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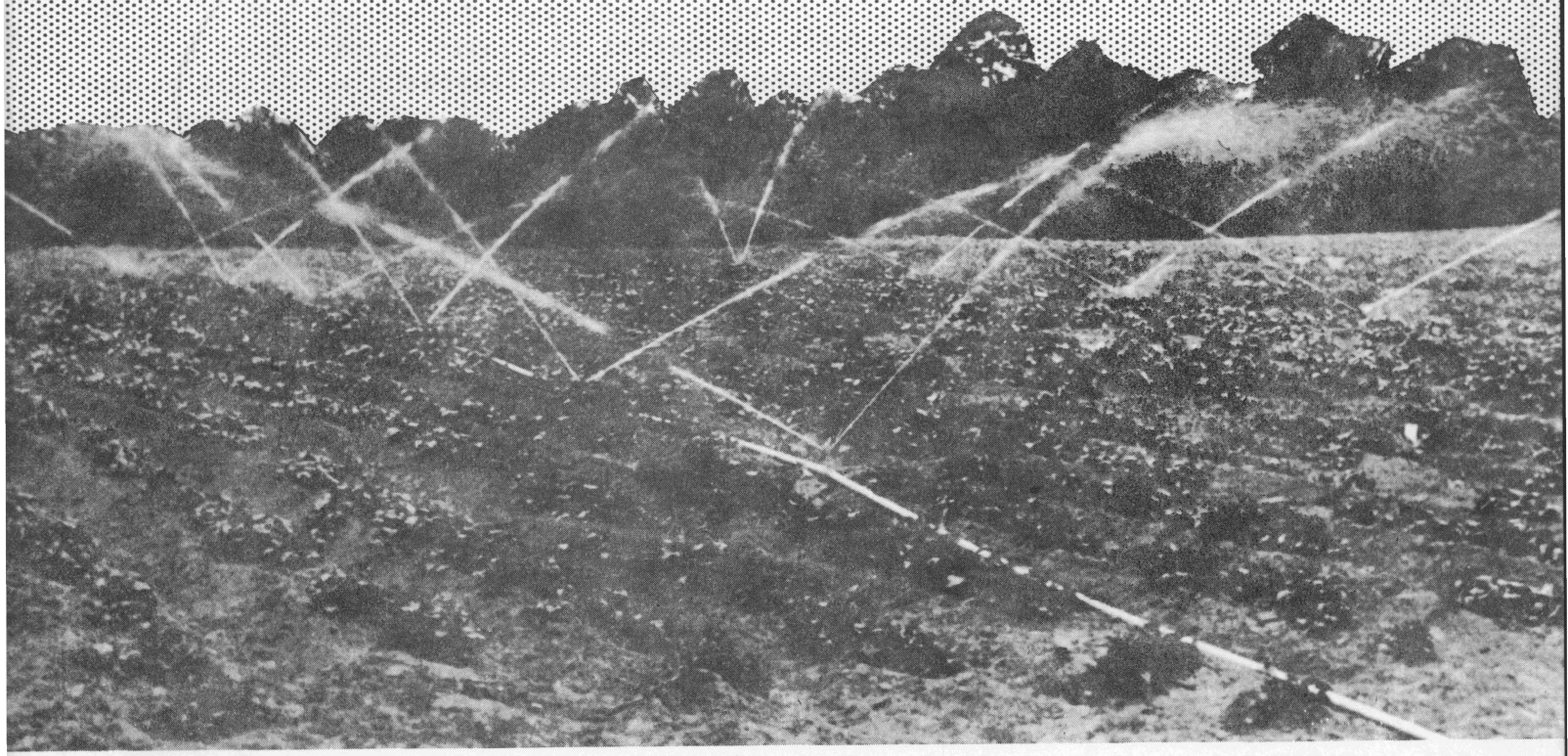
Sprinkler Irrigation



TEXAS AGRICULTURAL EXTENSION SERVICE
G. G. GIBSON, DIRECTOR, COLLEGE STATION, TEXAS

SPRINKLER IRRIGATION

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Sprinkler irrigation has been gaining popularity in recent years as a method of irrigation. Probably the main reason for this is that it can be readily adapted to land that cannot be irrigated successfully by surface methods. The farmer must remember, however, that sprinkling is only one of many methods of applying water to land. The important phase of irrigation is applying the right amount of moisture to the soil for plant use at the proper time. Any method which accomplishes this without unreasonable waste of water, soil, time, and effort is satisfactory. When conditions are favorable for applying water by surface methods, it may be difficult to justify the comparatively high cost of sprinkling.

CONDITIONS FAVORING USE OF SPRINKLER IRRIGATION

1. Uneven, hummocky ground or steep slopes upon which leveling would not be economically feasible.
2. Sandy soils that are subject to erosion and have high water intake rates.
3. When the water supply is inadequate to cover the land by surface methods.
4. Shallow soils underlain by gravel, caliche or high water table.
5. Water supply so located that it must be pumped.
6. Land adaptable to the production of high cash value crops that can bear comparatively high irrigation cost.
7. Rainfall sufficient or almost adequate for crop production.
8. A constant farm labor supply that is used primarily for other purposes, but can be made available for moving sprinkler equipment.

LIMITATIONS OF SPRINKLER IRRIGATION

1. High initial investment -- The cost of a complete sprinkler system per irrigated acre may vary from $50 to $150 depending on the amount of land to be irrigated and location of the water supply.

2. Continuous expense for power -- Successful operation of a sprinkler system requires that water be under adequate pressure in the system. Pumping water to develop this pressure is a continuous cost.

3. Moving pipe is an expensive job and it is disagreeable, especially in cultivated fields where the soil is muddy. Laterals must be moved regularly from one set to another during irrigation. Although the expense for labor to move sprinkler pipe may not be higher than would be required for surface methods, it still is a large item.

4. A sprinkler system lacks flexibility. It is designed for only one capacity and is not easily adjusted to emergencies.

5. Wind affects water distribution -- High winds distort the spray pattern and increase evaporation.

THE SPRINKLER SYSTEM

Sprinkler systems consist of a pump and power unit to obtain water from the source of supply and provide adequate pressure for proper operation of the system; pipe lines transport the water under pressure to the desired points in the field, and rotating sprinkler heads or small perforations in the pipe distribute the water on the land.

Pumps -- The horizontal centrifugal pump is well adapted to a water supply obtained from a pond, creek, river, or irrigation ditch where the suction lift does not exceed 18 feet. Centrifugal pumps are relatively inexpensive and can deliver water in a steady flow against the required pressure for satisfactory operation of the system. Centrifugal pumps are light and portable. Inasmuch as centrifugal pumps must be primed, some convenient device should be provided.

Where water is obtained from a well, the deep well turbine pump is best adapted. Extra stages may be added to the pump to supply the necessary pressure for operating the system. In this case a booster pump would not be needed. Deep well turbine pumps are more expensive than centrifugal pumps and are not portable. The pump will lift water from a great depth and requires no priming as the bowls are submerged.

Power Units -- The centrifugal pump, or deep well turbine pump, may be powered by internal combustion engines or electric motors if electric power is available. Electric motors are convenient, dependable, require little maintenance, and operate efficiently. Three phase current is necessary to operate electric motors in excess of 10 horsepower. Internal combustion engines are desirable for their flexibility of speed and portability. The pump and engine may be mounted on a trailer affair and moved easily to desired locations.

Pipe Lines -- Aluminum or light weight galvanized steel pipe is ordinarily used for portable systems and is available in sizes ranging from two to six inches in diameter and lengths of 20, 30, and 40 feet. Couplings on each joint of pipe are provided for quick assembly and disassembly of the line. Pipe lines used to convey water to the sprinkler heads usually consist of a main line and one or more sprinkler lateral lines. Main lines are used to transport water from the pump to the lateral lines. They may be either portable or non portable. Main lines may also be equipped with tees and shut-off valves at proper intervals to permit quick and easy connection of lateral lines.

Lateral lines are laid out across one end of the field to be irrigated. Water is conveyed through the lateral line to the sprinkler heads spaced 40 to 60 feet along the line, or through small perforations in the pipe, which distribute the water to the land. The width of the strip sprinkled will usually be from 20 to 40 feet wide on each side of the lateral line. When sufficient water has been applied from one setting, the lateral pipe is then moved in sections and set up again on a line 40 to 60 feet from the first setting.

Sprinklers -- Rotating sprinkler heads with one or two nozzles provide for distribution of water. Water under pressure is discharged from the sprinkler nozzle, wetting a circular area about 80 to 120 feet in diameter. The pressure necessary to operate successfully rotating sprinkler heads will range from 20 to 50 pounds per square inch.

Systems using perforated pipe instead of rotating sprinkler heads usually operate under pressure of 5 to 20 pounds per square inch. Small perforations in the pipe are so spaced to give uniform distribution of water which will wet a strip about 25 to 40 feet in width.

IMPORTANCE OF PROPER DESIGN

Proper design of a sprinkler system is essential for successful operation. The best of equipment that is not properly designed for the particular needs of the individual farm unit to be irrigated may not perform satisfactorily.

Design of a sprinkler irrigation system is a complicated undertaking. To be assured of obtaining a system that will operate successfully, the farmer should purchase the system from a reliable dealer who has qualified personnel to design a system to fit his individual farm needs.

Some of the more important considerations in design should provide that:

1. The application rate should not exceed the water intake rate of the soil. Some soils may take water at rates as low as .2 inch per hour, with others as high as 2 inches per hour.

2. The total amount of water applied in one irrigation should be sufficient to wet only the soil plant root zone.

3. Lateral design should provide for not more than a 10 percent variation in sprinkler nozzle discharge rates. This will prevent one part of the field being over irrigated and another part under irrigated.

4. The system should have adequate capacity to meet peak water requirements of the crops to be grown.

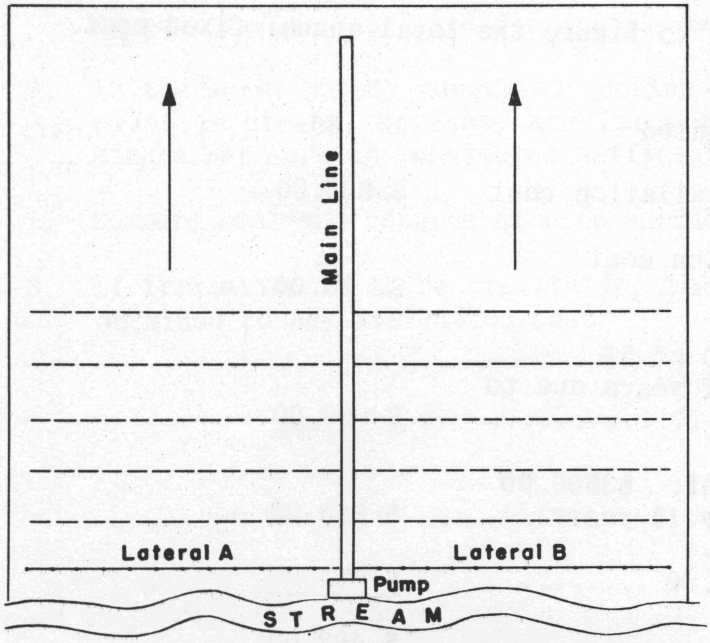
5. Pipe size should be economical from both purchase and operating standpoint. Pipe that is too small costs less initially, but will increase pumping cost because of increased friction.

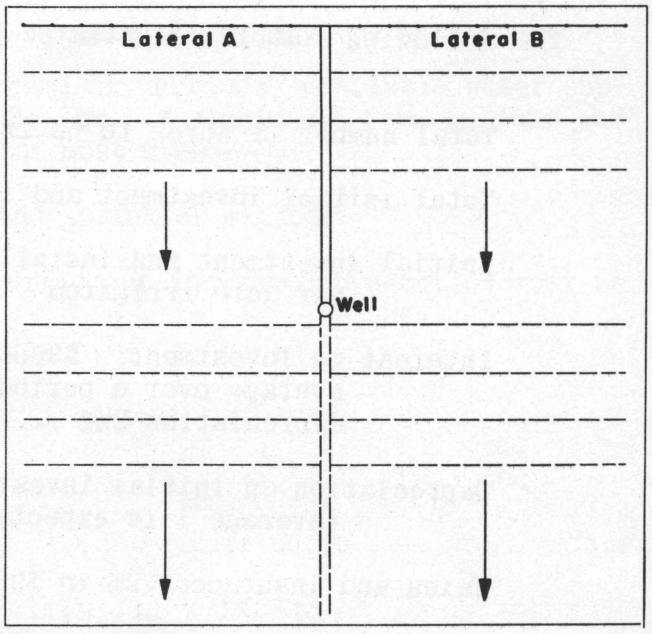
6. Limiting factors such as water, power, land, wind, and crops to be grown on the individual farm involved should be considered.

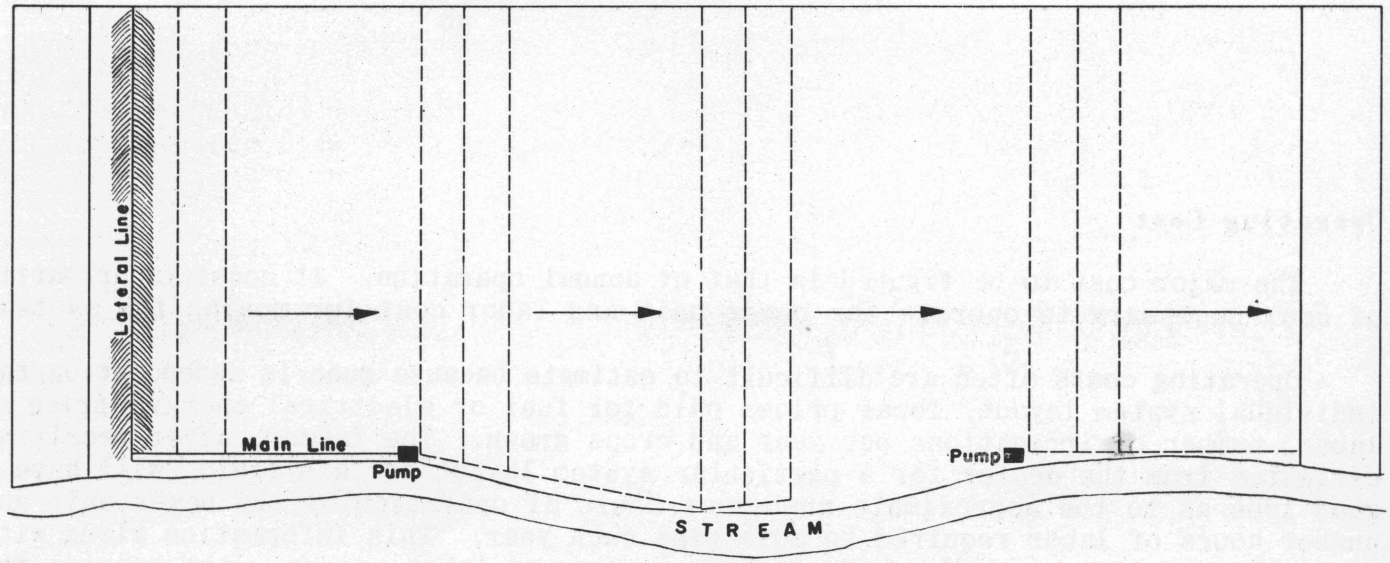
7. The proper application of water should be made at a reasonable cost.

POSSIBLE LAYOUTS

Sprinkler irrigation systems may be either semi-portable or portable. In either case, the sprinkler lateral is designed to be completely portable. Semi-portable systems are often designed with a stationary pump location where the main line may or may not be portable. Portable systems include those designed for complete mobility of pump and power unit, and main line. Systems that are completely portable require less pipe but will involve increased labor to move pipe.







HOW TO FIGURE COST

Initial cost of the sprinkler system will depend largely on the type and amounts of equipment needed for the individual farm unit. If the farmer receives cost estimates of the initial installation, he can then figure annual irrigation cost with some accuracy.

Total annual cost of sprinkling involves *fixed cost* including interest on the investment, depreciation, taxes, insurance, and *operating cost*.

Fixed Cost

The following example illustrates how to figure the total annual fixed cost.

Total number of acres to be irrigated	40
Total initial investment and installation cost	$3600.00
Initial investment and installation cost per acre irrigated	$ 90.00
Interest on investment: $3600.00 at 5% average over a period of years due to depreciation 2½%	$ 90.00
Depreciation on initial investment: $3600.00 (average life expectancy 15 years)...	$ 240.00
Taxes and insurance: 2% on $3600.00	$ 72.00
Total	$ 402.00
Total Fixed Cost per acre per year $\frac{\$402}{40}$ =	$ 10.50

Operating Cost

The major cost to be figured is that of annual operation. It consists primarily of cost necessary to operate the power unit and labor cost for moving the system.

Operating costs often are difficult to estimate because much is dependent on the individual system layout, local prices paid for fuel or electrical energy, price of labor, number of irrigations per year and crops grown. The farmer, after receiving estimates from the dealer for a particular system layout for his field, will have a good idea as to the approximate number of hours of operation of the power unit and number hours of labor required to move pipe each year. This information along with local prices paid for fuel of electrical energy and labor prices, will provide for figuring annual operation cost. Maintenance cost of the system is small in comparison with other cost, but should be included when arriving at the total annual operation cost.

After figuring annual fixed cost and annual operation cost, the farmer will have the total cost per year. Only after comparing the total annual cost of sprinkling with the cost of other methods and considering all factors involved, can the farmer be sure a sprinkler system is a good investment.

POINTS TO CONSIDER

If the farm is already irrigated by surface methods:

1. Compare present annual irrigation cost per acre by surface methods with estimated cost of sprinkling.

2. Compare the returns now received with those estimated for the sprinkler method. It is doubtful that increased yields will result by sprinkling if a good job is already being done by surface methods.

If new land is developed for irrigation:

1. Is the water supply adequate? During extreme dry periods, available water supplies in creeks, streams, and lakes may be low. A supply of five gallons per minute per acre is considered sufficient for most crops.

2. Compare cost and returns of both surface and sprinkler methods.

3. If irrigation is to be profitable, then sufficient increased production must be obtained to pay irrigation cost.

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