

Vineyard trusts its sensors

How technology is helping a tropical winery compete with the world's best

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Thailand is not recognised as a major wine producer, but today GranMonte, the largest winemaker in Thailand, has become the most advanced winery in South East Asia.



Visooth Lohitnavy (left), his daughter Visootha, an oenologist, and Teerakiat Kerdcharoen, head research team at GranMonte Smart Vineyard.

Thanks to a research collaboration between the public-private and academic sectors, Mahidol University and National Electronics and Computer Technology Centre (Nectec), Gran-Monte Vineyard has adopted technology known as "precision farming" at vineyard level.

On 100 rai (40 acres) in the Asoke Valley, which lies adjacent to Khao Yai National Park, the serene atmosphere and truly beautiful surroundings of the valley makes for a perfect environmental setting for GranMonte Vineyard.

GranMonte, at 350 metres above the sea level and situated in a valley, enjoys all the right microclimate conditions for growing high-quality winemaking grapes.

The research team from Mahidol University's Nanoscience Centre and Nectec has helped GranMonte to become the most hi-tech vineyard and winery in South East Asia, said Visooth Lohitnavy, GranMonte CEO and managing director, who noted that all the parties have worked together for three years now in running the Micro Climate monitoring system.

Visooth noted that the system helps GranMonte to improve the yield and quality of crops. It wirelessly transmits temperature, humidity and wind data to the computer server in the office.

"GranMonte's website links to the satellite so that we can see photos in real-time via satellite, and we can also link the network with the radar stations nationwide so that we can know the weather conditions," the CEO explained.



Weather sensors monitor humidity, temperature, mass movement of the air, rain accumulation and sunlight energy in vineyards.

"Once we can predict storms or rain, we will be able to anticipate soil moisture levels, so can prepare accordingly, helping us reduce costs."

Apart from Mahidol and Nectec, another team from Chulalongkorn University is studying grape diseases at GranMonte.

Visooth, who is also the president of the Thai Wine Association, pointed out that growing grapes is a science, unlike growing corn, which depends primarily on weather.

"Grape-growing requires close attention and time-precision all year. We have more complete data and technology than others, so in case of a crisis we can limit the damage," said the CEO, pointing out that when the team knows to expect rain in the coming days, they will not water the grapes during that time. The so-called "GranMonte Smart Vineyard" is an application of precision farming technology for vineyard management. It comprises and integrates various multi-functional and multi-dimensional sensors to assist the vintner to monitor his vineyard closely from the internet or mobile phone.

The weather sensors monitor humidity, temperature, mass movement of the air, rain accumulation and sunlight energy in the vineyard. Soil sensors measure the humidity and temperature of soil around the vines area. Video images help vintners to follow activities in the vineyard, even from a distant location. An "electronic nose" is employed to track chemical conditions in the soil and aroma molecules in the grapevine and wine. GPS tracking is employed to optimise energy and input in the field.



E-nose proves that grapes from the same plant can have different scents, with chemicals of those exposed to light developing differently to those hidden from light.

All above-mentioned sensors and technologies are integrated with meteorological data from external sources into a decision-support system based on the Smart Farm Factory of Science, Mahidol's in-house software.

According to Dr Teerakiat Kerdcharoen, of Smart Farm Factory, "precision farming" is very popular in the US and Australia and such technology is likely to spread into Europe, Japan, Malaysia and India.

He noted that, in this regard, GranMonte is probably more advanced than European vineyards. "Actually, our jobs here are more difficult than in those nations because we are in a tropical area, while grapes are cool-climate plants, so it's more challenging," the research project head said.

Three key components of precision farming are information, technology, and management, based on the idea that crops and conditions (soil, water, light and weather) differ even in the same area. Differing conditions affect productivity and thus require dissimilar cultivation.

Five processes of precision farming comprise data collection, diagnostics, analysis, precision field operations and evaluation.

In simple terms, Teerakiat noted, this can be considered environmentally friendly agriculture, in that farmers are able to adjust resources according to ground conditions.

All the processes of agriculture, including planting, fertilising, use of pesticides, watering and harvesting, must be precisely performed. They may use soil-mapping to match with farm-mapping and download site-specific fertiliser information to a GPS-tracking tractor.



GranMonte Smart Vineyard system integrates various multi-functional sensors to assist the vintner to monitor the vineyard closely from the Internet or mobile phone.

"The difference between traditional farms and smart farms is the precision of resource utilisation," Teerakiat said.

The researcher pointed out that types of soil in the same area can be dissimilar; the soil in the middle part of a farm and in areas close to rivers or mountains require different irrigation because of the varying humidity levels. Even grapes from the same plant can yield different scents. Grapes that are exposed to sunlight have a different development of aroma molecules than those which are hidden from sunlight.

Traditionally, grapes from the same plants have been fermented in the same tank, but here precision research can identify differences in the grapes so that they can be fermented separately.

"The electronic nose is employed to track aroma molecules in the grapevine and in the wine and it also confirms that the aromas can be different," Teerakiat said, adding that "e-nose" also keeps records and helps farmers to check the differences of grapes each year and trace the origins of what leads to these differences.

GranMonte has employed sensor systems in several fields. Interaction of the farm with the environment covers three levels: Macro-climate, a distance of around 200 kilometres surrounding the farm from which

data is sent via satellite to the farm; Meso-climate, which covers about one square kilometre of the farm, which employs sensors to monitor wind, light, temperature, humidity and rain; and Micro-climate, where sensors are dug into the roots to monitor the humidity in the soil and the grapevine.

"Sensors will tell us whether the irrigation is enough. If the sensors that monitor weather detect rain in the next 5 hours, we can halt irrigation. This helps GranMonte to save some 10,000 baht a month in energy costs,"said Teerakiat.

Micro-climatic data at GranMonte is not only useful for the vintner but also for its customers. The vineyard is located in Khao Yai, a World Heritage site and one of the most important national parks and tourism sites of Thailand, which surprisingly lacks a real-time weather station. The installation of a smart vineyard system therefore means GranMonte doubles as Khao Yai's first and only weather station.

It is hoped that the smart vineyard system is will support GranMonte's vision of becoming a world-class wine producer, said the CEO, who noted that GranMonte wines received awards from 20 international and domestic wine competitions in 2009.

Teerakiat said users can easily learn to benefit from its data. For instance, basic weather information such as temperature, rainfall and sunlight can be easily understood. One can estimate the sky conditions by observing the sunlight energy graph. This graph usually shows a bell shape on a sunny day and a roughness and spikes on a cloudy day.

The micro-climatic data of GranMonte, such as temperature, moisture, wind, sunlight and soil conditions, is displayed over a three-day history so that users can estimate weather conditions over the next few days.

Teerakiat pointed out that while meteorological data is available throughout the world, agriculture has not typically consulted it in spite of the fact it can be very helpful to farmers.

The project has finished its research into the e-nose and has applied this technology to the smart farm. The first phase focuses on ambient intelligence to learn weather and environment conditions so that farmers can respond effectively to them. The next phase, which Teerakiat called "plant intelligence" will monitor the crops.

By using sensor technology to interact with the crops directly, the researcher said plant intelligence will learn how the plants function and try to find a channel to communicate with them.

"Plants are not stupid; they are able to communicate with each other through their chemical languages," concluded the physician.

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