



Application Note

Irrigation Techniques and Automation

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Irrigation Techniques and Automation

It used to be said: "The man with the hose grows the rose." Now it would probably be more accurate (not to mention, politically correct) to say: "The person managing a fully automated irrigation system grows thousands of roses." Not so poetic, but much more profitable!

Irrigation management is the keystone of successful plant production. Given the number and complexity of different crops produced by the typical North American grower, and the huge number of irrigation equipment and irrigation system design choices he faces, irrigation is arguably the most complex production input the grower manages.

This seminar briefly explores some of the considerations for automated irrigation management.

1) Definitions – what is "automated" irrigation?

- (a) The term "automated" irrigation applies to any irrigation system that is controlled by something other than the direct actions of a person. Typically it means any irrigation system where irrigation is initiated by a control system using operator settings and measured environmental conditions.

2) What are the "levels" of automation you can purchase and what do each offer? Typical cost?

- (a) Time clocks – low cost, but must be constantly adjusted by the user to compensate for changes in the crop and environment. Suitable for small numbers of irrigation zones in one location. Not well suited for larger irrigation systems or where efficiency and accuracy are important. This is often the entry level for most growers. Better than an inattentive or badly trained person.
- (b) Electronic leaf, mechanical weight scale and other environmental sensors that measure some aspect of the crop or its environment and directly initiate irrigation. Moderate in cost, suitable for single zones or small groups of zones if used with a sequencer (some time clocks can also act as sequencers when initiated by an external watering input signal). Sensors can be a big improvement over time clocks because the system can respond to some type of 'feedback' information from the production system and automatically adjust watering response for at least some environmental changes.
- (c) Fully computerized control systems that incorporate all of the features of the simpler systems and add support for a much wider range of input sensors, crop water use models, and most

importantly, efficient irrigation system capacity management. Capital Costs can be low if needs are simple and if irrigation is part of an existing climate control system, or range to very high for advanced capabilities in stand-alone systems. Almost always, this is the only way to go as irrigation system complexity increases. Accuracy and efficiency improvements reduce operating costs considerably, and improvements in crop quality and yield improve bottom-line performance.

3) Why automate your irrigation? What are the benefits? Any drawbacks? Don't you "lose control" of your irrigation?

i) Benefits:

- (a) Reduces daily workloads for management and staff
- (b) Increases irrigation system performance (more crop production area supported by the same irrigation system)
- (c) Reduces run-off, thereby reducing water and fertilizer costs while lessening environmental impact
- (d) Improves irrigation uniformity through more accurate water application
- (e) Improves control of your irrigation by ensuring it gets done exactly when it is needed, not when you can get a round 'tuit'
- (f) Improves crop quality and yield while often reducing disease.

ii) Drawbacks:

- (a) Greater up-front system irrigation design costs
- (b) Sometimes greater irrigation system installation costs
- (c) Steeper learning curve
- (d) Requires better overall crop production organization (this is not always a bad thing!)
- (e) Requires a better level of irrigation system mechanization and maintenance (again, this is not always a bad thing!)
- (f) Automated systems still require close supervision to catch system failures or mistakes.

4) Who should do it? Who gets the most benefits? What crops? Who, if anyone, should NOT automate their irrigation?

i) Who will benefit?

- (a) Almost all commercial growers will derive significant benefits from increasing their level of irrigation automation.
- (b) Larger growers with many irrigation zones derive the most benefit.
- (c) Any grower with well organized crop production systems is an excellent candidate for full automation
- (d) Almost any crop will benefit, but the benefit may not always justify the expense.

ii) Who should not automate?

- (a) Small growers of very forgiving crops (some types of nursery stock, for example)

- (b) Growers with inadequate irrigation delivery systems; they need to upgrade the irrigation system before they can automate it
- (c) Growers who have no desire to improve current production capabilities
- (d) Growers without the management drive to push irrigation automation through to a successful completion.

5) What do you need in place to consider automating your irrigation? Design considerations of your water supply, etc.

- (a) A well maintained, mechanized irrigation system. This includes pumps, piping, control valves and suitable application equipment (drippers, sprinklers, flood benches, etc.)
- (b) Constant availability of sufficient water volume and pressure.

6) FAQs – what are the most frequently asked questions you hear?

- (a) How can I get my present irrigation system into shape, in preparation for automation?
- (b) How do I convert my present management practices to work with increased automation?
- (c) How can I apply sensors and crop models to my unique growing situation?
- (d) How can I get my employees to 'buy into' the automation concept?
- (e) How can I integrate nutrient feed management into an automated irrigation system?

7) Mistakes – what are the most common mistakes you've seen or heard growers make?

- (a) Lack of commitment to complete the automation process. The project dies half way through.
- (b) Asking an inadequate irrigation system to do more than it is capable of doing
- (c) Growers getting carried away with the potential of automation and designing an overly complex system with too many irrigation zones or other system features. Keep it simple!
- (d) Insufficient spatial management of crop types and ages, resulting in a poor fit between the irrigation system's design capabilities and actual crop needs.
- (e) Poor matching between environmental zones and irrigation zones, resulting in some interference between the two (always at the crops expense)
- (f) Poor selection of automation equipment due to a lack of understanding of the benefits and drawbacks of each strategy – the wrong equipment for the job at hand.

8) How can a grower justify the investment? How many ways does automated irrigation pay for itself?

- (a) A well-engineered, automated irrigation system will provide a long service life. Longer amortization periods for equipment can result in lower annualized capital costs even for much more expensive irrigation systems

- (b) An irrigation system designed with full automation in mind can be smaller and less complex (less costly) than one that cannot take advantage of automation features such as irrigation capacity management
- (c) Much lower operating costs with respect to:
 - a. Labor
 - b. Water
 - c. Fertilizer
- (d) Reduced disease
- (e) Increased yield
- (f) Reduced crop inventory 'shrinkage'
- (g) Improved crop quality
- (h) Reduced waste water mitigation costs.

9) Do you think automated irrigation will become a requirement due to environmental regulations? How does it help a grower prevent runoff and conserve water?

Full automation is one of several tools you can use to address environmental regulations. In addition to the efficiency improvements and waste reduction described earlier, a fully computerized automation system can also manage peripheral issues such as wastewater reclamation or processing, holding tank management, drain water monitoring, and performance or conformance auditing.

10) What's the future? Any high-tech stuff in the works?

The future should see continued development of 'smart' systems that increasingly transfer short-term management responsibility from the grower to the automated system. Future smart systems may also be able to simplify the irrigation system design and automation process by becoming more flexible and adaptable to less than optimal irrigation system design or management. In the meantime, most growers have lots of existing technology they can consider for automation today.

Irrigation design is not a simple subject! Argus has prepared an additional document to help growers work through irrigation system and automation design issues for their specific operations. Ask for: [Irrigation System Design and Automation Considerations](#).



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