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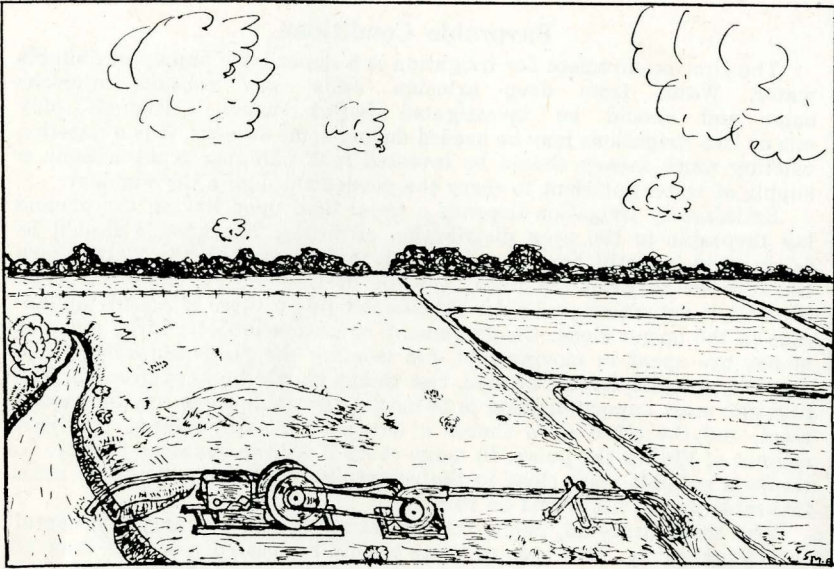
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South Dakota State College Extension Service, A. M. Eberle, Director
Brookings, South Dakota

Irrigating a One-Acre Garden

By Ralph L. Patty

Garden irrigation is becoming a common practice even in humid regions of the United States. This is especially true of commercial gardens, and semi-commercial and private gardeners are rapidly taking up the practice. In humid regions it is not uncommon to have one or more dry periods during the growing season long enough to injure the quality as well as the quantity of the garden crops. One irrigation, if applied at the right time, will often bring the crop through such a period without injury. The water will be pumped in practically all cases and the purpose of this leaflet is to give a general idea of the cost of a small pumping plant and the way to go about securing one that will be satisfactory.

Irrigating is not an easy task and it requires intelligent and painstaking planning to distribute water evenly and with a minimum amount of labor.

A person who is not a good manager and a willing worker will not be successful at irrigating—even a good sized garden. On the other hand those who are good gardeners and enjoy the work will have no trouble in using a small irrigation pumping outfit under favorable conditions.

Favorable Conditions

The first requirement for irrigation is a dependable supply of suitable water. Water from deep artesian wells may contain injurious salts and should be investigated before using. Although only one or two irrigations may be needed during some seasons, it is a question whether much money should be invested in a pumping plant without a supply of water sufficient to carry the garden through a dry summer.

Satisfactory irrigation depends a great deal upon having the ground lay favorable to the even distribution of water. The ground should be fairly level but still have a uniform slope for carrying the water down the furrows between the rows. A slope of three to 12 inches for each 100 feet is satisfactory and for the smaller pump there is a little advantage in the larger slope. On permanent irrigation projects large sums of money are spent in moving dirt and leveling the fields beforehand. In choosing the site for the garden, two things should be kept in mind. The first and most important thing is to have a favorable slope for the garden tract, and the other is to choose a location that will require the least amount of lift for the pump. In many cases it will no doubt be possible to secure a suitable tract close to the reservoir's edge. This would be most favorable as the lift would be very low.

The most practical pump for irrigating is the ordinary horizontal centrifugal pump. This type of pump should be located not more than 15 feet above the surface of the water supply at its low mark and 10 feet is better. The pump will usually be driven by a small gas engine or electric motor. The water can be forced from the centrifugal pump to a point in the garden several feet higher, but as this lift increases, more power is required for pumping. The increased lift makes more difference in the power needed in pumping for irrigation, than in pumping for the ordinary water supply because the irrigation pump throws water so much faster than the ordinary pump. If a 1½ horsepower gas engine is to be used the total lift from the surface of the water supply to the highest point to which the water is to be forced should not be more than 15 feet for a 2-inch pump or 20 feet for a 1½-inch pump. A 2-inch pump is more practical for garden irrigation because one man must usually be on the job all the time in distributing the water anyway, and with the 2-inch pump much less time will be required for each irrigation. There is only \$4.00 difference in the cost of the two pumps. However, if power is available for only a 1½-inch pump, it would be satisfactory. The 1½-inch pump will throw just a trifle more than one-half as much water as the 2-inch pump.

A One-Acre Garden

The reason we have chosen to figure on an acre garden is because an irrigated acre should produce all the vegetables one family could possibly use and it will serve well for comparative purposes. This size project will not be burdensome and unless there is a ready market close by, a larger one would not pay.

Power To Use

In any pumping plant of this kind that is not used continuously, a power plant should be used for pumping that can be used to best advantage for other purposes around the farm. We have mentioned a 1½

* The author wishes to acknowledge the kindness of Mr. M. R. Lewis, Irrigation Engineer, Bureau of Agricultural Engineering, Washington, D. C., in reading this copy and making suggestions.

horsepower gasoline engine for that reason. It is often used for other purposes. However, it is only when pumping against a very low head that so small an engine can be used. In more cases the 2 or 2½ horsepower engine would be required because of a higher lift. This same thing would apply to larger irrigating plants. If the tractor can be used for pumping incidental to other work, then the cost of the irrigation plant is greatly reduced. The following brief table shows how the required power will vary with the total lift:

Power Required and Recommended Speed (R.P.M.) of 2" Centrifugal Pump for Garden Irrigation at Different Total Lifts in Feet*

Total Head	10	15	20	25	30	35	40	45	50
Horsepower Required	.61	.92	1.25	1.56	1.87	2.19	2.50	2.81	3.13
Speed—R.P.M.	575	675	780	850	925	980	1045	1100	1150
Gallons per Minute	80	90	100	100	100	100	100	100	100

It is important that the pump be driven at the speed recommended by the manufacturer. The right speed is obtained by having the right sized pulley on the pump to match the pulley on the gas engine. The gas engine will have a certain rated speed and a certain sized pulley and the pump should be equipped with the proper sized pulley to match it. The rated speed of the engine and the size of pulley should be furnished to the manufacturer in buying the pump. Electric motors are ideal for irrigation pumping purposes and the same thing applies to them. Electrically driven irrigation pumps can be bought with a direct drive, i.e. without a belt. They are advisable when the motor is to be used for pumping only.

The Pump

This leaflet refers especially to garden irrigation from farm reservoirs or small streams where the lift is not great. For such an installation the horizontal centrifugal pump would be used. A 2-inch pump would be the most practical sized and it would cost around 46 dollars. It would require a 2-horsepower gas engine to drive it in most cases, but in pumping from the reservoirs the lift in some cases would be low enough for a 1½ horse engine.

Speed of Pumping

A 2-inch pump should throw from 80 to 100 gallons of water per minute. At this rate enough water will be pumped in 10 hours to cover the acre with 2 inches of water. This will probably be about the right amount for each irrigation and will be a good day's work. For sandy soils slightly less water should be applied at more frequent intervals.

Installing The Plant

The pump should be set up as close to the water surface as possible and still be safe from a sudden rise of water. It should not be more than 12 or 15 feet above the lowest level of the water supply at most. Both the pump and engine should be solidly installed to reduce vibration to a minimum. A platform on heavy skids may be most satisfactory for the installation. A 2½-inch hose long enough to reach well under the water supply at all times is attached to the pump intake and dropped into the water. It should be equipped with a screen fixture at the intake end to keep out trash. In order to lead the water down the furrows of the garden it is necessary to deliver it through a pipe to the highest point to be irrigated. The length of this delivery pipe may be anywhere from 40 to 400 feet, depending upon the distance to this high point. Where the slope of the

* Figures from chart of the American Well Works.

ground is favorable and the garden is located below the reservoir an acre of ground should be laid out that can be reached with a small amount of pipe. This delivery pipe should be larger than the discharge pipe from the pump. It should be 3 or 4-inch pipe, 4-inch to be safe, and if much of it is needed a special lightweight and inexpensive pipe that slips together like a stovepipe can be bought for the purpose. It is called "slip-joint pipe" and can be bought through any hardware or pump dealer, at around 25 cents per foot.

The Cost of the One-Acre Garden Plant

Not including the delivery pipe the cost of plant would be about as follows:

2-inch horizontal centrifugal pump -----	\$ 46.00
2 horsepower gasoline engine -----	75.00
Intake hose & screen, 12 ft. @ \$1.00 per ft. -----	12.00
Belt -----	4.00
Deliver pipe, light sheet steel slip-joint pipe @ 25c per foot -----	
Total -----	\$137.00

Distributing the Water

Good irrigating is to distribute the water evenly over the acre of ground and not get too much water on part of it and not enough on another. The furrow method of irrigation is used almost entirely in gardens. This is done by pumping into a head ditch which will carry the water along one end or one side of the garden and across the ends of the rows. When the head ditch is tapped then at a point between each row the water will be carried down the furrows between the rows for soaking the ground. The furrows between the rows are probably best made with an old style single row cultivator with large shovels. A favorable location for the garden would therefore have a slope two ways. The rows should all slope away from the head ditch, of course, and the head ditch would be along the upper side (on the side hill) of the tract, and it must have enough slope to carry the water along to the last furrow at the far corner. In leading the water out of the head ditch into the furrows a short tube or pipe is generally used. Four plaster lath, nailed so as to make a square tube, are often used for that purpose.

Irrigating can often be done profitably before the garden is planted in the spring. In fact, a good soaking at this time and when the water is most plentiful is good practice. For garden irrigation in regions where rains can be expected at intervals, smaller and more frequent irrigations are probably best. Applications of 1½ to 2 inches of water at a time would generally be about right. At no time should irrigation be delayed until the plants suffer for moisture. In case of doubt it is good practice to irrigate just before it is needed.

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