Irrigation Practices

efficiency of different systems
determined by various factors

C. N. Johnston

An efficient irrigation system depends
upon adapting equipment and practices
to the soil type and contour of the land
being worked.

An irrigation system which has proved
satisfactory in one area will not necessarily
work well in another.

The tools of irrigation are limited to a
few standard ones—ditches and pipe lines
for distribution of the flow to the sides of
the field, delivery gates on the ditches, or
siphons and outlet valves on the pipe lines.

Other devices used to bring water to
the soil are the sprinkling system and
the spud ditch which is used in some areas
to bring the water table up into the root zone
of the crop by seepage from the ditch.

Soil types range between the extremes
of peat—which is wholly organic—and
sand—which may be almost pure quartz.

The soil may vary in texture from the
sands which are loose and porous to the
clay which are sticky and relatively impervious
to water.

Another basic factor for consideration
in planning an irrigation system is the contour
or general slope of the land,
which is likely to vary greatly even in
short distances.

Modifications Necessary

The great variability in soil type and
contour compels modification of irrigation
practices from one locality to another.

In adapting the tools of irrigation to
the soil type, a number of factors deter-
mine the best method of irrigation. These
determining factors include seepage,
operation simplicity, maintenance, ro-
dent destruction, life of the system, first
cost, weed contamination, degree of inter-
ference with cultivation and contour of the land.

As far as seepage is concerned, use of
the ditch will result in high and wasteful
percolation losses when passing through
sand; moderate but occasionally high
losses when passing through loams, and
low to negligible losses through clay.
Little or no seepage will result when a
concrete pipe is used through these soils.

Four factors influencing an irrigation
system are independent of soil type.
These are costs, contour of the land, weed
contamination and the effect on cultivation
practice.

The cost of outlets such as ditch struc-
tures and pipe line valves is extra over
and above the cost of the ditches and pipe
lines themselves. It is difficult to compare
them since they serve a specialized type
of conduit. Some of the effects resulting
from soil type—such as washing—come
after delivery of the water by these out-
lets.

Application

There are several methods for applying
water to the soil—basins, furrows, checks,
and sprinklers.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Soil Type</th>
<th>Ditch</th>
<th>Pipe Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seepage</td>
<td>Sand</td>
<td>High—wasteful</td>
<td>Slight to none</td>
</tr>
<tr>
<td></td>
<td>Loam</td>
<td>Moderate—occasionally wasteful</td>
<td>Slight to none</td>
</tr>
<tr>
<td></td>
<td>Clay</td>
<td>Low—negligible waste</td>
<td>Slight to none</td>
</tr>
<tr>
<td>Operation simplicity</td>
<td>Sand</td>
<td>Washing a problem</td>
<td>Less washing than ditch</td>
</tr>
<tr>
<td></td>
<td>Loam</td>
<td>Some washing—may be high</td>
<td>Limited washing to none</td>
</tr>
<tr>
<td></td>
<td>Clay</td>
<td>Little or no washing</td>
<td>None</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Sand</td>
<td>Difficult to keep in shape</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Loam</td>
<td>More stable than sand</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Clay</td>
<td>Relatively stable—keeps shape</td>
<td>None</td>
</tr>
<tr>
<td>Rodent destruction</td>
<td>Sand</td>
<td>Often not suitable for burrowing (caves in)</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Loam</td>
<td>Burrowed readily and frequently</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Clay</td>
<td>Burrowed readily and frequently</td>
<td>None</td>
</tr>
</tbody>
</table>
| Life                   | All types | Must be remade frequently to plug ro-
|                        |           | dent holes and control weed growth          | Long—15 to 20 years or more    |
|                        |           | for all soil types                           |                                |
| First cost             | All types | Low—few cents per ft. (3c to 10c)           | Higher—from $5.50 for 8" to $1.50 for 18" (approx. price laid in field) |
| Weed contamination     | All types | Always a hazard, sometimes serious         | None                           |
| Interference with culti-
| vation                | All types | Often definite obstruction to cultivation   | Below ground—little or no interfer-
|                        |           |                                            | ence                                  |
| Contour of the land    | All types | Must have fall toward point of delivery     | Can disregard grade of land if all
|                        |           |                                            | points are below elevation of supply, which may be under pressure |

Basins, checks, and borders are basi-
cally alike, being for the most part flat
areas surrounded by earthen levees which
hold the water flooded over them until it
infiltrates the soil. Basins are generally
smaller, such as the square-leveled areas
about individual trees. Borders or checks
are usually long and narrow with the
slope down the length in the direction of
irrigation.

The cross slope—the narrow way of
borders and checks—is restricted to two-
tenths of one foot or less between the
borders. Sometimes the cross slope, and
at other times the available water supply
control the spacing of the levees.

Devices

Other irrigation devices may be used to
advantage under certain conditions. One
such device is the syphon which con-
ducts the water over the ditch bank to the
field, eliminating the cutting of ditch-
banks and effecting a saving in irrigation
labor.

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Black-end of Pear problem is subject of extensive field and laboratory studies

L. D. Davis

Intensive investigations have been conducted in the field and in the laboratory since about 1930 regarding black-end or hard-end condition of pears and the relation of the rootstock to the incidence of the disease.

Investigations were extended to include many thousands of trees whose rootstocks were known. The greatest incidence of the disorder occurred on the Japanese stock—P. pyrifolia—although black-end was found on pear trees propagated on P. ussuriensis, P. betulafolia and on P. calleryana stock, it always has been on trees that were said to be propagated on hybrid stock. The greatest incidence of the disease has been obtained by counting the number of black-end fruits on selected trees at weekly intervals.

Materials Tested

A number of materials have been applied to the soil and injected into black-end trees. Among those applied to the soil have been: A complete fertilizer, beet lime, sulfur, iron sulfate, a combination of manure and lime. Oxalic acid, tartaric acid, citric acid, iron sulfate, copper sulfate, boric acid, and a mixture of 12 different salts containing copper, boron, manganese, molybdenum, zinc, thorium, barium, strontium, tungsten, chromium, cadmium, and cobalt have been injected into the trees. None of the soil applications or tree injections has changed the black-end condition of the trees.

Grafts Studied

Reciprocal and intermediate grafts have been made in an effort to transmit the disease. In the intermediate grafts root pieces were used as the intermediates, some having soil filled boxes built around them. None of the grafting experiments has been successful in transmitting the disease.

Several thousand inarched trees have been observed. None of them has cured the disorder except when the original stock has been separated and the top caused to stand upon the inarches.

Young trees have been produced by propagating Bartlett on piece roots obtained from trees that produced black-end.

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IRRIGATION

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The spud ditch finds favor in peat areas where the water table is already reasonably high. It simply saturates the surrounding peat mass with water by rapid percolation through the porous peat.

Cost of irrigation naturally varies with the type of system used. It costs about $3 to pump one acre-foot of water where the total lift is 100 feet. If this total lift is in a well and a sprinkler system is operating requiring a pipe line pressure of about 40 pounds per square inch at the pump discharge, the pumping cost is increased by approximately $3 per acre-foot.

In contrast, some supplies for gravity systems cost as little as 50 cents or less per acre-foot.

The cost of gravity or ditch water depends upon the gross cost of the project and how rapidly it is being amortized.

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<table>
<thead>
<tr>
<th>Type of irrigation</th>
<th>Slope of land in ft./100'</th>
<th>Coarse sandy soils</th>
<th>Medium silt loam</th>
<th>Very heavy clay soils</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Supply needed</td>
<td>Length of run</td>
<td>Supply needed</td>
</tr>
<tr>
<td>Basin</td>
<td>0-2'</td>
<td>20 cubic feet per second/acre</td>
<td>. . . . . . . .</td>
<td>5 cfs</td>
</tr>
<tr>
<td></td>
<td>2-5'</td>
<td>20 cfs/acre</td>
<td>. . . . . . . .</td>
<td>5 cfs</td>
</tr>
<tr>
<td></td>
<td>5-8'</td>
<td>20 cfs/acre</td>
<td>. . . . . . . .</td>
<td>5 cfs</td>
</tr>
<tr>
<td></td>
<td>8-12'</td>
<td>20 cfs/acre</td>
<td>. . . . . . . .</td>
<td>5 cfs</td>
</tr>
<tr>
<td>Border or Check</td>
<td>0-2'</td>
<td>1.5 cfs/10' width</td>
<td>220'</td>
<td>. . . . . . . .</td>
</tr>
<tr>
<td></td>
<td>2-5'</td>
<td>width</td>
<td>220'</td>
<td>. . . . . . . .</td>
</tr>
<tr>
<td></td>
<td>5-8'</td>
<td>. . . . . . . .</td>
<td>220'</td>
<td>. . . . . . . .</td>
</tr>
<tr>
<td></td>
<td>8-12'</td>
<td>. . . . . . . .</td>
<td>220'</td>
<td>. . . . . . . .</td>
</tr>
<tr>
<td>Furrow</td>
<td>0-2'</td>
<td>.02 cfs each contour</td>
<td>220'</td>
<td>.01 cfs ea.</td>
</tr>
<tr>
<td></td>
<td>2-5'</td>
<td>.02 cfs each furrows 2%</td>
<td>220'</td>
<td>.006 cfs ea.</td>
</tr>
<tr>
<td></td>
<td>5-8'</td>
<td>.02 cfs each slope</td>
<td>220'</td>
<td>.002 cfs ea.</td>
</tr>
<tr>
<td></td>
<td>8-12'</td>
<td>.02 cfs each</td>
<td>. . . . . . . .</td>
<td>. . . . . . . .</td>
</tr>
<tr>
<td>Sprinkler</td>
<td>0-2'</td>
<td>2&quot; per hour</td>
<td>. . . . . . . .</td>
<td>.5' per hour</td>
</tr>
<tr>
<td></td>
<td>2-5'</td>
<td>2&quot; per hour</td>
<td>. . . . . . . .</td>
<td>.5' per hour</td>
</tr>
<tr>
<td></td>
<td>5-8'</td>
<td>1.5' per hour</td>
<td>. . . . . . . .</td>
<td>.4' per hour</td>
</tr>
<tr>
<td></td>
<td>8-12'</td>
<td>1.0' per hour</td>
<td>. . . . . . . .</td>
<td>.3' per hour</td>
</tr>
</tbody>
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