OF AGRICULTURE AND APPLIED SCIENCE

Is Your Land Suited to IRRIGATION ?

D. J. McLellan, Jr.
Associate Extension Agricultural Engineer

CIRCULAR A-466 DECEMBER 1964

LAND

Land is a most important factor in your decision to irrigate. Before land can be considered suitable for irrigation it must meet certain physical conditions. Unless these conditions are met, there is little chance of a successful irrigation enterprise.

Ask your County Extension Agent and your soil Conservation District for help in irrigation planning. Your County Agent will help you with over-all planning. Your Soil Conservation District will study the land being considered for irrigation and determine if it conforms with the standards necessary for irrigation.

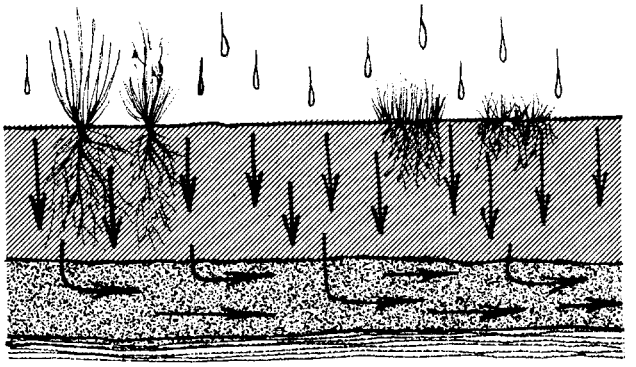
DRAINAGE

Internal soil drainage is essential for successful irrigation. Poor drainage leads to salt accumulation and waterlogging in the soil.

Salt accumulations, either saline or alkaline, result from a build-up of soluble salts in the soil. All irrigation water carries some soluble salts. As water is added, it carries soluble salt into the soil. Plants and evaporation eventually remove the water, but the salt is left.

On well-drained soils, occasional deliberate over-irrigations will flush the surplus salt from the root zone. Poorly-drained soils cannot be flushed effectively. As a result irrigation causes an accumulation of salt that will eventually reach damaging proportions.

In nontechnical language, salt accumulations (1) break down the soil structure making it difficult to work, and (2) compete with crops for soil moisture. Salt attracts water. When salt accumulations in the soil become concentrated, they prevent plants from getting water, even though the soil is moist.



1. Good drainage makes it possible for water to move through the soil and remove excess salts.

To raise crops, the soil must provide the plant with both air and water. When water is applied to a well-drained soil the soil retains a specfic amount of water, and any extra water penetrates deeper. Each soil type has definite characteristics.

When supplied with adequate moisture, soil will reach a balance with a certain percentage of its pore spaces filled with water and the rest filled with air. If the soil lacks good drainage, the pore space required for air will be filled with water, and the soil-moisture will be out of balance. This condition is called ''waterlogging''. It is caused by failure of the soil to get rid of excess moisture. A waterlogged soil virtually drowns the plant.

Problems caused by salt accumulation and waterlogging cannot be corrected unless adequate internal drainage is provided. Poor internal soil drainage cannot always be corrected. If you have any doubt about the drainage of your soil, ask your Soil Conservation District for advice. The SCS soil scientists and engineers, after investigation, can tell you if your soil can be drained, and will provide an estimate of the cost.

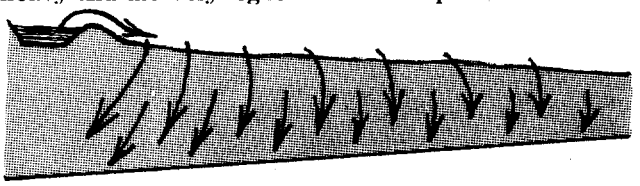
INTAKE RATE

Intake rate is the rate at which water enters the soil. It is measured in inches per hour.

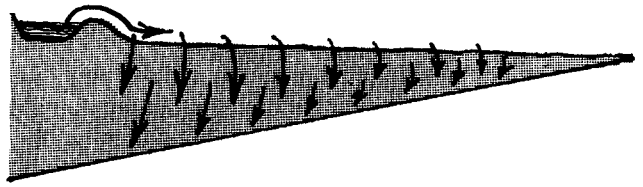
Soils with very high intake rates, 2 inches or more per hour, are difficult to irrigate by surface methods. The water is taken by the soil so rapidly that it moves across the field slowly. The result is short runs between field ditches, which increases the labor demands; or severe over-irrigation, which wastes water and leaches plant nutrients from the root zone. Often, both short runs and over irrigation will result from irrigating soils with excessively high intake rates.

Soils with very low intake rates, less than 0.20 inch per hour, are difficult to irrigate because they take water so slowly. For example, if a crop needs 5 inches of water, and the intake rate is 0.10 inch per hour, it will take 50 hours to complete the irrigation. Because of the time involved, soils with low intake rates frequently receive less water than they require. Water will quite freely run over soils with low intake rates. Free-running water over slowly-absorbent soil results in substantial run-off and usually the run-off is lost.

The intake rate of your soil is important from an economic standpoint. Most soils from sandy loams to clay loams have acceptable intake rates. The very heavy and the very light soils cause problems.



2. High intake rates often result in too much water near the ditch and too little water at the lower end of the field.



3. The ideal intake rate will result in even water application over the entire field.

4. Low intake rates often result in under-irrigation and excessive run-off.

Very slow intake rates result in under-irrigation and waste water through surface runoff. It is costly because not enough water gets into the soil to provide maximum crop returns. Further, you are pumping or handling much more water than you are using. If you respond by putting the water on more slowly, you will find the capital investment for the system increasing rapidly. It is not practical to irrigate if the intake rate is less than 0.2 inch per hour.

Very high-intake-rates usually are closely related to low water-holding capacity which is discussed in the next section. When surface irrigation methods are used, high intake rates mean high costs, either in labor or in wasted water.

WATER-HOLDING CAPACITY

Water-holding capacity is a measure of the amount of water the soil can store for plant use. It is measured in inches of water per foot of soil.

Irrigation is nothing more than storing water in the soil for the use of growing crops. An effective irrigation will fill the soil to capacity in the crop root zone.

It is important to know the water-holding capacity of the soil to be irrigated. It is used to determine the amount of water that can be stored for plant use after each irrigation.

In irrigation planning you must consider both the water-holding capacity and the depth of your soil.

A soil that holds less than 0.75 inch per foot is a bad irrigation risk. Four feet of a soil holding 0.75 inch per foot will hold 4 feet x 0.75 inch/foot, or 3 inches of water.

Two inches per foot is considered a good water holding capacity, but it has to have some depth. A soil that can hold 2 inches of water per foot, and is only 18 inches deep over sand, will hold 1.5 feet x 2 inches/foot,or 3 inches of water.

In both examples, the soils are no more than borderline risks.

Low water holding capacities in soil, because of of either soil characteristics or lack of depth, are serious economic factors in irrigation planning. A soil that can store twice as much moisture in the root zone as another will need to be irrigated only half as often. When the soil has a very low water-holding capacity it may be physically impossible to irrigate it often enough to get the yields you would like to have.

While soils with a water-holding capacity of less than 0.75 inch per foot can be considered non-irrigable because of inadequate water-holding capacity, there is no upper limit for water-holding capacity.

TOPOGRAPHY

Topography is the lay of the land. It helps determine the type of irrigation to plan. Land with gentle, even slopes lends itself to surface irrigation methods. Land that has rolling, uneven slopes is difficult to level, and might be best adapted to overhead, or sprinkler, irrigation.

Topography limitations for surface irrigation generally are the rolling, uneven fields that require heavy leveling before irrigation can be practiced. Heavy leveling is costly, and it may expose undesirable soils. Uneven topography for surface irrigation often results in small odd-shaped fields that are difficult to work. Land so steep it can't be irrigated without severe erosion should not be irrigated.

The most overlooked topographic limitation for sprinkler irrigation is steepness. Particular care must be taken with row crops. The use of approved erosion control practices is important in irrigating slopes of more than 2 per cent. If sprinkler irrigation lateral lines are placed up and down hill, substantial elevation changes will cause important pressure differences between the high and the low end of the line. For every 2.3 feet of elevation differences there will be a 1 pound per square inch pressure difference. Pressure difference in the lateral will result in uneven water distribution from the sprinklers.

Assistance in determining topographic features as they relate to irrigation is available through your County Extension Agent or your Soil Conservation District.

USEFUL INFORMATION

A poorly drained soil is a bad risk for either surface or overhead irrigation.

A soil that cannot hold 3 inches of water in the top 4 feet of soil is a bad risk for either surface or overhead irrigation.

Your County Extension Agent and your Soil Conservation District can help you plan irrigation for your farm. Starting irrigation is a big step, ask them to help you get the facts you will need to make the final decision.

Extension Service, North Dakota State University of Agriculture and Applied Science, and U.S. Department of Agriculture cooperating. A.H. Schulz, Director, Fargo, North Dakota. Distributed in Furtherance of the Acts of Congress of May 8 and June 30, 1914.