Exploring Robotic Technology for Wine Grape Production

Authors:
Dean A. McCorkle, Extension Program Specialist – Economic Accountability, Department of Agricultural Economics, Texas A&M AgriLife Extension Service, College Station, TX. E-mail: d-mccorkle@tamu.edu

Rebekka M. Dudensing, Assistant Professor and Extension Economist, Department of Agricultural Economics, Texas A&M AgriLife Extension Service, College Station, TX. Email: RMDudensing@tamu.edu

Ed W. Hellman, Professor and Extension Viticulturist, Department of Horticultural Sciences, Texas A&M AgriLife Extension Service, Lubbock, TX. E-mail: ewhellman@ag.tamu.edu

Dan Hanselka, Extension Associate, Department of Agricultural Economics, Texas A&M AgriLife Extension Service, College Station, TX. E-mail: Dan.Hanselka@agnet.tamu.edu

Keith Gunnett, Chief Technology Officer, RE², Inc., Pittsburgh, PA. E-mail: keith.gunnett@resquared.com

Reeg Allen, Director of Business Development, RE², Inc., Pittsburgh, PA. E-mail: reeg.allen@resquared.com

Objectives

The motivation for this study centers on the labor and cost-intensive nature of wine grape production, and the potential opportunities for robotic technology. The objectives of this study are four-fold: 1) develop a cost of production budget typical of wine grape production in Texas, 2) identify common tasks and concerns, 3) determine which operations are most suitable for robotic technology development, and 4) assess the economics of vineyard production under risk.

Background

Texas ranks ninth in grape production in the U.S. with 5,330 tons (2011). In 2011, there were approximately 88 vineyards and 4,400 acres of grapes in the state (Texas Wine and Grape Growers Association, 2012). More than 80% of Texas grapes are used in wine (USDA – NASS, 2012).

Grapes are among the most intensively managed fruit crops, requiring a great deal of manual labor to complete many key tasks including vine training, pruning, canopy management, and harvest. Scarcity of skilled labor has been identified as an increasing challenge for the grape industry and has constrained continued expansion (MKF Research, 2007).

Machines have been developed to reduce most of the previous season’s growth, remove leaves, position shoots, and thin fruit. However, these machines do not perform any of these tasks with the selectivity that many premium wine grape producers require.

Robotic technology has made significant contributions over the last decade and offers the potential to duplicate the efficacy of skilled human labor for vineyard tasks requiring selective activity. Today’s industrial robots have dexterity, strength, reliability, speed and precision that is unparalleled by human workers. The agricultural industry in particular is primed for robotic technology as it faces a variety of production issues that could affect long-term competitiveness.
Mechanization will be key to achieving vineyard efficiencies within the production process, as robotics can potentially allow for selective pruning, thinning, training of vines and canopy and crop estimation.

Data and Methods

Using a grower panel process, this project includes the development of two representative wine grape vineyards – medium and large – in each of the following five states: California, Washington, New York, Oregon, and Texas. This paper is focused on the Texas representative vineyards. Investigators have worked with the panels to develop a representative production budget for each vineyard size, and to gather input on production tasks that the growers feel would be most suitable to robotic technology.

Given the production budgets, production risk and price risk parameters, an Excel-based model is being developed to assess baseline pro-forma financial statements for each vineyard size using Simetar®.

Results

The production budgets developed through grower panels, the production tasks identified as being most suitable for robotic technology, and potential challenges with robotics will be presented. The production costs associated with these tasks and the panels’ views on important characteristics of potential technology will be discussed. The results of the stochastic analyses of the medium and large representative vineyards will also be presented. Together, these results will explore opportunities to strengthen vineyard profitability using robotics.