Drought response in grapes studied

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A student's scholarship-winning project at South Dakota State University may help scientists better understand how grapes and other plants respond to drought.

The study could pay off in better production as plant breeders develop varieties for regions facing increased drought stress due to climate change.

Kimberley (Victor) Vaughn, from Laurel, Neb., won the 2011 Joseph F. Nelson Graduate Scholarship at SDSU for the ongoing research, which is funded in part by the National Science Foundation.

“Current predictions of climate change will force wineries to adjust to drier conditions worldwide,” Vaughn said. “Grapevines are one of the most economically important and widely cultivated crops in the U.S. and internationally. The billion-dollar grape industry is the sixth-leading crop in the U.S. and we rank third in production worldwide. A study of the whole-plant responses and differential gene expression of vascular bundles of grape roots to drought stress could significantly impact how the grape industry prepares for climatic changes.”

Vaughn is carrying out the research with SDSU professor Anne Fennell, a specialist in grapes and woody plants in SDSU’s Department of Horticulture, Forestry, Landscape and Parks. She is isolating cells from *Vitis riparia* grape root tissues under drought stress by using a technique called laser capture microdissection, or LCM.

In addition to her work at SDSU, Vaughn is participating in an ongoing collaboration through the National Science Foundation-funded Grape Research Coordination Network. That program has enabled Vaughn to travel to the University of Nevada, Reno, in order to observe drought stress studies, learn how to analyze drought stress signaling metabolite data, and work with researchers there on integrating their metabolite data with SDSU's transcript data.

Vitis riparia is a grape species native to North America that grows over a wide geographic area and is subject to a range of environmental stresses. It was one of the rootstocks imported to Europe to help vines there recover from the phylloxera epidemic of the late 19th century. It is a riverbank grape and so is commonly not thought to be drought-tolerant.

"With the global climate change increasing concern about water use, we were interested in looking at what was *Vitis riparia's* response to a water deficit, or decreasing water amounts, and what signaling was taking place between the roots and the shoots," Fennell explained. "It's been hypothesized by some researchers that a key component of drought response signaling takes place in the root parenchyma cells."

The SDSU researchers are trying to learn more about the drought signaling mechanism by using a laser capture microscopy unit that allows them to identify and examine specific cells.

"If we fix the tissue correctly, we can capture the cells and capture the information in those cells by extracting RNA, which is the DNA converted to message. We can look at the message, say, between a drought-stressed and a non-stressed plant and identify what's going on in the drought-stress process," Fennell said.

Vaughn will then use a whole grape genome microarray — somewhat like a "molecular portrait," since it monitors differences in the gene

expression for many thousands of genes at one time — to determine how cells of the grape plant under stress are responding compared to a plant that isn't facing drought stress.

The study will generate data that can be compared to other grape genotypes that are more tolerant of water stress.

"It's valuable for grapes because we're concerned about sustainability of our crops and water use and the interaction of that roots stock and the top part of the plant that produces the fruit. But it's also important for providing information for people working on other crops," Fennell said. "It can give information, say, for somebody that's working in alfalfa — is this the right tissue to be looking at, what is the signaling that's going on?"

Provided by South Dakota State University