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FURROW IRRIGATION

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While furrow irrigation should be considered only on areas where the surface slopes are fairly regular, the soil fairly heavy, and especially where there is a good water supply at or near the surface, we should not overlook the fact that its use is not limited to relatively flat land. In some localities it is managed with complete success, even on steep hillsides. In California and Oregon large areas of hillside orchards depend wholly upon irrigation water moving slowly along furrows that, in general, follow the contour of the land with just enough gradient to cause flow along the winding rows of trees or bushes.

In recent years farmers, generally, have learned the benefits of terracing and contour farming for control of soil erosion. Hence they know something about the fundamental principles underlying control of water flow on steep hillsides. Contour farming may just as well be practiced for irrigation as for control of soil erosion. In strip farming for soil erosion control, if care is taken to lay the strips on a slight grade, one could also irrigate them by running water down the furrows between the well-hilled rows. Conversely, a system of furrows for distribution of irrigation water will also serve as an effective erosion control system.

Tillage of a hillside orchard, planted on the contour, tends to form bench terraces. This result is usually a highly desirable one since, on a well-developed bench terrace holding a row of trees, there is ample room for a basin around each tree, resulting in a modified form of the basin system of irrigation. It is quite possible that a system of terraces for soil erosion control might be used also as a surface irrigation system for an orchard. The trees could be planted about on the crest of the bank of the terrace. Above each tree the terrace ditch could be deepened to form a basin that would collect, for the use of the trees, both rainfall and any irrigation water that might be applied.

In Minnesota a common location for raspberries and other small fruit plots is on rolling land adjacent to lakes. It would be impossible to furrow irrigate most of these fields as they are now planted but such fields can be laid out in the beginning so that water will flow slowly between the rows.

Planning the System

When planning contour furrow irrigation, unless the slope of the field is quite uniform a topographic map should first be made. Various plans may then be tried on paper and the best one selected before laying it out on the field. Guide lines should be laid out with the aid of a field level. A furrow gradient of from 3 to 6 inches per 100 feet of ditch, depending upon the soil type, affords the ideal condition of water flow in the furrows. On lands having a natural fall of more than 3 to 5 feet per 100 feet of distance, the furrow gradient must be increased to insure against overflow. On steep hillsides where the natural fall of the surface is as much as 20 to 25 feet per 100 feet a maximum furrow gradient of about 2 feet per 100 feet for the lighter soils and about 3 feet per 100 for the heavier soils that tend to resist erosion, may be used. In general, according to soil type, the desirable length of furrow usually lies between 300 and 600 feet, although in special cases it may be as much as 1,300 feet.

Equipment and Power Requirements

Portability in irrigation equipment for semi-humid areas is desirable because such equipment may be stored readily when idle. Permanent field structures rapidly deteriorate, with disuse, during wet years. Where the irrigated area borders a lake or stream a portable pumping plant is easily moved from one position to another, along with the distribution pipe, thus saving materially on the amount of pipe needed. In such cases or where the water supply is at or near the surface, a single stage centrifugal pump, direct driven by a used automobile engine in good condition, may be used. Such a combination provides a low cost unit that is compact yet of large capacity. Portable steel pipe, obtainable in almost any size in from 10 to 20 foot lengths equipped with quick-acting couplings, is very advantageous. Such pipe may be moved to successive positions across the rows, applying the water to the furrows at intervals the length of which will depend upon the furrow gradient and soil type. One kind of portable pipe is equipped with reinforced, tapered ends which fit together like stove pipes. This pipe, which works very well under heads up to about 40 feet, is equipped with small gated openings in the walls through which controlled amounts of water may be turned into each row. For greater pressures a heavier, electric-welded, portable pipe, equipped with rubber-sealed, quick-acting couplings, is obtainable. It may be moved just as easily as the lighter pipe and will stand any pressure ordinarily encountered in irrigation. It sells, in the 6-inch size, for 80 cents to $1.00 per foot with couplings. The lighter, gated pipe is somewhat cheaper. A combination of the two works nicely, the stronger for delivery of water to the field, and the lighter for distributing it to the rows. Six-inch pipe will deliver, without excessive frictional loss, about 500 gallons of water per minute, which is sufficient for supplemental irrigation of 25 to 50 acres of land.

Economic Considerations

Irrigation in Minnesota is a stand-by proposition. As a rule precipitation supplies the greater part of the needed moisture. Some years no irrigation is needed. Many seasons a single irrigation, only, is required. Therefore, it is desirable to keep the overhead cost of irrigation equipment as low as possible. There will usually be not more than 30 pumping days in an ordinary dry year. A low priced gasoline engine will often be cheaper, in the long run, than a Diesel, even though the latter burns much cheaper fuel. Where the power requirement does not exceed 5 horse power and where the pump is near the power line, electric pumps are more satisfactory and about as cheap to operate as gasoline driven pumps. In deep wells where more than 50 gallons per minute are needed, a deep well turbine pump must be used.

Due to greater losses, furrow irrigation requires about twice as much water as spray irrigation, but the latter requires about twice as much pressure, thus making the power requirements for the two systems about equal. Because of the greater losses when the cost of water is high, as in pumping from deep wells or purchasing from city mains, spray irrigation is usually preferable. In such cases the high cost of supplemental irrigation seems justified only for crops such as fruits and vegetables yielding a high return per acre.

In Nebraska, where pump irrigation is extensively practiced, pumping operation costs an average of about 10 cents per acre-foot per foot of lift.

Furrow distribution is easily and cheaply accomplished on slightly sloping lands. On steeper lands the cost is considerably greater, but even there, as a rule, it is less than that of spray distribution, and the furrow method has the additional advantage that it may also serve as an erosion control system.

The principal item of cost of the furrow distribution system is that of the farm labor requirement in laying out and making the furrows, while the greatest item of cost of a spray system is the heavy initial investment necessary for spray equipment.

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