Warren J. Baker Endowment
for Excellence in Project-Based Learning
Robert D. Koob Endowment *for Student Success*

CAL POLY

PROPOSAL NARRATIVE

(Max. of 3 pages including figures/tables but excluding budget page, 1" margins, 12-point font. See Sec. XII of RFP for more details.)
Proposals not complying with format guidelines will not be considered.

I. Project Title

Effect of vine age on performance of *Vitis vinifera* L. cv. Zinfandel grapes and wines in the Edna Valley, California

II. Abstract

This study evaluates the effect of vine age on vine performance and wine chemistry and sensory aspects of *Vitis vinifera* L. cv. Zinfandel in California's Edna Valley. Wine from old vines are frequently considered and marketed as superior compared to wine from young vines. However, this popular conception has not been studied thoroughly with respect to the viticultural traits or the subsequent wine chemistry and sensory attributes. Two side-by-side vineyard sites, planted with identical plant material (cv. Zinfandel grapes), that vary only in vine age have been selected. Data collected will include shoot length, internode length and diameter, vine balance indices (yield/pruning weight ratio) and nutritional status, timing of key phenological events (budbreak, bloom, set, veraison, maturity), fruit maturity indices (soluble solids, pH, TA, color and phenolics) as well as wine chemistry (pH, TA, color and phenolics) will be tracked each year. Additionally, at harvest, berry number per cluster, berry mass and berry size will be determined. Formal descriptive sensory analysis will be carried out on the finished wines using a trained panel of 10 individuals.

III. Objective(s)

The purpose of this study is to determine the relationship of vine age on viticultural and enological factors. Typically, most winegrape cultivars (*Vitis vinifera* L.) are commercially planted with the expectation being economically productive for 25 years. Generally, the longer the vines are kept in production, the larger the profit margin potential. Despite the economic advantage of prolonged production at a specific vineyard site, damage and decline by the root aphid, phylloxera (*Daktulospaira vitifoliae* Fitch), nematodes (Pongrácz 1983), wood root diseases, and/or poor management practices are all factors that contribute to decreasing vineyard lifespans. In addition to the aforementioned issues, natural reproductive and vegetative decline in old vines can also contribute to this trend. As a result of the rarity, production difficulty, and perceived increase of wine quality, "old" vines have become increasingly sought after by the industry and consumers. Few studies have examined role vine age has in phenological development or wine chemical and sensory attributes. Only a handful of those studies have suggested the importance of vine age in wine quality (Heymann and Noble 1987, Renyolds et al. 1994, Zufferey 2007, Grigg et al. 2017). Unlike other studies, this study has the unique opportunity to compare identical clones, at identical sites, under consistent management practices. In addition, much needed research about the wine quality of young and old vines under these conditions will be evaluated. Considering the wine industry's value of wine from old vines, particularly with Zinfandel, this study will provide objective evaluation of the validity of this claim.

Objectives:

1. To determine the effect of vine age of Zinfandel on a) chemical and sensory of the finished wines and b) vine performance.

2. To determine the effect of vine age of Zinfandel on consumer preference.

IV. Methodology

This study will consist of two adjacent vineyard blocks of *Vitis vinifera* L. cv. Zinfandel in California's Edna Valley. The vines are head-trained, spur pruned. The young vines are 10 years old and the old vine block is 80 years old. All vines in the younger block were vegetatively propagated from cuttings from the old vine block. The young and old vineyards will be designed as a complete randomized block design with (n=4 blocks of 10 vines per block).

Carbohydrate reserves will be determined by drilling out a pith sample from the established vines. Samples will be dried overnight at 70°C. Following a drying process, the samples will be ground to 0.12 mm with a heavy-duty cutting mill and then processed with an ultra-centrifugal mill. For non-structural carbohydrates analysis the procedure by Smith and Holzapfel (2009) will be followed using a commercial enzyme assay (Megazyme International, Bray, Ireland). For non-structural carbohydrates (TNC) analysis, the procedure by Smith and Holzapfel (2009) will be followed. The soluble sugars will first be extracted from a 20-mg subsample of each tissue using 3 x 1 mL x 10 min washes of 80% aqueous ethanol. The first two volumes are completed at 80°C and the third at room temperature. Between each wash cycle, the samples will be centrifuged and the three aliquots will then be combined, diluted to 10 mL, and the concentration of sucrose, D-fructose and D-glucose determined with commercial enzyme assay (Megazyme International, Bray, Ireland). For the analysis of starch, the remaining wood samples will be re-suspended in 200 uL dimethylsufoxide and heated at 98°C for 10 min. The rest of the analysis will then be performed using commercial enzymes and glucose assay kits (Megazyme International). Next, 300 uL thermostable α-amylase in MOPS buffer is added and mixed thoroughly before being incubated for 15 min in a 98°C water bath. Once cooled, an addition of 400 uL amyloglucosidase in sodium acetate buffer will be added before incubating for 60 min at 50°C. Next, the samples are mixed at 20 min intervals, and then centrifuged at 10,000 rpm for 2 min. Supernatant from root samples are then diluted 1:11, and dormant cutting samples 1:6 in Ultra-pure water. Glucose concentration of the diluted samples will then be determined colorimetrically and the amount of starch in the original 20 mg sample calculated.

Additionally, trunk diameter and circumference will be measured at post-harvest, at full dormancy, approximately 100 mm from the soil level around the circumference of the main supporting trunk. Internode and shoot length above the second cluster will be examined as well. Key phenologic developmental events (budbreak, bloom, set, veraison and maturity) will be tracked. At bloom, blade/petiole nutritional status will be recorded. Maturity sampling will also take place in the weeks leading up to harvest. Fruit analysis will include soluble solids, pH, TA, color and phenolics. For grape analysis will involve keeping the vineyard replicate samples separate. Sampled berries will be stored at -80 °C. Tannins, anthocyanins and iron-reactive phenolics will be measured as previously described by Harbertson et al. 2003. Phenolics will be expressed on a fresh weight, FW (mg/g FW) and on a per berry basis. Skin, pulp, seed weight, number of seeds/berry and skin berry surface will be determined as previously reported (Zouid et al. 2013). Grapes from both blocks will be harvested at a target Brix of 24.5 ± 0.5 normally indicated for standard (commercial) winemaking practices. Once harvested, grapes will be immediately precooled to reduce field temperature to a target of 12 ± 1 °C. After attaining target temperature, grapes will be destemmed and crushed.

Vineyard replicates will be kept separate during the winemaking process and fermented in individual fermenters (in triplicate for each vineyard replicate). Wines will be produced at the Pilot Winery of the Wine & Viticulture Department in Cal Poly San Luis Obispo. For wine analyses, tannins, anthocyanins and iron-reactive phenolics in wines and pomace samples (recovered after fermentation) will be measured by protein precipitation (Harbertson et al. 2003) following a previously described protocol (Casassa et al. 2013b). Anthocyanins and tannins will also be followed during maceration, post-maceration and bottle aging to determine the kinetics of extraction and retention of wine phenolics (Casassa et al. 2013b,c). Red wine color will be measured using tri-stimulus colorimetry by the Cie-Lab system, as previously described (Casassa & Sari 2014). A sensory panel of 15 individuals will be convened. Training and 4 evaluation protocols for sensory descriptive analysis will be performed as described (Casassa et al. 2013c). Taste and aroma attributes will be determined according to a previously described protocol using descriptive quantitative analysis (Lawless & Heymann 2010).

V. Timeline

- January – March 2019 — Vineyard Research Design Field Marking
- March – September 2019 — Viticulture Field Data Collection and Phenology Tracking
- September – October 2019 — Harvest Fruit, Ferment Research Wines, Train Panelists
- November 2019 — Bottle Wines, Sensory Analysis

VI. Final Products and Dissemination

The final product of these experiments will include a Cal Poly Senior Project and contribute to a Cal Poly Master's Thesis. The report will also be disseminated at the following events and publications

- American Society of Enology and Viticulture Annual Meeting: Poster and Student Flash Talks, Student Oral Presentations (Napa, CA)
- American Journal of Enology and Viticulture (peer reviewed)
- Practical Winery and Vineyard Journal (non-peer reviewed)

This work will also be discussed with industry and research professionals at field days hosted by UC Extension and/or industry groups such as the Paso Robles Viticulture Technical Group.

VII. Budget Justification

This budget is necessary for the growing season viticultural trait tracking, the stored carbohydrate analysis, wine fermentation, sensory panel training and conference travel.

In-state Travel $900

- Summer Research Site Travel — $250
- Conference Registration — $120 ($60 per Student)
- Hotel for Two Nights — $240 ($60 per Student per Day)
- Mileage — $290 (53.5 Cents per Mile for ~ 540 Miles)

Operating Expenses $2,160

- Enzymatic Analysis Kit — $350 (100 Sample Kit)
- Laboratory Consumables — $200 (Gloves, Flasks, Pipette Tips)
- Laboratory Standards — $200 (pH Standards, NaOH, etc.)
- Poster Printing for Conference — $60 (Campus or Kinkos Poster Printing)
- Vineyard Flagging Tape — $100
- Sensory Standards — $800 (Standards, Crackers, DI Water)
- Fermentation Supplies — $450 (Yeast, DAP)

Total: $3,060

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PROPOSAL BUDGET

Student Applicant(s): **Vegas Riffle** **Samantha Stauch**	
Faculty Advisor: **Dr. Jean Dodson Peterson** **Dr. Federico Casassa**	
Project Title: Effect of vine age on performance of *Vitis vinifera* L. cv. Zinfandel grapes and wines in the Edna Valley, California	**Requested Endowment Funding**
Travel *subtotal*	$
Travel: In-state	**$780**
Travel: Out-of-state	$
Travel: International	$
Operating Expenses *subtotal*	$
Non-computer Supplies & Materials	**$2,100**
Computer Supplies & Materials	$
Software/Software Licenses	$
Printing/Duplication	**$ 60**
Postage/Shipping	$
Registration	**$120**
Membership Dues & Subscriptions	$
Multimedia Services	$
Advertising	$
Journal Publication Costs	$
Contractual Services *subtotal*	$
Contracted Services	$
Equipment Rental/Lease Agreements	$
Service/Maintenance Agreements	$
TOTAL	**$3,060**