

5-Current products, water management systems and maintenance procedures to maximize the water efficiency on irrigation systems for green areas

By Xavier Botrel & Santi Casanella

We have many different products available today in the market to irrigate and to manage our landscape with a great water efficiency manufactured by the different companies in our Industry:

- **Drip line:** We have point -source emitters that normally are self-piercing barb or thread to be inserted to the pipeline, normally are pressure compensate and color coded. Also, there is the possibility to use multi-ports emitters to irrigate groups of plants effectively from one source.
For subsurface that are becoming the more used, the emitter is inserted inside the pipe, there are models that are pressure compensate, anti-siphon and slow draining check valve. There are different sizes of coils as well as with different flows and spaces. Also is available the option of emitter that have copper as is proven to inhibit root growth.
Also exist some system that to deliver the water uses organic chemistry to allow each plant to self-regulate its own water and nutrient delivery. A microporous tube that responds directly to root signals, releasing water and nutrients only when the plant calls for it.
Other options available for subsurface irrigation are the fleece - wrapped dripline and the fleece mat that provides a maximum efficiency for the root zone.
- **Micro irrigation:** These are the micro sprays that apply water accurately for small area coverage. They may have several streams of water, or an adjustable umbrella and there also models that may have different configurations.
- **Sprays and nozzles.** There are several models on the market with several heights available and they may have the options to incorporate a check valve, a pressure regulator, and a flow guard technology to eliminate water waste in the event of a missing nozzle.

Regarding nozzles there are different types: fix arc nozzles, adjustable arc nozzles, strip pattern nozzles, stream nozzles, bubblers. This big variety of nozzles allow us to irrigate the exact area we want without caring of the shape of the design. All nozzles have different radius and flow and are normally identified by colors. When using bubblers to irrigate trees or shrubs, there is the option to use a system call Root Zone Watering, that deliver water and oxygen directly across all levels of the root zone thanks to their StrataRoot baffles. We may use pressure compensate bubblers for accurate water flow as well as choose different flows depending on the tree. This system has a durable locking cap for vandal resistance.

- **Multi stream, multi-trajectory rotating nozzles (MSMTR):** Represent an alternative to fixed spray heads for the irrigation of small landscape areas. Preliminary investigations have suggested that MSMTR sprinklers can apply water with higher distribution uniformities than fixed sprays, offering the potential for water conservation around 31%. MSMTR sprinklers have lower precipitation rates than fixed sprays heads and may be expected to need longer run times to meet a given required amount. The higher uniformity they have partially mitigates this.

Study done by (K. H. Solomon, J. A. Kissinger, G. P. Farrens, J. Borneman).

2007 American Society of Agricultural and Biological Engineers
ISSN 0883-8542

We have actually different brands on the market, as mentioned the save of water is very important. They have a better distribution, have less affectation by the wind and have a better infiltration on the soil, because all these reasons, they are becoming the more used product for the professionals.

- **Rotors:** There are many different types: on plastic or on stain steel. Also, there is the option of to have a pressure regulated on the body to be sure that the nozzle works with the exact pressure and have a good uniformity. There is the option of a drain check valve on the body to prevent low -head drainage up to 4,5m of elevation. Some brands have also a flostop to close the flow of water from an individual sprinkler. Is interesting for vandalism to use the Automatic Arc Return option or Memory Arc option, so when

someone move the turret manually, it returns the turret to the original arc pattern. Always there are available several choices of nozzles that have different colors and may have also different trajectories: standard, high flow, low angle, and match precipitation ones.

- **Valves:** More current ones are manufactured of PVC and Glass-filled nylon but also are available on Brass. We also find the option of valves that have a special filter that are used when we have dirty water, each time the water pass through the diaphragm, there is a disc that scours the filter to prevent any debris to go inside the diaphragm channel.

There is the option to use a pressure regulator to be installed between the solenoid and the valve, this one maybe with a fix pressure or an adjustable one, depending on if we are using drip, sprays, or rotors. Valves may have a 24v solenoid or DC- latching solenoid depending on the kind of controller we are going to use.

- **Controllers:** We have on the market many available Standard controllers. Also are available a big range of Battery powered controllers and Bluetooth controllers. Controllers maybe connected with electrical cables or with a decoder cable when using this type of technology. We have options on the market that goes from 2 stations to 225 stations. Also, we have other options as: to connect different sensors, to manage one or more master valves; to use the function of cycle and soak that someone's has; to use a remote control; to use a flow management option that is interesting for the big installations.
- **Smart controllers:** They offer the option to connect to Wi-Fi platforms. They allow to have a predictive watering base on weather forecast and data collected. They allow to have a remote management. Also is interesting the option for maintenance companies to do a Multisite management as they have a Map-based navigation and status. All these systems are Cloud base, they have a good flow monitoring, they provide with a quick alarm message in case a problem occurs and provide with an interesting alarm reporting. They have the capability to be integrate on the Smart home of an end user.

Today we have the possibility of integrating some controllers that have all these great features to the management of a big city on what is known as a BMS system, so the manufacturer needs to pass their controllers protocols to the Municipality to integrate irrigation on their other system and this is what we know today as a “Smart city”

- **Sensors:** There are many kinds of sensors available on the market today and is important before to choose one to know for what we want to use it: Rain sensors, Weather sensors, Flow sensors, Soil moisture sensors, Temperature sensors, Weather Station's. Some of these ones have the possibility to be also wireless what for many sites is very useful as prevent to have to do cross under asphalt, concrete or other hardscapes.
There are also in line pressure regulators with different sizes that are connected to the pipe in this way we may adjust the exact pressure on a water going downline an installation.
- **Fliters:** If we are not using drinking water, is highly recommended to use a filter, there are many types of filters available on the market, sand filters, mesh filters and disc filters. The more used for a medium and big size installations are the disc filters with an automatic autocleaning.
If we are using recycle water or water coming from lakes, channels, or other sources and specially if we use drip irrigation, always the use of a filtration is recommended.

Maintenance procedures to be recommended:

- To check always if there are units that have some leaking.
- To check that nozzles perform correctly and don't have any debris that affect their performance
- To check that the pressure on the nozzle is the appropriate one to avoid a bad irrigation of this one.
- To verify that the products installed at the pressure they work are placed at the recommended distance by the manufacturer.
- To check that the controller program is well set up and don't forget any station. Or have a no time or only a low time for one station. Or have the seasonal adjustment that is too low or too high. Or there is an overlap on some station. Or there is an electrical problem on the output from the controller to some station, etc.

- To verify that we are giving the appropriate l/h requested by the different plants according to the precipitation of the products used and the irrigation time used.
 - To verify that we don't mix in one sector sprays nozzles with rotors or multi stream and multi rotating nozzles.
 - In case to have to change a nozzle to change for the similar one as one rotor may have a big difference on the performance mainly in flow and radius depending on the nozzle.
 - To verify that if we use fix nozzles, they are installed correctly according to the area to irrigate, if there is a quarter nozzle it must cover 90 degrees not 180.
 - To check that the plants that are not interfering with the jet of the nozzles.
 - To verify that the rotor or spray has not moved from his original position and are installed at the correct height.
 - To verify that the product has not been broken or affected by vandalism.
 - To verify that the valves are working well and are not leaking.
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- To verify the pressure regulation of the valve or the system when using pressure regulators.
 - To verify the filtration of the system as well as the pump station is working correctly.
 - Is important to know which kind of land we have, to know which infiltration rate, it has so we may adjust the time per station or apply what we call cycle and soak.

Below is a table done by the Irrigation Association where it shows the results of a deferred maintenance.

