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Trellis Height Influences MSD Risks in Vineyards, Study Finds

A study of five different trellises used in California vineyards has shown that one trellis—the popular VSP (vertical shoot positioning)—protects workers best against developing musculoskeletal disorders (MSD) of the wrist and lower back while pruning.

COEH faculty member Fadi Fathallah and Andrew Kato, then a graduate student in the Agricultural Ergonomics Research Center at UC Davis, evaluated five trellis systems commonly used in the Napa and Sonoma Valleys to learn which, if any, would minimize MSD risk factors such as repetitive forceful hand and shoulder motion, sustained forward bending, overextension, and other awkward body postures.

In the first study ever to quantitatively measure trunk posture and wrist motion during simulated pruning activities, Kato and Fathallah tracked the movements of skilled vineyard workers as they pruned actual branches embedded in foam at heights where the branches would be cut during actual pruning.

The workers wore a Motion Analysis System, which captured information about wrist motion, and a Lumbar Motion Monitor that tracked their body motion on three planes, including forward bending. They pruned branches attached to five standard trellis systems that ranged in height from two- to four-feet off the ground. In addition to measuring the workers' wrist and trunk movement, Fathallah and Kato asked them to rank the trellis systems for bodily discomfort. Their subjective response—a clear preference for the VSP system—corroborated the quantitative findings.

Workers in California's burgeoning wine industry suffer from a high incidence of work-related MSDs—80 reported incidences per 1,000 workers. The most common and most costly injuries involve the lower back and upper extremities. Pruning requires long periods of physically demanding, highly repetitive work. With a grant from the National Institute for Occupational Safety and Health (NIOSH), Fathallah and Kato undertook their research to help the industry select trellis systems that might improve worker health.

“Height dictates the difference in risk levels and comfort,” Fathallah said. “We found that only a few inches can be significant. It's tricky, because of the small difference, and it's hard to pick up visually, which is why gathering quantitative data is so important. You might think intuitively that the highest system would work best, because it requires the least bending, but our quantitative results showed that the workers were extending their back while pruning branches using the highest system, which isn't good either. They corroborated these findings by telling us that they were most uncomfortable with the systems at the extreme—the very lowest and the very highest.”

VSP System

At a height of 42 inches, the VSP system required the least bending or extension of the left wrist and the least forward bending, helping workers maintain an upright, neutral body position to a greater extent than the other systems.

“It is fortunate that the VSP is the most widely used system in the Napa and Sonoma Valleys,” said Fathallah, who hopes to get the word out to the industry that, when the time comes to replant old vineyards, using the VSP is a good choice for worker health and safety.

Other COEH faculty and academic staff members involved in this project included John Miles, Julia Faucett, Jim Meyers, and Ira Janowitz.

Fathallah and his graduate students are continuing to work on agricultural ergonomics, with a focus on the biomechanics of back injuries. They are currently analyzing data on harvesting grape clusters and will be reporting their findings soon.