



ARIZONA GOLF AGRONOMY ENVIRONMENTAL STEWARDSHIP

In the desert Southwest, it is important to use resources wisely, especially water, and Arizona's golf industry conserves this precious resource in many ways. The following provides insight into the cutting-edge technology, applied chemistry and hard work undertaken by local golf course agronomy teams at golf courses across Arizona.

Irrigation Foundation

- Water is, by far, the largest input of material for any golf course.
 - Financial Incentive: Water is a big expense for golf clubs.
 - Quality-of-Play Incentive: Overwatering leads to poor playing conditions.
- Ongoing efficiencies began to accelerate when a 90-acre turf limit was first adopted in 1984. Since then, Arizona's golf industry has experienced increased demand, while using less water.
- Modern, precision irrigation systems are powerful tools for water conservation.
 - Most courses use sophisticated and effective irrigation systems that gather daily data from an onsite weather station to determine, among other things, evapotranspiration rate (ET) – the amount of water leaving plants, soils, and other surfaces.
 - Since the ET measurement tells agronomists the amount of water removed, it also tells them how much to put back: no more, no less.
 - The system even factors recent rainfall into the calculation. For example, if the ET is 0.3 inches, and it rains a tenth of an inch (0.1), it will recommend adding only 0.2 inches to restore the 0.3 ET number.
- On rainy days, the irrigation system fills a virtual "rain bucket"
 - Rainfall is classified as "weather rain" or "accepted rain."
 - When rain falls slower than 0.28 inches/hour, every drop is "accepted" into the soil, instead of running off as moisture from "weather rain."
 - Accepted rain builds up in the system's virtual "rain bucket," which is first emptied based on to the ET numbers, before irrigation is allowed to resume.
- Small, handheld probes give superintendents a wealth of data e.g., moisture, salinity, salinity index, surface temperature and soil temperature.
 - These flexible, real-time, clear, and accurate irrigation, nutritional and uniformity assessments provide a complete understanding of turf and soil conditions.
 - More importantly, the data-supported, actionable conclusions minimize the labor and resources needed to maintain healthy turfgrass.
 - Long-term data can help superintendents identify patterns and adjust systems to maximize efficiency
- Maintenance teams focus on irrigation and perform irrigation audits.
 - They adjust, fix, replace and monitor the hundreds of sprinklers on each golf course.
 - Catch leaks immediately, daily, and check sprinkler run times.

Mobile Moisture Monitor

- In addition to soil core samples, handheld, mobile probes are used to collect data.
 - Sensors capture moisture, salinity, salinity index, surface and soil temperatures.
- Quantifiable data feeds into smart phone display
- Real-time, clear and accurate assessment of irrigation, nutritional and uniformity of turf and soil conditions, as well as water and fertilizer optimization and causes of stress.
- Gives actionable conclusions to maximize turfgrass health with minimal effort.
- GPS technology gives the exact location of every sample recorded.

Making Water Wetter

- Monthly, depending on time of year, surfactants are applied to make “water wetter.”
- This maximizes the effect of every drop by helping water move through the soil, retain moisture in the soil and reduce runoff of water and soil-applied chemicals.
 - For example, a penetrant-type surfactant applied in the winter months pushes water deeper into the soil, causing the roots to grow longer to reach the water.
 - This minimizes water used while producing healthy plants.
- In the summer months, a “holder” is added, which reduces the amount of water lost to the environment through evaporation.

Microbiome, Big Helpers

- Research is uncovering ways the microbiome can help by propagating beneficial strains of microalgae found in Arizona’s soils and reapply them to turfgrass.
 - Anticipated to reduce turfgrass need for water by up to 25% through improved soil structure and nutrient availability.

Tight on Turf

- Since 1984, 90 acres has been the turf-area goal for golf courses in Arizona.

Golf and Wildlife

- Steady supply of water, food and shelter helps wildlife.
 - Arizona Game and Fish regularly surveys waterfowl populations at area courses.
 - In a two-year study beginning in 2018, Arizona Game and Fish alongside University of Arizona began trapping gambel quail at Grayhawk and other local golf clubs, relocating them to Southern Arizona.
 - During that time, approximately 250 birds took a free ride to the Old Pueblo.

Not all water is equal

- The source of the water and its chemistry determines the soil profile.
- It’s all about the chemical makeup of the water.
 - In Arizona, that usually means excess sodium salts.
- Salty soil is left behind after water is removed, causing the need to put down calcium.
- Excessive sodium “holds” water molecules near the surface, not allowing them to move down through the soil to encourage root growth.

- Golf courses can be wet while the grass still struggles.
- North Scottsdale golf clubs typically use effluent or recaptured water for irrigation, which is high in sodium.
 - Sodium levels are a big factor in the quality of effluent water, especially when using less ground and potable water.
- Reverse osmosis treatment in North Scottsdale removes some of the sodium.
 - Sodium comes from the environment as well as in-home soft water units.
- Using potassium instead of sodium in soft water units would solve the problem.
 - However, potassium is several times more expensive.
- Bicarbonate is another key factor.
 - Known as the “little robber,” bicarbonate attaches to calcium or magnesium, making them insoluble.
 - Turns into the type of salt left behind in the “bathtub ring.”
 - When bicarbonate is broken down with a weak acid, like vinegar, calcium and magnesium become available for plants to use instead of building up as a salt.
 - How does this affect water conservation?
 - When water chemistry is poor, it takes more of it to grow plants.
- Water sources – well water, ground water, effluent – throughout the Valley feature different chemical profiles.
 - Even wells drilled relatively close together can feature very different water chemistry.
 - Taking this variability into consideration when devising water allocation guidelines is critical.
 - Clubs across the state face different water challenges. It’s not simply about gallon-for-gallon volume.

Other Benefits

- Golf courses use innovative products, such as a type of seaweed, which produces a more developed root structure that requires less water.
- The abundant tree canopy cover on golf courses help to curb the effects of urban heat islands.
- Turfgrass root systems help the micro biome by breaking down pollutants.
- Insecticides and fungicides used are designed with molecules that breakdown to become inert over time.

