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Concrete Tile For Sub-Irrigated Gardens

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Concrete Tile for Sub-Irrigated Gardens

By W. M. CASE, District Extension Agent

The use of tile for sub-irrigation of the garden is recommended in dry-land districts where a limited amount of water may be supplied by windmills.

Irrigation with underground tile reduces the loss of water by lessening the rate of evaporation from the surface of the soil which is extremely high under dry-land conditions. This method of irrigation may not be successful in sandy soils, unless they are underlaid with a layer of "hard-pan," which is rather close to the surface. It functions best on the ordinary dry-land soil where this hard-pan layer is within 1 to 2 feet of the surface.

Its best application is where narrow beds are used, about 4 to 5 feet wide and about 50 feet long, and where the soil is especially well fertilized so that the plantings may be made in rows from 6 inches to 1 foot apart, depending upon the type of vegetables grown. This will increase the yield per square foot about 4 times that of a normal yield.

These sub-irrigated beds can be combined with the frame garden by placing 12 to 18-inch boards on edge along the sides and ends and covering them with slats, such as a lath corn-crib, to provide partial shade, or they may be covered with cheesecloth, which will admit sufficient sunlight, and yet keep out grasshoppers and other insects. The use of a covering over frame gardens will also protect against frost, so that gardens may be planted much earlier in the spring, and continued after frost in the fall.

The most important considerations are: (1) That the water should be clean and free from sediment; (2) that the tile should be laid as near to the surface as possible without interfering with cultivation, the top of the tile to be not over 10 inches below the surface; (3) that the tile should be laid as near level as possible, so that water will be evenly distributed. The top of the tile joints should be covered with 3 to 4 thicknesses of paper, so that dirt will not penetrate through the cracks. The bottom of the tile joints should be left open, however, so that water will seep through.

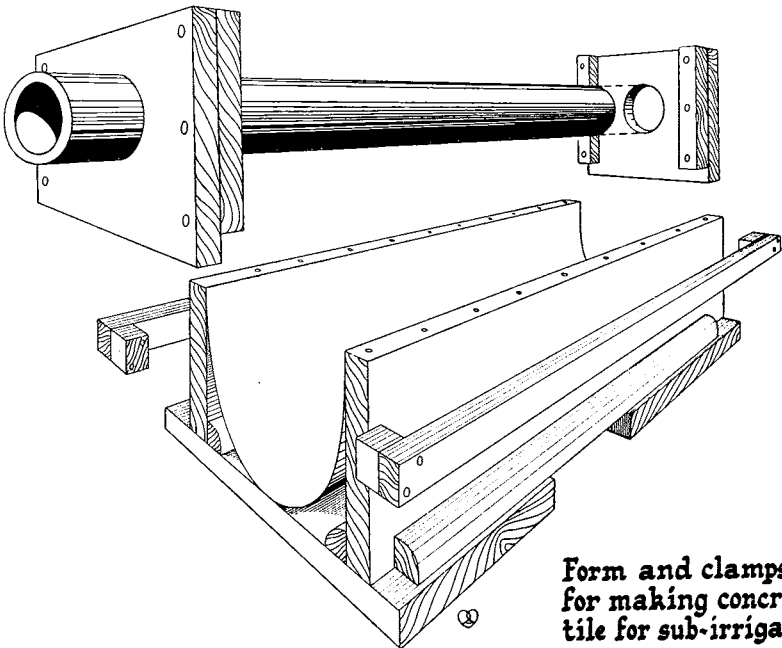
Water may be applied to the garden in the fall, winter, or early spring, before growing season starts, to saturate the sub-soil. This will cut down the demand for water during the growing season. When seeds are first planted the bed may have to be sprinkled until the seeds sprout and root systems develop.

Rows of vegetables should be so alternated that root crops are next to such crops as lettuce and spinach, to allow them to develop above ground.

Making the Form

The form for making the tile is shown in the sketch. It should be large enough to make a tile about 12 inches long, by 3 inches wide and 3 inches deep. The iron pipe to mold the core in the tile should be $1\frac{1}{2}$ -inch gas pipe or something similar, at least 2 inches in diameter, outside measurement.

Number 26 gauge sheet iron, or similar material, will be suitable. It should be cut 12 inches long by 9 inches wide, to allow for a $\frac{3}{4}$ -inch lap over each side at the top of the form. If it is run through the roller at the tin shop, it will have a smooth curved surface, and thus produce a neater job.



**Form and clamps
for making concrete
tile for sub-irrigation.**

Making the Tile

Mixing Mortar.—In making this tile, use one part cement to four parts of sand by volume. The sand should be screened and free from rocks, since the wall of the tile is only $\frac{1}{2}$ inch thick when completed. Thoroughly mix the dry sand and cement, then add the water slowly. Use just enough water in mixing so that when a portion of the mixture is squeezed in the hand it will pack together, leave the print of the fingers on it, and not ooze between the fingers. Too much water will cause the tile to stick to the form. In this work the form is re-

moved from the tile as soon as tamping and packing the mixture are completed. It may take several trials to learn just how much water to add so the tile can be taken out of the form immediately.

Filling Form and Tamping.—Put the form together and start putting in the mixed mortar. Partially fill space around base of core and tamp tightly with a narrow paddle. Two short sections of any non-splintery wood may be used as paddles. It is a good practice to tamp the cement tightly on both sides of the core at the same time. Then add more mortar and continue the tamping, using a larger tamp as the form fills up. After filling and tamping to above the core, fill the form full, and tamp with a brick or similar object. Then cut off level with top of form with a trowel.

To remove the tile from the form, take the iron core out by turning slightly and pulling straight. After the core is out, take the clamps off and remove the end pieces. Lay a 1 in. by 4 in. pallet (a 1 in. by 4 in. board 1 ft. long) on top of the tile. Take hold of the form with both hands, one hand on each side, with the thumbs underneath and fingers on top of the pallet. Turn it over sideways. Now the form is upside down with the pallet underneath. Lay in a shady place, out of the wind and sun, and lift off the form. It is now ready to assemble for making another tile.

It will be necessary to have as many pallets, 1 foot long, as the number of tile to be made each day.

Curing.—The tile should be sprinkled 2 hours after they are made. After several hours they should be covered with wet paper or sacks. The second day they should be put in a pile and covered with hay or straw and wet down to cure. Then every day or so add a little more water to keep them wet for 2 weeks while curing.

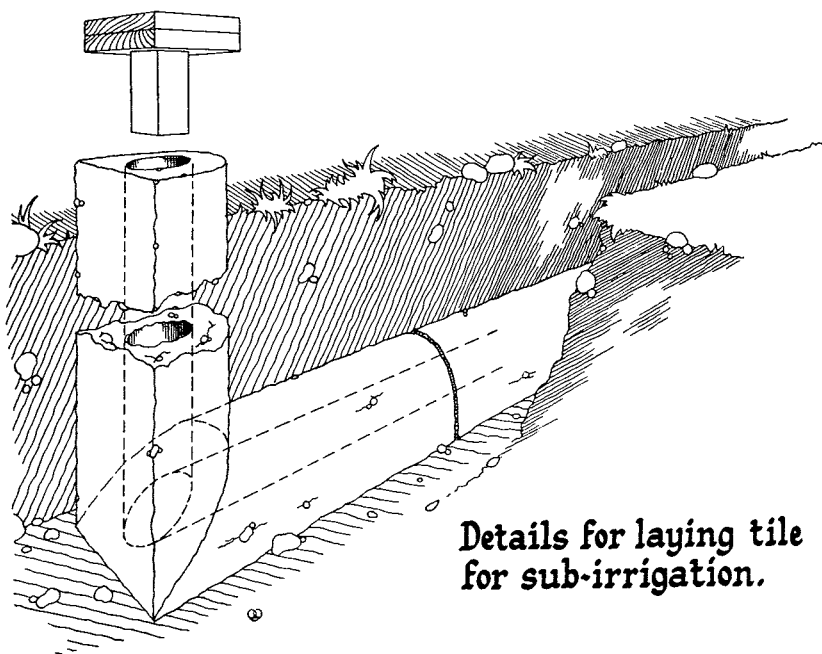
If one is ready to lay the tile, they may be laid in the ditch, if handled carefully, when $2\frac{1}{2}$ or 3 days old, covered with soil, and wet down in the ditch to cure. The main thing to remember is to keep them wet while curing. If made during the winter, they should not be allowed to freeze while curing.

Vertical Feed Pipe

To make the feed pipe, cut the end of the tile at an angle of 45 degrees as shown in the sketch. This should be done as soon as the tile is taken out of the form. Two of these tile with the ends cut at a 45-degree angle are put together making a right-angled elbow. This joint should be put together with cement. The sketch shows the feed pipe laid in place. It should project a few inches above the ground.

It is well to cast a ring of concrete around the top of the vertical tile to strengthen it so that the end will not get broken. The opening

in the feed pipe should be covered when not in use. A can lid nailed on one end of a section of an old broom handle will make a good cover. The short section of the broom handle drops into the tile, holding the lid in place. Be sure this wooden plug that drops into the tile, does not fit tightly for if it should get wet and swell it might break the tile.



**Details for laying tile
for sub-irrigation.**

Laying the Tile

The illustration shows the feed pipe and a section of tile laid in the bottom of the ditch. Care should be taken that the tile fit closely together so the joints are practically tight.

Under ordinary conditions, lines of tile 50 feet long are more satisfactory than lines 100 feet long. With the shorter lines one gets a more even distribution of moisture along the line. Practically all of the moisture seeps out through the joints of the tile.

The spacing of the tile lines will depend somewhat on the texture of the soil. They are generally put about 4 feet apart with a feed pipe for each line. To determine accurately, lay one line of tile 12 inches deep. Supply it with a very small stream of water over night. Examine the soil the next morning to see how far the water has spread from the tile. Then the rows of tile should be laid twice as far apart as the water has spread from the tile.

Ditches for the tile should be 10 to 14 inches deep. It is essential to get the top of the tile below the plow line. The top of the tile should be about 6 inches below the surface of the soil in strawberry plantings. The tile lines should be 4 feet apart or whatever distance was found by the method mentioned in the preceding paragraph. The bottom of the ditch should be **level**. There must not be any rises or holes in the bottom of the ditch.

To get the bottom of the ditch level, drive stakes every 14 or 15 feet along the lines of the proposed ditch; then with a carpenter's level and a 16-foot straight edge, make marks on each stake at the same level. Now stretch a heavy cord or small wire tight and fasten it to each stake at the marks. Then this string will form a level line. If the bottom of the ditch is kept the same distance below the string, it will also be level. This can be done by cutting a stick the length from the string to the bottom of the ditch, and every little while using it to see that the desired depth is kept.

A terracing level and rod can be used here to good advantage, if available. It is best in digging not to get quite as deep as the ditch is to be; then finish with a hoe or a tiling spade. Be sure to have the bottom of the ditch level and true.

After all the tile are laid, it is well to lay a straight edge on the top of the line and check with the level before covering with dirt.

It is advisable to lay a strip of heavy paper over the top of the tile before covering with soil. This allows the soil to become firm before the paper rots, and assures no soil entering the joints.

A perfectly level piece of soil is more desirable than a slope for underlaying tile. When the tile is placed level below the surface of the ground, it should be the same depth from the surface at all points. If the slope of the ground is so great that it would be impractical to lay the tile in the desired direction, it should be run across the slope rather than with the slope; that is, if the tile would be 8 or 10 inches below the surface of the soil at one end and perhaps 2 or 3 feet below the surface at the other end, it should be run across the slope.

The end of the line of tile opposite the feed pipe should be closed with either a wooden or concrete plug. In locations where there is a depression near the dead end of a line of tile, the tile would serve very well as drainage tile during excessively wet periods of weather by a little ditching and the removal of the plug from the dead end.

It is advised that there be one feed pipe for each straight line of tile rather than cross lines connecting several lines of tile, or the tile system branching in a herring-bone fashion.

Where facilities are available, however, it would be entirely satisfactory to have the lines of tile double length with a feed pipe at each end where water is fed in and runs toward the center of the line.

It is well to have feed pipes in a row along the garden fence where they will not be disturbed. They should be in a straight row so that a trough or pipe with a small hole empties into each feed pipe. By this means water from a windmill or storage tank can keep the trough or pipe supplied with water and a stream kept running in each feed pipe, or in as many of them as desired.

Cost of Tile

One sack of cement and 4 cubic feet of sand will make about 110 tile 1 foot long. If one has his own sand and does his own work, then 110 feet of 2-inch tile will cost the price of 1 sack of cement.

Caution.—Where elms and other trees are nearby, roots often grow into the tile joints and repairs are necessary.

If this type of irrigation is used for roses or other ornamental plants, the tile should be laid between the rows rather than immediately underneath the growing plants. If the tile should become stopped up at any joint, it would be easily detected as the water will not flow beyond the stopped portion. Tile which has become stopped up may easily be taken out, cleaned, and replaced.