

## AUTOMATIC IRRIGATION SYSTEMS

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The subject of "automatic irrigation systems" is certainly not new. However, what an automatic irrigation system is supposed to do seems to be new to many persons. There are basically two types of automatic irrigation systems being installed today. Most common is the automatic SPRINKLING system. However, a few surface flood systems are now being automated by means of automatically controlled ditch gates, etc. In this paper I shall only talk about automatic sprinkling systems.

Too often the person responsible for the design is concerned only with what kind of pipe, what kind of sprinklers, what kind of valves and what controls must be used to build the system, rather than what the system will actually do.

Let us compare the purchasing of an automatic sprinkling system to the purchasing of a new tractor. The tractor is a preengineered and preassembled piece of machinery which is designed to do a certain amount of work. The size of the tractor is directly proportional to the amount of work that it can do. However, it does not become real property and can be replaced. The automatic sprinkling system is not prossembled and the system must be site-engineered to fit a particular application, usually consisting of components from several manufacturers. Most automatic sprinkling systems are installed underground and are considered to be permanent. Therefore, they have little trade-in value and must be adequate to do a given job without the need for future changes. Each component of the system must, of course, perform its function as it is intended by the manufacturer. However, too often the components become victims of misapplication.

For example, many sprinkling systems are designed to apply water at a "cloudburst rate" which results in what I call "automatic flooding by sprinkling." The cost of the automatic sprinkling system must be offset by reducing irrigation labor, by eliminating unnecessary wasting of water, and by increasing the crop value; otherwise, they are not economically feasible.

Again, let no stress the importance of what the automatic sprinkling system designer must consider. If we define what the system is supposed to do, perhaps it will be easier because a properly designed sprinkling system is one which, after being properly installed, will apply the exact amount of water for growing a quality crop over the entire area, will not waste water and labor for operation and maintenance, be economical in first cost and utilize components that will not require premature replacement.

For some crops it is important to consider the need for applying water for frost protection or for cooling during periods of high temperatures. Once we realize what the automatic sprinkling system is supposed to do, then we can decide what parts and pieces are needed. Basically, the sprinkling system has about the same requirements whether it be for a golf course, a field of potatoes, or a nursery.

An automatic sprinkling system for a nursery should be most interesting for this group. Therefore, let's talk about what some of the requirements of a system for a nursery might be.

Perhaps the first consideration will be to determine the amount and the quality of water which will be needed. The amount of water is based on the maximum demand in any given period of extreme temperature and will vary greatly from the beginning of the growing season to the end. The system must be designed to apply enough moisture for optimum growth through the peak demand, even though this peak may only be of one week's duration. The quality of irrigation water is also very important. Many times the high amount of salts present in the water source is not tolerable. Also the water must be free of debris to avoid plugged valves or nozzles. Proper screening is a technique in itself because we cannot spend too much time in the maintenance of screens if we are dependent on saving of labor. For instance, wrapping a piece of screendoor screen around the foot valve on a pump is not adequate:

In choosing the type and size of sprinkler heads for a nursery, one must consider several factors. For the large outside nursery, normally the medium size rotating sprinkler which discharges about five gallons per minute each are used, as those are the most economical. These sprinklers must be properly spaced, have the proper pressure at nozzles, and have a good profile of water application to assure even coverage.

Proper spacing is related to the diameter of throw of a given sprinkler. Proper pressure is related to the nozzle size and each must be accurate. For instance, low pressure causes large droplet size, and results in a poor profile and soil compaction.

Once we have selected the proper size of sprinklers, their spacing, etc., we then need to determine how many sprinkler heads can be operated from each automatic valve. The number of heads on each circuit, valve, or lateral is very important in the system design as the need for moisture from one area to another can vary greatly.

Some of the factors affecting this are: (1) sun vs. shade; (2) north slope vs. south slope; (3) fertility of soil; (4) size of plant; (5) temperature tolerance; and (6) freezing tolerance. If we are going to conserve water, we must take all these factors into consideration. But most important, what effect does too much or too little water have on the plant?

The number of sprinklers per circuit and the number of circuits must also coincide with the time we have to water a given area. Perhaps we can only water 16 hours each day which requires a larger flow than a system which is operated 24 hours each day. This also increases the cost of the system.

Earlier I said that a properly designed sprinkling system must not waste water. However, sprinklers apply water faster than most soil can absorb water if they are left on too long and run-off is wasted water. This can be avoided provided we design a system that can be easily recycled. This means that a circuit or group of sprinklers are automatically turned on for a few minutes, off for perhaps an hour, then on again for a few minutes, etc. This allows the water to penetrate the soil between cycles. We have learned that recycling also helps to fight the problem of wind distortion of the sprinkler pattern because each cycle may be at a time of different wind direction and velocity. The designer must beware of line drainage through the low heads on each circuit or lateral if he plans to operate the system on a recycling schedule because this would cause waterlogging at each low head, waste water, and perhaps cause excessive hydraulic ram pressures each time the circuit valves open.

The method of automatically timing each circuit valve is also a very important factor to be considered. For example, a 40-acre nursery may require five automatic controllers each located in the center of an 8-acre plot, and each operating 10 automatic valves or circuits. If this is the case, the watering schedule for the night must be set at each controller and requires time, and time is labor. The field controllers may be balancing controllers only to time each valve according to their respective area water needs, and the time for each cycle may be set at a central controller located at the most convenient place. Once the system is in balance, the number of sprinkling cycles required to replenish the soil moisture, as determined by the nurserymen, can be quickly set at the central controller. Perhaps the nurseryman has used tensiometers as an accurate means of measuring soil moisture and then programs the correct number of cycles into his automatic sprinkling system.

In conclusion, I hope I have created an interest so that each of you will think about what an automatic sprinkling system should do, and go far beyond the relatively easy task of equipment selection. There has been a considerable amount of time and money spent by one manufacturer over the past six years in developing a truly automatic sprinkling system for turf irrigation. The same principles may be applied to any automatic sprinkling system without increasing the cost beyond the present systems being installed today. Automatic sprinkling systems are becoming economically feasible at a rapid pace, and any new developments or techniques which will assure a better job without materially increasing the cost surely will be welcomed.

Question: When watering parks, what about picnickers?

Answer: Most watering in parks is done in the dark hours. Persons using the park after dark have to look out for themselves.

Question: Does your company put out any above-ground systems?

Answer: We have a test plot in the State of Oregon - on potatoes. It can be used as a cooling cycle. New types of valves and equipment are eliminating many problems.

Question: Can a system be installed to turn on just the right amount of water?

Answer: This is possible. It might apply fertilizer or be used for weed control. The system would have to be a good one. The designer must think of what it is supposed to do.

Question: Are automatic sprinkling systems ever tied up with automatic monitoring - say 5 to 10 automatic monitors to set off the system?

Answer: A golf course could use such a system. A large main line is needed with a valve in every sprinkler head so heads will not drain out. The system would start sprinkling at pre-programmed times.