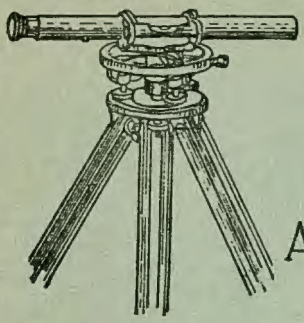

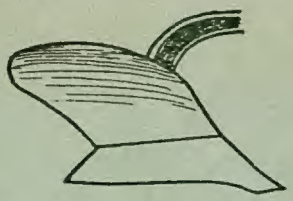

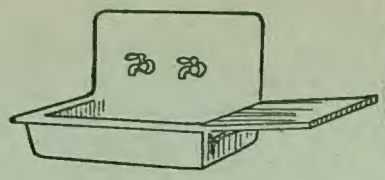

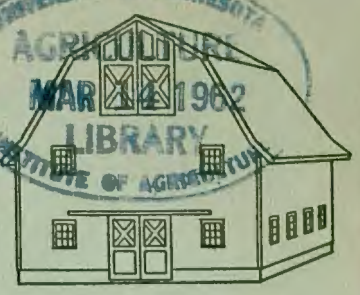

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Minnesota's Irrigation Problem

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Minnesota a Semi-Arid State

Geographically, Minnesota lies in the semi-arid belt where, between May 1 and September 1 of almost any summer, short sharp dry spells of one to two weeks' duration are almost sure to occur. Certain types of agriculture can here be practiced with success only if provision is made for irrigating some of the more delicate crops during this critical period. At present artificial watering systems have been installed on comparatively few farms in the state.

The severe dry cycle of the last 8 years seems to have made the Minnesota farmer more conscious of this problem than ever before. In districts where truck crops and small fruits are increasingly grown for their nearby large markets, the use of some type of supplemental irrigation system has increased phenomenally the last 5 or 6 years, but a much greater growth of this practice is indicated for the near future.

Essential Features

The Plan. The plan for such a system should be worked out in detail well ahead of the time when it is to be installed and used.

Water Supply. Is an ample water supply available? Under ordinary soil conditions at least 1 inch of water over the entire area to be watered is usually required about once a week. On very sandy soils this amount may have to be doubled. An inch of water over only 1 acre is 27,000 gallons. It will require a delivery of about 55 gallons per minute for 8 hours to cover 1 acre. If you must water 5 acres can you afford to take 5 such 8-hour days to do it, or can you deliver the water continuously at the same rate night and day for 40 hours? If not, is your water supply sufficient to permit a greater delivery capacity? Can you afford such larger plant? The variations on this problem are many, but it all comes back to the **sufficiency** of water supply.

Sources of Water and Necessary Lift. What is the source of water? How far must it be lifted to get it on the land to be irrigated? On this often depends whether or not the irrigation system is likely to pay. Usually, in Minnesota a maximum total lift of 30 feet (both suction and discharge head) is about all the job will stand and pay out.

As surface systems of storage and gravity delivery of water are not at present available in Minnesota and the development of such, in the near future, seems doubtful, sources of water for supplemental irrigation will generally be either nearby streams or wells of one type or another. Hence, a pump must be used to lift the water to the surface of the land to be irrigated.

Wells fall mainly into two types, shallow wells and deep wells. Shallow wells are those in which the direct suction lift of piston pumps with pistons practically at the ground surface is 22 feet or preferably less. With centrifugal pumps this suction lift must never exceed 15 feet, and less is desirable. Frequently, ample water supply can be secured near the surface by driving 5 or 6 sand points 20 feet apart or more, but one should be assured by tests that the greater part of the length of each point will be in a good water-bearing sand. Many disappointments have been experienced with sand points where the reservoir tapped was in sandy silt or silty sand which sooner or later clogged the points. Deep wells are those so deep as to require that the cylinder be set down in water or so near its surface that the suction lift does not exceed the figures given above.

Types of Pumps. For ordinary lifts and for discharges up to 50 gallons per minute, piston pumps properly selected and set give excellent satisfaction, but for steady flow must be equipped with some type of pressure control. Centrifugal pumps give steady flow without a pressure tank, and may be had with much greater capacities than can be secured with piston pumps, but usually require priming to start unless set on a vertical shaft and down in the water.

Where large amounts of water must be furnished from deep wells, a deep well turbine pump with the requisite heavy power may be best. As this means heavy first cost, the prospective irrigator will do well to figure the whole thing through first with some qualified engineer. It is common experience that high lift pumping for irrigation does not pay except for crops yielding an unusually high return per acre with good markets.

Power. Almost any available type of power may be used if there is enough of it. Electric power from a high line with continuous service is, probably, the most satisfactory. Gasoline power, often in the form of belt power from a tractor, is often used satisfactorily. As the irrigation system will be used for only a short time each year, however, the power unit should, if possible, be adaptable to other work to keep down the cost of power. Even windmill power, under favorable conditions of location of windmill and for small areas, has been used effectively.

Type of Distribution System. The most commonly used types of distribution systems in Minnesota at present are overhead spray systems.

The oscillating spray system or Skinner type is best suited to small areas although first cost is relatively high. This is offset to a certain extent by the long life and low maintenance and operating cost of the system. This type is especially well suited to small fruit and truck crops for both economy of water use and labor involved.

The large circular spray type is better suited to large fields, where such low growing crops as sugar beets, onions, or potatoes are being raised in quantity. Available distribution pipe systems for this type are easily and inexpensively handled and cost of attendance is reduced to a minimum. There is necessarily considerable overlap of spray areas with consequent double watering, but even at that, the water cost is relatively low. The time required to water a given area with the circular spray type is considerably less than with the oscillator spray type.

Either type of spray irrigation provides good protection for tender crops against late spring and early fall frosts.

Where lifts from nearby streams are low, **furrow irrigation,** little used in Minnesota as yet, may often be employed to great advantage at relatively low distribution, equipment, and labor cost. In the irrigation of row crops by this method, head supply canals may be earth ditches, plank flumes, or galvanized gated pipe. The greater elasticity of handling undoubtedly lies with earth ditches or gated pipe. However, it is well known that water distribution is not so uniform, and that water losses and expense of preparing the land are greater by the furrow system than by any spray system.

Types of Crop Irrigated

Wherever carried on in Minnesota according to a well worked out plan, supplemental irrigation of truck crops, small fruits, sugar beets, and potatoes has resulted in increased returns, paying the cost of the system in from 1 to 3 years.

Irrigation of such field crops as grains, corn and alfalfa has not been tried in Minnesota. It requires more water over larger areas with much more extended works and equipment for handling, adding greatly to the initial investment. It does not seem justified to the writer until such time as large surface storage systems and gravity distribution are developed here. However, our water resources for irrigation, without impounding, are far greater than is generally realized. These resources, which are now, for the most part, flowing away to the sea, are capable of putting much money into the pockets of farmers disposed to raise crops that may readily be irrigated.

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