

Irrigation TODAY



VOL. 1, ISSUE 4 | April 2017

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Drought

Conserving Resources: Preparation Is Key

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President's Message

Expanding the IA's Reach in the Industry



By Gregory R. Hunter

By now I hope you have heard our big announcement that the Irrigation Association acquired *Irrigation & Green Industry* magazine. The IA Board of Directors has been discussing this possibility for a number of years now, and we are so pleased that it has come to fruition. Our surveys tell us that *Irrigation & Green Industry* is the most highly read publication of the landscape irrigation industry with a circulation of over 40,000 subscribers. The acquisition aligns with the IA's strategic plan to grow its reach and resources to better serve the greater industry.

Staff are working closely with Denne Goldstein and the Reseda, California, team to make sure operations continue as usual. Advertisers and readers may not even notice the ownership change, as we plan to keep everything intact. Why mess with success?

What does this mean for agriculture? Our plan with the acquisition is to not only broaden our reach into the landscape segment, but also to use this new revenue stream to build programs and services to benefit agricultural irrigation companies. The first step will be to transform this very publication, *Irrigation Today*, into one that focuses on agriculture.

As many of you know, Hunter Industries acquired Senninger Irrigation last year. This follows a long-time partnership of the two companies, but it is still an exciting new avenue for my family's traditionally landscape company. I am excited to be "all in" the agriculture business, and I look forward to being a dedicated reader of the new *Irrigation Today*.



IA president Greg Hunter congratulates 2016 Industry Achievement Award recipient Inge Bisconer, CID, CLIA, The Toro Company.



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From the CEO

Working to Secure Irrigation's Future

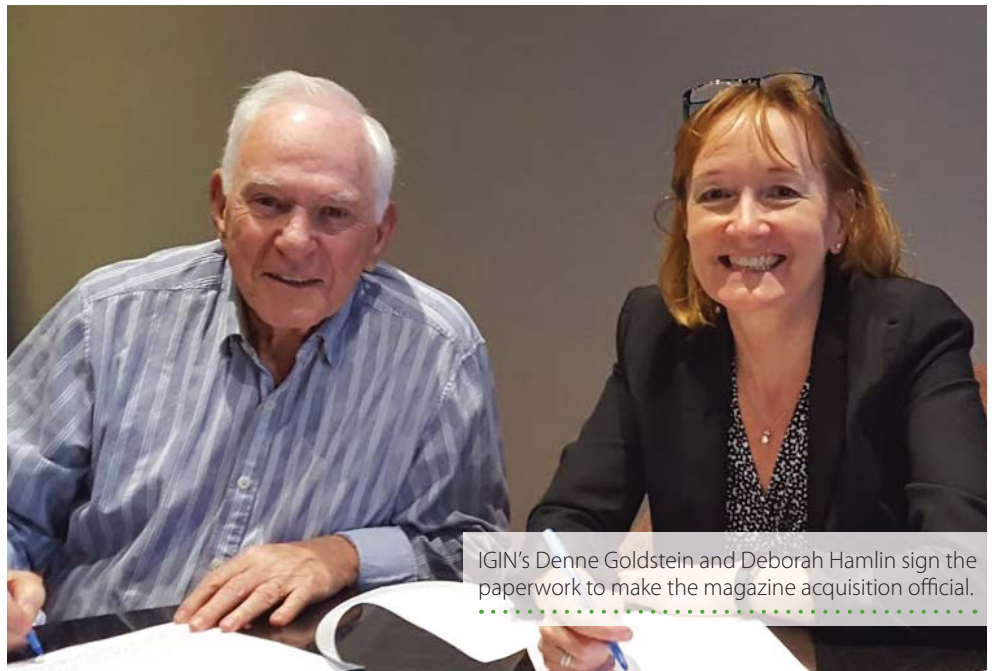
By Deborah M. Hamlin, CAE, FASAE

Spring has sprung and great things are happening at the Irrigation Association. Though the acquisition of *Irrigation & Green Industry* magazine is our biggest news, there is still a lot more going on. As Greg Hunter mentioned in his January message, developing our future workforce and promoting the value of irrigation are two important new elements in IA's strategic plan approved by the IA Board of Directors in December.

As we go to press, I am pleased to report that the Irrigation Foundation has just selected 16 students to be the first recipients of the Foundation's new educational scholarships. We hope this program will help students studying agriculture and horticulture to pursue careers in irrigation. Like Faculty Academy and the E3 grant program, this new scholarship program is focused on recruiting our industry's future workers — and possibly *your* future employees.

The IA is thinking outside the box and taking a new and different approach to promote the value of irrigation — in elementary schools. We have partnered with Young Minds Inspired to introduce irrigation concepts to third-, fourth- and fifth-graders through a student-teacher activity pack. In April, 10,000 teachers in California, Texas, Florida and Nebraska will receive *How Does Your Garden Grow*, a lesson plan to teach the benefits of agriculture and landscape irrigation and the basic water cycle. This curriculum project is just one of the many initiatives we plan to launch as part of our new public affairs efforts.

My goal over time is to lessen the frequency in which I hear: 1) It's hard to find good people, and 2) People don't appreciate the value of irrigation — whether it be agriculture or landscape. The above programs are just the tip of the iceberg of what we can and will be doing moving forward. Stay tuned for more!



IGIN's Denne Goldstein and Deborah Hamlin sign the paperwork to make the magazine acquisition official.

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IA Happenings

IA Staff on the Move

Irrigation Association staff are busy traveling the country to advocate for you.

Brent Mecham, CID, CLWM, CIC, CLIA, CAIS, industry development director, presented during the Northern Green Expo in Minneapolis and the ProGreen Expo in Colorado. Mecham attended the Utah Green Industry Conference and the Central Plains Irrigation Association Conference and Exposition in Burlington, Colorado. He participated in standards meetings held in Las Vegas, Nevada, and taught classes at Northern Water in Berthoud, Colorado.

CEO Deborah Hamlin, CAE, FASAE, was a guest on the podcast "Through the Noise" that features cutting-edge thought leadership in the nonprofit, association and charity organization arena. The podcast can be heard at www.throughthenoise.us/guests.

Elizabeth McCartney, senior policy and advocacy manager, attended the California Irrigation Institute 2017 Conference and the annual meeting for the Irrigation Association of New England.

Hasia White, professional development coordinator, attended the National Association of Conservation Districts Expo in Denver, Colorado.

Rebecca Bayless, finance director; Janie Hakim, membership manager; and John Farner, government and public affairs director, attended the World Ag Expo in Tulare, California.

Farner also attended the annual general meeting of the Canadian Prairie Chapter of the Irrigation Association in Calgary, Canada. Farner and McCartney attended the Family Farm Alliance 2017 Annual Meeting and Conference in Las Vegas, Nevada.

Professional Development

The Irrigation Association hosted an Electrical Troubleshooting: Diagnosing Field Wiring class at the IA headquarters in March. The class focused on diagnosing field wiring problems and proper use of volt-ohm meters in the landscape and golf irrigation fields. Attendees learned to systematically assess and resolve electrical problems.

All landscape irrigation seminars from the 2016 Irrigation Show and Education Conference are now available on the Irrigation Association website, www.irrigation.org/Education/Irrigation_Seminars.aspx. These one-hour online seminars address the underlying how-to's of efficient irrigation and water management.

Certification

Listening to the Bringing Water to Life podcast now counts toward earning continuing education units! Certified individuals can earn 0.25 CEUs per hour with the podcast. For more information on earning CEUs, visit www.irrigation.org/earn-ceus.



Irrigation Association & Irrigation Foundation Awards

Each year the Irrigation Association and the Irrigation Foundation recognize individuals and organizations that have made, and continue to make, outstanding contributions toward the advancement of the industry. Honor your hardworking colleagues by nominating them for an IA or Foundation award by May 15, 2017.

Award winners are selected by the IA Awards and Honors Committee and will be recognized during the general session at the 2017 Irrigation Show and Education Conference in Orlando, Florida.

To nominate someone, go to www.irrigation.org/awards.

Irrigation Association Announces Acquisition of Irrigation & Green Industry Magazine

The Irrigation Association is excited to announce that it has acquired *Irrigation & Green Industry* magazine from ISG Communications, Inc. The acquisition, which was over a year in the making, was finalized on Feb. 28.

Irrigation & Green Industry magazine is a monthly publication focused on the business of landscape and irrigation. The magazine reports on landscape news, highlights recent key happenings among landscape businesses and outdoor power equipment companies, spotlights new products, and monitors the economic state of the industry as a whole.

Irrigation & Green Industry is a national magazine with circulation of nearly 47,500. Headquartered in Reseda, California, the magazine was founded in 1995 by Denne Goldstein. The current magazine staff will remain in place in California, and Goldstein will remain an integral part of the publication.

With this addition to IA's portfolio of books and publications, the association's new *Irrigation Today* magazine will transition to an agriculture focus with its July issue. This quarterly publication will hone in on advances in ag irrigation technology, cutting-edge research and other issues relative to the ag market.

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Legislative Update



Rep. Jim Costa, D – Calif.; Deborah Hamlin, IA chief executive officer; and John Vikupitz, Netafim USA president and CEO, participated in the IA and NGWA Water Resources Fly-in on March 8, 2017.



The Irrigation Association continues to focus on influencing the national and state policy debate by promoting efficient irrigation. Throughout the year, the IA has engaged in ongoing conversations about water use and has worked to promote incentives for efficient technologies. The irrigation industry can offer unique solutions to current policy issues, and IA is focused on maintaining relationships with stakeholders in the broader agriculture and landscape industries to advance irrigation industry priorities.

Congress Begins Work on the 2018 Farm Bill

Every five years, the United States Congress must review and reauthorize the farm bill. Since 1933, this comprehensive piece of legislation has governed agriculture policies in the United States. The current farm bill was scheduled to be renewed in 2012, but it was unable to pass the House of Representatives on time. The final version of this bill was passed and signed into law in February of 2014; it includes 12 titles focused on food and farm policy, including crop insurance, nutrition and conservation.

The Irrigation Association engages in the farm bill process and advocates for voluntary farm conservation programs, like the Environmental Quality Incentives Program. In March 2017, representatives from IA member companies met with their members of Congress to share details about the industry's work innovating and promoting technologies that apply water more efficiently in agriculture. IA and its members want to ensure the irrigation industry has a seat at the table as decisions about conservation programs are made. The association's activities around the farm bill will be ongoing. See the article "Irrigation Association Hosts Legislative Fly-in" on page 13 for more details.

The IA is also a member of the steering committee of the Western Agriculture and Conservation Coalition. The goal of this coalition is to support the common interests of agriculture and conservation. As the farm bill process continues, WACC will work to ensure a strong conservation title.

The Farm Bill Process

With the current farm bill expiring in late 2018, lawmakers in both the House and Senate are beginning to focus on the next farm bill. The House Committee on Agriculture and the Senate Committee on Agriculture, Nutrition, and Forestry have jurisdiction, and these committees will spend time in 2017 drafting their respective versions of the bill.

The farm bill process kicked off with the House and Senate agriculture committees holding hearings. Since the start of 2017, the House Committee on Agriculture has held 10 hearings on the farm bill, including one on conservation policy (agriculture.house.gov/calendar/eventsingle.aspx?EventID=3677).

In addition to the hearings on Capitol Hill, members of Congress will travel the country to hold hearings — and listening sessions — to hear directly from the public. The Senate's first and only hearing so far was a field hearing in Kansas.

The goal over the next year and a half is for Congress to propose, debate and, hopefully, pass a new farm bill. Congressional leaders on the agriculture committees have signaled their intent to construct this farm bill without the drama seen in 2012. While obstacles are still expected, there does seem to be less contention around the nutrition programs, which make up approximately 70 percent of farm bill spending. Additionally, with the low commodity prices and a struggling agriculture economy, leaders are motivated to ensure a strong farm safety net.

For more background on the farm bill, check out episode 20 of the Bringing Water to Life podcast: www.bwtlpodcast.com.

Visit the House and Senate agriculture committee websites to see if your member of Congress is a member.

House – agriculture.house.gov/about/committee_members

Senate – agriculture.senate.gov/about/membership



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Irrigation Association Hosts Legislative Fly-in

By Elizabeth McCartney

On March 8, representatives from 11 Irrigation Association member companies traveled to Washington, D.C., to promote the importance of efficient irrigation in both the agriculture and landscape sectors. This event was a unique opportunity for IA members to speak directly with lawmakers and provide insight into the challenges and opportunities their companies are facing on the ground.

The group also took time to educate congressional offices about current legislative opportunities for the irrigation industry. By the end of the day, attendees had met with 28 congressional offices. By sharing their expertise, IA members hope to foster the adoption of efficient irrigation technologies and establish the IA as a relied-upon source of information during the production of policies affecting our water resources.

The congressional meetings made up day two of the two-day Water Resources Congressional Summit hosted by the IA in partnership with the National Ground Water Association and the Water Quality Association. On March 7, these three groups met for presentations and issue briefings around water-related issues. Attendees heard from a variety of experts on tax reform, the budget process and infrastructure spending. Former House

Majority Leader Richard Gephardt also addressed the group and shared insight into the current mood in Washington and the outlook for this year's legislative agenda.

Advancing Efficient Irrigation

During the fly-in, IA members made sure to focus on ways to promote efficient irrigation through upcoming legislative and budgetary activity. With 2018 Farm Bill activity underway in both the House and Senate, IA members made sure to promote the Environmental Quality Incentives Program. This voluntary conservation program, authorized by the farm bill, provides financial and technical assistance to farmers and ranchers who face threats to soil, water, air and related natural resources on their land.

On the landscape side, IA members focused on educating policymakers about the WaterSense program. WaterSense is a voluntary, public-private partnership program administered by the Environmental Protection Agency. Its mission of reducing the strain on the nation's aging water infrastructure by promoting and enhancing the market for water-efficient products and services is timely and important. IA has partnered with EPA since the inception of WaterSense in 2006.



Chris Mitchell of Ewing Irrigation attended the IA 2017 Fly-in to promote efficient irrigation before Congress.

Promoting Infrastructure Investment

During their meetings on Capitol Hill, IA members highlighted the fact that the irrigation industry's 21st century technologies are currently being used with 19th century infrastructure. With President Donald Trump's focus on investments in the nation's infrastructure, IA members made sure to carry the message about the importance of including water infrastructure investments in any infrastructure package. While the irrigation industry is proud to offer state-of-the-art technology that promotes efficient irrigation, this technology can only take us so far.



Tony LaFetra, left, president of Rain Bird Corporation, and Mike Donoghue, director of Rain Bird Corporation – Golf Division, met with Rep. Grace Napolitano, D – Calif., during the fly-in.

Elizabeth McCartney is the senior policy and advocacy manager at the Irrigation Association. In this role, she monitors and advocates for policies and legislation that support the irrigation industry and works to engage stakeholders at all levels of government. McCartney holds a master of public policy degree from George Mason University and a bachelor's degree in political science and communication from the University of Cincinnati.





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Bringing Water to Life



The Bringing Water to Life webinar series is back!

This popular webinar series explores the issues surrounding irrigated landscapes and irrigated agriculture and how the industry is working to promote the benefits of these landscapes and farms to society.

The Plant Something Initiative

May 18, 2017 | 2:00 p.m. Eastern

Speaker: Cheryl Goar, Executive Director, Arizona Nursery Association

**Agricultural Irrigation in the
Mississippi River Basin**

June 8, 2017 | 2:00 p.m. Eastern

Speaker: Kurt Readus, Mississippi State Conservationist

**WaterSense & SWAT —
What's the Difference?**

Held in partnership with the Alliance for Water Efficiency

June 20, 2017 | 2:00 p.m. Eastern

Speakers: Veronica Blette, Chief, WaterSense Program, and Robert E. Reaves, CIT, CLIA, Water Conservation Coordinator, City of Oklahoma City

**Telling a Positive Story About Irrigated
Agriculture**

June 29, 2017 | 2:00 p.m. Eastern

Speaker: ShanRae Hawkins, Founder, Stingray Communications

**Water Infrastructure in America —
Challenges & Opportunities for Irrigated
Agriculture**

July 13, 2017 | 2:00 p.m. Eastern

Speakers: Dan Keppen, Executive Director, Family Farm Alliance, and Laura Ziemer, Senior Counsel and Water Policy Advisor, Trout Unlimited

For more information or to register for these
webinars, visit

www.irrigation.org/webinar_series.



Foundation News

Faculty Academy Registration Is Open

Join instructors from around the nation this June for two days of free, hands-on training at the agriculture or landscape Irrigation Faculty Academy. Learn what matters most for students and bring back valuable knowledge and teaching techniques to the classroom.

The agriculture version will be held June 8 – 9, 2017, in Grand Island, Nebraska, at the University of Nebraska – Lincoln Extension. Registration closes April 20, so register now! Enjoy sessions on automated irrigation management, hands-on with a center pivot, irrigation management approaches, pumping plants, recent advances in center pivots and variable rate irrigation — all geared for the agriculture instructor. There will also be a tour of T-L Irrigation Company.

The landscape version will be located in Orlando, Florida, June 15 – 16, 2017, at the Disney World Horticulture Services. Register now; April 27 is the registration deadline. Landscape instructors will have two days of sessions on the anatomy of an irrigation system, design capacity, drip conversion with a hands-on activity, irrigation maintenance at The Walt Disney World Resort, pipe sizing, pressure regulation with a hands-on activity, and a tour of the irrigation at Animal Kingdom. There will also be a tour of Behind the Seeds at the Epcot Center.

There is no cost to attend these two events, and they are open to all instructors at high schools and two- and four-year institutions. The Irrigation Foundation has a grant assistance program to aid with travel expenses on a first-come, first-served basis.

Many thanks to our sponsors, Rain Bird Corporation, lead sponsor of the Agriculture Faculty Academy, along with supporting sponsors Irrrometer, T-L Irrigation and Nebraska Extension. The Landscape Faculty Academy is supported by BrightView Landscape Services, Hunter Industries and Irrrometer.

To register, visit www.irrigationfoundation.org. For further questions, contact Foundation Coordinator Nicole Preisner (nicolepreisner@irrigation.org).

Now Accepting Nominations for the Excellence in Education Award

Students and colleagues are invited to nominate educators who have inspired those around them. The award recognizes a person who is actively teaching, or has formerly taught, irrigation, water management and/or water conservation in affiliation with a two- or four-year institution. This person helps supply the irrigation industry with educated professionals who provide efficient irrigation solutions that protect water and the environment.

The Foundation is now accepting nominations for its annual award. Submit a nomination by May 15. The recipient will receive a full travel grant to the 2017 Irrigation Show and Education Conference, Nov. 6 – 10, in Orlando, Florida. The nomination form can be found at www.irrigationfoundation.org.

Irrigation E3 Program

Mark your calendars! In May, applications will be accepted from students and instructors for the acclaimed Irrigation E3 Program.

The program focuses on the three E's as they relate to the irrigation industry: exposure, experience and education. This is accomplished by providing the winners with an education and travel award to the 2017 Irrigation Show and Education Conference in Orlando, Florida, Nov. 6 – 10.

Watch for details coming soon. For further information, contact Foundation Coordinator Nicole Preisner (nicolepreisner@irrigation.org).

National Collegiate Landscape Competition

The Foundation had a presence at the National Collegiate Landscape Competition career fair held March 16 at Brigham Young University, Provo. Many engaged students and instructors stopped by the booth to find out about the Foundation's programs and how we are promoting careers in irrigation by engaging with both students and instructors.



Foundation Coordinator Nicole Preisner meets with attendees at the National Collegiate Landscape Competition career fair.



Chemigation & Fertigation

Chemigation — Delivering Chemicals to Crops & Soils Using Irrigation

An excerpt adapted from chapter 28 of Irrigation, Sixth Edition, by Ted W. van der Gulik and Robert G. Evans

The use of irrigation systems for purposes other than providing water for plant growth has increased rapidly in recent years. An irrigation system offers the ability to deliver fertilizers and pesticides to the plant and soil, a practice termed chemigation.

Generally, an irrigation system that delivers chemicals to crops and soils must be designed and managed differently than conventional irrigation and must apply water uniformly. Chemigation can take place via a normal irrigation cycle, but additional factors to consider include uniformity, rate of application, timing and the need to flush chemicals from the system. Adding any chemical to irrigation water requires reliable backflow prevention devices to ensure that the chemicals do not drain or siphon back to the water source.

Generally the chemicals applied are fertilizers and pesticides, including fungicides, insecticides, nematocides and herbicides. In addition, soil conditioners and growth regulators can be applied through an irrigation system under certain circumstances.

Fertigation, which is a form of chemigation, is the term given to the application of fertilizers. Many commodities such as tree fruits, citrus, vegetables, small fruits and berries, and greenhouse and nursery crops use drip irrigation systems to apply fertilizers directly to the plant rooting area. Center pivot systems are used to apply certain fertilizers, insecticides, fungicides and herbicides to many types of field crops. Traveling guns and booms are not acceptable chemigation systems because of their typically poor application uniformity.

Benefits & Limitations

Chemigation offers many benefits over conventional application of fertilizers, pesticides and other chemicals:

- Chemicals can be applied to the crop at the most opportune time even if the field is not trafficable by farm equipment. Nutrients can be scheduled and applied to the crop throughout the growing season at specified rates and intervals.
- Chemigation can reduce the leaching potential of certain nutrients such as nitrogen into the groundwater by applying the correct amount of compound throughout the growing season when the plant most needs the nutrient.

- Crop yields and quality improve if chemigation is done correctly.
- Chemical application costs are lower because of reduced labor, chemical use and power consumption.
- Fertigation may be the only method by which fertilizers can be incorporated into the soil if using microirrigation in dry climates.
- The irrigation system can incorporate the chemical to the desired soil depth by applying the appropriate amount of water based on soil type and soil moisture.
- Chemigation is compatible with no-till farming because chemicals can be applied under various tillage situations.
- Mechanical damage to the crop by air blast sprayers is avoided.
- Operator exposure to chemicals is reduced because operators are not required in the field during the application.
- Chemigation of post-emergence, soil-acting herbicides may reduce crop phytotoxicity and increase activity.



While the benefits of chemigation are evident, other considerations and limitations must be evaluated before deciding to use an irrigation system to apply chemicals:

- Some chemicals cannot be used for chemigation because of their chemical properties.
- Many chemicals, especially insecticides, fungicides and herbicides, may be used for chemigation only if the product

Photo credits: Irrigation Training & Research Center, California Polytechnic State University, San Luis Obispo, California



label specifically states that the product can be applied by the type of irrigation system to be used, the pest to be controlled, and the crop to which it is being applied. Chemigation may therefore be limited in countries where registration for the specific use has not been attained.

- Some chemicals are corrosive to the irrigation equipment.
- Additional components such as injectors, tanks and safety devices are required.
- Chemigation requires a change in management techniques. Operator training is required to ensure that the operator is careful and attentive and understands backflow prevention equipment, injector calibration and the operation of the irrigation system.
- Chemigation cannot be used when soil moisture is already near field capacity and irrigation is not needed.

Laws & Regulations

There are many local, municipal, state, provincial and federal laws, regulations and codes that pertain to the use, handling and application of chemicals through an irrigation system. The laws and regulations seek to ensure that the chemical is used for the intended purpose and that proper steps are taken to protect the environment. Local governments often have plumbing codes or other regulations that specify backflow prevention requirements to protect against backsiphonage or backpressure of the chemical into groundwater, surface water or other drinking water supplies.

The rules regarding pesticides are intended to protect workers from exposure; contain the chemical to the target site or pest; avoid uncontrolled or accidental entry of the chemical into the environment, especially drinking water supplies; and ensure that the crops produced are safe for the intended use or human consumption.

Worker protection is addressed by regulations specifying personal protective equipment and safety equipment on the injection system and by restricting entry of workers into the field after chemigation has been completed. In some jurisdictions, certification is required for the application of pesticides through an irrigation system. Field posting is often required to inform the public that the water from the irrigation system is not potable and field entry is not permitted.

For pesticides, the product label is the law, and label application rules must be followed. The label specifies (a) the type of irrigation system that the product can be applied with, (b) the type of injection system to be used, (c) required injection system safety features (e.g., interlocks with the pump), (d) automatic system shutdown precautions should pressures drop to the point where product distribution is adversely affected, and (e) the pest to be controlled and the crop on which the pesticide can be used.

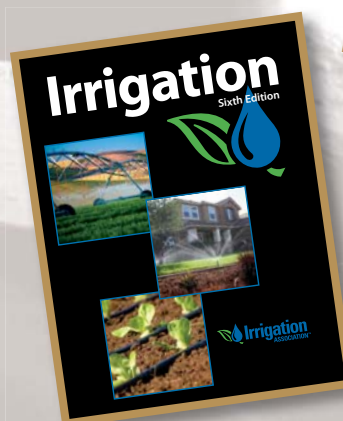
Rules governing fertigation are generally intended to protect the environment and drinking water supplies. There is more flexibility with the type of injector that can legally be used, but similar backflow prevention equipment and other safety equipment such as interlocks with controllers and pumps are still very necessary to protect from backflow risks into the connected irrigation water source.



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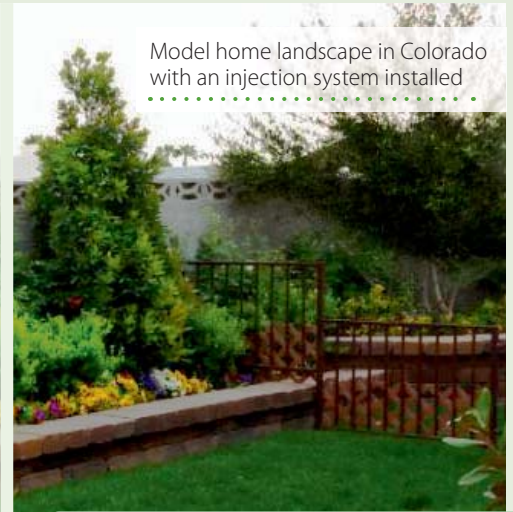


*For more information on chemigation and fertigation, see **Irrigation, Sixth Edition**, the most comprehensive reference book ever published on the evolution of irrigation systems and the many facets of irrigation systems, technologies and practices. **Irrigation, Sixth Edition** is available at www.irrigation.org/store.*

Injection

— A Proven Tool Adapted for the Needs of Today

By Jeff Gilmore



Model home landscape in Colorado with an injection system installed



Typical injector servicing up to 2 acres of mixed landscape

Fertigation and chemigation are the application of fertilizer or chemicals through the irrigation system. Using the term fertigation can make the technology sound too restricted in that it is only valuable as a fertilization tool. Conversely, chemigation can be a more accurate description, but it often causes alarm, as people associate chemicals with harm. So, to properly describe what fertigation and chemigation mean to the industry, it is best to focus on the actual function of the technology, which is injecting products into irrigation systems, or simply referred to as injection.

Injection is a technology used extensively by a broad array of industries for a variety of purposes. Injectors can be found at gas station car washes, hospitals, computer-manufacturing plants and in fields of

strawberries. Regardless of where it is being used, the primary goal of injection is to provide increased automation to a process resulting in better efficiency and simplicity.

Consider the process of irrigating a landscape, which can be done by hand with a watering nozzle and a hose. This is a practical method for a vegetable garden or small yard. However, if the area is larger and must be watered multiple times per week or day, the garden hose becomes a bit of a problem and an automatic irrigation system makes more sense.

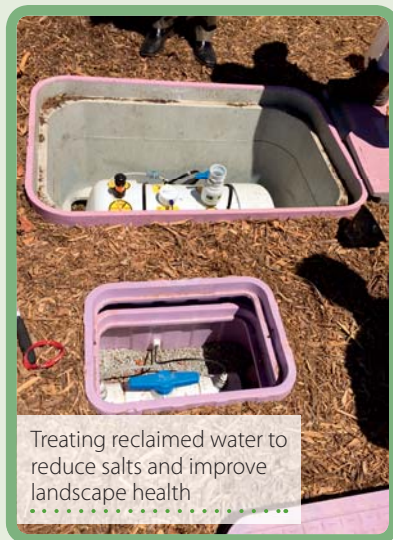
When this need was first realized, initial attempts for landscape injection included adapted systems from other markets to the landscape environment. As industry professionals are aware, the landscape world can often be a brutal environment

to endure with ever-changing variables from hot and cold temperatures to high water pressure with water hammer or low water pressure and variable flow rates. These variables did not bode well for the early injector, nor for its price and ease of use. Fortunately, now there are injectors available for use in landscape that were designed for that purpose alone. But the question remains: When should injection on a landscape be utilized?

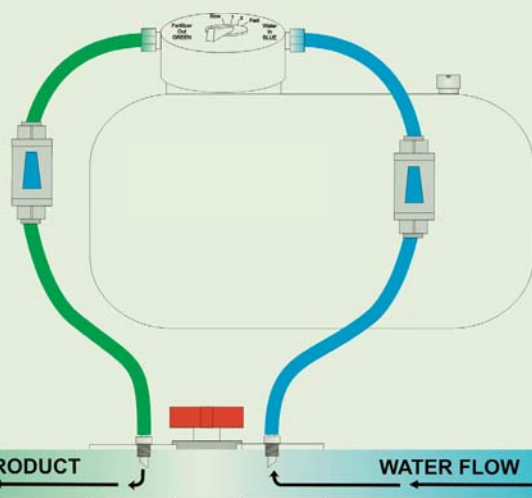
The use of injection should be just as routine as adding an irrigation system to a landscape. To keep this simple, it is best to review the needs of a landscape and determine if injection can meet any of those needs and if the property meets the

requirements. Common uses for injection can be any or all of the following: water and soil management, fertilization, pest repellent and water treatment. So, the landscape needs may be controlling gophers for one site, treating hard water on another, or just providing added convenience to reduce costly labor hours. The needs will vary, but often there is an injectable solution.

Once an injector is installed, it is important to ensure that it is used with effective products. Just as a sprinkler does not work without water, an injector does not perform without the proper products. The quality of the results is directly correlated to the quality of the products. Fortunately, many injectable products are available in distribution and supported by various equipment manufacturers. The injector manufacturers will generally be able to provide a broad knowledge of what products to use and when. Programs can be created from something as simple as a desire for enhanced growth and health to detailed application time periods derived from soil, water and plant tissue testing.



Simple view of the injection process



In Summary

Fertigation has expanded into a much broader tool for the landscape and irrigation market. What was once a nifty way to fertilize has now become a necessity. Without injection, the application of specialty products is generally cost-prohibitive. The ability to treat a 6-acre property in as little as 15 minutes with a fertilizer, pest repellent and wetting agent all at once is a tremendous advantage. Now consider if the same 6 acres were drip irrigation. This would fully circumvent the need for manual spraying of each planted area. With injection options to service five container plants up to 300 or more acres via a pump station, there is a suitable solution for any landscape treatment need.

Jeff Gilmore is vice president and international sales manager of EZ-FLO. With over 20 years of experience in fertigation, he has assisted irrigation professionals since the inception of the fertigation concept through the design, manufacture and assembly of all EZ-FLO components.



Photo credits: EZ-FLO Fertilizing Systems, Inc.

Fertigation

— The Next Frontier

By Charles M. Burt, PE, PhD, D.WRE, CAIS, CID



The irrigation industry has experienced major changes over the past 20 years. So, what is new on the horizon? Now that we understand the concepts of maximizing irrigation efficiency, how can we not only maintain but also increase crop yields with less water and less acreage? The answer lies in improved nutrient management combined with proper irrigation water distribution and management.

Just as irrigation dealers specify pressure relief valves and air vents on all pipelined irrigation systems, irrigation designs now incorporate fertigation (i.e., fertilization through the irrigation system) hardware.

Benefits

The benefits of good fertigation are very real and increasingly important. The manufacture of nitrogen fertilizers is very energy intensive. The Cal Poly Irrigation Training and Research Center, on behalf of the California Energy Commission, documented the energy associated with various irrigation practices. The energy required to manufacture the fertilizer can equal the combination of all other energy inputs (e.g., pumping, tractors, pipe manufacture) in vegetable fields. Good fertigation practices can reduce fertilizer applications. In general, the ITRC has found that with subsurface drip irrigation (i.e., buried drip on vegetables) under good management:

- The fertilizer application is reduced about 25 percent.
- The yields increase.

The net result is that the yield per unit of fertilizer (or water) is increased. This is a true measure of improved efficiency.

One can quickly understand that the lower fertilizer applications, coupled with

increased yields (i.e., increased intake of fertilizer by the plants), also results in less groundwater contamination with nitrates. This is a major consideration for long-term, sustainable irrigated agriculture.

Irrigation Systems

Although fertigation is used with virtually all types of irrigation systems, its advantages are most pronounced when it is combined with fairly high frequency irrigation management. This includes solid-set sprinkler systems, linear moves and center pivots, and all types of drip-microirrigation. Such systems allow managers to finely tune and spoon-feed both water and nutrients. Just as water schedules can be adjusted daily or weekly to match weather demands, fertilizer dosages and types can be adjusted as frequently to match plant demands.

Good fertigation management requires that managers look beyond the supply of nutrients in the soil. They must also look at the availability of those nutrients to the plant. If an irrigation system only provides water once per week or two weeks, the top foot or so of the root zone is quite dry immediately before an irrigation. Many of the important plant nutrients (e.g., phosphorus) are predominately in this top layer, and they cannot move into the plant roots if the moisture content is reduced. High frequency irrigation allows the manager to make certain that if the nutrients are in the soil, they are also available to the plant.

Irrigation System Distribution Uniformity

As long as the fertilizer is completely dissolved and applied in moderately low dosages, the fertilizer will be distributed as

evenly as the water. High irrigation system distribution uniformities (i.e., greater than 0.85) are very important for finely tuned fertigation practices.

Legalities & Safety

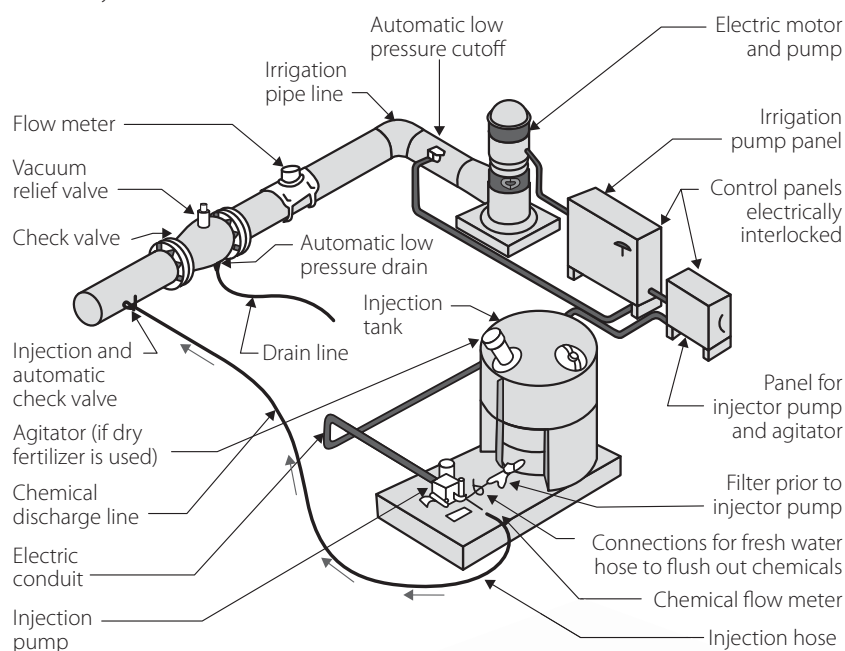
Certain hardware items are required by the U.S. Environmental Protection Agency for all pesticide injection systems if there is a possibility of pesticide backflow into a well or drinking water supply. Local agencies (e.g., counties, water districts, states) may apply these hardware requirements for fertigation systems also.

In many areas of the United States, enforcement of chemigation regulations is minimal or nonexistent. As fertigation becomes more common and sophisticated, and as it is accompanied by more chemigation of insecticides, fungicides and nematicides, the enforcement will become standard.

Certain hardware should be installed even in cases where there is no hazard of contaminating groundwater or drinking water supplies. Equipment should be installed to prevent fertilizer tanks from overflowing, exploding or draining and to prevent the buildup of high pressures that could cause hoses to burst. Systems should also be installed with a means of limiting the amount of fertilizer that can be injected, preventing overapplication of chemicals.

In other words, an irrigation dealer should not just sell a chemical injector. An irrigation dealer should sell a chemical injection system that includes all the essential safety devices, as well as being simple to adjust and operate. Figure 1 illustrates a configuration with essential hardware.

Figure 1. A fertigation installation with necessary hardware



Injector Locations

There are three basic locations for injectors: upstream of filters, downstream of filters and in field. Some growers use all three locations.

Upstream of Filters

This location for fertilizer applications enables any contaminants or precipitates to be caught in the filter before entering the field. The injection system should be interconnected with the filter backflush controller so that the fertilizer injection is temporarily halted during backflushing. If backflushing occurs too often, usually pre-filtration is needed to remove large contaminant loads and/or the backflush adjustments need adjustment. Another

option is to recycle the backflush water after removing contaminants.

One downside of injecting upstream of filters is possible corrosion problems. These can be eliminated by one or all of the following, depending upon the situation:

- Ensure filters have excellent noncorrosive internal linings.
- Spoon-feed fertilizers rather than applying them in large, occasional dosages. Spoon-fed dosages are generally noncorrosive and are also better for plant nutrition.
- Inject acids downstream of the filters.
- Inject all chemicals into the middle of the pipe so that they can be well mixed before entering the filters.

Downstream of Filters

This is the recommended location for acids.

In Field

Some fields of vegetables or permanent crops are divided into many small blocks of different ages, maturity or varieties. In such drip irrigated fields, a central injection system is generally used to apply compounds such as acids, gypsum, chlorine and sometimes a base level of nitrogen. However, each block will have varying fertilizer needs depending upon the stage of growth and variety. An injection port is generally provided at each block valve, and a portable tank and injection pump is used to fertigate. In some cases, the irrigators are provided with a list of irrigation hours and fertilizer amounts for each block. Irrigators must be specially trained in procedures to prevent contamination of the system while connecting hoses. It is very easy to introduce dirt into the irrigation system with this configuration.



Charles M. Burt, PE, PhD, D.WRE, CAIS, CID, is the chairman of the Irrigation Training and Research Center and bioresource and agricultural engineering department of California Polytechnic State University in San Luis Obispo. ITRC was the winner of the Irrigation Association's 2016 Partner of the Year Award.

Fertilizer Injectors Selection, Maintenance & Calibrations

By Craig Barrett



Fertilizer injectors are devices used to apply water-soluble fertilizers, pesticides, plant growth regulators, wetting agents and mineral acids to landscaped areas. However, just like other mechanical devices, proper and frequent maintenance and calibration are crucial steps to ensure optimal injector performance and, thus, healthy plants.

How Injectors Work

Injectors take a small portion of concentrated fertilizer solution from a stock tank and inject it into the water line. For every part of stock solution, there are x parts of water, where "x" is determined by the injector ratio. For example, with a 1:100 ratio, one part of stock solution is mixed with 99 parts of water for a total of 100 parts of final solution (see fig. 1).

Injectors work on one of two principles: Venturi-type and positive displacement.

Venturi-type injectors use a pressure difference between the water line and the stock tank to draw a concentrated solution into a faucet connect valve and mix it with water in the hose (see figs. 2A and 2B). These inexpensive injectors can be easily attached to any faucet but do not allow precise control over the concentration. Because of wa-

ter pressure fluctuations, variable amounts of chemical may be injected into the hose. In addition, the injection ratios are low (typically 1:16) and therefore require a large stock tank, limiting the use of Venturi-type injectors to small growing areas.

They typically require very little maintenance, such as checking the screen on the suction line for clogs and periodically removing salt deposits from the mixing valve.

Positive displacement injectors provide consistent injection ratios for the designed flow rates over wide variations in water pressure. A measured amount of stock solution, determined by filling a specifically sized chamber, is injected into the irrigation water, the rate of which is also controlled by the unit (see fig. 3). In most cases, the limiting factor in these injectors is the minimum and maximum water flow rate permissible. However, the industry offers models that can accommodate a wide range of flow rates. The injection ratio depends on the size of cylinders and the relative rate of displacement of fluid in the cylinders by the pistons. Precise control over the amount of injected chemicals, smaller stock tanks and broader injection ratios have made positive displacement injectors an industry standard.

Choosing an Injector

Important factors must be considered when choosing an injector.

Operation Size

The needs of small-sized operations, less than and up to 10,000 square feet, can be serviced with smaller units.

Type of Fertility Programs

A fertility program should be based on the types of landscape materials, nutrient requirements of individual plants and number of different species. Consider potential future expansion because this would be the most economical approach.

Water Flow Rate

When selecting an injector, it is important to know your water flow rate range. Flow rates fall into three categories: low (0.05 – 12 gpm), medium (12 – 70 gpm) or high

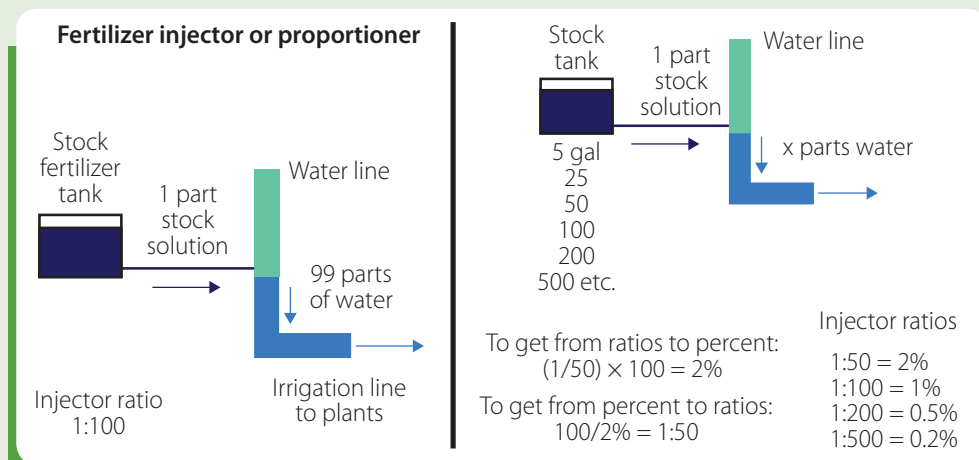


Figure 1. Fertilizer injector or proportioner.

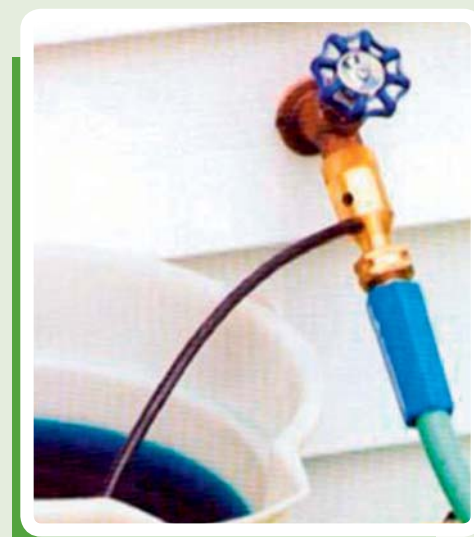


Figure 2A. A small brass mixing valve that screws onto the faucet and has a hose attached to it. As water passes through the injector, it creates a suction that draws fertilizer solution from a concentrate tank. It needs a minimum 35 psi water pressure for proper operation. Besides fertilizer, it can be used to dispense insecticides, fungicides and other water-soluble chemicals through a hose. (Photo credit: Hummert Int'l. Catalog 2003)

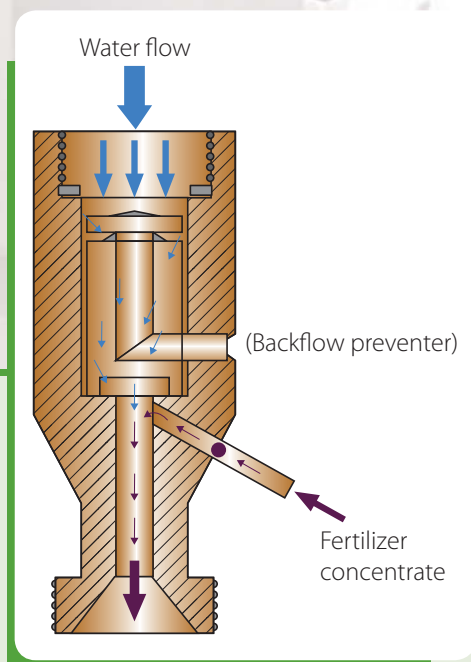


Figure 2B. The injector has an injection ratio of 1:16. For each gallon of concentrate taken up, it produces 16 gallons of liquid fertilizer solution. The injector draws 1 gallon of concentrate in about five minutes, and this will be mixed with approximately 12 to 18 parts of water through the hose (i.e., 5/8-inch instead of 1/2-inch produces a higher flow rate). Excessive backpressure will cause the siphon to stop drawing. The injector should not be more than 50 feet from the nozzle end to work properly. If more than 50 feet of hose is used, the injector can be connected between two sections of hose. (Photo credit: Hummert Int'l. Catalog 2003)

(over 100 gpm). For example, a 10-gpm flow rate will service only one 3/4-inch pipe, and thus only one area of plants will be fertigated at a time. If this is all the water available from the water supply, a low flow rate injector is adequate. If the water flow is not a limiting factor, the amount of bench or ground area to be fertigated simultaneously is the main factor.

This relates back to the size of the operation. Factors to consider include:

- Minimum and maximum areas to be watered at one time.
- Fertilizer solution required for each square foot of ground area.
- Time needed to deliver the fertilizer solution.

Injection Rate

Having an adjustable injection ratio is desirable because a single fertilizer concentrate can be applied at different concentrations to different plants with varying nutrient requirements. Injection rates fall into four ranges: very low (1:4000 – 1:250), low (1:500 – 1:100), medium (1:200 – 1:100), high

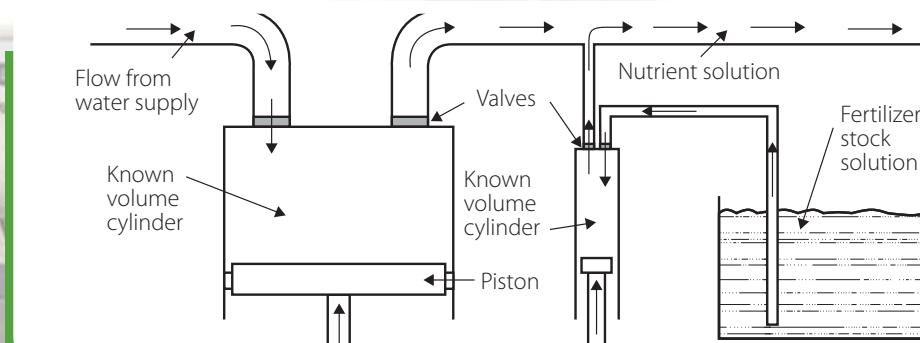


Figure 3. Positive displacement pump injector. Source: Water and Nutrient Management for Greenhouses (NRAES-56)

(1:100 – 1:20) or highest (1:50 – 1:10). A low injection rate means that a small portion of concentrated solution will be injected into the irrigation line, while a high injection rate equates to a large portion of concentrated solution being injected into the water. A low injection ratio also means a highly concentrated stock solution.

Stock-tank Size

Stock-tank size should be based on proportion ratio and daily water usage. The stock tank should be sufficiently large enough to allow the entire fertilization job to be completed with one batch of fertilizer concentrate. A large stock tank is needed if a low proportion ratio is used and if the injector is used frequently. Also, if a constant liquid feed program is used, a larger stock tank size is beneficial.

Stock tanks need to be opaque. The chelating agents in fertilizer (help make micronutrients available to the plants) break down if exposed to light. Stock tanks should be covered to prevent algae and/or debris buildup, contamination or evaporation of stock solution. If debris buildup occurs, it may plug the injector intake and cause less than the required amount of stock solution to be taken up.

Water-soluble fertilizers tend to accumulate in the bottom of stock tanks, which can result in large differences in fertilizer concentrations. If using a large stock tank, make sure the stock solution is mixed well before using it.

Installation Considerations

A permanently installed injector should be plumbed off the main water line, which will permit clean water to flow through the irrigation line to purge the line of fertilizer solution or supply water to crops where fertilizer is not needed. A bypass installation also allows easy removal of the unit in case of malfunction or the need for maintenance or replacement.

Verifying an Injector Is Working Properly

The dilution ratio should be known and adjusted as needed. If large deviations (more than 5 percent) from the expected setting occur, contact the manufacturer for possible repair, replacement or maintenance. Soluble fertilizers should be dissolved completely; use hot water if necessary but allow the solution to cool before starting the injector. Constant agitation may be needed when applying wettable powders because they suspend but do not dissolve in water.

Regulations Concerning Water Supply Protection

Any irrigation system designed or used for the application of fertilizer, pesticide or chemicals must be equipped with an anti-siphon device adequate to protect against contamination of the water supply.

It is unlawful for any person to use any irrigation system designed or used for the application of fertilizer, pesticide or chemicals if the system is not equipped with an anti-siphon device.



Craig Barrett currently serves as head of management at Barrett Engineered Pumps, including sales, engineering and service. Barrett belongs to and has been on some of the governing boards of various industry organizations, including the Irrigation Association.

Drought

Due to the Drought, Farming, Irrigation & Groundwater Wells Are Forever Linked

By Gary L. Hix, CWD/PI, RG, CPG

The link between drought, farming, irrigation and groundwater wells was clearly illustrated when the Irrigation Association and the National Ground Water Association partnered in December of 2016 in Las Vegas, Nevada, for the co-location of the Irrigation Show and Education Conference and National Groundwater Week. The synergy was explosive as these two associations mingled, shared their recent experiences and demonstrated their respective advances in technology toward improving efficiencies in both industries. Necessity breeds invention and adaption to new standards, and this was apparent as both industries demonstrated their latest wares.

Nowhere, perhaps, has the drought had a greater impact nationally than in the Central Valley of California where agriculture and the nation's food supply are strongly linked. So much of the nation's food supply comes from the Central Valley of California, and the drought has had a major effect. When available surface water was limited or cut back completely because of the drought, groundwater was needed to irrigate the crops. Access to groundwater is only possible through water wells, hence the link.

Switching From Surface to Ground

It became apparent early on that in order to continue producing America's food, many farmers were going to have to switch from irrigating with surface water to irrigating with groundwater. For some farmers, this meant getting water from new wells. This created a demand for qualified well drillers that exceeded the current supply in some areas, so well drillers from other states moved their equipment into California and began drilling wells for farmers. A boom for the drilling industry was generated by the drought.

For a short while, it was a frenzy of getting permits, setting up to drill, drilling and making a well, and moving on to the next well site or farm to repeat the process. Many farmers were then capable of continuing to grow their crops using groundwater. However, this resource is not in infinite supply either, and drought can drastically impact the recharge and availability locally of this resource. Too many wells pumping too close together lowers the water table, which means that some pumps have to be lowered and wells have to be deepened, rehabilitated

or replaced. Groundwater sustains the flow of rivers and streams where wildlife exists; extensive pumping adversely impacts these treasures, as well. It became apparent that doing more with less was needed in both areas.

Responding to the Issues

In response, water well contractors found better and quicker ways to drill wells. Hydraulic-powered drill pipe-handling equipment led to quicker and safer trips in and out of the borehole, perhaps with fewer employees. Innovations and improvements in drill bit design led to cleaner and faster drilling in many formations. Improvements were made in well casings and connections and in screen designs where pre-packed filtration shortened a critical portion of well construction. There were advances in the



understanding of well fouling and decreased productivity that led to applying better well rehabilitation methods to existing wells, sometimes saving the need to drill new wells.

Advances were made in pumping equipment for water wells that reduced the power requirements needed to move water to the surface and put it on the field. The biggest change was the increase in variable frequency drives that turned the motor and pumped the water at a variable rate that met the specific needs of the farmer, thus reducing wasteful pumping and excess energy. VFDs reduced the amount of electrical power required to move water by automatically tailoring pumping rates to real-time water needs in the field.

Farmers found better ways to apply irrigation water to the fields that reduced waste. Utilizing better ways of applying fertilizers to crops reduced the cost of application and the runoff of chemicals into streams. Advances made in agriculture soil science teamed with the irrigation industry greatly improved efficiencies and reduced water demands.

Due to the need caused by the drought, advances were made in weather predictions and local weather observation stations. Field moisture sensors, and variations in soil adsorptions across a given field, are now integrated into the pumping of groundwater and surface water onto the fields and crops. We are learning together how to grow more food with less water and lower energy costs. The same techniques were also applied to turf irrigation where conserving groundwater and reducing pumping costs are just as important.

The drought brought new opportunities for farmers outside of California, as well. Some agriculture firms moved into neighboring states, such as Arizona, Nevada and Utah, looking for new or existing farms and fields to grow crops. This created new opportunities for both parties in these states. New well drilling began, and some struggling farms were rejuvenated with new management and improved irrigation technology.

We are all in the same breadbasket, so to speak, when it comes to food and water. We all need a sustainable food supply and a sustainable surface and groundwater resource. Food and water are linked — as are the industries that provide both. Our future depends on maintaining the link that exists between agriculture and water wells and achieving a sustainable use of our precious groundwater.



Farm in Grand Staircase Escalante National Monument, Utah

Gary L. Hix, CWD/PI, RG, CPG, is a well inspector and consultant for In2Wells. He is a certified well driller and pump installer by the National Ground Water Association and a certified professional geologist as recognized by the American Institute of Professional Geologists. He is an experienced instructor and a published author on many subjects related to water well construction, development, testing and equipping.



Drought

Preparation Is Key

By Mark A. Crookston, PE, D.WRE, CAIS, CIC, CID, CIT, CLIA

Multistream multitrajectory rotating sprinklers on bluegrass

Drought is a shortage of water, particularly a period of little or no precipitation. Whether short or long term, drought can create significant difficulties for municipal water providers, agricultural producers and the landscape industry. In turn, those difficulties affect the lives of countless more individuals. Preparing for drought is both prudent and necessary. Such preparations can help mitigate the severity and extent of drought impacts.

Drought-like conditions can occur whenever water demands exceed the available supply. Increased conservation is also needed to close the gap between both current and future demands and with available supplies — not just during periods of drought.

Key Aspects of Preparedness

Key aspects of drought preparedness include:

- Increasing awareness and education.
- Establishing priorities and procedures to be followed during drought.
- Developing needed tools and processes to reduce water needs and conserve dwindling supplies.

Implementing regulations during drought to control water use can be effective in curtailing demands for water and its use. However, regulations may not always foster true water conservation, which is the wise use of water to realize and maintain desired

benefits, both individually and by society in general.

The first aspect of creating public awareness and providing educational opportunities can be likened to “blowing the horn and beating the drum.” These efforts need to capture the attention and interest of people across a wide spectrum of society. This increased awareness can encourage individuals to voluntarily make changes in their own priorities and practices, such as acquiring water-efficient appliances, taking shorter showers, waiting for full loads to run dishwashers and fixing wasteful leaks. Support for such changes can be enabled by the drought planning and preparations made by municipal and state governments. However, more will be needed to effect significant conservation in the agricultural and landscape industries.

Agriculture

Irrigated agriculture continues to have great importance to our society by more reliably producing higher yields per acre on average. This key contribution to the food supply and other vital industries is significant and is literally irreplaceable. Efficient systems for the irrigation of agricultural crops have been developed and continue to be improved. New and emerging technologies are providing enhanced tools and capabilities. These include drip and microirrigation methods, controlled deficit irrigation procedures,

in-field sensor networks, automated irrigation systems capable of real-time adjustments and more. Support for efficient agricultural production is largely market-driven and encompassed by myriad regulations and court proceedings concerning water rights. Such constraints can undermine, delay and/or nullify the adoption of improved technologies and efforts toward drought preparedness. However, drought can be a great instigator for change. Continued implementation of advanced technologies will advance true conservation and bolster long-term production from irrigated agriculture.



Pop-up spray sprinkler

Landscape

The individual health benefits and societal advantages of efficiently irrigated landscapes are currently receiving renewed appreciation. In the past, their value was largely taken for granted or overlooked. However, as the number and size of population centers have increased, the monetary costs to society from reduced access to greenery in open spaces have proven to be highly significant.

Outside of natural areas, urban landscape resources are managed and maintained by the corresponding property owners, either directly or indirectly. Widespread awareness and understanding of appropriate outdoor water conservation practices are steadily increasing but still lagging behind. Landscape irrigation equipment has advanced rapidly in its potential to achieve meaningful water conservation. However, the importance of proper management of landscape watering is becoming increasingly clear. Good management can often achieve desired landscape water conservation, even with basic irrigation equipment that is simple to use and low in cost. However, poor management can nullify the water conservation potential of an advanced watering system that was well-designed, utilized high-quality components, was properly installed and is appropriately maintained. Good management is essential to water conservation.



Close-up of multistream multitrajectory rotating sprinkler

Landscape water conservation can be realized when property owners and landscape water managers elevate their knowledge and understanding of key landscape management practices. It is not necessary for everyone to become proficient in every aspect of landscape management or in the first-hand application of the appropriate technologies. However, having a basic understanding of landscape water conservation is an important key. Smart irrigation technologies can simplify day-to-day management burdens. Watering schedules can be automatically adjusted for local weather conditions and still meet landscape needs. An appropriate and stable regulatory framework established by local governments will help guide landscape design and water management toward further progress in water conservation and continued realization of associated landscape benefits.

Pre-drought reductions in landscape watering through conservation may reduce revenue streams for water providers, including funds that are much needed for maintenance and upgrade of the water supply infrastructure. Further rate increases would likely be implemented, even though per capita water use was reduced.



Drip tubing with inline emitters

Preparation for drought could include incorporation of landscape zones that may have watering completely shut off during drought. These sacrificial zones would be comprised of plants that have a drought dormancy mechanism for self-preservation or that could be readily replaced, such as annual flower beds.

Although the present is the best time to prepare for drought through increased conservation, it should be recognized that landscape watering needs will not magically reduce an additional amount (such as 20 – 30 percent) during periods of low precipitation. Watering needs for high-value landscapes (established trees and woody shrubs) will actually increase because less precipitation is available to help meet plant needs. Once full landscape water conservation is implemented, further watering reductions could result in significant plant mortality, including urban forests. The prized benefits of green spaces in population centers would then be greatly reduced. Their post-drought recovery would come at great cost.

Summary

Continued and expanded water conservation practices in both agriculture and urban landscapes are vital for the preservation and protection of water supplies. Freshwater supplies are limited, and the needs and demands for its use are steadily increasing. Past droughts have helped drive development of new irrigation technologies and improved equipment. Significant progress in water conservation has already been made, but more will be required. Our collective understanding and priorities will largely determine the success of our planning and preparing for times of drought — for it will surely come.

Mark Crookston, PE, D.WRE, CAIS, CIC, CID, CIT, CLIA, is the irrigation management department manager for Northern Water in Berthoud, Colorado. He has earned his Master of Science in engineering from Utah State University and is also a licensed professional engineer in Colorado. Crookston has recently become an Irrigation Association instructor.



Drought

California Growers Look for Long-term Solutions to Conserve Resources

By Dirk Lenie

While recent storms have ended the drought in many parts of the state, California growers are planning for the future — looking for long-term solutions to combat future water shortages.

Years ago, when there was an abundance of water and inexpensive labor, gravity flow systems worked well in California. Because water resources are now scarce and labor costs are rising, it's imperative that growers consider newer forms of irrigation in order to wisely maximize limited resources and remain sustainable.

Among the options, replacing flood irrigation with "pressurized irrigation" (e.g., drip, center pivot or permanent set sprinklers) could help address water shortages as well as the state's rising labor costs.

According to the USDA's 2013 *Farm and Ranch Irrigation Survey*, of the 7.5 million acres of land currently irrigated in California, the vast majority (4.5 million acres) still use flood (gravity flow systems) for irrigation, with 2.3 million acres using gravity systems exclusively, which are much less efficient than other methods.¹

Commonly used on row crops and vegetables, center pivots have sprinkler heads that can be lowered to just inches above the tops of plants, minimizing water loss from evaporation and wind drift. Switching from flood to center pivot irrigation is both water- and labor-efficient and typically results in the following:

- Up to 75 percent labor savings
- Up to 45 percent less water use
- Energy savings of more than 33 percent
- Fewer pumping hours, which extends pump life
- More even application for up to 50 percent higher yields
- Less runoff for fertilizer and chemical savings²

Using microirrigation, or a drip system, is generally more efficient than using a flood system because it slowly delivers low volumes of water directly to the plants' roots, eliminating runoff and evaporation. Drip irrigation systems typically consist of pressurized tubing that runs along crop rows. The tubing is fitted with emission devices at specific distances that allow water to drip into the root zones. While initial investment costs per acre may be higher than other systems, there are many benefits to microirrigation. Results from a study published in the *World Academy of Science, Engineering and Technology* indicate the following:³

- The drip irrigation method saved 55.4 percent water and gave 22 percent more yield as compared to that of the furrow irrigation method.
- Higher water-use efficiency of about 4.87 kilograms per cubic meters was obtained in the drip irrigation method, whereas lower water-use efficiency of about 1.66 kilograms per cubic meters was obtained in furrow irrigation.

For California grower Ed Hale Jr., converting from flood to drip irrigation resulted in reduced costs and improved yields.

According to an article in the *Sacramento Bee* about Hale, "He converted a 2,600-acre alfalfa field to drip irrigation. Flood irrigation would have caused lots of water wasted, he said, because the field sloped too much, causing water to run off too fast. He estimates drip uses about two-thirds less water, yet the crop yield has doubled."⁴



Photos courtesy of Lindsay Corporation

With precise irrigation technology, such as remote control and management, center pivot and microirrigation systems can save California growers up to 75 percent on labor costs and increase yields by up to 50 percent — putting more money back into growers' pockets.²

Research shows that when it comes to pursuing new forms of irrigation, the time to act is now. According to a study conducted by the University of California, Davis, direct losses in agriculture revenue in 2015 topped \$1.8 billion, with the total economic impact on agriculture and related industries reaching nearly \$3 billion.⁵

According to University of California Cooperative Extension Farm Advisor Jeff Mitchell, California growers simply can't afford to ignore automated systems any longer.

"New technology advances make them more advantageous for California," Mitchell said.⁶

Center pivot and microirrigation systems also offer environmental benefits for the state, as they have the ability to utilize reclaimed water for irrigation and produce

less water/chemical waste due to their precise applications, thereby decreasing the chances of contaminating nearby water sources. In addition, they use less energy, reducing more than one-third (36 percent) of all energy costs.²

Of course, with any irrigation system, proper management is the key to achieving optimum efficiency. New technologies are now available to monitor soil moisture and other conditions to ensure that the applied water closely matches crop water requirements in order to maximize yields and improve water-use efficiency.



Dirk Lenie is the recently retired vice president of global marketing for Lindsay Corporation. He has served the IA as the vice chair of the Awards and Honors Committee, chair of the Expo Advisory Committee, a member of the Directors Nominating Committee, and a member of the Board of Directors.

Notes

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Cloud-connected Landscape Irrigation Control

By Parry Webb, CLIA

Connecting an irrigation controller to the internet has a number of inherent benefits. A connected controller allows multiple users to monitor and change the programming. This introduces a level of accountability that is not only beneficial for the end user but also for the contractor. Essentially, it ensures both the end user and the landscape professional are on the same page regarding what is happening in the irrigation system and the use of water. Visibility to how the connected controller is programmed and whether the controller is running in smart mode or if the rain sensor is working can be monitored and remedied should any settings be changed.

Additionally, the contractor benefits from having remote access to the irrigation system, eliminating the need to drive to the location just to check the controller's programming or make a change. The idea of a lower-cost, higher-profit virtual service call is something a contractor could offer to clients. By installing flow sensing and having remote access, the contractor has the ability to "see" what's happening and respond proactively to weather changes and irrigation breaks, as well as be able to schedule repairs and order parts more quickly.

Technology Options

There are multiple ways to connect to the cloud. The type of connection device is largely dependent on the scope of the project and what type of internet connection is available at the location.

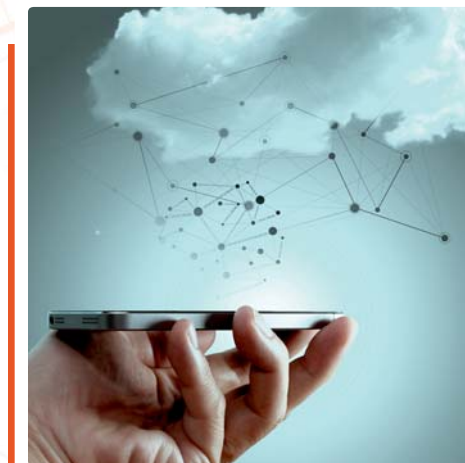
Wi-Fi works great in locations where a client allows access to their Wi-Fi network. Setup is typically simple by joining a Wi-Fi network and entering the network password. Connecting an irrigation controller to Wi-Fi is largely determined by the distance between the controller and the Wi-Fi router, as well as the stability of the Wi-Fi network. A Wi-Fi router using 2.4 Gigahertz typically has a range of 150 feet within a home and 300 feet in a line-of-sight configuration.

Another option offered by some manufacturers is a 900-Megahertz controller, which can travel up to 2,000 feet. A 900-Megahertz controller connects to the same internet connection as a Wi-Fi controller but uses a standard Ethernet cable. It broadcasts its own 900-Megahertz wireless network, enabling a controller with a 900-Megahertz radio to connect to the internet.

A third communication option for connecting an irrigation controller is cellular. The advantage of cellular is that it does not rely on connecting the controller to the client's internet connection, making it an ideal choice for locations where the client does not have internet available or does not want to allow a third-party connection to their wireless network. The range of cellular is measured in miles but is dependent on the type of cellular technology used and the location of the local cellular towers. The types of cellular technology are code division multiple access (known as CDMA) or global system for mobiles (known as GSM).

One of the areas bound to cause confusion with contractors is how a network is set up. Wide area networks (known as WAN) are a network of computers connected over a large geographic area. The biggest WAN in the world is the internet. On the other hand, a local area network (known as LAN) is a "closed" network of computers that communicate over a much smaller geographic area, usually via private infrastructure using Ethernet cables, radios or other wireless devices.

The difference between WAN and LAN is important to understand because as irrigation communication technology



continues to evolve, both network options are likely to be part of an adequate connected irrigation controller platform. In other words, while a Wi-Fi controller connected to the internet (WAN) might be a good option for a homeowner who wants to give a contractor access to an irrigation system, a LAN option using 900 Megahertz might be a better solution for a commercial property whose facility management team needs a more secure, non-internet-based solution.

Summary

As the momentum for connecting irrigation controllers continues to accelerate, the irrigation industry will be challenged with getting up to speed on this technology. The tech-savvy customer will expect the irrigation professional to be more knowledgeable and proficient in implementing smart and secure connected solutions. The opportunity to provide expertise and improved water management for our customers has never been greater.

Parry Webb, CLIA, is the Western U.S. sales manager for Weathermatic. Weathermatic has been serving landscape professionals for 70 years and has a full line of irrigation products including software, controllers, sensors, valves, rotors, sprays and nozzles.





International Protection Markings

By Michael Grzywacz

The International Protection Markings, also known as Ingress Protection or IP codes/ratings, are standards that classify the degree of protection provided against intrusion (solid objects including body parts like hands and fingers), dust, accidental contact and water in electrical enclosures. The standard aims to provide users detailed information so that informed decisions can be made in the selection of electrical devices to meet an application's criteria.

IP Ratings — Raising Performance Standards

IP standards were developed in Europe and adopted in the United States for lighting products around the year 2000. Prior to IP ratings, the standard for wet location performance testing for lighting products was the Underwriters Laboratory wet location rain test. That test consists of the fixture or lamp being "rained" on via showerheads at a specific angle for a designated period of time. During that time, the product is turned on and off (or cycled) to ensure that less than the allotted amount of water enters the

Table 1. Interpretation of IP Ratings — First Digit: Solids

The first digit indicates the level of protection that the enclosure provides against access to hazardous parts (e.g., electrical conductors, moving parts) and the ingress of solid foreign objects.

Digit	Object Size	Effective Against
0	Not protected	No protection against contact and ingress of objects
1	>50 mm	Any large surface of the body, such as the back of the hand, but no protection against deliberate contact with a body part
2	>12.5 mm	Fingers or similar objects
3	>2.5 mm	Tools, thick wires, etc.
4	>1 mm	Most wires, screws, etc.
5	Dust protected	Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment. Complete protection against contact
6	Dust tight	No ingress of dust; complete protection against contact

Table 2. Interpretation of IP Ratings — Second Digit: Liquids

The second digit indicates the level of protection of the equipment inside the enclosure against harmful ingress of water.

Digit	Liquid Amount	Effective Against
0	Not protected	No protection against contact and ingress of liquids
1	Dripping water	Dripping water (vertically falling drops) shall have no harmful effect.
2	Dripping water when tilted up to 15 degrees	Vertically dripping water shall have no harmful effect when the enclosure is tilted at an angle up to 15 degrees from its normal position.
3	Spraying water	Water falling as a spray at any angle up to 60 degrees from the vertical shall have no harmful effect.
4	Splashing water	Water splashing against the enclosure from any direction shall have no harmful effect.
5	Water jets	Water projected by a nozzle (6.3 mm) against enclosure from any direction shall have no harmful effect.
6	Powerful water jets	Water projected in powerful jets (12.5-mm nozzle) against the enclosure from any direction shall have no harmful effects.
7	Immersion up to 1 m	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion).
8	Immersion beyond 1 m	The equipment is suitable for continuous immersion in water under conditions that shall be specified by the manufacturer. Normally, this will mean that the equipment is hermetically sealed. However, with certain types of equipment, it can mean that water can enter but only in such a manner that it produces no harmful effects.

lighting product. As shown in table 2, the IP ratings are far more stringent to achieve various levels of protection. That is not to say that the UL wet location testing procedures are invalid (it is still a viable listing used today); however, IP testing — and achieving the various levels of protection — can ensure the durability of a lighting product when exposed to the outdoor elements. In addition to water, IP ratings introduced solid particle intrusion limitations as well.

Understanding IP Ratings

The IP rating consists of the letters “IP” followed by two digits and an optional letter (the letter is rarely used). The first digit indicates the size of various solids that cannot penetrate into the product, and the second digit indicates the amount of liquids that, under certain pressures, cannot enter a product. The digits represent a range and indicate conformity with the conditions summarized in tables 1 and 2. For example, an electrical socket rated IP65 is protected against ingress of dust and will not allow water projected by a nozzle against enclosure from any direction to penetrate the enclosure or have any harmful effects. IP ratings are now frequently used for both lighting fixtures and certain outdoor use lamps, such as a multifaceted reflector lamp at 1¾ inches (MR16), a parabolic aluminized reflector lamp with a 4.5-inch diameter (PAR36) and JC products, referring to low voltage halogen bulbs. Although they cost a little more than traditional products, lamps and fixtures with these ratings are certain to outperform products without IP ratings in outdoor environments.



Example of an IP65 rated JC LED Bi-Pin by Halco

The Benefits of IP Ratings

An IP-rated lamp or fixture provides an added level of confidence to installers that the system they install will perform as they specified for their clients. To home and building owners, it's the peace of mind that their homes or businesses will be illuminated for many trouble-free years.

Michael Grzywacz is the national sales manager for Halco Lighting and Technologies. With over 23 years of experience in the landscape industry, he has specialized in the landscape lighting industry for the past 15 years.



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Irrigation Water Leasing in Colorado and Nebraska

By George Oamek, PhD

Irrigators in Colorado and Nebraska are being encouraged to enter into water leasing arrangements with municipalities seeking permanent or emergency water supplies and with agencies responsible for providing instream flows for endangered species.

This encouragement comes from state resource agencies worried about balancing water's competing uses and from the financial terms being offered for these leases. The Colorado Water Conservation Board is hoping that about 50,000 acre-feet of water currently used for irrigation can be shared in the future with rapidly growing municipalities and environmental interests in the South Platte River Basin.

These buyer-willing seller leases aim to prevent thirsty cities from outright purchasing the water rights, with the indirect impact of "drying up" rural communities dependent on irrigated agriculture. In Nebraska, the State Department of Natural Resources, local Natural Resource Districts and the Platte River Recovery Implementation Program are all experimenting with various forms of lease markets in order to restore the Platte River to a more natural condition.

Broadly termed alternative transfer methods (or ATMs) for water, these leases vary from long-term rotational fallowing where an irrigator agrees to fallow a portion of their operation on a regular rotating basis (such as one in three years), to dry-year options that are only exercised during severe droughts, to short-term traditional leases. To date, the leases have been more talk than action.

Rotational fallowing is currently being used in Colorado on a small scale, but other forms of leases have been rather slow to develop compared to agencies' expectations. The reasons for slow adoption have been economic and cultural. With currently volatile commodity prices and uncertainties regarding future water shortages, it appears irrigators want more than they have been offered.

Economic Prospects

From an economic perspective, prospective water purchasers tend to base their offers on the value of the water for irrigation use or, alternatively stated, the contribution the water makes to the irrigators' profits. Although intuitively appealing, this contribution varies widely from year to year due to fluctuating commodity prices. Under current prices, for instance, the additional profit afforded by irrigation may be less than \$100 per acre in some areas. However, with prices near their 2013 – 2014 levels, this return may be near \$500 per acre.

In addition, irrigators know that the prospective purchasers' other water supply alternatives may be much higher than this foregone profit. Irrigators may also be concerned that the good faith act of temporarily transferring some of their supplies might trigger legal action regarding the amount of water to which they actually have rights.

Cultural Considerations

From a cultural perspective, there has been a reluctance by some irrigators to enter into leases because it might "show their hand" with respect to how much water they use and need. There is a general level of trepidation about being the first in the neighborhood to try something new with such an important asset like water. Some irrigators view water as something too important to lease at any price.

So far, lease success stories have been on a small scale. The aforementioned Colorado rotational fallowing program has yielded about 500 acre-feet per year at a cost near \$500 per acre. The Grand Valley Water Users Association is participating in another form of ATM, water banking, involving leasing about 3,200 acre-feet per year from local irrigators at \$356 per acre. These prices are well above the water's value for irrigation under current crop prices. Other ATMs are currently being investigated but have yet to show promise to fulfill Colorado's 50,000 acre-foot goal.

For the 2016 and 2017 crop years, the PRRIP and Central Nebraska Public Power and Irrigation District have offered surface water irrigators within the district \$220 per acre to fallow up to 2,000 acres on a year-to-year basis to enhance Platte River flows. In light of the low price of corn, about 1,100 acres were enrolled for 2016, primarily consisting of center pivot corners and smaller hard-to-irrigate parcels. Based on the modest success of 2016, the number of participants increased by 50 percent for 2017, but the number of acres enrolled has not yet fully utilized the program. Nearby, the Central Platte Natural Resource District is pilot testing an electronic auction market for groundwater irrigation water. For the 2017 crop year, the PRRIP bid \$250 per acre-foot and only received 35 acre-feet at this price. Considering crop consumptive use and depletion allowances, this equates to about \$200 per acre to the irrigator. Similar to the Colorado leases, the lease prices in Nebraska tend to be in excess of the water's value in irrigation under current commodity prices.

For purposes of providing a framework for the sharing of increasingly scarce water supplies across multiple uses, irrigation water lease markets are still evolving. However, in an era of volatile commodity prices and increasing data availability, we know that irrigators have been able to negotiate a significant premium for their water in excess of its productive value.

George Oamek, PhD, is an economist with Headwaters Corporation and is also on the staff of the Platte River Recovery Implementation Program's executive director's office. His 30-year career has focused on agriculture economics, including irrigation water leases, municipal water supply planning and methods for managing risks. He received his undergraduate education at Colorado State University and his graduate degree from Iowa State University. He also operates his family's Century Farm in Southwest Iowa.



High-profile Sporting Events in Brazil Benefit From Rain Bird Irrigation Systems

By Lynette Von Minden

While all irrigation projects have their unique challenges, few experience the intense scrutiny that accompanies projects associated with global sporting events. The pressure to have nearly perfect, green, healthy, playable sports fields and surrounding landscapes is at its pinnacle on the international stage with events watched by millions worldwide. Over the past few years, Rain Bird experienced this type of pressure firsthand, successfully providing irrigation systems for not one, but two, multiweek international sporting events in Brazil.

International Soccer Tournament

Between September 2012 and January 2014, a total of 11 regional soccer stadiums were constructed to host the largest

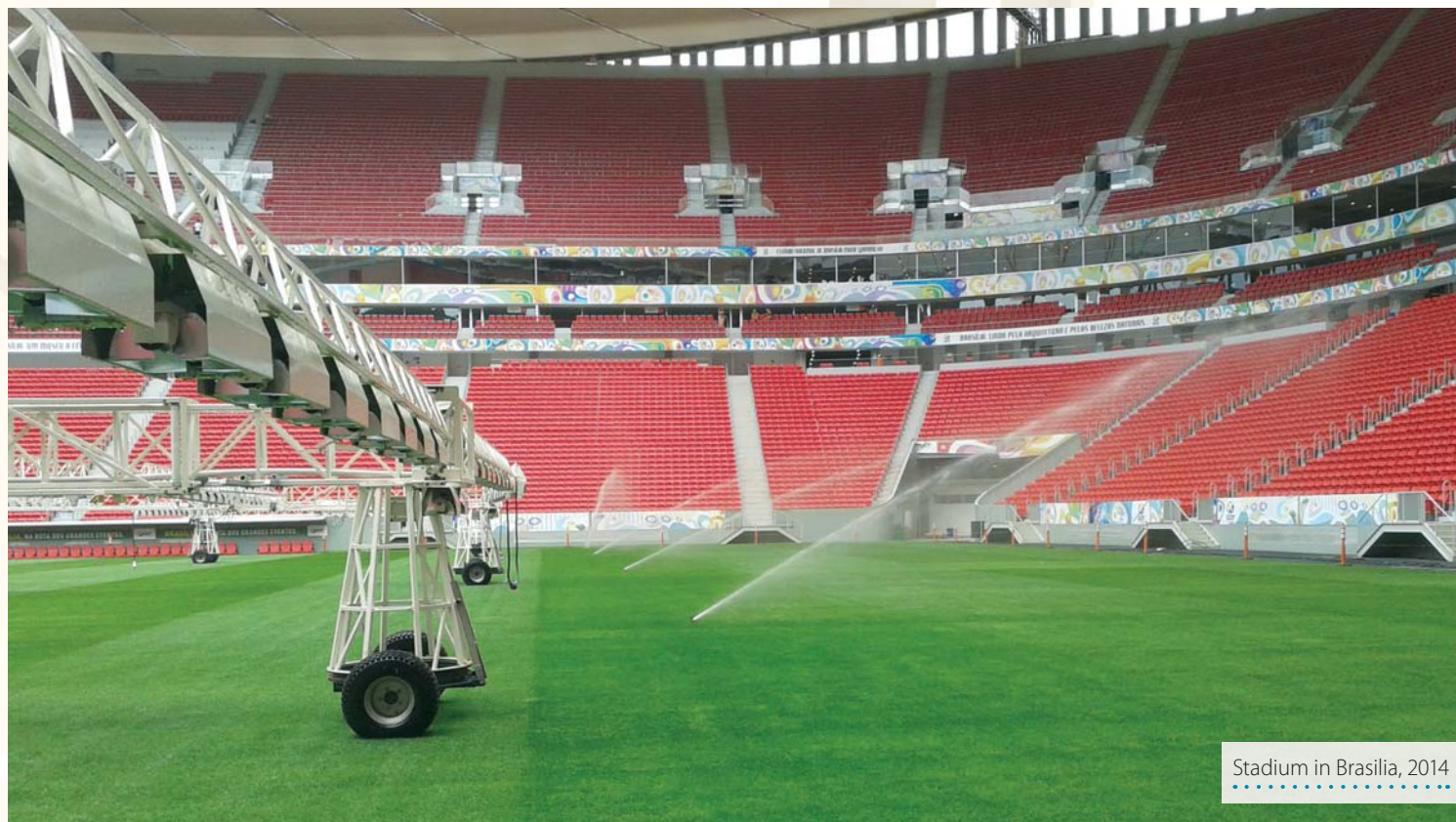
international soccer tournament, all of which had Rain Bird irrigation systems installed to keep their turf in top condition.

"The sports turf managers at these stadiums were focused on providing the absolute best playing surface for elite soccer athletes," said Jose Giacoia Neto, Rain Bird Brazil's international business manager. "Obviously, irrigation is a key element of soccer field maintenance."

The first Brazilian stadium to install an irrigation system was Castelão Stadium located in the city of Fortaleza in September of 2012. Over the next year, Rain Bird signed on 10 more stadiums in the Brazilian cities of Rio de Janeiro, São Paulo, Salvador, Belo Horizonte, Brasília, Cuiabá, Manaus, Natal, Recife and Curitiba.

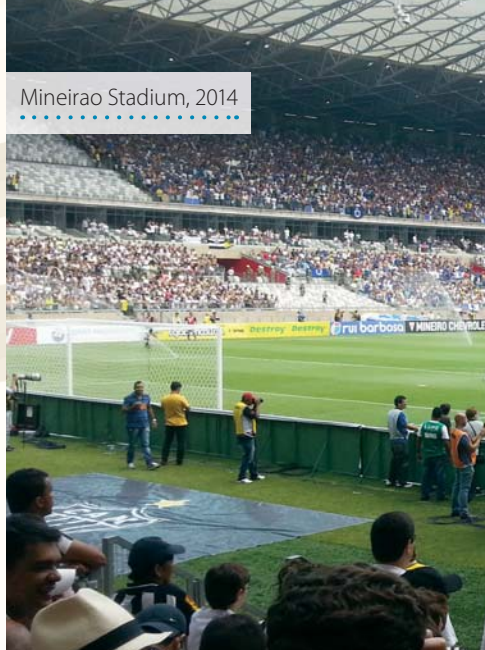
Global Multiweek Sporting Event

In 2016, Rain Bird irrigation systems were in the spotlight once again, as Brazil prepared to host what is perhaps the world's most famous multiweek sporting event — the Olympic Games. The Barra Athletes' Housing Complex, Barra Sports Park Complex, the equestrian cross-country course, the field hockey and rugby pitches, and Madureira Park in Rio de Janeiro installed Rain Bird products. Other areas within the city of Rio de Janeiro, including Tomorrow's Museum and Downtown Boulevard, were also renovated with irrigation systems in anticipation of the thousands of international visitors that were soon to converge upon the city.



Stadium in Brasilia, 2014

Mineirao Stadium, 2014



Each venue had its own specific challenges. At Barra Athletes' Housing Complex and the Barra Sports Park Complex, the goal was to deter irrigation system vandalism and improve water efficiency. Twenty-five miles of subsurface dripline was installed underground, providing a highly efficient, vandal-proof alternative to aboveground irrigation sprays and rotors. At these two venues, the SSD is estimated to have reduced water consumption by at least 30 percent. Commercial controllers were also installed at these two properties to enable precision watering of various microclimates caused by areas of sun and shade. At the rugby pitches, rotors and 2- and 3-inch rain guns were chosen for their long throw radii.

Key Relationships & Support

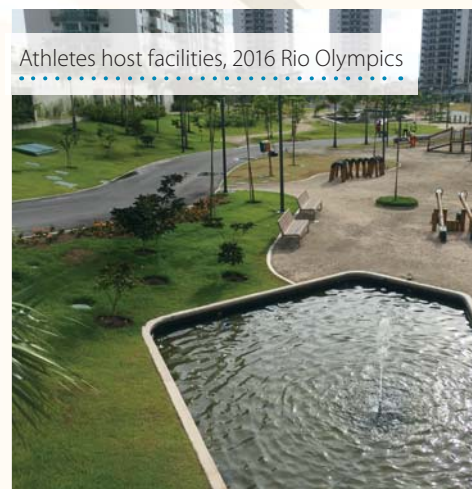
With a focus on sustainability and its commitment to The Intelligent Use of Water™, Rain Bird helped these venues provide the world's best soccer, hockey and rugby players with superior field conditions. Fans also got to enjoy beautiful, water-efficient green spaces in various sports complexes and city parks throughout Brazil.

According to Rain Bird Brazil's Jose Giacoia Neto, a variety of factors helped his team successfully win the bids for these projects. Rain Bird Brazil's team consists of high-level engineers with solid reputations throughout the country. A trusted distributor network provides local service throughout each sales territory, allowing the team to create unique solutions customized for each market and customer's needs. After each of the irrigation projects

Athletes host facilities, 2016 Rio Olympics



Athletes host facilities, 2016 Rio Olympics



Olympic Park (during construction), 2016 Rio Olympics



for these sporting events was defined, the sports field and landscape builders who won the event's primary bid began directly contacting Rain Bird partners.

Like most irrigation projects, the successful installations at these high-profile events can be attributed to building strong relationships with local builders, providing high-quality products and providing consistent technical support.

Lynette Von Minden is a senior public relations counsel for Swanson Russell, a marketing communications agency in Lincoln, Nebraska, that represents Rain Bird Corporation.





Contractor/Small Business Corner

Retaining Irrigation Talent

By Eric Santos, CAIS, CGIA, CIC, CID, CIT, CLIA, CLWM

With the recent economic upturn, unemployment rates are lower than they have been in many years. For many irrigation contractors, securing irrigation talent has become one of the biggest obstacles in keeping up with business demands and growth. Retaining existing staff members can be just as challenging as finding new talent. The following steps are simple reminders of how managers can retain the current talent that has helped their businesses grow and become successful.

Step 1 – Recruit Right

The first step in improving retention is hiring the right people from the start. Always look for potential team members with traits that show a passion for what we do, and always be honest about the difficulties in the jobs we face. Yes, we may have the fortune of working in the beautiful outdoors, but don't forget to let candidates know about the days when temperatures are in excess of 100 degrees. It's also important to mention the days when it's below 50 degrees, and the job involves working outside in water. Never "candy coat" the reality just to convince someone to take the job.

During recruiting, look for potential team members searching for a career and not just a 40-hour-a-week job. Be cautious of team members who jump from company to company within the same industry. There is nothing wrong with looking for a better opportunity, but the potential

candidate who is looking to leave their existing company will likely continue looking even after they are onboard.

Be extra critical of the candidate who says, "I've been working in irrigation for many years and know how to do it all!" As part of the interview process, develop open-ended questions to get the candidate to talk about specifics, but beware of fast talkers who sling irrigation jargon to try to impress you with how much they know. During the interview, assume you are looking to hire someone to replace yourself. Taking the extra effort to recruit right will help long-term retention.

Step 2 – Welcome to the Team

Once the candidate is hired, treat your new staff member as a member of the team and not just as an employee. People don't work for companies — people work for people. If new hires feel like they play an important part on the team, they are more likely to become loyal employees.

Take every opportunity to connect with your team and make the interaction as personal as possible. Never open a conversation with a request related to the business. A simple, "Good morning" at the start of each day with a smile or a, "Thank you for all of your help" at the end of the day with a handshake doesn't take a lot of time, but it really goes a long way. On Fridays, ask your team members if they have any exciting plans for the weekend,

and on Mondays, ask about their weekend. Take the time to genuinely connect with every team member regardless of position and tenure, and always treat them as equals. There is nothing more demoralizing than having a manager walk by you without saying hello, making eye contact or acknowledging you.

Never underestimate the impact of small details such as taking time out of your busy schedule to wish team members a happy birthday. Be genuine and show them that you care about them as individuals, their safety and their families. Always be flexible about personal and family commitments. Team members should know that families always come first.

Step 3 – Motivate Your Team

Make the time for motivating activities such as the occasional team lunch. If the team needs to work late to finish a project, take them out to dinner. If the team has to give up a Saturday away from their families for work, offer to treat them to lunch. Use these opportunities to get to know your team better, announce events such as employment anniversaries, or recognize team members in front of their peers for hard work and a job well done.

Step 4 – Invest in Your Team

Always invest in education, training and continuing education for your employees throughout the year. There is a growing number of online education training sessions offered by the Irrigation Association, Cal Poly's Irrigation Training and Research Center, Rain Bird and Hunter Industries that can be taken on your own time. Offering to pay for education and certification classes shows team members that you value education and that your organization is willing to make an investment in personal development.



Step 5 – Teach Something New Every Day

Look for opportunities to continually teach your team something new. Turn every mistake into a learning opportunity, and never shame a team member over failure or for lack of knowledge. It is a manager's responsibility to train team members. Without proper training, direction and guidance, it is impossible to hold team members accountable. Challenge your team to grow and improve themselves from one job to the next, and always lead by example.

No matter how hard you try, turnover can never be completely eliminated. When a team member decides to part ways, it is always important to depart on a positive note. Never blame a team member for pursuing a better opportunity. At the end of the day, what matters most is that team members do what is best for them and their families. As a manager, always try to determine why an employee is leaving and if there is anything you can do to make him stay. Finally, if the team member still decides to leave, let him know that he is always welcome to return if things don't work out, and always part ways with a smile and friendly handshake!



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- Automated Irrigation Management
- Center Pivot and Linear Move Irrigation System Overview
- Center Pivot Hands-on Activity
- Irrigation Management Approaches
- Pumping Plants
- Recent Advances in Center Pivots
- What Is Variable Rate Irrigation?
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June 15 – 16, 2017

Disney World Horticulture Services
Orlando, Florida

- Anatomy of an Irrigation System
- Design Capacity
- Drip Conversion and Hands-on Activity
- Irrigation Maintenance at The Walt Disney World Resort
- Pipe Sizing
- Pressure Regulation and Hands-on Activity
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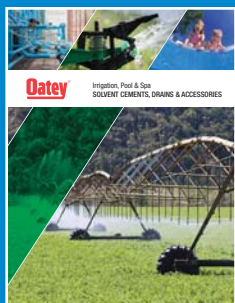
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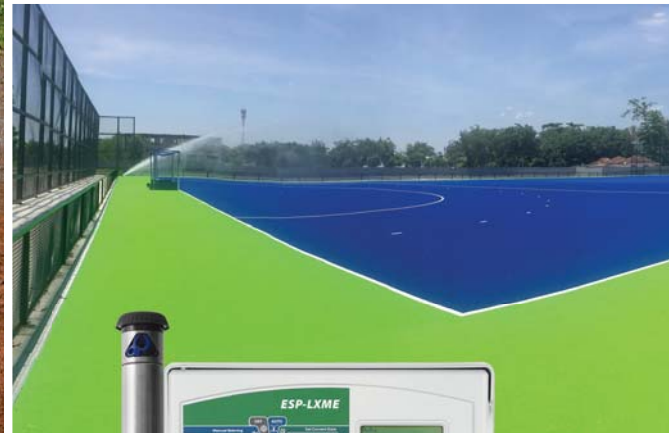
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