3. Cut out and burn the old canes immediately after the fruit has been harvested. Badly infected new growth should be removed also at this time. This treatment removes the source of infection and opens up the interior of the rows to better ventilation and more sunlight.

4. Spray with lime-sulphur or bordeaux. Raspberry leaves are sometimes injured by spray materials, but at the dilutions recommended the injury is seldom serious for applications before the plants bloom. Lime-sulphur 1 to 49 has been used for a number of years by the Missouri College of Agriculture without appreciable burn when care was exercised to avoid spraying the foliage as much as possible.

### Spraying Schedule

<table>
<thead>
<tr>
<th>First Spray</th>
<th>Just before growth starts</th>
<th>Lime-sulphur 14 gal. to 86 gal. water, or Bordeaux 8-8-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second Spray</td>
<td>When new shoots are 8-10 inches high</td>
<td>Lime-sulphur 2 gal. to 98 gal. water or Bordeaux 4-6-100</td>
</tr>
<tr>
<td>Third Spray</td>
<td>Just before blossoms start to open</td>
<td>Same as second spray</td>
</tr>
</tbody>
</table>

A fourth spray as soon as the fruiting canes have been removed may be made if anthracnose is bad or the weather wet. Danger from
burning is increased with applications this late and lime-sulphur 1½ to 98½ and care to avoid spraying the foliage as much as possible is advisable.

**Orange Rust.**—Orange rust is a disease of both blackberries and raspberries, but is more often found on blackberries. It is easily recognized by the bright orange-red color which appears in the spring on the under sides of the leaves of affected plants. The infected shoots are clustered and spindly with small wrinkled greenish yellow leaves.

Diseased plants as soon as detected should be dug and burned. Care should be taken to get all the larger roots as the disease lives over in the crowns and roots. If there are only a few diseased plants, and the work is thorough, the disease can often be eradicated by this means. When a large number of plants are affected, it is not practical to dig out the diseased plants, but diseased canes should be cut below the ground as soon as detected and burned to check the spread of the disease to other plants. Affected wild plants near the plantation are often the primary source of infection and should be destroyed. After orange rust becomes general over the plantation, it should be plowed up and planted
to other crops. New plantations of brambles should not be made on rust-infested land for several years after all affected plants have been destroyed.