

Some Thoughts On The
Irrigation Problem.

by.

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Some Thoughts on the Irrigation Problem.

From the earliest dawn of history, irrigation has played a very important part in furnishing man with the necessities of life. The Oriental Countries depended almost entirely on this method for supplying their crops with water. The phenomenal fertility of the Valley of the Nile is a wonder to the people of all nations. It, however, is not any more productive than the now bleak and barren fields along the Euphrates were when Nineveh and Babylon were at the zenith of their glory.

Egypt irrigates her land now just as she did in the time of the Pharaohs; and we can observe her methods any time that we may go there.

Although the irrigation problem is not new to the Oriental people, it is new to the Anglo-Saxon. Ever since becoming a nation he has been accustomed to live upon the fat of the land; and not until within the last few decades has he felt himself called upon to regulate some of Nature's irregular ways.

With him, as with all other people, the irrigation problem arranges its self under three general heads.

1. Where to get the water,
2. How to get the water,
3. How to use the water.

In those regions that lie along the course of great rivers, the waters of which are at all seasons of the year adequate to furnish all demands for water that can be made upon it, the first part of the problem is already solved.

On our great plains, however, where perennial streams are few and far between, and the supply in them is but scanty during the time when the water is most needed, this part of the problem is much more complex. A number of schemes have been tried, and with more or less success.

One method that is practiced to some extent, is that of making the head of the canals a self supplying reservoir, by extending it far enough up the river so that its level is considerably below that of the water level in the river, and depending upon the underflow to furnish the supply. There has been a number of such canals constructed in The Valley of the Arkansas River in Western Kansas, and by The Irrigation Investigating Committee are said to work nicely. Some practical

men, however, who have visited these canals say that they are not a success.

Where the water cannot be turned directly into the canals from the river, on account of the elevation of the land, the water is generally raised by some mechanical means; and the supply is furnished by wells sunk to the water bearing stratum. In Western Kansas and Eastern Colorado, where the wells are in the sheet water or underflow, it is not yet definitely known just how much water they can be made to furnish.

It is not known to a certainty just what the original supply of this sheet-water is. The majority of writers on the subject say that the source of supply is the rains that fall on the

plains themselves. These rains sink into the ground until they reach an impervious layer, and are thus held as in a great under ground reservoir. After several years residence in Western Kansas, and some observation, I am sure that such an explanation is not well grounded. In digging a well on these plains one does not find moist ground until he gets near to the water-bearing stratum. All above this, with the exception of a few inches on top, the earth is dry. As water cannot pass through soil without wetting it, and as the soil for at least three fourths of the distance is not wet, it is evident that the water that has fallen as rain has not gone down from the top.

Another thing, the wells, with scarcely an exception, remain the same regardless of the amount of precipitation. Whether the season is wet or dry the water in the wells remain the same height, and furnishes the same quantity.

I have seen some of the creeks of that country, whose entire length is within the plains, dry up entirely during the summer and early fall so that one could walk dry-shod anywhere in the bed of the stream, where normally the water would be from five to eight feet deep.

I have seen these same streams, during the late fall and winter when the evaporation was not so great, fill up these ponds and holes with water and start to running without any pre-

precipitation, either as rain or snow, having fallen.

As a rule when digging wells in that country; water, in the vast majority of cases, is found in sand. How thick this veine of sand is is still a matter of speculation. At a point near Arkalon in Seward County it is one hundred and sixty feet; as was found out recently while drilling a well at that place.

The amount of water stored up in a cubic foot of such sand has been carefully determined by experiment and found to be as follows.

When fully saturated,

Fine sand	^{holds} 2	gals	per	cubic	ft.
Coarse sand	2 $\frac{1}{2}$	"	"	"	"
Sand and fine gravel	3	"	"	"	"

As a cubic foot is equivalent to about seven and a half gallons, it is evident

that at least one fourth of the volume of the sand veins is water.

It seems to me that the best available plan of tapping this under-ground supply is by means of wells similar to those used by the Railroad Companies.

At Garden City is such a well. It is twenty five feet in diameter; and penetrates the water bearing stratum eleven feet. It is walled with rock laid in cement, so that the water comes in only at the bottom. Under these conditions it has furnished 800,000 gallons of water per day; or enough to cover ten acres of land nearly three inches deep. Later this well has had several six inch, perforated, galvanized iron pipes put down several feet

deep at different points over the bottom of the well; and the supply is ^{now} practically without a limit.

The idea of constructing dams across small streams, ravines, and draws, in order to catch and hold the storm water, is one that has been presented often, and is deserving of some careful thought and consideration.

Nearly all the rains that fall upon the plains fall in torrents; and an extremely large percent of the water goes into the streams and runs off to a country that already has a super-abundant supply. If such dams were constructed so that the water that falls on the plains was kept there it would undoubtedly be better for all the parties concerned.

In many cases these reservoirs could be so situated that their water would be available for use on small areas lying at a lower level, and would thus furnish a means for tiding over a months dry spell in pretty good shape.

Probably the greatest benefit that such a practice would give would be its influence on the atmosphere. Such an innumerable number of ponds and small lakes could not fail to make their influence felt. The atmosphere would contain more moisture, the temperature would not rise so high, and the hot winds would be robbed, to a limited extent, of their most destructive element.

Another source of water supply in limited quantities is that from artesian wells. This is an ideal way of

getting water; and in some localities a practical one.

It comes a little the nearest to a solution of the perpetual motion problem of any thing that we have. The cost of putting down the wells, and the limited areas in which such wells can be had is the chief drawback to this system.

After one knows where he can get water, and get it in practically unlimited quantities, it often becomes a very grave problem to know how he can get it. Where the water is taken directly from a stream in canals it often has to be carried many miles before it can be placed at the point wanted. Constructing such canals requires an enormous amount of money; so much so in many cases that individual capital is not adequate

to the demand, and the irrigation canals become the property of a corporation. In such cases the prices paid for a water right is often so high as to make the use of the water of doubtful economy to the user.

Where the canal system is not possible and in some cases where it is, pumping is the other alternative. Where the supply wanted is not too great this method, in several points, is preferable to the canal system. In most cases the steam and gasoline engines furnish the best and most economical means of pumping any great amount of water, unless coal and gasoline are quite expensive. The principal objection to their use is the first cost, and the fact that it requires a good deal of mechanical skill

to keep them in proper running order.

The small farmer or market gardener, who has only a few acres under cultivation, very often cannot afford the outlay necessary to secure such machinery.

For supplying such small areas horse-power or wind power requires the least outlay of money.

Horse power can be depended upon to furnish the power at any time that it is wanted; which cannot always be said of a windmill.

To get the most satisfactory results from a windmill it is essential that one should have a reservoir, one of pretty liberal sized capacity, so that his mill can be kept working at all times when there is sufficient wind. The construction of such a reservoir, although not a difficult problem, is

one in which a little experience and some good sense are of no small value.

To me it seems that the windmill has a great possible future development on our Western prairies. On these prairies wind is one of the things that is seldom lacking. In the more Eastern parts of the country the dry hot days of July and August are generally accompanied by a stillness that is oppressive; but such is not the case on the Western plains. At the time when the ground is dry there is nearly always a good breeze going.

Up to the present day windmills have been built largely for appearance. Although their efficiency, when measured by the amount of wind that comes in contact with the wheel, is

as large as there is any hopes of making it; yet if measured by the amount of money put into the structure the efficiency is verry low. In the future where the windmill becomes a factor in the irigation question, that mill will look the best which will raise the most water for the least amount of money. I Think the day is not far distant when a windmill, that will do the work of the present twelve or fourteen foot wheel, can be set up in a thirty foot well ready for business for twenty five dollars.

There are few people who would doubt the ability of a sixteen foot windmill to raise an abundance of water to irigate an acre of land thoroughly if it did not have to lift the water more than

thirty or forty feet. Putting this statement in the form of a query, if the area of a sixteen foot circle furnishes energy enough to irrigate one acre of land how large an area will it take to furnish sufficient energy to irrigate one hundred sixty acres? One could readily see that it is the means of utilizing the energy and not the energy its self that is lacking. Any economical means of harnessing these disagreeable winds and putting them to useful work will be a great boon to the inhabitant of our Western prairies.

How to use the water to the best advantage after it is obtained is a point in which there is a good deal of difference of opinion. Any definite answer to this question must depend largely on the conditions; that is,

1. On the amount of water available,
2. On the cost of getting the water,
3. On the kind of crops grown.

If the supply of water is limited and the market a good one, with prices high, one might be able to afford the expense of the sub-irrigation plan. This plan is to place under-ground just below the frost line a system of porous tile at intervals of every rod or two apart. These tile would all be connected to a reservoir, and this reservoir kept full of water. This method is the most economical with the water. It works nicely for the first year or two while the tile are new; but later the water fails to pass through the tile as freely as it should. This method is expensive and as yet has been used only by Market gardeners.

The trench or ditch system is used by those that have more water at their command, and usually for crops that are planted in rows. By this method a small ditch is made along each row, sometimes between two rows, and the water is supplied to the plants from these ditches.

The most common and the most satisfactory method used is flooding. This is the universal method for such crops as the grains and grasses. It consists of contouring the ground at a few inches difference in level, and throwing up a small ridge or bank and flooding each enclosure separately, beginning with the one on the highest ground and draining the water from the plat above to the next lower after the ground has

been covered for a sufficient length of time, usually an hour or two.

As intimated in a previous paragraph, the practicability of irrigation will depend largely on the cost at which the water can be supplied. In India sufficient water to irrigate an acre of land for one season costs from \$2.⁰⁰ to \$5.⁰⁰ per acre. In California from \$4.⁰⁰ to \$17.⁰⁰ per acre. On small areas devoted to small fruit culture or market gardening one might well afford to pay a considerably larger sum rather than suffer the loss caused by an occasional drought.