EXPERIMENT STATION

OF THE

KANSAS STATE AGRICULTURAL COLLEGE,

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HORTICULTURAL DEPARTMENT.
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SMALL FRUIT CULTURE BY IRRIGATION.

PART I.—Water Supply, Storage and Distribution.
PART II—Culture of the Strawberry

PART I.

WATER SUPPLY, STORAGE AND DISTRIBUTION.

The uncertainty of the strawberry crop, even in the more favored portions of the west, from the lack of rain at the critical time when needed to develop the fruit, makes it a wise precaution that the means should be at hand for irrigating as needed. In the eastern counties of the State, where the annual rainfall is usually ample for this crop, if properly distributed, we find comparatively few seasons when the berry patch would not be benefited, at some period of its growth, by the liberal application of water; and now and then a season occurs when the entire crop will be dependent upon such a timely rescue. As we go west from the Missouri River, the need of supplementing the rainfall with irrigation steadily increases, as will be shown by the precipitation tables of the past twenty years. The probability that extensive systems of irrigation ditches will ever be established in Eastern Kansas need not be discussed here, but that thoughtful gardeners and fruit growers in the east as well as in the west are waking up to the fact that it will pay them to invest in some means of getting

water on to their crops, is becoming apparent to all.

The means most readily at hand for getting a supply of water in a position ready for use are pumping by wind-mill or other power from wells; pumping from streams or ponds with engines or by horse power; impounding storm waters in ponds, or "tanks," as they are called in the southwest, above the level of the fields to be irrigated; and occasionally the utilizing of water from a hill-side spring favorably situated.

It should be recognized as a fundamental principle, by any one planning to irrigate, that a volume of water equal to two or three inches in depth over the surface of the land to be irrigated must be available for immediate use. Applying less than this at once, unless it is sprinkled on with a hose, is of little benefit, and allowing a small stream from a spring or pump to run on to the land is generally worse than useless.

An instance is recalled where a farmer attempted to irrigate a potato patch directly from his well, and that too, with a wind-mill and pump of small capacity. Some wooden spouting was provided, leading out to the ends of the rows; the mill was then turned into the wind, and the confiding irrigator went about his other work. He doubtless pronounced irrigation a failure when he found that the water of a day's pumping had not wet the ground a hundred feet from the spout, having soaked into the earth with little benefit to anything.

Unless the water can be drawn from a ditch of ample capacity and sure supply, a tank, reservoir, or earth-walled pond should be built and the water allowed to accumulate till enough is on hand to flow rapidly over the desired land, or down the furrows, as the plan may be.

If the ground to be watered is not more than an acre or so, a wooden tank will be very satisfactory and economical of water. A main supply pipe of good capacity should be laid below the reach of frost and plows to a convenient point for distribution. The lateral pipes may be carried along the ground and uncoupled when the season is over. They should be fitted with ¾ inch hose bibs, and carried out so that two or three 50-foot lengths of hose will reach to any part of the ground. Woven cotton hose has proved the most durable for such work.

Our Station irrigation at the College has been done from a two-inch main connected with the city water works, and even with the pressure that we have here about 60 pounds, the flow becomes so reduced by the time it has passed through several lengths of hose that the work of getting over land with water from one outlet is quite slow

We sometimes turn the hose into the furrows running along the rows of plants, but when they are in full leaf and maturing the fruit, we have found that a given quantity of water is worth much more when showered directly on to the matted rows than when run down the spaces between the rows and allowed to soak out laterally to reach the plants. A thorough showering is worth more than the same water used in several light applications. This work should

always be done in the afternoon and evening, and in special stress at ripening time we have kept the hose going half of the night. This is much better for the plants than to put the water on during the heat of the day under a clear sky and with a dry wind blowing.

Doubtless the cost of wooden tanks of sufficient size has kept many from attempting to irrigate, and we owe a debt of gratitude to the pioneers in pump irrigation in the western counties, whose very lack of means to buy expensive wooden tanks compelled them to solve the problem in another way They built their reservoirs of the material they had nearest at hand—the fine prairie loam. The successful methods of puddling the bottoms and sides of these ponds to prevent seepage, of putting the outlet box in securely, and of protecting the sides from washing, though all based on old and well-known engineering practices, have been discovered for themselves by these prairie irrigators and adapted to their conditions of work.

The problem of building a dam to hold storm water is a much more difficult one than that of providing a pond to hold a few day's pumping, as a much greater volume of water must be stored, and the added danger of the breaking of the dam by the storm flood must be provided against. By consulting a competent engineer before beginning such a work, much labor and expense may be saved and sometimes absolute danger avoided.

In planning a reservoir for irrigating a certain field, it should be located on the highest point of the land, so that a slight fall may be secured from it to all parts of the ground. Our Station land at the College has a fall of six inches in a hundred feet in the lower part, which gives a very nice grade to work on. A little higher up, there is a fall of a foot in a hundred, and this gives about as rapid a flow in furrows as is comfortable to handle. With a slope much greater than this, it is better to abandon the section line direction of the fields and lay the rows off in such a direction as to give only the right amount of fall. Our ground at the Garden City Sub-Station is, in spots, so nearly level that the lateral ditches have to be raised a little above the level of the soil in order to get the water over the ground.

WELL IRRIGATION.

The depth from which it will pay to raise water for irrigation must depend upon the value of the crop which can be produced by it. That it can be made profitable to pump from shallow wells for all sorts of garden crops, orchard trees and small fruits has been shown too often to need further proof.

With a fruit that has been made to produce from two to four or five hundred dollars' worth of berries to the acre as often as the strawberry has, there would seem to be little doubt that pumping from a well of reasonably strong supply at any depth less than fifty feet could be made to pay. Whether much deeper wells than that can be used must depend upon circumstances. At a ranch in the Pan Handle of Texas a thrifty garden is irrigated with water raised by

a wind-mill 230 feet, and to that family, no doubt, those vegetables are worth all they cost. And so there is no doubt that strawberries, raised to supply the family, rather than that they should go without, can be irrigated with very high-priced water and it will still pay.

Having a well of sufficient capacity, and the mill or other pumping power in position, the pond is usually placed near enough to allow the water to be run into it from a spout. The height of the walls of the pond should be anticipated, and the delivery spout of the pump carried up high enough to allow a good fall over the top of the wall into the pond. There will be occasional cases where the pump and mill must be over a well, pond, or spring in a ravine or draw, while the pond must be on the proper ground to run the water from, on to the land. Here a forcing cylinder on the pump and proper supply pipe to the pond will have to be provided.

The mistake is often made of building the pond too large. For a twelve-foot mill or less, a pond sixty feet square is usually large enough.

An acre of ground contains 43,560 square feet; hence it would require 43,560 cubic feet of water to cover it a foot deep. An inch in depth over an acre would require one-twelfth of this, or 3,630 cubic feet. A pond 60 feet square on the bottom would contain 3,600 cubic feet of water for every foot of depth, if the sides were square, and with sloping sides somewhat more, so that, as nearly as we can approximate, a pond of this size will hold, for every foot in depth, water enough to cover an acre an inch deep, or one acre-inch.*

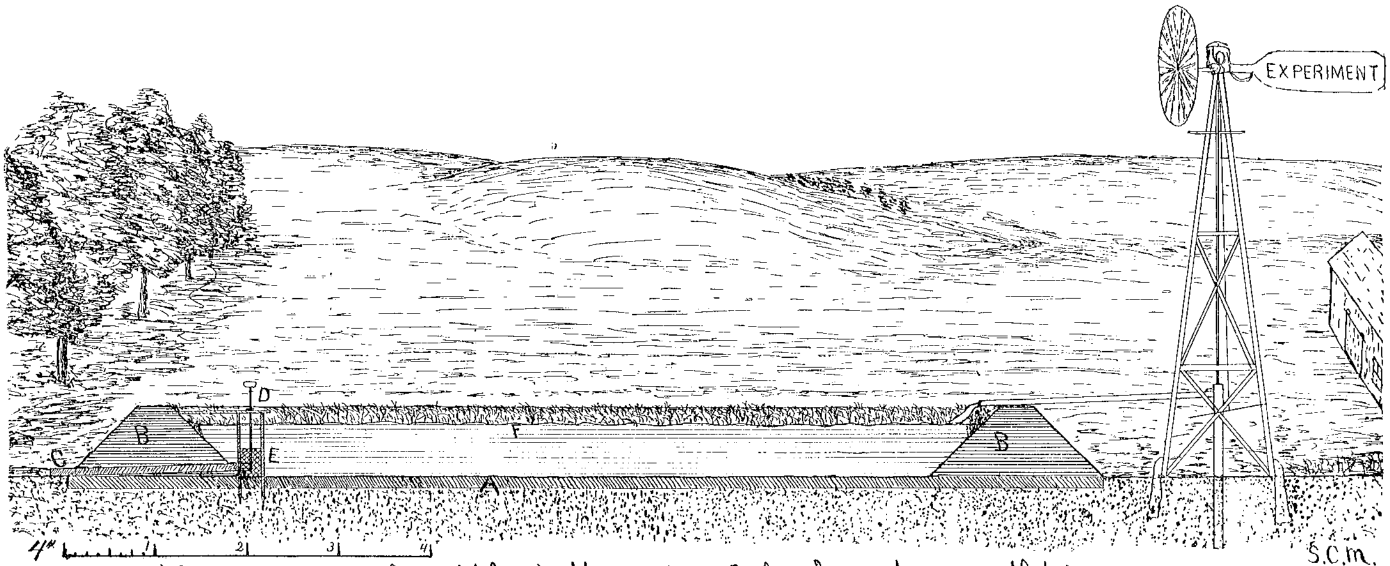
As it is desirable that the berry grower should know somewhat nearly how much water he is using, and how much he has on hand at a particular time, a pond of these proportions is recommended as a convenient one, or if a larger one is required, 60x110 feet would hold two acre-inches to a foot in depth, when four feet deep.

By having a gauge marked in feet and inches, set on the valve platform and reading from the bottom of the outlet upwards, the depth of water is readily seen; and by taking readings on opening and closing this valve, the volume of water used can be pretty closely calculated. A record book of this for the season would develop much valuable information for future use.

BUILDING THE POND

Plate I. gives an ideal sectional view of a pond 60x60 feet, with location of pump, outlet-box, and valve shown. The banks are shown as six feet high, three feet wide on top, and the sides with a slope of "one to one," or 45°. Such a bank would be 15 feet wide on the bottom. This would add 30 feet to the diameter of the pond, making it 90x90 feet on the outside. The ground plan of this pond is shown in Plate II. Such a bank will give a cross section, as at

*Such a pond actually contains, at four feet deep, 16,405 1/3 cubic feet, or 12 9-10 per cent more than four acre-inches. The first foot would contain 3721 1/3 feet; the second, 3969 1/3; the third, 4225 1/3; and the fourth, 4487 1/3 feet.



Scale 8 ft to 1 inch. A. puddled bottom: B.B. Embankments: C. outlet box: D. Valve rod & platform; E. Valve, surrounded by wire screen. F. water line.

Sectional View of Irrigation Pond 60x60 feet

PLATE I.

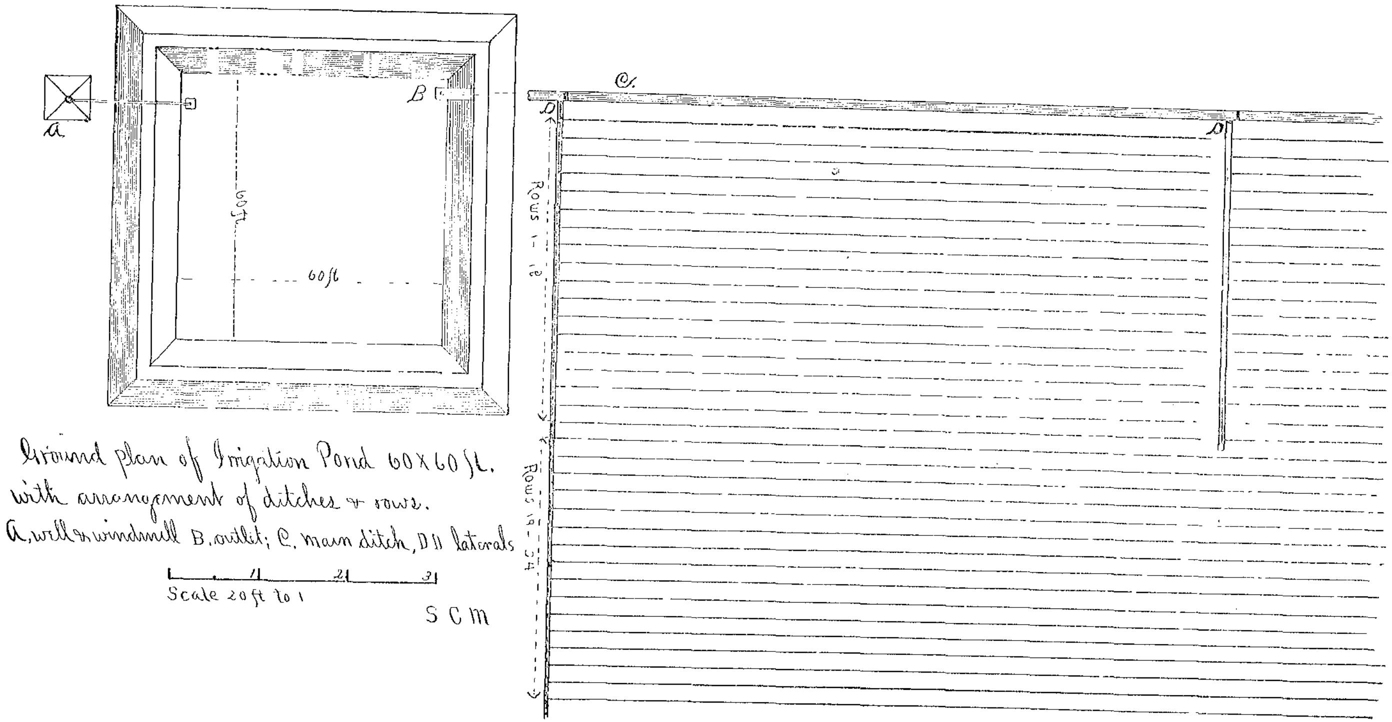


PLATE II.

B. Plate I., of 54 square feet, and will contain 51 cubic feet or two yards, of earth to every running foot. Where a smaller volume of water is sufficient, a bank four feet high will answer every purpose, and by making it three inches narrower on the top, but with the same slope to the sides, it will give a cross section of 27 feet, and contain only half as much earth as the other.

As ponds are often constructed, a serious leakage occurs at the junction of the bottom and sides, which is explained by the fact that the earth upon which the embankment rests has not been puddled or made water tight.

Then, where the earth is taken from the interior to build upon the bank, lowering the bottom, that much in depth is left at the base of the embankment, exposed to the heaviest pressure of water.

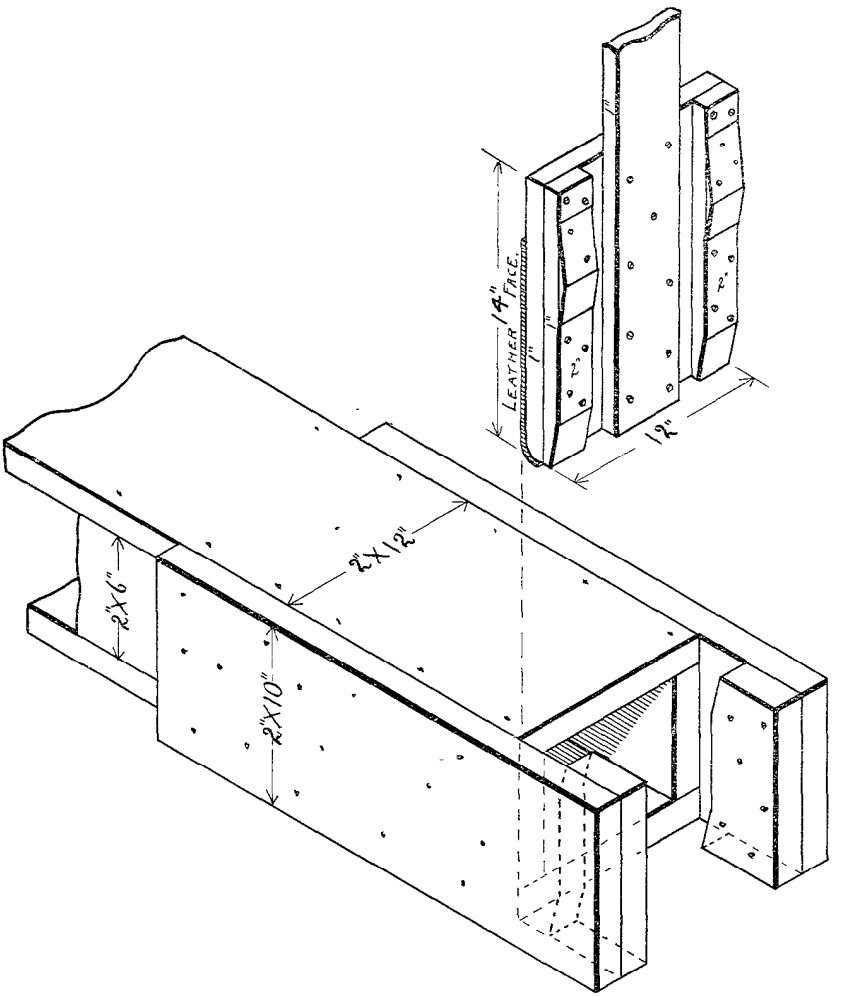
The pond which was upon the land leased by the Station at Garden City had been built in this way, and gave constant trouble, which was only remedied by working the entire embankment over throwing it in and tramping it thoroughly with teams from the bottom up.

A much better plan is to lay off the ground 90x90 feet, or the size the pond is to be outside of banks, run one or two furrows around this, forming a ridge that will hold a little water; start the windmill and run on water till the whole is well soaked; then, with a bunch of horses or any kind of stock that can be driven over it, the whole mass is worked into a mud. As this settles and becomes stiff enough, it is smoothed down with a plank and tramped till as smooth and firm as a floor. It should be slightly lower at the corner where the outlet is to be.

On this well-puddled bottom, shown at A, Plate I. the walls can be built up, putting on the earth in thin layers and thoroughly tramping and settling it all the way A slope of 45°, or having one foot rise to one foot run, is as steep as an embankment can be maintained, and a more gradual slope on the inside will perhaps be better unless the bank can be promptly sodded over to keep it from washing.

The outlet-box should be made long enough to reach well through the bank at either end. Use 2 inch plank of good quality Pieces of 2x6" for the sides, with top and bottom 2x12" will give an outlet of 6x8" which will be ample. The lumber should be well jointed and the joints laid with strips of cloth soaked in white lead. The valve is usually placed on the inner end of the box, that the pressure of the water against it may help to keep it tight. It is most commonly made as a gate to be lifted, having a standard extending above high water mark and reached by a platform from the bank The end of the box is dressed off square and true. The gate should be of good clear lumber, faced up to match the end of the box, and covered with pump leather on the faced side, securely tacked around the edges. Strong cleates screwed on the outside may be made so as to wedge a little after the gate is closed, holding it up closely in place. Detail drawings of this, shown in plate III., will enable a carpenter to build one which will hold securely A very good outlet, costing a little more,

PLATE III.



Showing perspective view of outlet box with guides attached for holding valve. The valve shown above should be faced with pump-valve leather, securely tacked on. A carpenter's bench screw attached to the upper end of the standard will raise and lower this valve very nicely from the platform. Do not have this valve fit too tightly before the lumber has swelled.

is made of spiral-riveted galvanized pipe. A flanged elbow is placed on the inner end, having the flange covered with pump valve leather. A heavy circular valve of iron sets down on to this, like a lid on a kettle, and is kept centered by a conical guide of iron rods. This valve is raised by a rod operated by a lever from the platform This is the device of Mr E. E. Frizell, of Larned, Kansas. The valve used in our Garden City Station pond is made by cutting off the inner end of the outlet box at an angle of 45°, and screwing on to it an iron face covered with packing leather. The valve is also of iron, hinged to this, accurately fitted and raised by a rod attached to a ring. An improvement on this has been made by attaching the rod to the under side of the valve and carrying it out horizontally through the outlet box, where it is worked by a lever. This enables the valve to be drawn down perfectly tight against the packing.

The box or pipe outlet should be set with the inner end a little above the bottom of the pond, and kept clear from mud It should have a slight fall to the ditch.

The setting of this should be done with a good deal of care, tamping the earth very firmly around it, as this is one of the most difficult spots to keep from leaking. Set four posts around the end of the box which will reach a little above the water, and will support a platform from which the valve is worked. Around these, wire netting may be tacked to keep weeds and trash from clogging the outlet.

The banks should be finished up in good shape, tramping every inch of the earth well. Sodding the inner face is an excellent way to keep the earth from washing at the start. Of course such grass will not live below water line; but in the meantime plant the coarse sedges and water grasses that naturally grow in moist places, and in a short time their roots will effectually hold the banks in place.

Some ponds, where trees have been planted around them and water plants are growing in the margin, are made very attractive, adding greatly to the beauty of the home rather than marring it.

The supply spout from the pump should be carried out well over the bank. and if a floating box or trough is provided for the water to fall into, all damage from the wash will be avoided.

The main ditch should be built with the sides thrown up so as to bring the bottom on the level of the surface where the water is taken out, or even a little above, if the ground is very level The capacity of this ditch should be ample, and the banks carefully built and well settled, as annoying breaks and losses are sure to occur if the work is carelessly done. The size of the ditch needed will of course vary with the slope of the ground. A strong slope will carry off a large volume of water in a quite small ditch. If the ditches do not hold well, as is apt to be the case in a loose or sandy soil, it may be necessary to puddle them. This is done with a short log or trough of the right shape, hauled over the bottom after a little water is run in to make a mud.

At the Garden City Station, a record of the water used in one instance shows that with the gate opened to give an outlet of 4x8 inches, we drew off, as nearly as could be estimated, 7800 cubic feet of water in an hour's time, starting with a head of three feet and lowering it to about two. The main ditch was 20 inches wide on the bottom, 40 inches wide on top, and 12 inches deep. From this water was distributed equally to three laterals, each 12 inches wide on the bottom, 30 inches at the top, and 7 inches deep. At the branching of each lateral was a box with a 12 inch opening, the gates to these being raised from 2½ to 3½ inches to properly divide the water. This volume of water filled the main ditch and laterals as full as they could safely carry and kept two men very busy to take care of it.

In Plate II., at B, is shown position of outlet box to discharge into ditch, C. At D D, laterals lead out to the field prepared for furrow irrigation. At such points should be placed boxes securely fastened down, having gates of suitable size arranged with standards and pin holes to allow them to be set at any desired height.

Water should not be carried over the land too great a distance, either by flooding or by furrow irrigation, as the upper part of the land absorbs too large a proportion of the water before the lower part has enough.

In irrigating small fruits, it is better to divide a long land into blocks of 100 or 150 feet in length, running the water from the main ditch out to each one separately, than to run down through the rows for the whole length.

This is illustrated in Plate II., in which the distance between the laterals, D D is 150 feet. Rows 1-18 can be watered much more economically than rows 19-34, where the water is carried clear through. It must not be forgotten that this whole field should be brought to as even a surface as is possible in order to secure the best results. If the field is a plane sloping with the main ditch. C, and from it in the direction of the laterals, then the water can be delivered evenly over the whole.

This is the ideal irrigation field; and much of our land in Kansas is in that condition, or may be brought to it by the use of a plank leveler, which can be easily constructed. Land that is more or less uneven and broken may be managed by curving the main ditch and laterals around, so as to follow the higher ridges and keep the proper fall, sometimes even carrying the water over low places in sluices; but this involves a good deal of work in laying out and still more in cultivating, as it often cuts the land up into small and irregular patches.

In concluding this subject, it is but just to say that the irrigation of even one acre of land involves a great deal of work when compared with the ordinary methods of culture practiced in our State. There are many things about the successful use of water, only to be learned by practical experience. It is wise not to attempt too much at first, and to be willing to make haste slowly In the long run, we may expect that the profits of fruit raising or gardening by irrigation will be sure and ample enough to justify the increased outlay

PART II.

STRAWBERRY CULTURE.

The strawberry, of all fruits of the temperate regions, should be grown nearest the consumer. While it is a fact that large quantities of berries are shipped considerable distances, even several hundred miles, these shipments are mostly confined to a few varieties of firmest texture and not always of the finest flavor Even fruit of this quality does not reach the distant consumer in anything like the fine condition it does the one who can buy it fresh from the vines, while there are many of the choicest varieties of strawberries which it is useless to attempt to ship. These may be made to yield large quantities of the very finest fruit for the consumption of the home grower or his immediate customers.

The object of this bulletin is to encourage the more general raising of strawberries: first, for home use by the farmer and owner of a village lot; and second, for market in the vicinity of the smaller towns and villages. The larger markets and the shipping trade are pretty well provided for, and need little encouragement.

The importance of farmers and village residents raising a home supply of this most wholesome and delicious fruit cannot be too strongly stated. Those who buy a liberal supply in the market find at the end of the season that the bill has amounted to a snug little sum, which, in many cases, might have been saved by raising the berries at home. Too often, from lack of means or on account of the distance from town, the farmer's family taste but few strawberries during the year

The arguments in favor of raising berries for market may appear to be weakened somewhat by the advice to raise them more generally for home use, but there will always be a large class who can more conveniently buy than raise their berries, and they will invariably buy home-grown berries when offered side by side with imported ones. While the demand may not be an unlimited one, yet there are few towns in the State where, if the strawberries shipped in could have been produced at home, they would not have given a comfortable income to at least one grower and his family and often to several. While it may not be laid down as a safe rule that all the imported berries might have been replaced by home-grown yet, wherever we have given us three factors of a good soil, sufficient supply of water, either in the form of rain or available for irrigation, and a careful and energetic man or woman to push the business, strawberries can be grown and sold at a profit near home. Strawberry culture is as simple as that of any other field or garden crop, and the value of the product possible from an acre of ground is equal to that of anything the gardener can plant.

A small piece of ground and few varieties should be the rule till one becomes familiar with the details of the work, and has gained the deftness and experience necessary to successfully handle a large crop.

SITUATION AND SOIL.

Strawberries should be given a situation sheltered from hot, sweeping winds, though they should never be much shaded. Very rolling ground, liable to strong washing and filling, should be avoided, and a level piece at the foot of a steep slope is sometimes open to the same objection: for a fine berry patch after a heavy rain, buried beneath several inches of mud and silt, is a sight to discourage the most enthusiastic.

The best soil is one just sandy enough to work nicely and drain well, and about the worst is a stiff, waxy, or gumbo land which tends to hold water after a rain. Strawberries will do little in a sour, undrained soil. While strawberries will repay the generous treatment, yet it is an easy matter to get the land too rich in the elements furnished by stable manure; and one should especially avoid the use of too much raw or unrotted manure just previous to setting a bed. The crop of white grubs that takes possession of land freshly manured often destroys a large portion of the young plants.

Manuring the land well the year previous, and cropping with something that will insure clean and thorough cultivation, is the best preparation that can be given.

It is better that the land should be plowed shortly before the time for setting. No trash should be plowed under and the work should be done when the soil is neither too wet, so as to pack, nor too dry, so as to turn over hard and lumpy. Plow well and harrow thoroughly, and if lumps appear work them out with roller or clod crusher.

METHOD OF CULTURE.

The plan of culture most successful in Kansas is by matted rows. For this method, the rows should be set four feet apart and the plants twelve to eighteen inches apart in the rows. Some have recommended setting as far apart as two feet, but the chances of an uneven stand at this distance are much too great. In providing plants for setting, with the distance of twelve inches, 10,890 plants will be needed for an acre; at eighteen inches apart, two thirds of this number, or 7,260. For varieties which make runners freely, like Warfield and Martha, this will be an abundance. A good stand of Parker Earle would be better insured by the closer setting. It is well to allow a few extra plants, so as to be able to reject any weak or poorly rooted ones. When plants are received from a distance, always unpack them at once, open out the bundles, puddle the roots, and heel them in in a cool, shady place where they will be kept moist till set out. Look carefully to the labels, and check off on your invoice or order sheet. Write plain and conspicuous labels if they are needed.

CHARACTER OF BLOSSOMS.

In a wild state, strawberry blossoms are said to be perfect, that is, having both pistils and stamens present in the same flower.

The pollen produced by the stamens is not blown about by the wind to any extent, as in the case of corn or wheat, but insects visiting the flowers for nectar, carry the pollen from flower to flower, and the fertilization is thus accomplished.

One of the results of cultivation has been the production of many varieties of the strawberry in which the stamens are wholly wanting or are so much reduced in size as to produce no pollen. Some of our most, productive varieties as Crescent, Bubach, and Warfield, are of this character. In many catalogues and strawberry books, the term "Staminate" is applied to the perfect form of flowers, and "Pistillate" to the imperfect form, or flowers having pistils only; but the terms "Perfect" and "Imperfect" used by some writers are much to be preferred as they convey the correct ideas in regard to the character of the flowers.

Figure A, in Plate IV., shows a stem of perfect flowers, about two-thirds natural size. The stamens are shown radiating from the central cone of pistils. In Figure B, a stem of imperfect flowers is shown, the circle of stamens wholly wanting.

If a bed of imperfect flowered plants is set, no fruit may be looked for. Even when there are perfect flowered plants in the same yard, several rods away, much of the fruit is found to be knotty and inferior in quality from imperfect fertilization.

Berry growers differ in opinion as to the proportion of "fertilizers," or perfect flowered plants, that should be set, some favoring every other row, while others think that one row in five is sufficient. Our practice in the Station grounds has been to set one row in three of perfect flowered plants. To illustrate, a combination which is often used is Captain Jack with Crescent, setting two rows of Crescent, imperfect flowered then one of Captain Jack, which has perfect flowers.

PROPAGATION.

New plants of a given variety of strawberry are obtained from runners, which are sent out from the old plants about the middle of June or at the end of the fruiting season. A slender, thread-like stem, growing out from the old plant takes root at the tip, if it can find moist, mellow soil, sends up leaves, and in a few weeks a vigorous young plant is grown. This in its turn may send out one or more runners which repeat the story, and with favorable conditions as to moisture this may continue till frost stops their growth. The earlier formed plants will of course be the stronger and better

A method of securing extra strong plants is by means of "potted runners." As the young plant is getting nicely rooted, a three-inch flower pot full of mellow soil is slipped under it, nearly buried in the earth and the young plant, still attached to the parent by the runner, is transplanted into this. The presence of the pot seems to greatly stimulate root growth, and the plants of extra size obtained are sold at a corresponding price.

PLATE IV.

A—Perfect flowers. B—Imperfect flowers.
C—Roots bunched; wrong way to set.
D—Roots spread; right way to set.

In Plate V., a sectional view is shown in which A represents the old plant. At B, a runner has rooted forming a strong plant from which another runner is starting. At C, another runner has been rooted in a pot.

New varieties of strawberries are obtained from seed. The fact that every seedling plant is more or less distinct from all other in characters of leaf, flower, and fruit, leads to endless possibilities in the way of new varieties. Where one variety is offered to the public, doubtless hundreds have been tried and rejected, and yet one who has tested any considerable number of the numerous varieties offered cannot but wish that the rejecting process had been carried out still more rigidly by the introducers.

However, it is by this work of raising seedling plants, and by careful selection, that the wonderful improvement of the last half century has been made in this fruit. "Be not the first by which the new is tried." is a safe motto for those who have not plenty of money to invest in such experiments

SETTING.

The question of spring or fall setting of strawberry plants is an oft recurring one, and may be answered by saying that with plenty of water for irrigation, plants may be set about as well at one season as the other.

Without irrigation, spring is doubtless much the safest time to set, over a greater part of Kansas. We have practiced setting a considerable patch in September or October for a number of years with good success; if we consider this as only taking the place of setting in the following spring With liberal watering, a good stand has been secured and the plants sufficiently well estab- to go through the winter in good shape with a little covering. They should not be expected to bear anything of a crop, but will be ready to send out a somewhat more vigorous crop of runners than spring-set plants. In our more southern counties, where the new crop of plants is strong enough to set in July, and plenty of water can be used to offset the drought and heat usually prevailing during August and early September, it is quite possible that a light crop might be obtained the following season; but over the greater part of the State this will be found impracticable, and whether to set in the spring or fall will be simply a matter of convenience.

If only a small bed is to be set, it is well to do the work in the cool of the evening, and it is better with large plantings to do as much of the work as possible in the afternoon, unless a damp, lowery day can be taken advantage of. For a small planting, a garden line answers very well to set off the rows with, but time is saved in a larger field by the use of a light marker. Unless the ground is in a fresh, moist condition, it will be best to run a very light furrow down each row, turn in water and let this become well soaked up; then, after it has settled away so as not to leave the ground sticky, set the plants in the side of the furrow. We prefer not to set with a dibble, as this is apt to throw the roots into a mass, as shown in Fig. C, Plate IV., but by walking sideways and

facing the furrow or mark, a hand with a hoe can, with a single stroke, open a place just right.

The person setting should have the plants in a pail with a little water, or a child may carry the pail ahead, dropping the plants as needed, care always being taken that the roots are never exposed to the sun and wind a moment more than necessary. The roots should be spread out as in Fig. D, Plate IV., against the flat side of the hole, and fine, moist earth pressed firmly against them; and *firmly* means so firmly that it is quite difficult to pull the plant out again.

A strawberry plant has little stem, merely a crown with a bunch of leaves from the top and roots below, so the exact depth to set is an important point. A plant set just right is shown in sectional view of Plate VI., Fig. A. Fig. B is set too high with part of the roots exposed, while Fig. C is set too deep, endangering the smothering of the buds.

Loose and careless setting is a very common cause of loss. The importance of having a full stand should not be overlooked, for whatever the loss in the crop may be from lack of it, comes directly out of the profits. The outlay is about as great for a poor stand as for a full one. The beginner who keeps this in mind will not fail to watch the plantation carefully and fill up the gaps where any of the first setting die.

If the plants have been set in an irrigated furrow, this should be raked or cultivated in level before the ground dries so as to crack. Do not let plants flag for lack of water. The field that is equipped with surface pipes and hose has rather the advantage at this stage of growth, as a thorough soaking from a nozzle in the cool of the day is the best medicine the young plants can have till well established, though the judicious use of a stream of water along a little furrow will give them more deep moisture.

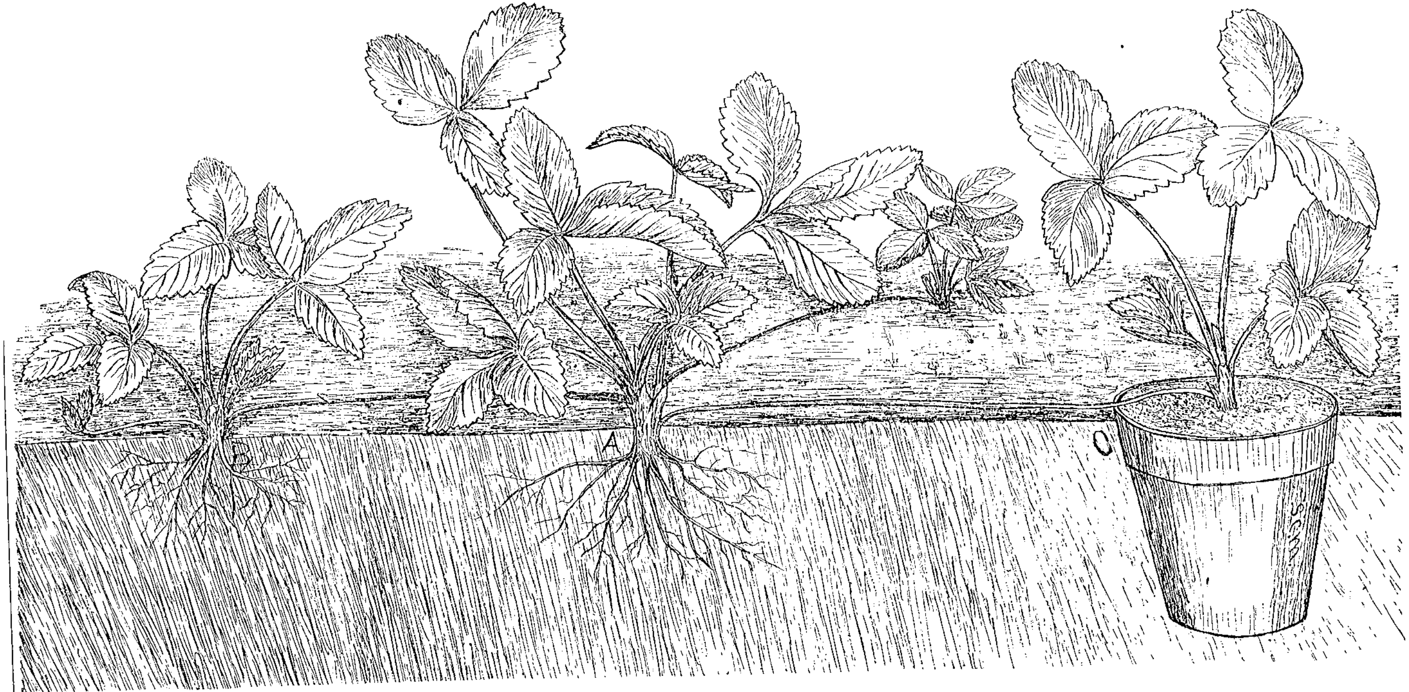
A fine-toothed cultivator should be used and the surface kept loose and mellow. The ground should be stirred after every rain or irrigation, before it has time to bake or form a crust. This treatment helps greatly in retaining the moisture in the soil.

When the runners begin to spread over the ground, which will usually be in the latter part of June, if the rains are not opportune, an irrigation and stirring of the soil should be give at the right time to provide them a fresh bed to take root in. A little careful placing of the runners at this stage, so that the matted rows may be as even as possible, will be a great help. When about twenty inches of space has been covered by the young plants, those that form beyond should be kept clipped off.

If more than one variety is set in a row, the ends where they meet should be watched, that the runners do not overlap and the varieties become mixed.

MULCHING

Not all strawberry growers agree as to whether mulching for winter protection is profitable, but aside from a few counties along the eastern border,



PLTAE V.

B—Young plant from runner. A—Old plant. C—Potted runner

PLATE VI.

B—Too shallow. A—Correctly set. C—Too deep.

there is little question as to the advantages of it, and in the more central portions of the State one should never do without it.

Our practice has been to wait till the ground is frozen somewhat firmly, provided this occurs in December, then put two or three inches of straw evenly over the whole bed. Usually after a little settling it mats together enough so that it does not blow around badly. It only put on over the rows where it is needed, the wind catches under it too readily.

If the straw is foul or full of unthreshed grain or chaff, it is apt to cause trouble from sprouting next season

Clean, bright wheat straw we have found to be the best, as it is stiff enough not to mat down too closely. Some recommend coarse damaged hay, as free from seeds and grain.

In Bulletin No. 10 of the Missouri Experiment Station, Professor Keffer describes an experiment in the use of forest leaves for mulching, which were found to mat down so closely as to hold moisture and rot the plants. A covering of some kind, in this country of so little snow, is a great help in protecting the surface of our lightest soils from drying out and blowing and also doubtless protects the plants from the sudden extremes of heat and cold so common to our winters.

This covering is found to retard the crop several days in the spring, so if early berries are wanted the straw should be opened up over the rows quite early. On the contrary, it may be made the means of prolonging the season a little by leaving it in place as late as possible and not have the plants drawn and bleached beneath it.

We usually remove about half of the straw from the bed, leaving the rest between the plants and in the walks to keep the dirt and grit from the berries.

BOXES AND CRATES.

The grower who has a good prospect of berries to sell should not delay getting a supply of boxes and crates ready until the picking season is upon him, for they cannot always be had at a day's notice.

Prices vary somewhat, but our last purchase of oblong poplar boxes cost $1.85 per thousand, and crates holding 24 quarts each cost $6.25 per hundred. These come in bales, and the work of putting up may come in at odd times, but should be out of the way before the rush of berry picking begins. There are few markets where anything but a quart box is demanded, and it would seem to be only good business morals that this should be a real quart. As the trade runs, many short quart boxes are sold, and the honest grower sometimes has trouble in getting honest boxes in which to market his fruit

The full quart box has the "high bottom" which the average customer imagines is intended to defraud him, just as the short box has, and is so built that two rounded boxes of fruit may be placed in the crate, one above the other, without bruising the lower layer. Even if filled rounding full as picked,

they will be sure to settle to level or less in shipping. A crate occasionally appears in our market holding 16 boxes instead of 24, and this will no doubt be a very popular size in which to handle a portion of the crop where one has a home market.

PICKING AND HANDLING.

The question of pickers is sometimes a vexatious one. Women and girls do the most careful work, as a rule. There are boys who will do as good work as can be done, but a careless, heedless picker should hardly be retained at any price. The rules to be rigidly enforced are these: Pick the berry with the least possible handling, leaving the hull on and cutting off the stem with the nail. Pick no unripe, decayed, bird-picked, or otherwise imperfect berries. Pick clean. Pick without damage to what is left. Fill up the boxes fairly and honestly.

If the field is at all a large one, some system of tickets by which to pay the pickers will have to be adopted. By all means have some system by which every crate of berries can be traced to the picker. Every box should be inspected by a responsible person before it goes to the market. Do not allow the pickers in the field while the berries are wet, unless they are gathering for immediate use. The grower once having gained a reputation for furnishing a high grade of berries to his home market, should guard this jealously by sending nothing below this standard to his customers. When this is done, he will find that the imported fruit will spoil in the crates as long as he has fruit to supply the demand.

RENEWAL.

Some growers plant in the spring, secure the matted row, gather the next season's crop of berries and then plow up the ground, having a new planting to take its place.

Others take off a second crop before plowing up. We have practiced the following plan: As soon as picking is over, the matted row is cut down to six inches wide, leaving this just to one side of the center, so that only last year's plants are included.

We have done the work by cutting down with spades along lines set at proper distances and then cutting away the vines with sharp hoes, afterward raking the straw mulching, vines and all, into piles and hauling it off. The space between rows is then irrigated, if in need of water, and put in fine, mellow condition with cultivators with small teeth. The young runners will soon occupy this space with a fresh matted row By this means we have taken off three and even four crops.

In Plate VII,. at the top of the page is shown a photographic view of our berry field at gathering time. Below it is a view taken in the field during the work of cutting down the matted rows for renewal, the trimmed rows showing

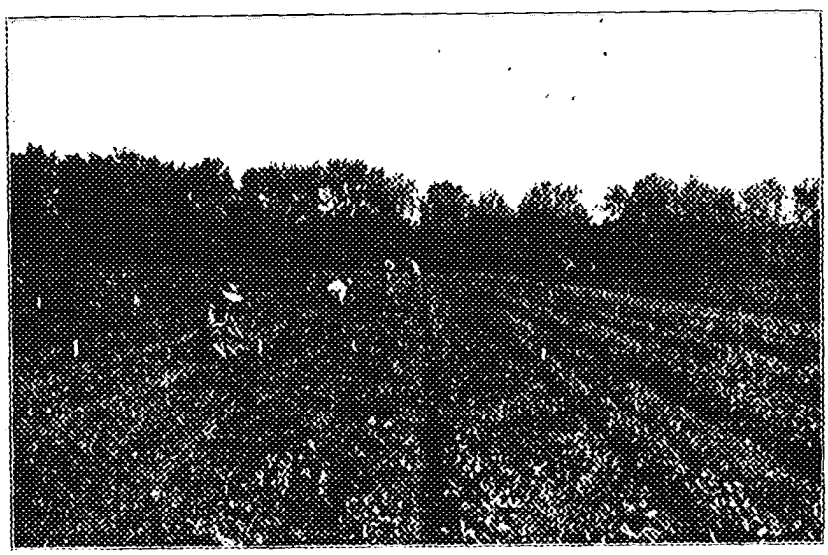


PLATE VII.

Upper view—Gathering berries. Lower view—Cutting down matted rows.

rather indistinctly on the right.

The most serious objection to allowing a bed to remain several seasons is the prevalence of the rust or blight on the leaves. This is a fungus disease *(Sphaerella Fragariae)* which spreads much more rapidly in warm, wet weather, and is worse on old beds than on young ones.

Some varieties are much more subject to this disease than others, as is shown in Bulletin No. 26, from this station. Spraying with Bordeaux Mixture has been only partially successful in keeping this pest in check.

VARIETIES.

In bulletin No. 26, the varieties then fruited one season were reported upon. Of those given a high rank, the majority still hold that place, though Bomba has not since given good results. In the following table are twenty sorts which have given the best returns during the past two years, arranged in order of ripening.

These are regarded as the best on our list, considering the season, the two earlier, Ella and Covell, being included on account of earliness and fair quality rather than productiveness, and Gandy, the latest, because, though often disappointing in yield, it gives fine, firm berries later than anything else we have.

Captain Jack, Beder Wood, Martha, and Parker Earle we regard as excellent varieties to plant as fertilizers. Warfield has not only been the most generally productive, but the fine appearance of the fruit finds it a ready sale, and it is firm enough for any but long-distance shipments. Its yield during the past two seasons has been at the rate of 6,000 quarts to the acre, and these results are fully sustained by its record since 1891. That the varieties given in this table will prove best for all soils and situations we do not claim, and only offer this list as a suggestive one There are a number of other varieties of good repute which we have not tested sufficiently to report upon.

BEST TWENTY STRAWBERRIES.

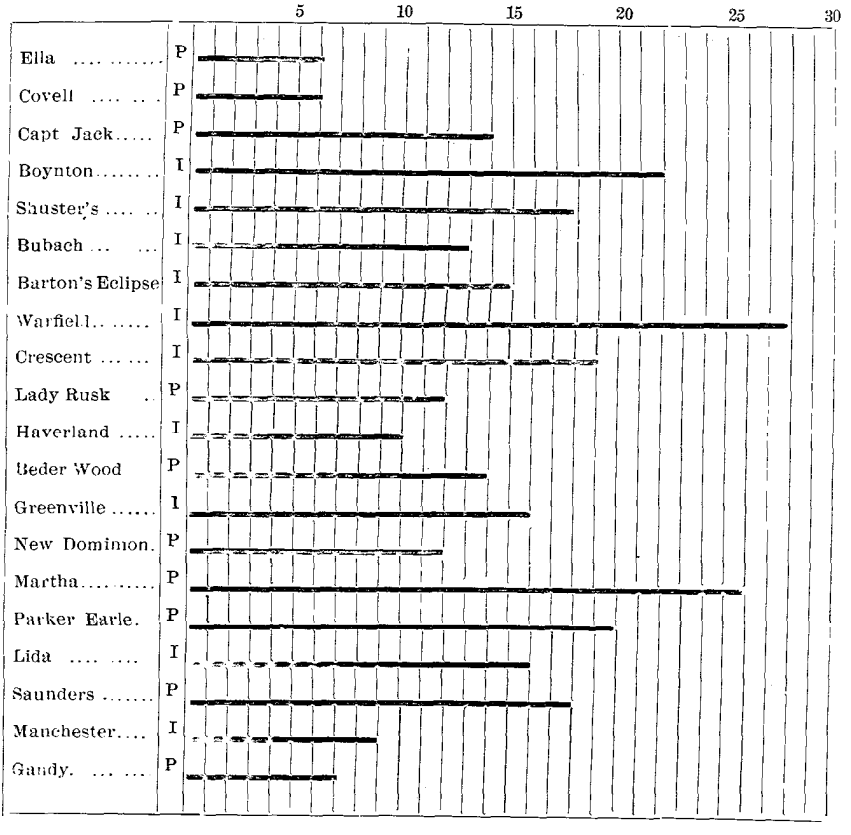


Table showing best twenty varieties during seasons of 1894 and 1895, arranged in order of ripening. Productiveness indicated by length of black lines: one space equals one quart per 50 feet of row

P—perfect flowers. I—imperfect flowers.