In-field Weather & Crop Monitoring

Holistic management in real time minimizes agronomic and financial risk

By Jamie Hardy, head of marketing, and Ian Bailey, strategic sales executive, Arable Labs, Inc.

Images courtesy of Arable Labs, Inc.

In the United States, there are 2 million farms across nearly a billion farmed acres. Even with 10,000 crop advisors to help keep an eye on things in the field, ultimately this means millions of acres go unchecked every year.

This lack of visibility feeds widespread risk throughout the supply chain—from seed breeders, input companies and machine manufacturers to growers, processors and consumers—as well as significant financial consequences when field conditions depart from the expected.

One key way to address this agronomic risk at the base of the pyramid is through digital in-field weather and crop monitoring.

For example, tracking a full season's NDVI (Normalized Difference Vegetation Index) across fields can help a grower, breeder or advisor spot trends and anomalies, such as early senescence.

NDVI quantifies vegetation by measuring the difference between near-infrared (which flora strongly reflects) and red light (which plants absorb).

Combine that with crop evapotranspiration, precipitation, soil moisture, crop water balance,

Above: The Arable Mark 2 sits about a meter above the crop canopy, delivering real-time crop and weather insights direct from the field.

crop water stress and growing degree days, and you have a holistic management overview in real time.

A pioneer in decision agriculture, Arable Labs, Inc. has developed a robust suite of accurate, real-time, in-field data to fill exactly this gap.

Arable's flagship device, the Mark 2, is the world's first LTE-M- (network radio technology) enabled irrigation management tool, weather station and crop monitor in one.

> *"The top dome also measures rainfall using an acoustic disdrometer, essentially listening to the rain and calculating amounts based on the sound the drops make."*
>
> ***– Jamie Hardy and Ian Bailey***

40 MEASUREMENTS

In addition to the metrics mentioned above, other Mark 2 measurements include temperature, solar radiation, leaf wetness, relative humidity, wind speed and wind direction, totaling more than 40 agronomic measurements.

With this data set, growers and field managers have unprecedented insight into the complexities of how environmental conditions and management decisions lead to crop outcomes.

Small enough to be held in one hand and deployed just above the crop canopy at the touch of a button, the Mark 2 connects to the cloud via a cellular network and begins transmitting data immediately, updating the most variable measurements every hour.

Both the top and underside of the device use sensors to detect longwave and shortwave radiation, infrared temperature and spectral reflectance, which contribute to crop growth and health indicators.

Also on the underside are air temperature, humidity and pressure sensors to keep track of weather conditions. Results are displayed in the app, including 10 days of historical data and a 14-day forecast.

The top dome also measures rainfall using an acoustic disdrometer,

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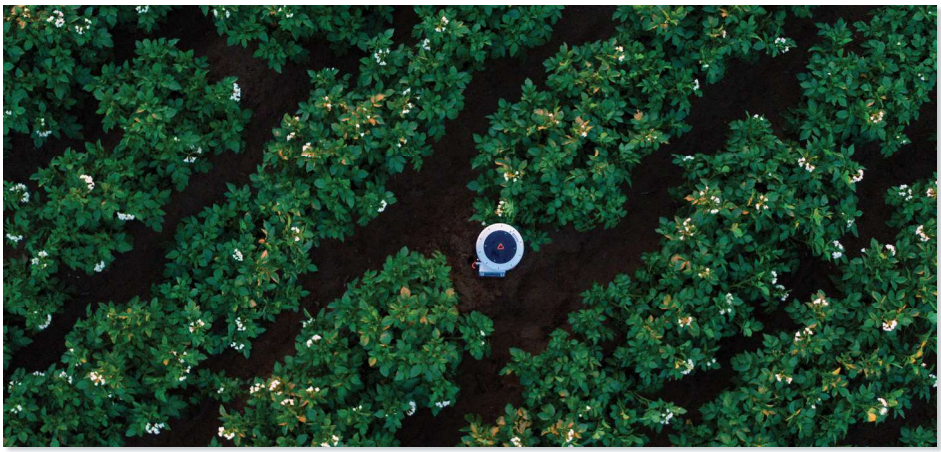


Above: With data accessible through a Web and mobile app, the Arable Mark 2 measures more than 40 agronomic metrics.

essentially listening to the rain and calculating amounts based on the sound the drops make.

Arable's simplicity includes machine-learning technology that allows for automatic and continuous data improvement and reliability.

The company has built extensive calibration and validation partnerships with global research institutions, called the Arable Cal/Val network.

WIDE-RANGING NETWORK

The network spans a wide range of institutions that rely on high-accuracy, high-precision instruments to provide meteorological inputs for studies at the finest research facilities around the world, including the NASA Goddard Space Flight Center, the National Renewable Energy Laboratory and others that are members of AmeriFlux.

With co-located devices at 36 sites across all growing climates, Arable's data is regularly compared to gold-standard data and kept current via automatic firmware updates.

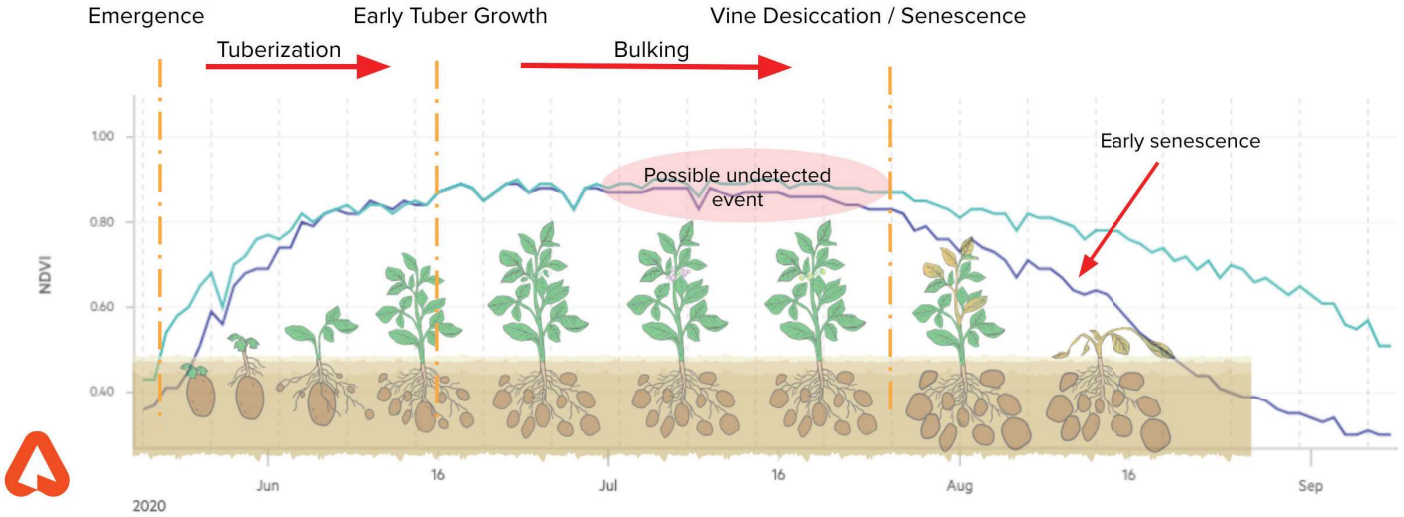
Arable's simple system belies the complexity underpinning its measurements and ensures that some of the most accurate agronomic data available can be delivered affordably and in real-time to the palm of your hand.

But what can you do with all this information? That depends on your role in the supply chain.

For potato seed breeders, the research-grade accuracy unlocks reliability, reducing time spent collecting and collating trial data and allowing for more time in analysis.

Measurements and calculations like ETc (crop evapotranspiration), NDVI, GDD (growing degree days), precipitation and soil moisture are particularly important.

For example, multi-depth soil moisture, temperature and salinity integrated with weather and growth



Tracking real-time NDVI (Normalized Difference Vegetation Index) across fields can show trends and anomalies, such as early senescence at one location.

stages show how environmental conditions inform outcomes.

In another example, comparing crop-specific evapotranspiration with measured rainfall and irrigation amounts illustrates how available water drove or can drive crop outcomes.

Application Programming Interface (API) tools streamline data integration with a company's existing business intelligence tools. Easy device deployment and low maintenance enable scalable field trials.

POTATO PROCESSORS

For potato processors, Arable provides multi-faceted value creation. Customizable analytics help identify varietal-specific potential, develop best practices and devise a strategic playbook early on.

Granular, real-time analytics unlock field-level yield forecasting, while data transparency increases supply chain visibility. Multiple measurements can be graphed together and compared across fields for making new connections and spotting problems early.

As an indicator of crop water stress, canopy temperature compared to air temperature shows how stress from a lack of water reduces yield and impacts quality.

Above: The Arable Mark 2 is easily portable and deploys at the touch of a button.

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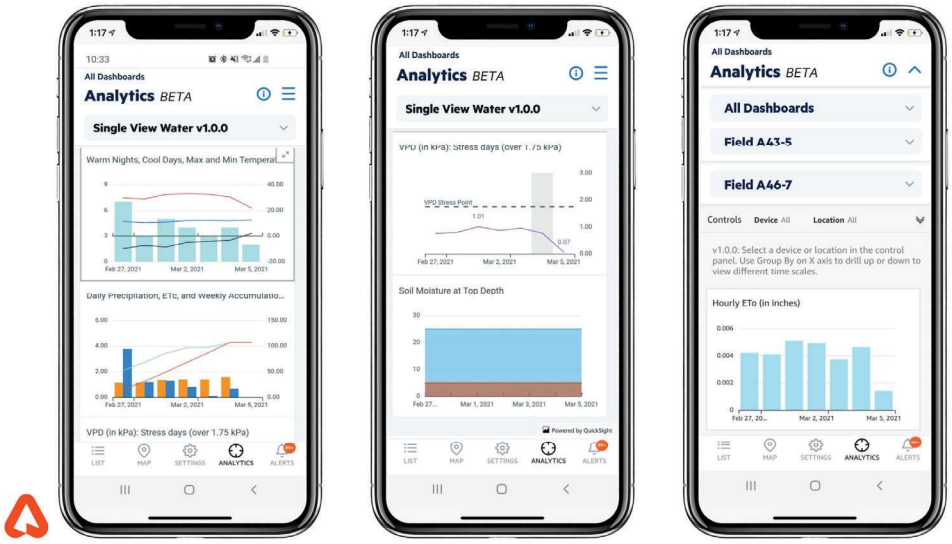
Reliable data and a simple setup improve relationships with partner growers and provide boots on the ground with agronomic support.

Noise from overhead irrigation can easily make a true crop water balance impossible for other systems.

Arable's integrated weather and soil moisture data eliminates the noise to give an accurate running balance of water need versus water supply to assess whether or how water plays a role in crop stress at key growth stages.

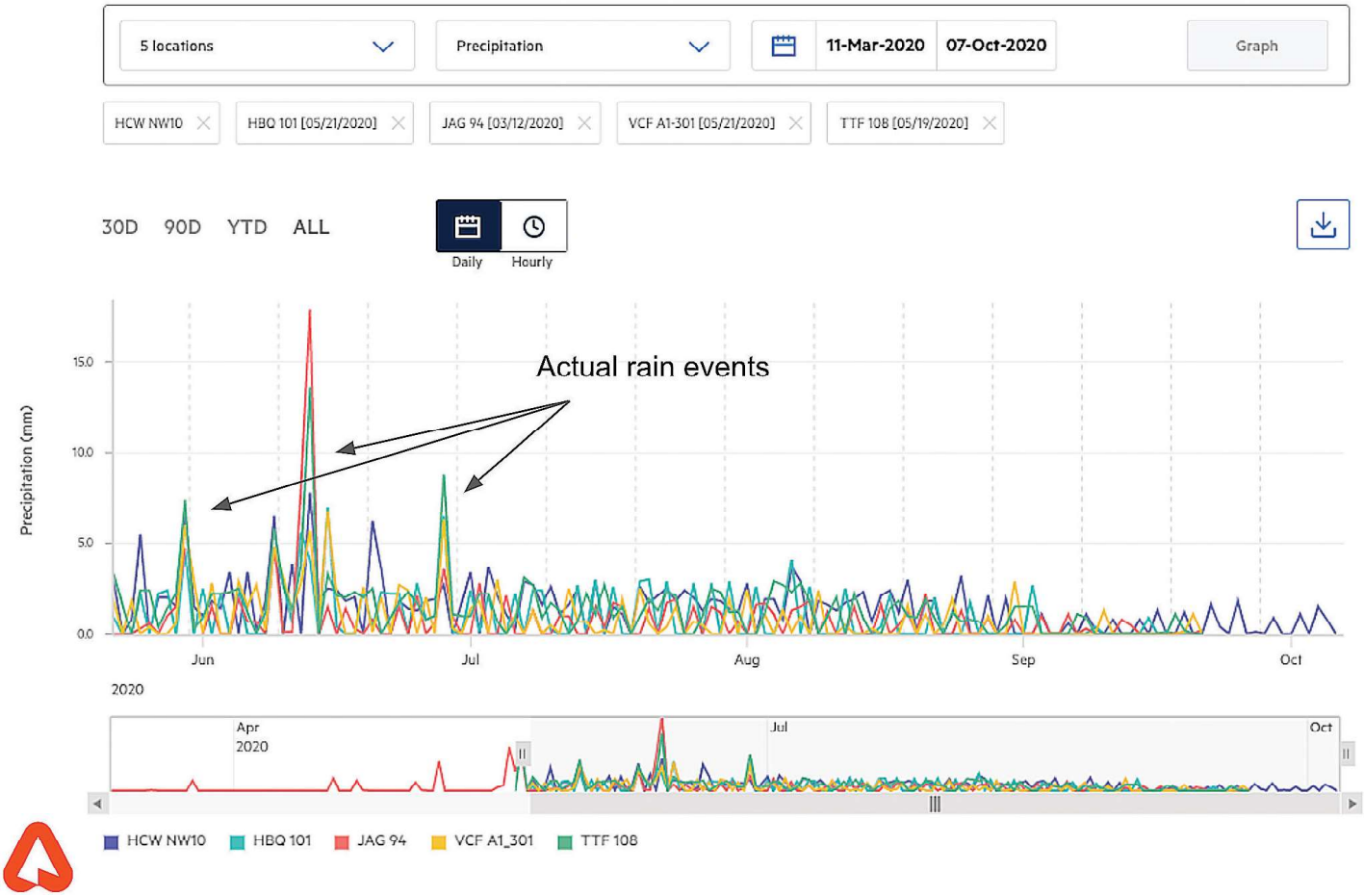
For technology solutions, accurate and reliable data enhance your brand and drive customer engagement.

A seamless API integration makes for a smooth customer experience, while a broad dataset in one affordable package simplifies logistics and operations.



Above: Arable's Advanced Analytics in the mobile app brings real-time agronomic insights with you wherever you go.

For more on how Arable can work for you, visit www.arable.com or email growth@arable.com. BC'T



Noise contamination from overhead irrigation can make a true water balance account impossible, but knowing in-field weather smooths out the noise.