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 clays 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 determine the best method of irrigation. These determining factors include seepage, operation simplicity, maintenance, rodent destruction, life of the system, first cost, weed contamination, degree of interference 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 structures 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 outlets.

Application

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

Basins, checks, and borders are basically 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-leveed 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 conducts the water over the ditch bank to the field, eliminating the cutting of ditchbanks and effecting a saving in irrigation labor.

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COMPARISON OF DITCH AND PIPE LINE IRRIGATION IN RELATION TO VARIOUS FACTORS

Factor	Soil Type	Ditch	Pipe Line
Seepage	Sand	High—wasteful	Slight to none
	Loam	Moderate—occasionally wasteful	Slight to none
	Clay	Low—negligible waste	Slight to none
Operation simplicity	Sand	Washing a problem	Less washing than ditch
	Loam	Some washing—may be high	Limited washing to none
	Clay	Little or no washing	None
Maintenance	Sand	Difficult to keep in shape	None
	Loam	More stable than sand	
	Clay	Relatively stable—keeps shape	
Rodent destruction	Sand	Often not suitable for burrowing (caves in)	None
	Loam	Burrowed readily and frequently	
	Clay	Burrowed readily and frequently	
Life	All types	Must be remade frequently to plug rodent holes and control weed growth for all soil types	Long—15 to 20 years or more
First cost	All types	Low—few cents per ft. (3c to 10c)	Higher—from 55c for 8″ to $1.50 for 18″ (approx. price laid in field)
Weed contamination	All types	Always a hazard, sometimes serious	None
Interference with cultivation	All types	Often definite obstruction to cultivation	Below ground—little or no interference
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

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 *Kieffer* seedling roots.

Although the trouble has been found on trees that were said to be propagated on *P. calleryana* stock, it always has been small in amount. There have been a few cases where black-end has occurred on what has seemed to be French—*P. communis*—rootstock. The occurrence on French root however, has been so rare that the question might well be raised whether these particular trees might not be propagated on hybrid stock.

Records have been kept of the performance of individual trees over a period of years. The trouble does not spread throughout the orchard. All degrees of severity have been found; trees tend to hold their relative positions from year to year with respect to the amount of black-end produced.

The curve of 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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Rate of Water Supply and Length of Run for Various Types of Irrigation and Slopes of Land

Type of irrigation	Slope of land in ft./100'	Coarse sandy soils		Medium silt loam		Very heavy clay soils	
		Supply needed	Length of run	Supply needed	Length of run	Supply needed	Length of run
Basin	0– 2'	20 cubic feet per second/acre	....	5 cfs	....	2 cfs	......
	2– 5'	20 cfs/acre	....	5 cfs	....	2 cfs	......
	5– 8'	20 cfs/acre	....	5 cfs	....	2 cfs	......
	8–12'	20 cfs/acre	....	5 cfs	....	2 cfs	......
Border or Check	0– 2'	1.5 cfs/10'	220'	.5 cfs/10'	550–880'	.3 cfs/10'	to 1,000
	2– 5'	width	220'	width	550–880'	width	to 1,000
	5– 8'	....	220'	....	550–880'	....	to 1,000
	8–12'	....	220'	....	550–880'	....	to 1,000
Furrow	0– 2'	.02 cfs each	220'	.01 cfs ea.	440–660'	.005 cfs ea.	880'
	2– 5'	.02 cfs each	contour	.005 cfs ea.	220–440'	.003 cfs ea.	550'
	5– 8'	.02 cfs each	furrows 2%	.002 cfs ea.	110–220'	.002 cfs ea.	330'
	8–12'	.02 cfs each	slope				
Sprinkler	0– 2'	2" per hour	....	.5" per hour	....	....	
	2– 5'	2" per hour	....	.5" per hour	....	....	
	5– 8'	1.5" per hour	....	.4" per hour	....	....	
	8–12'	1.0" per hour	....	.3" per hour	....	....	