

SPRINKLER IRRIGATION SYSTEMS FOR CITRUS ¹

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Florida citrus growers have the most diversified means of applying supplemental irrigation of any state in the nation. It is estimated that some 500,000 acres (200,000 ha) of Florida citrus and other fruit crops are under sprinkler irrigation of various types of systems.

There are 4 main types of sprinkler systems used in citrus: 1) perforated pipe, 2) portable high pressure guns, 3) permanent overtree or undertree and 4) self-propelled guns. Perforated pipe and other portable systems are rapidly being replaced due to high labor demands of 1.5 to 2.0 man-hours per acre-inch (ha-cm). Permanent overhead systems in Florida have gradually increased subsequent to the 1962 freeze to their present status in 1975 of over 150,000 acres (60,000 ha) and account for about 30% of irrigated citrus now under sprinkler irrigation.

The reasons for the influx of permanent and self-propelled gun systems are two-fold. First, greater mechanization with a reduction in labor, and secondly, greater crop returns when irrigation is used properly. Irrigation was used in previous years mainly for crop survival and insurance; therefore, only 1 or 2 applications were applied per year with little, if any, benefits from increased yields.

PLANNING SPRINKLER IRRIGATION FOR CITRUS

Citrus response to irrigation is the major factor contributing to the increase in permanent system installations. Research at the Lake Alfred Agricultural Research and Education Center show improvement in yields of 12 to 35% for certain oranges and up to 47% for grapefruit.

There are many important decisions management must make in planning irrigation. Many of these decisions should be made before consultation with a supplier of

irrigation equipment or a design engineer. First, the manager must decide on a given acreage and a variety which will respond most to supplemental irrigation. Secondly, he must make a decision as to labor and capital availability. Next, he must be familiar with the characteristics and performances of each type system. Finally, he must seek and insist on the best qualified irrigation firm to do the job.

It should be emphasized here that the total performance and dividends from an irrigation system are based on 1) planning by management, 2) the design, quality and installation of the system and 3) the operation of the system or how it is used.

PRESENTLY AVAILABLE SYSTEMS

Permanent sprinkler systems are generally used for high-value cash crops such as citrus or orchard crops, ornamentals, lawns and golf courses. Initial costs of permanent overhead vary from \$1,000 to \$1,200 per acre (\$2,500 to \$3,000 per ha). Use of plastic (PVC) pipe has greatly reduced costs of mains and laterals for permanent overhead systems. These systems serve a dual purpose in cases where there is need for frost or freeze protection which helps to justify the large investment costs.

Other types of permanent systems are undertree systems using either Senninger pop-up, spray heads or microjet nozzles. Microjet systems use PE hose above or below ground for laterals and thereby eliminate installation of PVC pipe, and total initial costs are some \$450 to \$600 per acre (\$1,125 to \$1,500 per ha).

Self-propelled or traveling gun units are simply large guns (sprinklers) that irrigate square or rectangular tracts. The first self-propelled gun irrigation unit was introduced into the U.S. in 1966. There are over a dozen manufacturers of these units in this country today. Some 700 to 1,000 units have been sold in Florida during the past 6 years.

The "traveler", as it is called, is a giant sprinkler (125 to 1,200 gpm) mounted on a 4-wheel transport and powered by either an internal combustion engine, water

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turbine, water-piston or oil hydraulic motor. The standard unit is the 550 gpm unit which handles 60 to 80 acres (24 to 32 ha) of citrus very well. The unit pulls a rubber hose (4.25-inch or 10.8-cm diameter) 660 feet (201 m) in length and travels from 0 to 60 inches (153 cm) per minute. The traveler, gun, hose and hose take-up reel retails for approximately \$8,500.

That "travelers" are adapted to odd-size fields, a wide range of plant and soil conditions and have low initial cost per acre are important advantages. Disadvantages include friction loss in the hose (20 to 30 psi), which must be added to total dynamic head and is reflected in higher power requirements, and a medium labor requirement of 0.20 man-hours per acre-inch (ha-cm). However, extreme flexibility makes the unit attractive for citrus crops.

SUMMARY

Sprinkler systems for citrus production come in a variety of styles and combinations. Low initial investment systems are self-propelled guns, portable guns and perforated pipe. Highest initial investment systems are permanent type (overhead and undertree).

For 12 inches (30.5 cm) of supplemental irrigation on an annual basis, total costs range from \$50 to \$75 per acre (\$125 to \$190 per ha) per year (Table 1).

QUESTIONS

Q: Did you say 12 inches (300 mm) per year in that last statement? (Yes). Well, we have just finished figuring our water cost, and we don't come up with \$75 per acre per year. Our irrigation is costing about \$35 per acre per year, using volume guns and applying 7 to 8 inches (175 to 200 mm) per year. How many irrigation days were used?

Myers: I'm not sure about the number of irrigation days involved, but your figures are about \$4 per inch (2.5 cm) for water, whereas our figures represent about \$6 per inch (2.5 cm). That simply means that your irrigation system is somewhat better than the state average shown here. Source of water is also a big factor in these figures, as they were computed on the basis of weighted averages for water costs from canals versus water from deep wells, with the latter being more expensive. Since your water comes from canals, it would be less expensive than the average cost used in these computations.

Table 1. Some characteristics of sprinkler irrigation systems used in citrus production^x.

Type system	Initial investment (\$/acre)	Variable costs (\$/acre-inch) ^z	Life Expectancy (yrs.)
Permanent overhead	1,000 - 1,200	\$1.50 - \$1.75	25
Permanent undertree	600 750	\$1.50 - \$1.75	25
Self-Propelled gun	275 375	\$2.50 - \$3.75	10 15
Portable gun	250 - 300	\$3.25 - \$7.50	10 - 15
Perforated pipe	250 300	\$5.50 - \$8.00	10 - 15

^xEstimates based upon applying 12-13 inches (305-330 mm) annually.

^z1 acre-inch = 1 ha-cm.