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JANUARY 2019

Volume 21 | Issue 1

Winter Manufacturers Edition

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Moisture Measurement Simplified with Instantaneous Handheld Analyzers

When growing, harvesting, buying/selling, processing, and preparing grains, seeds, and other small agricultural products, moisture is one of the most important variables to control. In addition to the quality of the final product, moisture levels completely predict shelf life, product stability, appearance and, of course, price and profitability.

Until recently, however, conducting frequent moisture content tests in the field has been difficult. In many cases, the primary barrier has been the time and expertise required to conduct such tests. Often samples must be brought to centralized locations and require meticulous sample preparation. Sophisticated moisture measurement devices must also be operated by trained personnel that can properly calibrate the equipment.

Fortunately, handheld devices are now available that allow virtually anyone to take essentially lab-quality moisture measurements. These options allow instant readings to be taken in the fields; during post-harvest processing; at auctions and grain elevators; on top of trucks, rail cars, and storage totes; as well as at receiving stations or any stage of blending or food processing.

The Benefits of Frequent Moisture Readings

Although the reasons for measuring the moisture content of grains and seeds can vary, the primary motivation is to improve product quality and the bottom line.

For farmers, quickly measuring samples in fields to determine which are ready to harvest reduces uncertainty and saves time. It also reduces the risk of buyer rejection due to improper moisture content, and maximizes the sales price by enabling the optimum amount of moisture to be counted toward product weight or volume.

Proper post-harvest processing is vital to maximize yield, vigor, longevity and seed crop quality. At maturity, seed must be harvested, threshed, cleaned, and thoroughly dried before storage; and each step involves proper timing, skills, and equipment.

At auction, when buyers get a fast, accurate reading of grain or seed samples, this helps to rapidly decide which product lots to buy and what price to offer.

With speedy, accurate, moisture readings, grain elevator operators can reduce spoilage, insect damage, and explosion risk. A major factor in silo explosions is the presence of airborne grain dust and its combustibility,

which can correlate to its level of dryness.

For food processors and blenders, mobile testing of the moisture content of grains on receipt – and even in trucks, rail cars, and storage totes – can help to ensure product quality. Such testing at various points along the production line can also improve quality and help to prevent altered taste, texture, and appearance, reduced shelf life, or even mold, staleness, and spoilage.

Simplifying Moisture Measurement

Although traditional laboratory and online based moisture measurement techniques are useful in the right settings, they have required rather lengthy centralized testing and lacked the simplicity and flexibility required for frequent spot checks.

One common test is Loss on Drying, which measures the total material weight change after drying. However, such tests traditionally require a sample to be prepared and brought back to an air oven and manually tested (weigh, oven dry, weigh), which can take 2-48 hours to complete depending on the standard.

Alternately, if an automated moisture balance (an integrated weighing and heating unit) is used, testing can take up to 15 minutes. Either way, such testing can be too slow when more immediate measurements are required. It also requires the sample to be altered or destroyed.

As a result, secondary test methods have typically been used to deliver faster results. This type of test uses an indirect method and a single conversion to achieve accurate results. If there is a disadvantage, it is that the secondary instrument must first be calibrated to ensure accuracy. In some cases, calibration can only be performed by trained staff familiar with the equipment.

In response, many agricultural moisture meters have simplified the process, using capacitance technology. Capacitance is a measure of an electric charge separated from a given electric potential; it exists between two conductors insulated from each other.

The dielectric capacitance technology



commonly used in grain moisture meters is based on the relationship between a grain's moisture content and its dielectric constant. As its moisture content increases, its dielectric constant increases. Since the rate at which the dielectric constant increases is different for all grain types, a unique calibration is necessary for each grain type.

One unit that follows this approach is the PM6go Advanced Portable Grain and Seed Moisture Meter by Kett, a manufacturer of a full range of moisture and organic composition analyzers. The unit offers instant measurement and over 150 calibrations for the most common grain and seed types. While some agricultural devices may require grain husking and grinding, no sample preparation is required with the portable, battery powered device.

Tests are simple. Pour the sample into the machine, and the moisture content and density (g/l) are instantly displayed. Automatic averaging enables quick spot check measurement of samples in bulk containers. To document such tests, the unit offers digital output to a computer or optional printer.

While many moisture meters using the dielectric principle claim to provide accuracy to +/- 0.5%, to achieve such accuracy it is important to look for a unit that provides automatic density and temperature compensation. This is because changes in ambient, sample, or device temperature will otherwise degrade measurement reliability.

When greater accuracy is needed across a wider range of grain, seed, or other agricultural product types, the most advanced moisture meters utilize Near-Infrared (NIR) light, a highly accurate, non-contact, secondary measurement method

that can deliver immediate laboratory quality moisture readings.

"NIR moisture meters follow the principle that water absorbs certain wavelengths of light," says John Bogart, Managing Director of Kett US. "The meter reflects light off the sample, measures how much light has been absorbed, and the result is automatically converted into a moisture content reading."

According to Bogart, such meters allow very accurate instant measurement of any agricultural product without contact or sample preparation, so there is no contamination in handheld and online models. "Once the meter has been calibrated against the lab or production standard, the calibration is stored in the device so no calibration is required in the field," he says.

Unlike air ovens or even moisture balances, portable NIR equipment is designed for ease of use. For example, with Kett's KJT130 Handheld Portable Instant Moisture Meter, the user simply points the instrument at the grains, seeds, or agricultural product. The moisture content is instantly shown on a digital display, with results accurate to .01% in a 0-100% measurement range.

The unit, which is the size of a camcorder and is operated via user friendly menu commands, is designed for frequent spot checks wherever necessary, on both stationary and moving (process line) products. Moisture measurement data can be stored in the instrument, downloaded continuously, or manually recorded.

"The goal is for anyone to be able to successfully use the moisture meter wherever it is needed, with minimal required training," says Bogart. "This allows ag professionals to be certain that their grain and seed products are of the highest quality."