ANR CE Specialist in Viticulture/Automation and Mechanization

Position Title: CE Specialist in Viticulture/Automation and Mechanization.

Position Description: California's grape growers are confronted by an increasingly expensive and less available labor force, compelling them to reconsider their traditional reliance on hand labor. The focus of this position will be to develop and optimize technologies to automate and mechanize vineyard operations such as site evaluation, soil tillage, spraying, canopy management, weed control, irrigation scheduling, estimating yield, assessing fruit maturity, and harvesting. It is expected that automation will include sensor development, as well as the ability to interpret and use distributed field data to facilitate management. This position will be located at the Kearney Agricultural Research and Extension Center in Parlier (KARE), with a main appointment in the Department of Viticulture and Enology and a joint appointment in the Department of Biological and Agricultural Engineering. The incumbent will be expected to serve California's wine, table and raisin grape growers. The Department would work with the KARE Center Director to identify office, laboratory and vineyard space for this position, and make available resources in our Davis campus and Napa Valley vineyards. The person filling this position will hold a doctoral degree in Agricultural Engineering or a related discipline with research experience in the automation and mechanization of crop production. This position request is fully supported by the UC Davis Integrated Grape Production Workgroup, which considers the position to be critical for California's grape industry.

Justification: The research performed by this CE Specialist will be critical to the future success of all grape industries. Labor is increasingly expensive and immigration policies are making labor far less available. Grape growing (wine, table and raisin grapes) is currently highly dependent upon manual labor, but many operations are amenable to mechanization. Some of the needed equipment/technology could be adapted from other crop production systems while substantial room for innovation exists. The National Grape and Wine Initiative, an industry-driven partnership with academic and government representatives, which includes all segments of grape industry, places automation and mechanization at the top of its research priorities. This position would have a great impact on grape growing across the State and would help expand the campus' partnership with grape growers. One of the key opportunities this position presents is a strengthening of the Department's relationship with San Joaquin Valley growers where the vast majority of the grapes are grown in the State, and a potential venue for collaboration with other institutions such as UC Merced and CSU Fresno. Economic margins are low in the SJV and management of labor costs is a critical component for a successful and sustainable industry that will remain viable in a competitive global market. Better sensing, automation, and mechanization can also improve fruit quality while lowering costs and optimizing resource use (e.g. water, energy, and chemical inputs) allowing this portion of the grape industry to increase productivity and remain viable in a competitive global market. The goals of this position align well with the ANR 2025 Strategic Vision, especially with the initiatives related to water quality and quantity (e.g. irrigation automation), competitive sustainable food systems (e.g. reduced reliance on manual labor), and green technology development (e.g. minimizing energy and water inputs to vineyard management).

We currently have one Viticulture Extension specialist in the San Joaquin Valley serving the wine, table and raisin grape industries, and recently hired a second Viticulture Specialist who is housed at our Oakville Experimental Station in the Napa Valley. The position detailed in this request would complement the existing positions and would serve all of the grape industries across the state.

Winegrapes had a $2.95 billion farmgate value in 2014 from 615,000 acres representing approximately 5,900 grape growers. The California wine industry generated $23.1 billion in domestic sales in 2013 with a total state economic impact of $61.5 billion. There are currently well over 4000 wineries in California, an increase of over 300% in the last 20 years. In 2015, California table grape producers shipped 110.5 million boxes of grapes to consumers in the US and around the world, valued at a record-high of $1.83 billion. Raisins represent an additional 184,000 acres, with 3,000 growers producing 325,000 tons annually. Yet we currently have only two CE Specialists working full time on grapes. One is based at the KARE and their work is primarily physiological. The second is based at our Oakville Station. He has an active program evaluating mechanization technologies, among other areas. This proposed position will therefore be highly complementary, as it will focus on development of new grape mechanization technologies. More positions are needed to support the critical network of Farm Advisors being rebuilt across the state after a period of extended vacancies. The addition of a viticulture automation and mechanization Specialist will greatly help and also complement campus-based senate and other CE sensor and agricultural mechanization positions that we are currently recruiting in V&E and BAE in this enormously important area for agriculture over the coming decades. Together, these current and proposed positions represent a new and exciting critical mass in the area of sensing and automation that will allow the University of California to solve key agriculture issues better than anywhere in the world. With this position, the V&E Department would also return to its CE staffing level of approximately 15 years ago, even though the industry is now significantly larger. We have received input and support for this position from major statewide and local industry organizations, vineyard and wine companies such as the American Vineyard Foundation, the California Table Grape Commission, and the California Raisin Marketing Board. Wineries and individuals supporting this position include Hal Huffsmith/Sutter Home Family Vineyards, Bruce Cakebread/Cakebread Cellars, and Rick Stark of Sun-Maid Raisins of California.

Extension: We would expect the person in this position to maintain a vigorous extension program on the automation and mechanization of all types of viticulture across the State, keeping the industry aware of the latest research related to

mechanization and optimizing cultural practices. Clientele groups include trade and commodity organizations, regional technical groups, and individual growers, who range widely in both size and experience. We would expect the person in this position to organize field days statewide by working with farm advisors and other CE Specialists, offer workshops and short courses in collaboration with faculty in the Department of Viticulture and Enology and Biological and Agricultural Engineering, and with industry partners, organize their own symposia and participate in pertinent departmental extension events—now at approximately 16-18 per year—around the state. While based at Kearney, the incumbent is expected to integrate with the V&E and BioAg Engineering departments at Davis and utilize all departmental vineyards to test and demonstrate new equipment and techniques. Automated irrigation and water use sensing, automated analysis of fruit quality including infrared spectral analysis, aerial and ground-based sensing, load sensors for yield estimates and optical and other automated sorting equipment to screen for quality after the fruit is harvested would allow integration with our new automated research winery facilities as well. Other means to reach clientele will include publications and other web-based tools. As this person gains seniority, we expect them to take on national leadership in viticulture extension.

Research: Key research areas would include the automation/sensing and mechanization of all aspects of grape production. The Specialist would be expected to identify new technological developments that could be adapted to help automate, mechanize, or optimize, various viticultural practices, possibly including: site evaluation (leading to estimates of the capacity of a given site and appropriate spacing, as well as trellis and rootstock choices); irrigation and nutrient application; pesticide applications, canopy management; identification and control of common vineyard diseases and pests; assessments of fruit quality and yields; optical sorting of fruit prior to entering the winery or packing house; harvesters; and pruning activities from pre-pruning to automated pruning. Current improvements in image analysis and robotics are making mechanization of what were impossibly complex tasks now accessible, so it is critical to become involved in the technological development or UC Davis will be left out. We will expect this research to be published in various electronic and print media such as California Agriculture, UC/ANR publications on grapes, sustainability guides, and refereed journals such as the American Journal for Enology and Viticulture.

ANR and External Network: The person in this position would immediately have a network of research collaborators including faculty ranging from basic to applied scientists in V&E, BAE, and other departments at Davis, Riverside, and Berkeley, USDA-ARS, the network of county-based viticulture farm advisors (now largely restored to previous levels). The person in this position would be expected to provide leadership in this network as they progress in their career. A wide array of growers, grower organizations, and equipment vendors would supply an additional external network.

Support: The director of KARE strongly supports this proposal and has identified office and lab space at Kearney. Lab space will include a spacious research shop with evaporative cooling and heating, an overhead bridge crane with a 2-ton capacity, an engine exhaust hose reel which allows for the safe operation of engines inside the shop, compressed air, an overhead power track bus system which allows for the easy installation of electricity breakers at any point on its length, an attached office and tool room, and a restroom has its own shower. The station will also provide use of vineyards and infrastructure, vineyard establishment and management, departmental computing and business functions, distance learning, and access to fabrication and rapid prototyping facilities. It is anticipated that the Kearney station will soon recruit another Agricultural Engineer who could serve as a valuable colleague.

Other support: Research funding sources include the American Vineyard Foundation, California Table Grape Commission, National Grape and Wine Initiative, USDA, and CDFA.

Location: Based at Kearney, this position would be centrally located to San Joaquin Valley production regions for wine, table, and raisin grapes. The location also nicely complements other farm advisor and CE position locations, especially recent and ongoing recruitments in this area.

Developed and Proposed by: Faculty in the Department of Viticulture and Enology (David Block, Chair) have developed this proposal with input from the Department of Biological & Agricultural Engineering (Bryan Jenkins, Chair). Jeff Dahlberg, Center Director for the KARE, is also supportive of this proposal and gave valuable input during proposal development. External stakeholders consulted and supportive are listed above.