THE UNIVERSITY OF ARIZONA
Cooperative Extension

az2135 May 2025

A Grower's Guide on Selection and Use of Weather Stations for Improving Crop and Irrigation Management Decisions

Diaa Eldin Elshikha, Said Attalah, Peter Waller, Jeremy Weiss, Douglas Hunsaker, Kelly R. Thorp, and Elsayed Ahmed Elsadek

Introduction

Weather plays a fundamental role in farming, influencing key decisions related to almost every farming operation, such as planting, irrigating, cultivating, spraying, harvesting, and more. Field-specific use of accurate weather data can significantly enhance growers' decision-making for optimizing resource use, improving crop yields, and avoiding economic loss. During field visits to Arizona farms, it was observed that improper installation was an issue on a few farms. It is recommended to deploy weather stations at a distance of about 10 times the height of such obstacles (Helms, 2005). Weather stations are sometimes implemented in places surrounded by obstructions (e.g., too close to buildings or under trees, etc.), or the weather sensors are installed at nonstandard heights above ground, or stations are out of the recommended distance from the crop, thus, report weather data that can lead to poor management decisions. Proper installation and setup are critical to ensure the accuracy and reliability of the collected data.

A weather station provides essential information related to atmospheric conditions, including temperature, relative humidity, precipitation, wind speed, solar radiation, and other important parameters needed for effective field farming (Bayer et al., 2023). For instance, accurate temperature readings aid in frost prevention, heat stress control, and cropping optimization. During wet seasons, precipitation data helps growers avoid overirrigating and reduce water waste by minimizing runoff, whereas during dry seasons, irrigation can be adjusted accordingly. Wind speed and direction are critical for determining the best times for sprinkler irrigation and chemical spraying to ensure high application efficiency and minimize wind drift losses. Compared to other weather parameters, wind speed and direction are more unpredictable and vary with local conditions (Brown, 2000).

Weather stations provide the key climate data that can be used to guide efficient irrigation scheduling and effective crop water management. Crop irrigation management is a critical concern for farmers in Arizona, where water resources are limited, and rainfall is often insufficient to meet crop water demands. Practical, weather-based irrigation scheduling methods have been developed, such as the widely adopted FAO56 method (Allen et al., 1998), which calculates the daily crop water requirements. However, such methods rely on having accurate weather data that is representative of the local field conditions. Weather data also provides information that can be used to predict optimal management strategies to maximize productivity. For example, weather-based assessment of crop heat stress provides a means for properly adjusting irrigation rate and timing during critical crop growth stages. Growers often use cumulative growing degree days (GDD), which are calculated from temperature data, to track crop development and make decisions on irrigation amount, timing, or termination. A GDD model can also help in predicting pest and disease outbreaks, determining the right time for harvest, and managing the different stages of crop development (Brown, 2013; Prentice et al., 1992).

The Arizona Meteorological Network, part of the University of Arizona Cooperative Extension, currently has 32 well-maintained weather stations providing high-quality data and related products (https://azmet.arizona.edu/). Stations are located mainly in agricultural areas with higher numbers in the southern and western regions of the state (Figure 1). Although AZMet stations are not available on every farm, network measurements and maintenance, and operation standards serve as a benchmark for those collecting field-specific data at other locations for improving farm management decisions. Additional stations are planned to further expand the network.

Use of weather data from a distant station far from the local field site may be ineffective for guiding efficient irrigation scheduling or for other crop management applications. Thus, many Arizona growers would greatly benefit from having a local farm weather station that provides a more representative source of weather data for guiding important decisions, such as irrigation scheduling. Weather stations come in a wide range of types, costs, and levels of precision, from simple analog instruments that require manual readings to advanced systems with wireless technology, smart algorithms, and IoT connectivity. IoT refers to a network of devices connected through the internet to facilitate the automatic collection of data and sending it to the grower's cell phone and other smart devices, allowing them to see real-time data remotely. These modern systems allow real-time data collection and processing through physical devices or cloud-based platforms like iCloud. Many also offer remote access, enabling growers to monitor weather conditions using smartphone apps or other digital tools. While high-end models provide greater accuracy and more advanced features, affordable options can still be highly effective when properly installed and maintained. Therefore, it is the goal of this publication to provide a summarized guide to assist growers with the selection, installation, operation, and maintenance of a variety of commercially available weather stations, including sensor components, logging devices, and system costs. The guide is designed to help growers choose the right weather station system for their specific needs and outlines best practices for installation to achieve accurate and reliable data. Understanding the key features, costs, and precision levels of the different commercial weather stations provided as examples should help growers make informed decisions based on their own needs.

Maximum distance over which weather stations provide accurate data

Data is most reliable within a 60-mile radius for large-scale weather patterns and within 6 miles for local applications, such as precision farming, where farmers use weather data to improve irrigation (World Meteorological Organization, 2008). Relative humidity (RH, %) data were recorded directly in a grower's field located in Gila Bend, Arizona, using a Li710 device. The data were compared to values obtained from the nearest AZMet weather stations, Paloma at 15 miles, Buckeye at 27 miles, and Harquahala at 41 miles from the field site. Figure 2 shows how the humidity changed during the day and night over one week, February 12-19, 2025. This comparison helps highlight differences that can happen between actual field conditions and weather station data. This example highlights how the distance between a field and a weather station can influence how representative weather data from another location may or may not be for a local field. Since relative humidity is one of several parameters used to estimate reference evapotranspiration (ETo), differences caused by measurement distance, or other factors such as whether the other locations are in production or have been recently irrigated, may impact local irrigation decisions. While additional data over a longer period is needed to validate these observations, the preliminary findings suggest that having on-farm weather stations could improve the representativeness of ETo calculations for site-specific management.

Choosing the right weather station for irrigation and field operations efficiency

There are many types of weather instruments and sensors available for weather stations, but the primary consideration for growers is to determine which environmental conditions are most important to monitor for their specific crops or farming needs, and the quality of the data. Based on our own experience and typical company descriptions, we have defined three categories of weather stations, although the division of categories is debatable: Basic, Advanced Research Grade, and Smart. Both the Basic and Advanced Research Grade weather stations can be Smart, where Smart refers to connectivity to the cloud, processing of data in the cloud, and real-time evaluation of such parameters as reference evapotranspiration. Basic weather stations typically have fewer and less expensive sensors than Advanced Research Grade weather stations. They typically include wind speed meters (anemometers), air temperature sensors (thermistors), humidity sensors (hygrometers), air pressure gauges (barometers), rain gauges, and sunlight sensors (pyranometers). Advanced Research Grade crop monitoring systems include higher quality weather sensors as well as a range of sensors that focus on crop growth, soil moisture, and irrigation status. In addition to weather stations, satellite-based and model systems such as OpenET (https://etdata.org/) and Meteoblue (https://www.meteoblue.com/) provide useful data for crop and irrigation management (Attalah et al., 2024). Evaluation and prioritization of data types and required data quality guides the selection of weather station platforms, satellite systems, and other sensors.

Table 1 illustrates the levels of weather stations, Basic, Advanced Research-grade, and Smart, highlighting their typical features, advantages, and potential drawbacks. Basic Weather Stations (BWS) monitor basic parameters such as air temperature, atmospheric pressure, humidity, wind speed and direction, solar radiation, and

Figure 1. Currently active stations in the Arizona Meteorological (AZMet) Network. More information about station locations and other metadata is available at https://azmet.arizona.edu/.

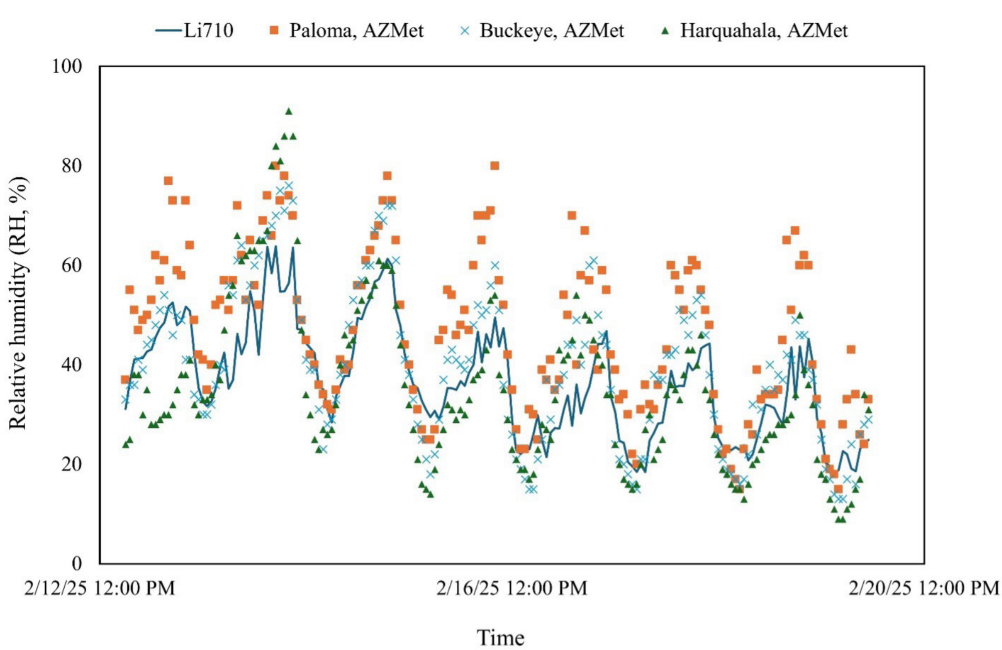

Figure 2. Comparison of relative humidity (RH, %) recorded by the Li-710 device in Gila Bend, Arizona, and AZMet weather stations in Paloma (15 miles away), Buckeye (27 miles away), and Harquahala (41 miles away).

precipitation. They are cost-effective and user-friendly, but the accuracy of their sensors may be lower. Advanced Research Grade Weather Stations (ARWS) include higher quality and additional sensors, and calculate crop parameters, such as reference ET. The ARWS generally incorporate high-precision sensors for superior data accuracy and detailed analysis. But they have higher capital, installation, maintenance, and annual calibration costs. These stations are optimal for scientific research but are expensive, complex, and generate vast amounts of data that may exceed the needs of typical agricultural operations. Nevertheless, they provide superior data, which may be preferable for some growers.

Smart Weather Stations (SWS) connect to the cloud and provide real-time data accessibility on the phone or other smart devices and provide data processing and estimates of parameters such as reference evapotranspiration. Companies generally charge an additional fee for this service. The extra charge for the SWS may pay off overtime through reduced maintenance needs, less manual interference and better long-term reliability.

Installation and other relevant considerations for weather stations

The accuracy and reliability of weather data are essential for making informed farming decisions. Therefore, knowing how and where to install a weather station is a vital key to achieving this goal. The following are some important steps to consider:

- Location: A weather station should be located in an open space away from obstacles such as buildings, fences, or trees, and where it can be easily accessible. A distance greater than 10 times the height of the nearby obstacle is usually recommended (Onset, 2010). Since they are intended to support farming, a long-term reserved space should be considered.
- Ground: Leveled ground is required for some instruments, such as rain gauges, and pyranometers (Photosynthetic Active Radiation sensors). Distance above ground is also important. For example, a height range of 1.3 to 2.0 m (4.1 to 6.6 ft) is suitable for thermometers and hygrometers, while rain gauges are typically installed at a standard height of 1.0 m (3.3 ft) above the ground. Anemometers are generally positioned between 2.0 m and 3.0 m (6.6 to 9.8 ft) above the ground (https://www.weather.gov).
- Weatherproof enclosure: Weather instruments such as thermometers and hygrometers should be protected from direct sunlight while mounted in a place with free airflow.
- Security: Weather stations should be easily accessible for data collection, inspection, and regular maintenance. Unattended stations require a secure area to avoid the risk of natural damage or vandalism.
- Maintenance: ARWS are recalibrated, with AZMet doing so four times per year (https://azmet.arizona.edu/about/general-operations).

Weather station packages and pricing options

As described previously, weather stations come in different shapes and sizes which make their cost spread over a wide range. Moreover, the cost of the same weather station or sensors may vary from one company to another, depending on the technology and service plan they offer. The National Weather Service (NWS) has published an extensive list of weather companies (https://www.weather.gov/enterprise/meteorological-instruments-6a), referring to their websites, the weather aspect addressed, and the services they provide. The present publication is an attempt to highlight the main criteria a prospective user would consider in purchasing relevant weather sensors, a complete set of sensors, or an entire weather station based on technology, connectivity, and cost information currently published. The specificities of each product are normally detailed in the companies' websites in brochures, manuals, and catalogs. The published products are mostly categorized as remote monitoring systems, data loggers, sensors, and service plans. Overall, an informed decision when purchasing a weather station or weather sensors should consider relevant and effective equipment while maintaining an affordable cost range. For illustration with relevance to farming management, we included the cost range of some weather equipment that can be integrated in WS, along with a short description and types of weather variables that each instrument can measure, as currently published by different companies (Tables 2-5).

The examples presented in Tables 2-5 show how wide the current cost range is from one company to another, even for the same type of instruments or services. The displayed prices ranged from $188 to $20,800 for weather stations (monitoring systems), $69 to $2,290 for data loggers, $47 to $1,800 for sensors, and $25 to $449 for service plans. Although the cost of some items might seem high, it should not be the only selection parameter to consider in choosing a WS or customizing an existing system. In some cases, the trade-off between usage convenience and cost affordability might be inevitable. For instance, cabled sensors are usually cheaper but cumbersome, whereas the wireless ones are convenient but require a reliable transmitting system, which makes them expensive. Moreover, the same parameter, such as temperature (T) or humidity (H), can be measured either with an inexpensive instrument ($31, Table 4) or an expensive sensor ($784, Table 4), both of which are offered with different packages. The type of weather station can also influence the cost, with research-grade stations costing more compared to basic stations. While price variability should be considered, data accuracy, acquisition time, and relevance should be the decisive criteria to fulfill the requirements of an effective weather station, especially in the farming sector.

Table 1. Instruments and their functions for the different types of weather stations.

Meteorological instruments	Function	Basic	Advanced/Research Grade	Smart
Thermometer (air temperature)	Tair	X	X	X
Barometer (atmospheric pressure)	Patmo	X	X	X
Hygrometer/Psychrometer (air humidity)	RH	X	X	X
Anemometer	WS	X	X	X
Pyranometer	Srad	X	X	X
Rain gauge	Pr	X	X	X
Soil moisture sensors	SWC		X	X
Soil temperature sensor	Tsoil		X	X
Leaf wetness sensor	Lw		X	X
Heat index monitor	Feels like (Tair + RH)		X	X
Data logger	Records data		X	X
A system with high capability for data processing	Data processing		X	X
Alerts with high capability	Sending alerts		X	X
Power source (battery, hybrid [battery + solar])	Electricity	Battery	Hybrid	Hybrid
IoT devices and apps	Remote Monitoring			X
Digital system	Supports data exchange			X
Transmitters	Sends data/signals			X
Repeaters	Extends signal range			X
Receivers	Receives signals/ data			X
Controllers	Controls device settings			X
Advantage/disadvantage				
Simplicity		X		
Cost		Low	Moderate-High	High
Essential monitoring		X		
Requiring time and labor		X		
Automatic data collection				X
Remote data access		X		X
Complexity of maintenance		High	Low-High	Low
Accuracy		Low	Moderate-High	Varies
Real-time data			X	X
Data complexity (post processing)		Low	High	Varies
Compact in size and versatile				X
Remote/Easy data access				X
Initial cost		Low	High	High

Notes: Tair: Air temperature, Patmo: Atmospheric pressure, RH: Relative humidity, WS: Wind speed, Srad: Solar radiation, Pr: Precipitation, SWC: Soil water content, Tsoil: Soil temperature, and Lw: Leaf wetness.

Table 2. Monitoring systems' type, description, and prices from different sources.

Type	Description	Price (USD)	Source
RX3000, MicroRX (Weather sensors not included) *	16-32 MB, 1-2 million measurements; continuous logging; cellular; solar powered, mobile alerts; wireless + wired, solar/battery powered	$735-$1,025	Onset (https://www.onsetcomp.com/products, accessed March 2025)
Wireless Vantage Vue & mounting hardware & WeatherLink console	Anemometer, Rain collector, Temperature & Humidity sensors	$1,075 – $1,205	Davis Instruments (https://www.davisinstruments.com/, accessed March 2025)
Vantage Pro2, Cabled/wireless	Professional WS; Includes wind speeds, temperature, humidity, barometric pressure, rainfall, heat index, and dew point	$1,015- $1,505	
Wireless Vantage Pro2 Plus & mounting accessories	Research-grade WS; includes all the features of the Vantage Pro2, plus UV and solar radiation sensors	$2,485	
KestrelMet 6000 Wi-Fi **	Wi-Fi Connectivity; range: up to 1000 ft line of sight, transmission rate: 1 min	$999	Kestrel Instruments (https://kestrelinstruments.com/, accessed March 2025)
KestrelMet 6000 Cellular **	Cellular data transmission (AT&T or Verizon); 3 months free data, then $100 annually; transmission rate:15 min	$1,299	
KestrelMet 6000 AG **	Wi-Fi or Cellular, Wi-Fi Connectivity, range up to 1000 ft line of sight, transmission rate of 1 min, cellular data transmission (AT&T or Verizon), first 3 months free, then $99.99 annually, transmission rate: 15 min	$1,946-$2,246	
AgroMET with a solar chargeable battery +	Professional WS. provides precipitation, temperature, humidity, leaf wetness, wind speed and direction, and solar radiation	$1,517	RainWise (https://rainwise.com/, accessed March 2025)
AgroMET-MB with easy connectivity to any compatible system	Commercial station with agricultural-specific sensors, wind speed, wind direction, ambient temperature, relative humidity, barometric pressure, rainfall, leaf wetness, and solar radiation	$1,937	
AgroMET & IP-100 network interface ++	Professional WS with Cloud Web Hosting. Provides temperature, leaf wetness, relative humidity, precipitation, solar radiation, wind speed, and direction	$1,890	
WS-1553-IP +++	Track outdoor conditions, including wind speed, direction, rainfall, UV, solar radiation, barometric pressure (via the optional WH32B sensor), temperature, humidity, dew point, heat index, and wind chill- No console	$189	Ambient Weather (https://ambientweather.com/, accessed March 2025)
WS-5000-IP3 +++ Ultrasonic Professional		$352	
WS-4000 Solar Powered Ultrasonic Wi-Fi WS +++	Measures temperature, humidity, dew point, barometric pressure, haptic rain, UV index, heat index, wind direction, wind speed, and wind chill.	$370	
CWS-1	Base cost includes a 7′ tall mast, cross arm, junction box, and base	$2,201	Texas Electronics, https://texaselectronics.com/, accessed March 2025
CWS-1 Industrial	Research-grade sensors: rain, temperature, humidity, and wind sensors	$4,439	
9610-C-1 Orion LX WS with Display Console ++++	Internet-ready interface, all-in-one sensor module, Orion Weather MicroServer, including ultrasonic wind direction and speed, an impact rain gauge, and capacitive relative humidity, temperature, and barometric pressure sensors	$7,777	Scientific Sales Inc., https://www.scientificsales.com/, accessed March 2025
420 PLC Orion	Complete weather station for industrial PLC interface. Most essential weather parameters in one compact module	$6,289	
9511-B-1 Orion	Six weather parameters are measured in one instrument	$5,389	

Type	Description	Price (USD)	Source
Table 2. Continued			
Aspen10/ClimaVue50 G2 Simple Cloud Solution	Cloud-based weather station. Measures air temperature, relative humidity, barometric pressure, wind speed, wind direction, precipitation, and solar radiation, a tripod, and a 12-month cloud subscription	$4,333	Campbell Scientific (https://www.campbellsci.com/, accessed March 2025)
WxPRO™	Entry-level/research-grade WS. Typical measurements as in the Aspen10/Climavue50 G2 case. Includes data logger, modem, and 250MB/m data plan	$9,400	
MetPRO™ with Remote IP-based modem	Highly accurate, durable, research-grade meteorological monitoring station. Measures the same parameters as in WxPRO + Soil water content. Includes Data Logger, Modem, and 250MB/month data plan	$3,000	
***MesoPRO™ Remote with 4G LTE**	Measures the same parameters as in MetPRO. Research-grade weather station	$20,800	

Notes: WS weather station. * Requires an annual data plan.** includes wind speed & direction, barometric pressure; relative humidity, temperature, and rainfall. + Requires receiving unit and ++ requires RainWise app for mobile data. +++ Requires Ambient Weather Network app. ++++ Requires software (~ $450).

Table 3. Data loggers' type, description, and prices from different sources.

Type	Description	Price (USD)	Source
HOBO U30	1USB or Bluetooth, solar-powered	$669	Onset (htOnset (https://www.onsetcomp.com/products, accessed March 2025)
HOBO USB	USB, battery powered	$285	
WeatherLink® USB	View data on your PC with WeatherLink Computer Software	$225	Davis Instruments (https://www.davisinstruments.com/, accessed March 2025)
Weather Envoy	Collect & store data; works with WeatherLink software; cabled or wireless	$295	
WeatherLink Live	Transmits information & alarms online; view & store data on smart devices	$395	
DROP D1	Monitors temperature	$69	Kestrel Instruments (https://kestrelinstruments.com/, accessed March 2025)
DROP D2	Monitors and tracks temperature, humidity, heat index, and dew point	$99	
DROP D3	Monitors temperature, humidity, heat index, dew point temperature, barometric pressure, density altitude, and pressure	$129	
RainLogger Complete System	A complete rainfall monitoring system that includes a RainLog data logger, RL-Loader 2 software, a rain collector, and a mounting mast	$365	RainWise (https://rainwise.com/, accessed March 2025)
WindLog™	Captures data every second; logs average and gust at set intervals	$425	
Network Weather Bridge	Universal Wi-Fi/Ethernet server for linking non-Ambient stations to Ambient Weather Network and more	$160	Ambient Weather (https://ambientweather.com/, accessed March 2025)
WeatherBridgePro2	LAN / WiFi Internet Appliance for Ambient Weather Observer and Davis Instruments (VantagePro2, VantagePro2 Plus, and VantageVue wireless weather stations). Includes a built-in temperature, humidity, and barometric pressure sensor	$525	
RG3	Datalogger with optical download cable for rain gauges	$306	Texas Electronics, https://texaselectronics.com/, accessed March 2025

Type	Description	Price (USD)	Source
Table 3. Continued			
RainLogger 2.0	Rain data logging complete system	$365	Scientific Sales Inc., https://www.scientificsales.com/, accessed March 2025
WindLog™	Wind data logger	$350	Scientific Sales Inc., https://www.scientificsales.com/, accessed March 2025
CR350	Entry-level data logger	$1,150	Campbell Scientific (https://www.campbellsci.com/, accessed March 2025)
CR1000Xe	DL for a wide variety of applications	$2,290	

Table 4. Weather sensors' type, description, and prices from different sources.

Type	Description	Price (USD)	Source
HOBO T/RH (2m cable)	Temperature & relative humidity Smart sensor	$219	Onset (https://www.onsetcomp.com/products, accessed March 2025)
Wind Speed	Smart sensor for wind speed (0 - 76 m/s)	$225	
HOBOnet Wireless Temperature Sensor	Solar-powered: air, soil, and water temperatures	$239	
T/Humidity	Measures T & RH	$120	Davis Instruments (https://www.davisinstruments.com/, accessed March 2025)
Solar Rad	Silicon photo diode	$225	
Anemometer for Vantage Pro2™ & EnviroMonitor®	Wind direction & speed	$235	
Solar Irradiance Kit	Add-on to the KestrelMet 6000 system, range is 0 to 1750 W m-2	$199	Kestrel Instruments (https://kestrelinstruments.com/, accessed March 2025)
Leaf Wetness Kit	Monitors surface moisture on foliage	$149	
Kestrel 7000 RH	Measure relative humidity	$99	
Solar Irradiance	add-on to the MK-III weather station	$200	RainWise (https://rainwise.com/, accessed March 2025)
Version. 80 Rh/T	Relative humidity and temperature	$90	
MK-III ST-TH2O	Soil temperature or liquid temperature	$60	
Solar Radiation/UV, and Solar Panel assembly	Solar radiation and UV sensors, solar panel, and connectors for easy replacement	$50	Ambient Weather (https://ambientweather.com/, accessed March 2025)
WH51LW Leaf Wetness	Accumulates moisture, enabling it to quantify the wetness of the surrounding leaves as a percentage.	$70	
Thermo-Hygrometer Assembly	Thermo-hygrometer sensor, control PC board, radiation shield, and ribbon cable	$31	

Type	Description	Price (USD)	Source
Table 4. Continued			
TTH-1315	Temperature Humidity Sensor. Doesn't require calibration	$784	Texas Electronics, https://texaselectronics.com/, accessed March 2025
TR-525I	Tipping Bucket Rain Gauge	$517	
SP-Lite	Solar Radiation Sensor	$999	
HMS112 with radiation shield	Analog humidity & temperature transmitter	$569	Scientific Sales Inc., https://www.scientificsales.com/, accessed March 2025
Kipp & Zonen SP Lite2 Pyranometer	solar radiation. It is especially designed for Photovoltaic/ solar energy module monitoring	$549	
91000 ResponseOne	Ultrasonic anemometer	$1,098	
Hygrovue10	A combined temperature and relative humidity sensor	$443	Campbell Scientific (https://www.campbellsci.com/, accessed March 2025)
CS301	Measures total sun and sky solar radiation	$232	
Rainvue20	Ideal for many hydrological or meteorological applications	$1,800	

Table 5. Service plan type, description, and prices.

Type	Description	Price (USD)	Source
LI-COR Cloud MX	Provides cloud access and data management; requires the HOBOconnect app	$25	Onset (https://www.onsetcomp.com/products, accessed March 2025)
Data update Interval	5 mins	$180	Davis Instruments (https://www.davisinstruments.com/, accessed March 2025)
	15 mins	$156	
	60 mins	$132	
Ambient Weather Net	3-day hourly forecast, 1-year data history, basic graphing	free	Kestrel Instruments (https://kestrelinstruments.com/, accessed March 2025)
TeleMET II Cellular Telemetry (Remote access - No service plan)	Standalone module for RainWise stations with 6-month data logging at 15-minute intervals	$449	RainWise (https://rainwise.com/, accessed March 2025)

Type	Description	Price (USD)	Source
Table 5. Continued			
Ambient Weather Network	Advanced map layers, 10-day hourly forecasting, degree days, enhanced graphing, SMS alerts, and three years of data storage.	$45	Ambient Weather (https://ambientweather.com/, accessed March 2025)
25MB-1GB Subscription	Monthly	$144-$300	Campbell Scientific (https://www.campbellsci.com/, accessed March 2025)
	Campbell Cloud	$225	

Conclusions

Successful agricultural operations rely on accurate and timely weather data that is representative of local field conditions to optimize planning and management while minimizing risks. AZMet weather stations have been installed throughout Arizona to support farm management. However, for the many farms in Arizona located far away from an AZMet station, data from the nearest AZMet station may not be representative. In these situations, on-site weather station data could ensure a more reliable data source based on the actual weather conditions on the farm. Local weather data are particularly important for assessing the irrigation application amounts needed to replace actual crop evapotranspiration using reference ETo methods. Spatial variations of ETo and precipitation are especially wide during the monsoon and winter seasons, which makes having local data even more important. Thus, a weather station for an Arizona grower should include, at a minimum, sensors needed to calculate ETo, including an air temperature sensor, a relative humidity sensor, a solar radiation sensor [pyranometer], and a wind speed sensor [anemometer]. To help manage field operations, other sensors would be required too, such as rain gauge, leaf wetness, soil moisture, and soil temperature sensors. These support decisions on irrigation, pest control, disease prevention, and overall crop health.

A wide range of weather stations is available on the market, but an effective system should include all the essential instruments necessary to support the grower's goals. Choosing the right weather station is a critical decision that involves selecting appropriate sensors, ensuring proper installation, maintenance, and calibration, and considering long-term durability. A fully equipped weather station can assist in necessary farming activities such as irrigation scheduling, pest and disease management, and climate deviation strategies.

While the cost of individual instruments may seem high, assessing the value of a complete system rather than isolated components is essential. Cost is an important factor in decision-making, but it should not be the sole criterion, as the accuracy, reliability, and overall functionality of the system are equally crucial for achieving optimal agricultural outcomes.

Disclaimer

This publication is intended to provide an objective overview of the use of weather stations in farming 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.

References

Allen, R.G., Pereira, L.S., Raes, D., Smith, M., 1998. Crop evapotranspiration-Guidelines for computing crop water requirements-FAO Irrigation and drainage paper 56. FAO, Rome, Italy.

Attalah, S., Elsadek, E.A., Waller, P., Hunsaker, D., Thorp, K., Bautista, E., Williams, C., Wall, G., Orr, E., Elshikha, D.E., 2024. Evaluating the Performance of OpenET Models for Alfalfa in Arizona, in: 2024 Anaheim, California July 28-31, 2024, ASABE Paper No. 2400041. American Society of Agricultural and Biological Engineers, St. Joseph, MI, p. 1. https://doi.org/10.13031/aim.202400041

Bayer, A., van Iersel, M., Chappell, M., 2023. What is a weather station, and can it benefit ornamental growers? [WWW Document]. URL https://secure.caes.uga.edu/extension/publications/files/pdf/B 1475_4.PDF (accessed 4.17.25).

Brown, P., 2000. Basics of Evaporation and Evapotranspiration [WWW Document]. URL https://repository.arizona.edu/bitstream/10150/146968/1/az1194-2000.pdf

Brown, P.W., 2013. Heat units [WWW Document]. URL https://repository.arizona.edu/handle/10150/299154 (accessed 4.17.25).

Helms, D., 2005. Citizen Weather Observer Program (CWOP). Weather Station Siting, Performance, and Data Quality Guide [WWW Document]. URL https://www.weather.gov/media/epz/mesonet/CWOP-OfficialGuide.pdf (accessed 4.17.25).

Onset (2010). Deploying Weather Stations: A Best Practices Guide. https://www.onsetcomp.com/resources/white-papers/deploying-weather-stations-best-practices-guide

Prentice, I.C., Cramer, W., Harrison, S.P., Leemans, R., Monserud, R.A., Solomon, A.M., 1992. Special paper: a global biome model based on plant physiology and dominance, soil properties and climate. J. Biogeogr. 117–134. https://doi.org/10.2307/2845499

World Meteorological Organization, 2008. Guide to Meteorological Instruments and Methods of Observation. ISBN 978-92-63-100085. 7th edition. https://www.weather.gov/media/epz/mesonet/CWOP-WMO8.pdf (access 4.17.25).

THE UNIVERSITY OF ARIZONA
Cooperative Extension

AUTHORS

Diaa Eldin Elshikha
Assistant Professor and Irrigation Specialist, Biosystems Engineering, University of Arizona, Maricopa, Arizona

Said Attalah
Research Associate, Biosystems Engineering, University of Arizona, Maricopa, Arizona

Peter Waller
Associate Professor, Biosystems Engineering, University of Arizona, Tucson, Arizona

Jeremy Weiss
Program Manager, Arizona Meteorological Network, University of Arizona Cooperative Extension, Tucson, Arizona

Douglas Hunsaker
Researcher, Biosystems Engineering, University of Arizona, Maricopa, Arizona

Kelly R. Thorp
Research Agricultural Engineer, USDA Agricultural Research Service, Grassland Soil and Water Research Laboratory, Temple, Texas

Elsayed Ahmed Elsadek
Research Associate, Biosystems Engineering, University of Arizona, Maricopa, Arizona

CONTACT

Diaa Eldin Elshikha
diaaelshikha@arizona.edu

This information has been reviewed by University faculty.
extension.arizona.edu/pubs/az2135-2025.pdf

Other educational materials from Arizona Cooperative Extension can be found at:
extension.arizona.edu/pubs

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Edward C. Martin, Associate Vice President and Director of the Arizona Cooperative Extension System , The University of Arizona.

The University of Arizona is an equal opportunity, affirmative action institution. The University does not discriminate on the basis of race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information in its programs and activities.