Crop Irrigation Nation's Prime Water Consumer

By M. N. LANGLEY

The earth's total water supply—especially its fresh water supply—needs to be put in perspective. Estimates have been made that there are approximately 326 million cubic miles of water on this earth. This is reassuring—until you consider that about 317 million cubic miles of that total supply is salt water in the oceans, and an additional 1 million is salty ground water. This leaves 8 million cubic miles of fresh water, or less than 2½ per cent of the total world supply. But here again, 7 million cubic miles is tied up in the polar ice-caps, and the remaining 1 million cubic miles of fresh water is largely confined to our underground aquifers.

Hence, only about one-hundreth of one per cent of the earth's water supply — 33,400 cubic miles — makes up the fresh water stored in lakes (30,000 cubic miles), the atmosphere (3,100 cubic miles), and the world's rivers (300 cubic miles). The wise use of water and water conservation in connection with irrigation involves utilization of a total supply of fresh surface water and ground water comprising only one- or two-hundreth of 1 per cent of the earth's water supply at any moment. And when this supply is limited only to the water in the atmosphere and in the earth's rivers at any moment, then only about one-thousandth of one per cent of the earth's water supply is involved.

To paraphrase an old saying, its "water, water everywhere, but mighty little fresh water within the economic reach of the farmer!"

The earth's total water supply remains almost constant, going through the hydrologic cycle of evaporation from the ocean, lakes, streams, and land surfaces, and transpiration from vegetation; condensation in the atmosphere, and precipitation back to the water and land surfaces. Water falling on the land surfaces may become soil moisture and support plant growth, it may enter ground water aquifiers, or it may run off into streams. Of course, water in the latter two stages finds its way often after use and reuse, back to the ocean again.

Use of Water for Irrigation

The dynamic nature of the hydrologic cycle is illustrated by the fact that while the earth's entire atmosphere holds only about 3,100 cubic miles of water at any moment, the average annual precipitation in the continental United States alone is approximately 1,430 cubic miles in volume.

In 1969 irrigation will represent more than 80 per cent of the total consumptive use of the water withdrawn from streams and the underground in the United States. Irrigation consumptive use totaled 57.1 million acre-feet in 1960, about 84 per cent of the total use for all purposes. By 1965, irrigation consumptive use had increased to 72.5 million acre-feet, about 83 per cent of a total use of 87.1 million acre-feet.

Irrigation Trends

The Bureau of the Census takes a census of irrigation once each 10 years and collects some limited data on irrigated acreages each five years in connection with its census of agriculture. The last such census was in 1960, with an interim census in 1964. Reclamation conducts a rather complete annual census of the irrigated acreage and crop production on federal reclamation projects, but this represents less than 20 per cent of the total irrigation in the United States.

In any event, judging from the best data we have been able to assemble, irrigation in general and sprinkler irrigation in particular, has been expanding significantly. During the 10-year period, 1958 through 1967, the total irrigated acreage in the United States increased from about 36 million acres to more than 45 million acres, an increase of approximately 26 per cent. Of these acreages, about 3.2 million acres were irrigated by sprinkler in 1958 and 7.6 million in 1967, an increase of over 4 million acres of 130 per cent during the 10-year period.

This increase of more than 4 million acres in sprinkler irrigation over the past 10 years is shared by all regions of the nation — but it has been especially marked in the West. Nearly a third—1,335,000 acres — occurred in the Pacific region. Here the sprinkler irrigated acreage increased from about 925,000 acres in 1958 to 2,260,000 in 1967.

The growth of sprinkler irrigation on the Columbia Basin Project in Washington has been much more dramatic than the national average. The total irrigated acreage on the Columbia Basin Project increased from 238,300 acres in 1958 to 452,800 acres in 1967. Of these acreages, about 54,800 were irrigated by sprinkler in 1958 and 179,700 acres in 1967, an increase of about 125,000 acres or nearly 230 per cent during the 10-year period compared to the national increase of 130 per cent.

The project's distribution system was initially laid out for gravity irrigation and most of the farms were initially irrigated by gravity flow, so this gain in sprinkler irrigation represents a major transition.

The Trend Towards Sprinklers

Several economic and physical factors have caused these trends toward sprinkler irrigation. Foremost is the opportunity to substitute electrical energy and capital investment (that can be amortized) for labor that is becoming more costly and less readily available.

For example, the capital cost of a self-propelled sprinkler irrigation system is approximately the same as the cost of leveling land and developing a farm irrigation system for gravity irrigation. The cost of maintaining the two systems is also about the same. Therefore, a major economic consideration by the water user is the relationship between cost of power to provide sprinkler pressure for a unit of water and the cost of irrigation labor to apply an equal unit of water by gravity irrigation. As labor costs have risen and electrical power rates have declined, it has become more and more feasible for the farmer to substitute electrical power for farm labor and convert to sprinkler irrigation.

With sprinkler irrigation the farmer can irrigate:

(1) Shallow lands, without disturbing the topsoil by land leveling;

(2) Steep lands without problems of excessive runoff and soil erosion; and

(3) Sandy lands, without excessive deep percolation and related fertilizer leaching.

As a result of these advantages, lands which would have been considered nonirrigable for gravity irrigation are frequently susceptible for sprinkler irrigation. This convertibility permits a consolidation of individual farming operations and of project distribution systems to most effectively serve a given acreage.

We are studying comparative costs between open canals for gravity irrigation distribution systems and for sprinkler irrigation for an area of approximately 20,000 acres in the Garrison Diversion Unit in North Dakota. Preliminary indications are that a closed pipe system designed for sprinkler irrigation can be constructed within the cost range of an open canal gravity system as originally planned for that area. This is possible partly because a dominantly closed pipe system for sprinkler irrigation means that a much more compact area of land can be served for a like irrigable acreage.

Winter Upkeep Adds to Life Of Water Gear

Without good maintenance you cannot expect your equipment to last or operate satisfactorily. The following are some suggestions:

Store aluminum pipe off the ground and away from birds and animals to protect it from chemical and physical damage. Inspect coupler gaskets and store them in water. Replace those with hard or cracked edges. Clean gasket seats. Repair bends and leaks.

Inspect sprinkler heads. Repair or replace those with bent parts, weak springs, or those that do not rotate properly. A sprinkler should rotate one to two turns per minute. Many times replacement of the washer and smoothing the washer seat will correct rotation problems. Inspect nozzles for enlargement. The size of the nozzle is stamped on it. Use the shank end of a drill bit to check the wear by inserting it into the nozzle.

Check horizontal centrifugal pumps. Remove suction cover and check wear at the impeller eye and wearing ring. Replace and repair if the clearance is greater than recommended by the manufacturer. If leakage through the packing gland has been excessive, remove the gland and packing. Check wear on the shaft sleeve. If worn or grooved, it should be replaced. In reassembling, always use new packing.

Turbine pumps. Have thrust bearing checked once a year. This should be done by a service man. Following a long shutdown, start oil dripping in oil-lubricated deep-well turbines a week before starting.

Electric motors. Check resistance of insulation (megohm check) in large motors annually. A change in resistance readings from year to year will provide a guide to baking and revarnishing schedules. Store small motors in a dry place. Check contacts on starting switch and main switch for burning. When starting in the spring, be sure rotation is right. In areas of high winter humidity, 480-volt motors should be thoroughly dried before being hooked up. This can be done by heating or by an electrical short circuit. The latter should be done only by a qualified service man.

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