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Seasonal Maintenance Practices for Drip and Sprinkler Irrigation Systems in Arizona

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Introduction

Irrigation is essential to sustaining agriculture in Arizona, where water is one of the most valuable but limited resources. With the arid climate and increasing water conservation pressures, efficient irrigation practices are more important than ever. Drip and sprinkler irrigation systems, when properly maintained, are essential tools that allow growers to manage water effectively while maintaining crop yields. These systems help to deliver the right amount of water to a crop, minimize waste, and reduce operational costs.

Regular seasonal maintenance of these irrigation systems is vital to keeping them operating at highest efficiency. Over time, issues such as clogged emitters or sprinkler heads, leaks, and damaged components can reduce irrigation system performance, leading to poor distribution uniformity, higher energy consumption and over- or under-irrigation. Addressing these issues through scheduled maintenance not only ensures optimal water distribution but also minimizes the risk of costly repairs and system failures during the growing season. By maintaining these systems, growers can prevent inefficiencies that would otherwise lead to unnecessary expenses due to increased energy and water use.

In Arizona, where water conservation is a necessity, maintaining irrigation systems is an investment in long-term sustainability. Properly maintained drip and sprinkler systems can lead to significant water savings and enhanced irrigation efficiency, helping to keep farm operations economically sustainable.

This publication will explore the best practices for seasonal maintenance of drip and sprinkler irrigation systems, offering practical advice for Arizona growers on how to extend the life of their irrigation systems and optimize water-use. With timely maintenance, growers can continue to succeed while adapting to changing environmental conditions and limited water supply.

Maintenance Practices for Drip Irrigation Systems

Subsurface drip irrigation (SDI)

SDI systems utilize permanently buried driplines to deliver water and nutrients directly to the root zone. This method offers several advantages, which may include increased water use efficiency, reduced evaporation and runoff, improved fertilizer management, increased yields, reduced energy use and consequently lower greenhouse gas emission. To provide the best return on investment, the system should be maintained to last as long as possible. There are examples of systems that have been in service for over 20 years. To ensure a long lifespan of optimal performance and benefits, effective maintenance is essential. The first step in maintaining your SDI system is to understand the primary components of a system.

System layout

This article does not cover SDI system design in detail. However, it is important to understand how the system is assembled and why specific components, such as the ones depicted in figure 1, are used.

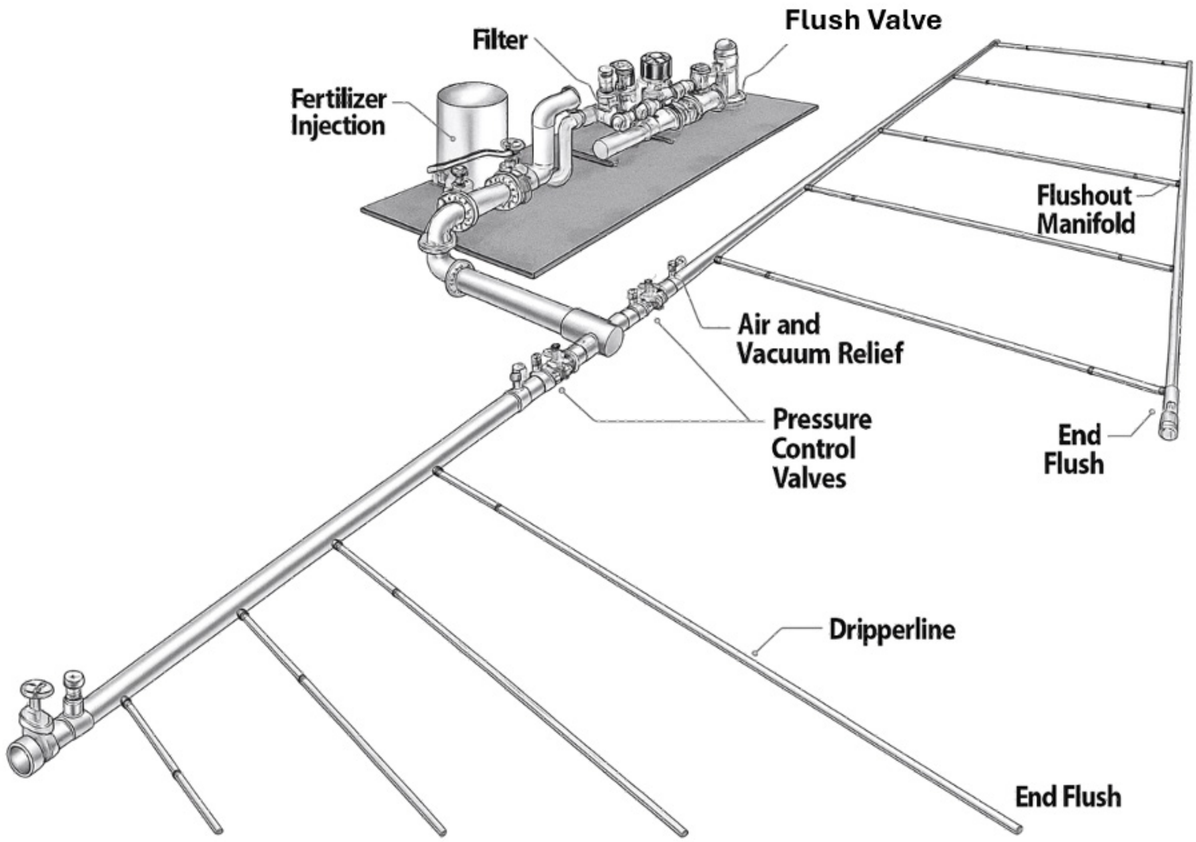

Figure 1. Schematic layout of drip system components. Image credit: reproduced from Drip System Operation and Maintenance, Netafim USA, retrieved June 01, 2025.

System components

Dripline (laterals)

Choosing the correct dripline for your field conditions is essential. Pressure compensating driplines are recommended for uneven or hilly terrain. Non-pressure-compensating driplines are typically used in flat areas. Additionally, factors such as soil type, length of run, topography, zone size, and water quality play an important role in choosing the right dripper. Where possible, the dripline should be installed with GPS-equipped drip tape insertion equipment so the position can be accurately determined in the future to support farming practices such as discing, ripping, and crop rotations, which utilize auto guidance technology.

Filtration

The filtration system protects the dripline from sand and fine particles that can cause clogging. A well-designed filtration unit enhances both performance and system longevity. It is vital to match the type and size of filter to your water quality, prevailing contaminants, and water source. Automatic filter cleaning is recommended. A pressure differential switch paired with a flushing controller is a common automation method that initiates backflushing when pressure differences exceed preset thresholds.

Pressure regulating valves

These valves are critical in systems using non-pressure compensating drip tape to maintain the correct operating pressure. They should be adjustable to allow higher pressures during system flushing.

Air vents

Air vacuum relief vents let air out of the system at startup and back in during drainage after shutdown. This prevents the suction of soil into drippers during system shutdown and prevents damage to main and submain pipes. It is recommended to have one vacuum relief vent per 50 laterals at the highest elevation, one vacuum relief vent on the highest point of the flushing manifold, a dual-purpose automatic air vent at the pump, and typically a vent in the mainline as well.

Fertilizer injection system

This system allows injecting fertilizers directly into irrigation water, promoting crop performance and maintaining dripline condition. Options may include automated or manual injection pumps. Always consult a qualified expert to verify that fertilizers are safe and compatible with SDI systems. Some fertilizers and chemicals can cause precipitates or leave residues that may promote emitter plugging.

Water meters

Flow monitoring is vital for system performance and assessing crop water use. SDI systems are designed to operate at specific flow rates at specified pressures. A water meter helps identify changes in flow rates that may indicate leaks, improper pressure regulator valve settings or malfunctions, or pumping and well performance issues. More information is provided in a later section on interpreting meter readings.

Pressure gauges

Gauges are essential for confirming proper system operation at the pump, filters, and driplines. Changes in pressure reading can help detect clogging or component malfunctions.

Flush manifolds

Flush manifolds enable entire irrigation zones to be flushed simultaneously and promote system uniformity. Installing manifolds at the end of each field significantly reduces the labor needed for routine maintenance.

System startup

Whether you are activating a newly installed SDI system or restarting after the off-season, following these startup procedures is essential for optimal performance:

Flush the well

Before running water through the filter, flush the well. A new or idle well may discharge a burst of sand or debris upon startup. This material can overwhelm the filtration system, triggering repeated and ineffective backflush cycles. If the well continues to produce sand regularly, consider installing a sand separator upstream of the main filtration unit.

Flush laterals and mains

New systems may contain debris such as PVC shavings or soil from installation. In operating systems, fine silt may bypass the filter and settle in the lines over time. Always flush after any line repairs to remove any intruded particles. Regular flushing is necessary throughout the season.

Check for leaks in dripline (laterals)

Damage to laterals can occur during installation. Startup is the best time to check for leaks, before plant canopies expand and hinder access for repairs.

System pressure and flow tests

Evaluating system pressure and flow ensures the system operates within design parameters. Distribution uniformity is essential to system performance and should be measured and evaluated regularly. Perform the following during startup and as an ongoing part of system maintenance:

Pressure measurement

- Measure the pressure at several points across the system and compare against the system design pressure.
- At minimum, record pressures at three locations near the header and three at the far end of the field.
- If pressure differences exceed 1 pound per square inch (PSI) between ends and the header, investigate for potential flow or design issues.

Flow rate verification

- Use a water meter to confirm the water flow matches the system design. If your system lacks a meter, retrofit one.
- Flow should be within ±5% of the expected rate.
- Use this formula to calculate the flow per drip tape:

$$\textit{Flow rate (Gallons Per Minute)} = 0.2 \times \frac{\textit{(length of drip tape (ft) x Emitter flow rate (GPH)}}{\textit{(emitter spacing (in.)}}$$

- Example:

  In a zone with six drip tapes, each 600 feet long with emitters spaced 12 inches apart delivering 0.5 GPH, the expected flow rate per drip tape is 5 Gallons Per Minute (GPM) (calculated as 0.2 × [600 × 0.5] / 12), resulting in a total design flow rate of 30 GPM for the entire zone (5 GPM x 6 drip tapes). If the actual measured flow rate is 27 GPM, this represents a 3 GPM deficit (10% less than the design rate). In such cases, it may be necessary to take corrective action, like applying an acid treatment (such as phosphoric or sulfuric acid) to break down mineral buildup or using hydrogen peroxide to clear out organic or biological clogging. On the other hand, if the measured flow rate is 29 GPM, the 1 GPM difference (3% less) falls within acceptable variation. However, a measured flow rate of 33 GPM, which is 3 GPM or 10% higher than expected, may suggest excessive system pressure and the need for adjustment.

Common issues in drip irrigation systems based on changes in flow rate and pressure are highlighted in Table 1. Gradual or sudden changes can indicate problems such as clogged emitters, damaged main or submain lines, stuck valves, or pump wear. Pressure drops often point to blockages, leaks, or equipment failure, while pressure increases may signal flow restrictions or emitter clogging. Each symptom helps identify specific system faults for quicker troubleshooting.

How to avoid excessive maintenance and optimize SDI

Maintaining an SDI system involves identifying and managing conditions that reduce performance. These may include suspended solids, chemical precipitation, biological growth, root intrusion, soil ingestion, physical damage (crimped lines, rodent damage, etc.), or injecting chemicals incompatible with drip irrigation systems. Visual inspection of water quality should be a regular practice. Flush water should be inspected for signs of grit sediments, organic matter and discoloration, Figure 2. Flushed water could be collected in a jar or by hand, considering hand protection if necessary. This will help you identify any problems with your filter, chemical or fertilizer injections, or frequency of maintenance routine.

Table 1. Possible problems diagnosed from system flow rates and pressures.

Indication	Possible problem
Gradual decrease in flow rate	Plugged emitters or possible pump wear (check pressure)
Sudden decrease in flow rate	Stuck control valve or water supply failure
Gradual increase in flow rate	Incremental damage to the drip tape by rodents
Sudden increase in flow rate	Broken lateral, submain, mainline pressure regu-lator failure
Large pressure drop across filters	Debris buildup in filters or inadequate flushing of filters
Gradual pressure decrease at filter inlet	Pump wear or water supply problems
Sudden pressure decrease at filter outlet	Broken lateral/submain/main line or pressure regulator/water supply failure
Gradual pressure increase at filter outlet	Dripper plugging
Sudden pressure increase at filter outlet	Stuck control valve or other flow restrictions
Sudden pressure decrease at submain	Damaged or broken lateral

Flushing the system

Flushing removes debris and chemical residues from the filter, mainlines and driplines (see Figure 3). It should be performed regularly, with frequency depending on water quality and filter efficiency.

Flush until water runs clear. The process occurs in two stages:

- Initial Wave: Removes material accumulated at the ends of driplines.
- Second Wave: Cleans out the driplines themselves, typically lighter in color but requires more time. When the second wave is clear, flushing is complete.

Preventing root intrusion

Root intrusion occurs when plant roots penetrate drippers, reducing or blocking water flow. This typically results from insufficient irrigation, which stresses plants and encourages roots to grow toward water sources, namely, the emitters. However, choosing appropriate products, such as Techline Check Valve Dripline (Figure 4), and adopting effective irrigation practice will help prevent obstruction from roots intrusion, as suggested in NETAFIM maintenance guide.

Causes of root intrusion and preventive measures are listed in Table 2.

If water stress is a crop management issue, it could be necessary to inject a precise dose of herbicide near emitters prior to stress periods, to discourage root growth, without harming the plant. Example herbicides are in Table 3. It is recommended to follow manufacturer guidelines and consult with an agronomist for safe chemical use.

Figure 2. Impact of maintenance on water quality (degraded water vs. clean water). Image credit: Netafim USA, retrieved on Aug 8, 2025, from https://www.netafimusa.com/.

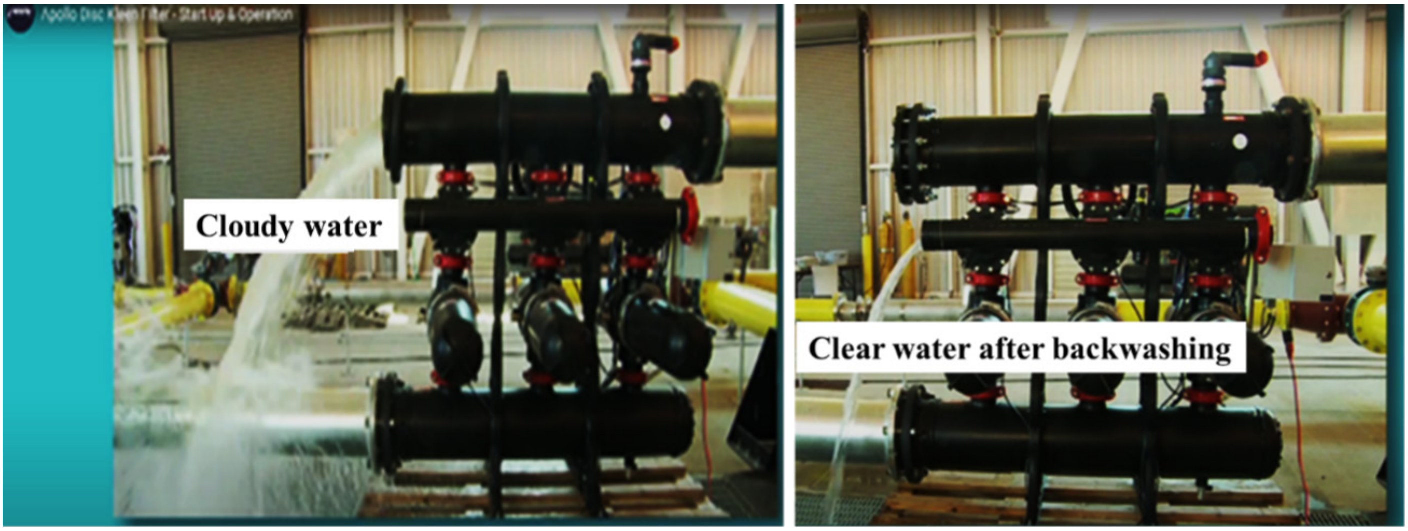

Figure 3. The filter is flushed as needed to remove sediments and organic materials. Image credit: Netafim USA, retrieved on June 01, 2025 (https://www.netafimusa.com/).

Figure 4. Preventing roots intrusion using Techline Check Valve Dripline. Image credit: NETAFIM USA, retrieved on Aug 08, 2025 (https://www.netafimusa.com/).

Table 2. Cause of root intrusion and preventive measures

Causes of root intrusion	Preventive measures
Mismatched soil infiltration rates and system design	Plan irrigation to prevent localized dryness around emitters
Inadequate irrigation scheduling	Maintain proper soil moisture by adjusting ir-rigation schedules
Poor water availability or pump issues (reduced pressure and flow rate)	Monitoring water pressure using pressure gauges
Sudden increases in water demand due to ele-vated crop evapotranspiration, such as during heatwaves	Use soil moisture sensors to monitor uniform wetting

Table 3. Common herbicides used to prevent root intrusion in driplines.

Brand name	Active substance
Treflan	Trifluralin 48%
Stomp	Pendimethalin 33%
Alligator	Pendimethalin 40%
Prowl	Pendimethalin 40%

Hydrogen peroxide, when applied with water, can be used to help prevent root intrusion and algae growth. It has become a widely accepted alternative to chlorine for disinfecting and oxidizing irrigation water. While chlorine was once commonly used, its application is now restricted or banned in many areas due to the risk of forming harmful by-products, such as trichloromethane. Hydrogen peroxide offers several advantages as it is relatively fast acting, environmentally friendly, and biodegradable, breaking down into harmless by-products (water and oxygen). It does not contaminate soil or groundwater and can improve soil oxygen levels while also aiding in the oxidation of organic matter, iron, and manganese.

The required quantity of hydrogen peroxide depends on the water quality, the cleanliness of the pipes and the driplines, and the size of the system. It is recommended to consult an agronomist for specific dosage recommendations and safe handling.

Rodent management

To manage rodent problems, Figure 5, effectively, it is best to use a layered approach. Start with site selection, fields that have had severe rodent issues in the past should be avoided if possible. Preparing the site is also important, for example, deep ripping the soil before planting can help destroy existing burrows and discourage rodents from settling in. Another helpful strategy is to encourage natural predators. For instance, installing owl boxes can reduce rodent populations (Wendt and Johnson, 2017). Trapping is effective for managing low-density infestations, while poisons such as baits and fumigants work well in localized hotspots. Burrow builders can be used to safeguard field edges, particularly near ditches, riparian zones, and neighboring fields. For areas using SDI, Protec-T offers another layer of defense. When injected, this product creates an environment that rodents find unpleasant, encouraging them to migrate away from irrigated zones and thus reducing damage to SDI systems.

Figure 5. Damage to drip tape by rodent. Image credit: Għaqda Bdiewa Attivi, retrieved on Aug 8, 2025, from https://timesofmalta.com/article/alarming-rat-invasion-wreaks-havoc-fields-they-re-big-many.1051679

Maintenance schedule

A consistent maintenance schedule ensures system longevity and efficiency. The following guidelines cover weekly, monthly, seasonal, and post-season tasks:

Once a week

- Check system flow rate and pressure during stable operation.
- Compare current values with benchmark data.
- Ensure water reaches the end of all driplines.
- Check pressure differential across filters:
  - Normal: 3-7 PSI
  - Investigate if: >12 PSI
- Check and fix for visible leaks, Figure 6.

Figure 6. Leaks identified and repaired during a broccoli irrigation experiment at the University of Arizona Maricopa Agricultural Center (Elshikha et al., 2025).

Once a week

- Measure pump flow rate and pressure.
- Flush driplines, which may require more or less frequent flushing depending on water quality.
- Manually trigger automatic filters and confirm functionality.
- Measure pressure after each pressure-regulating valve and compare with benchmarks.

Once per growing season

This is sometimes performed 2-3 times per season depending on water quality.

- Inspect all system valves.
- Check for carbonate, algae, or salt buildup.
- Look for dripper clogging.
- Flush main, sub-main, and distribution lines.
- Inject hydrogen peroxide or acids as needed. If you are dealing with organic clogging (slimy feel and odor), add about 0.5-1.0 gallon of 35% hydrogen peroxide for every 1,000 gallons of irrigation water during the last hour of watering. For regular prevention, every irrigation, you can use 1 gallon per 7,000-10,000 gallons. To get rid of mineral buildup (hard and crusty), inject acid until the water pH drops to around 2-3 for about 20-60 minutes, then flush the system. Keeping the system pH between 6 and 6.5 during all irrigations helps stop buildup from forming. Always adhere to safety protocols and confirm that your system is suitable for the treatments by checking the manufacturer's recommendations.

End of growing season

- Chemically treat and flush the entire system (see Section 2.7.3).
- Prepare for off-season by draining and sealing as appropriate.
- Winterize if temperatures may drop below 32°F.

Maintenance Practices for Center Pivot and Linear System

Regular maintenance of center pivots and linear systems leads to enhanced efficiency by identifying potential issues before they escalate, ensuring that irrigation systems function at optimal performance. This results in improved water application, which contributes to higher crop yields. Additionally, implementing a scheduled maintenance program minimizes unexpected breakdowns and costly emergency repairs. By committing to routine care, growers can extend the lifespan of their equipment and avoid the financial repercussions associated with downtime.

Moreover, regular maintenance plays a crucial role in water conservation. Issues such as leaks, clogs, and malfunctioning components can lead to significant water loss. Routine checks allow for early detection of these problems, facilitating repairs that conserve water and ultimately benefit both the environment and the financial interests of the grower. Consistent and adequate irrigation is vital for crop health; thus, a well-maintained system ensures uniform water distribution, contributing to improved plant growth and the production of higher quality produce.

Compliance with regulations also represents an important consideration. Many jurisdictions have regulations governing water use and conservation practices. Routine maintenance helps growers adhere to these regulations, thereby reducing the risk of penalties and promoting sustainable agricultural practices. Maintenance can be divided into different categories:

Mechanical system maintenance

Pivot points and tower joints

Check for structural integrity, rust, and proper bolt tension. Grease pivot bearings and structural joints regularly. Ensure pivot pads are clean and free from debris that can cause structural misalignment or resistance during movement, Figure 7.

Gearboxes and drive components

The gearbox oil should be changed at least annually and checked for water contamination, which may indicate seal failure. The gear teeth and input/output shafts need to be inspected, as well as the seals (for wear or damage). Vents and seals need to be cleaned to prevent overheating and early wear, Figure 8.

Figure 7. Center pivot tower requires regular checking and prompt maintenance. Image credit: Valmont Industries (Valmont Industries, 2015, https://www.valleyirrigation.com/).

Figure 8. Center pivot gearbox. Image credit: Valmont Industries (https://www.valleyirrigation.com/)

Center drives and motors

Monitor motor temperature and noise levels, overheating or grinding sounds may indicate internal wear. Tighten belt drives to manufacturer specifications and replace frayed belts immediately. Motor housings need to be cleaned and ensure proper ventilation to prevent overheating, Figure 9.

Figure 9. Center pivot gear motor. Image credit: Valmont Industries (https://www.valleyirrigation.com/).

Water delivery system maintenance

Nozzles and sprinkler packages

The nozzles, Figure 10, need to be inspected regularly for wear, cracks, or clogging. Replace worn nozzles to maintain precise flow rates. A nozzle cleaning tool could be used, or the nozzles need to be soaked in vinegar to dissolve mineral buildup. A wire or metal object should not be used for cleaning, because it could enlarge nozzle orifices and alter the nozzle flow rate.

Pressure regulators

Regulator output pressure should be tested with a gauge to confirm correct operation. Regulators that produce inconsistent pressure or show signs of internal wear should be replaced.

Figure 10. Center pivot nozzles in action. Image credit: Valmont Industries (https://www.valleyirrigation.com/).

Hose drops and end guns

Hoses should be checked for leaks, brittleness, or UV damage. Any deteriorated or twisted hose sections should be replaced. End-gun trajectory and nozzle performance should be checked, and adjustment or replacement could be necessary for correct coverage, Figure 11.

Electrical and control systems

Wiring and connections

Wiring should be inspected for rodent damage, corrosion, and loose terminals. Dielectric grease should be used on exposed terminals to prevent oxidation.

Control panels and timers

Start-stop functions, safety interlocks, and auto-reverse systems should be tested regularly. Software should be updated if applicable for computerized control systems to ensure compatibility and functionality.

System grounding

System grounding rods, and lightning protection should be inspected for proper connection, vital for preventing damage during electrical storms, Figure 12.

Structural and mobility components

Tire and wheel assembly

Tires should be inspected for correct pressure, sidewall cracks, punctures, and tread wear. Underinflated tires can cause drag and structural stress. Wheel bolts need proper torque.

Tower alignment and drive linkage

Alignment sensors or manual checks are needed to ensure that each tower remains synchronized. Alignment arms, micro switches, and steering mechanisms should be checked for wear and proper function, Figure 13.

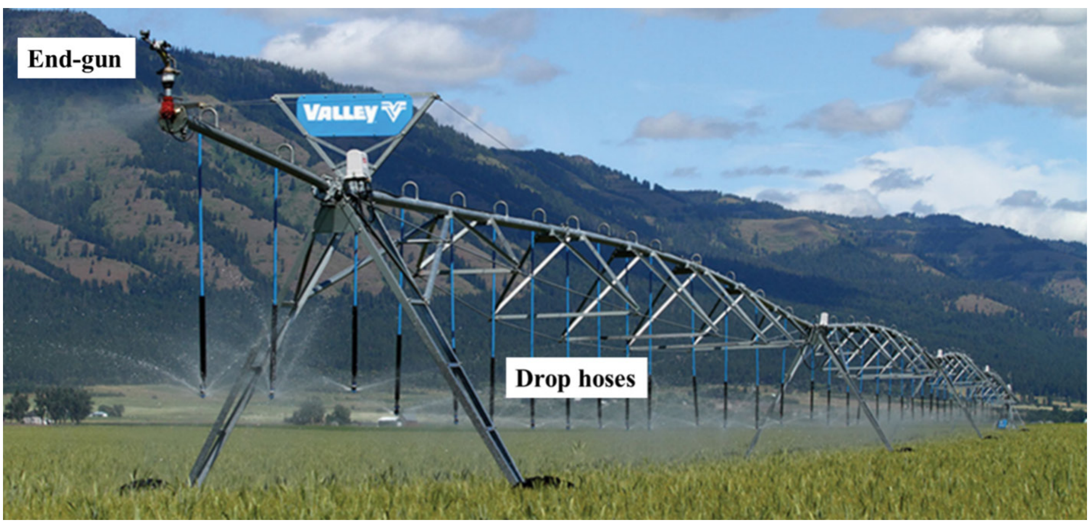

Figure 11. End-gun and drop hoses as integral parts of Valley Center pivot. Image credit: Valmont Industries (https://www.valleyirrigation.com/).

Figure 12. Center pivot main tower with a control panel box and necessary wiring. Image credit: Valmont Industries (https://www.valleyirrigation.com/)

Figure 13. Center pivot alignment check. Image credit: Valmont Industries (https://www.valleyirrigation.com/)

System performance monitoring

Water pressure and flow rate monitoring

Flow meters and pressure gauges should be used to detect inefficiencies, Figure 14. Sudden drops may signal a burst hose, leak, or clogged nozzle. Periodical recalibration of the system is needed which should be based on based on soil moisture monitoring data.

Irrigation uniformity checks

Catch-can distribution uniformity tests should be conducted but also aerial images could be used to detect dry spots or over-irrigated areas. Distribution Uniformity (DU) data should be analyzed, and adjustments to pressure or sprinkler spacing should be made as needed, in accordance with applicable American Society of Agricultural and Biological Engineers (https://asabe.org) standards that outline procedures for evaluating system uniformity.

Figure 14. Pressure gauge and flow meter used with Valley center pivot. Image credit: Valmont Industries (https://www.valleyirrigation.com/)

Maintenance schedule

A scheduled maintenance plan is essential for keeping center pivots and linear systems to be at their best performance. Proactive maintenance reduces emergency repairs, which are higher in cost, and could help avoid yield loss due to disturbed irrigation schedule or uneven water distribution.

Pre-season maintenance

- Flush the system to remove sediment buildup.
- Inspect all sprinkler heads and regulators.
- Test electrical systems, motor functions, and tower movement.
- Lubricate all moving parts and replace worn components.

Post-season maintenance:

- Drain the system to prevent freeze damage.
- Remove and store sensitive components if necessary (sensors, etc.).
- Clean and protect exposed metal from corrosion.
- Keep records of maintenance and replaced parts.

Conclusion

In Arizona, where over 100ºF days are a regular occurrence and rain is unpredictable, irrigation is essential, not optional. But just like a tractor or any machine that runs hard all season, irrigation systems need attention. They do not maintain themselves.

Whether you are running subsurface drip or a pivot, the performance of these systems depends on the care you put into them. With drip systems buried under the soil surface, it is advisable to have a proactive maintenance routine and address upkeep needs ahead of system failure. Flushing on a schedule, keeping an eye on pressure, and catching clogging or root intrusion early can save you time and expense mid-season. Little things like monitoring pressure differences or flushed water condition gives you a chance to correct issues before losing yield.

Pivots and linear systems might seem easier day to day, but they have their own issues, such as worn nozzles, broken regulators, leaking gearboxes, and towers getting out of line. When they are not working properly, your water does not go where it is supposed to and you end up with dry spots, stressed plants, wasted fertilizer and chemicals. In the desert southwestern U.S., wasting water is not an option.

This is not just about fixing what breaks. It is about looking after the system you have invested in, and making sure the water gets to your crop when it matters. Both the irrigation system and the crop are huge investments. The information in this guide is based on real field experience. If you are not keeping up with maintenance, you are gambling with your crop and investment.

Disclaimer

This publication is intended to provide an objective overview of maintenance practices for drip and sprinkler irrigation systems and does not promote or endorse any specific brand, product, or trademark. References to product names, trademarks, or companies are included solely for informational purposes.

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