Virginia Tech
Virginia Polytechnic Institute and State University
Proposal Cover Sheet

PROPOSAL INFORMATION

Virginia Winegrowers Advisory Board

Sponsor   **Solicitation No.**

Wine Grape Cultivar, Clone, And Training System Evaluations

Proposal Title

$17,626.00	7/1/04	6/30/05	☒ New or
Amount	**Begin Date**	**End Date**	☐ Renewal of

PRINCIPAL INVESTIGATOR(S)

Bruce W. Zoecklein

Principal Investigator	Co-Principal Investigator	Co-Principal Investigator
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Food Science and Technology		
Department / Center	Department / Center	Department / Center

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David W. Richardson	Date	VT Proposal No.
Director of Sponsored Programs		

RESEARCH PROPOSAL

A. TITLE: Wine grape cultivar, clone, and training system evaluations

B. DATE: July 1, 2004 to June 30, 2005

C. DURATION: One year of a multi-year request

D. OBJECTIVES:

1) To evaluate 10 Chardonnay clones for viticultural and enological strengths and weaknesses.

2) To evaluate Traminette, Cabernet Franc, and Viognier under three different training systems in northern Virginia.

3) To evaluate a series of novel wine grape cultivars in the Eastern Piedmont of Virginia

E. JUSTIFICATION / PRACTICAL IMPORTANCE:

Winegrape clones: Clonal variability offers the grower/vintner latitude in adaptation to climate or other growing conditions, while maintaining a recognized variety name. Clonal evaluation is a logical extension of variety evaluation, and growers are increasingly seeking clonal recommendations, rather than simply variety recommendations. The Chardonnay clone evaluation at Winchester, Virginia, yielded preliminary fruit quality and yield data. The information gained from this proposed research will provide growers with objective information about yields, fruit quality, bunch rot susceptibility, and wine quality, of different Chardonnay clones.

Training system comparison: Formal grapevine training system comparisons are justified from several bases. First, owing to differences in vigor and growth habit, as well as grower constraints, no one training system is universally suited to all situations. Divided canopy training systems are economically viable when cane pruning weights uniformly exceed 0.4 pounds per foot of canopy, but would not be recommended for smaller vines. High training systems, such as Geneva Double Curtain, may offer advantages of lower cost, as well as enhanced fruit chemistry, owing to greater fruit exposure to sunlight. The interactions of grape variety and training system should be investigated, in order to substantiate recommendations from an economic, viticultural, as well as enological basis. Traminette, Cabernet Franc, and Viognier either have potential, or are currently

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important, to the mid-Atlantic wine industry. Although Traminette may be grown on its own roots, the long-term merit of this route is uncertain; therefore it will be compared grafted and ungrafted. Traminette fruit and wine is aromatic. High phenol levels that impart bitterness to the wine, however, can reportedly accompany maximum flavors. The training system comparison will allow us to modify fruit exposure, and potentially optimize fruit flavors and phenols. Cabernet Franc is regionally important, but shows inconsistent yields due to fruit set and bud fruitfulness variability. Viognier is a high quality white *vinifera* variety. Viognier's weaknesses are low yields, due to bud necrosis, and inconsistent fruit flavors and aromas, which are due, in part, to seasonal differences. The several training systems evaluated with each of these varieties are contemporary, efficient designs that are adaptable to mechanization and, with the divided canopy designs, result in efficient land use.

Cultivar evaluation: The outcome and benefits of the cultivar evaluation at the Southern Piedmont Agricultural Research and Extension Center are expected to include several new (for the region) wine grape cultivars that can be recommended for the Eastern Piedmont, where spring frost, high heat, and abundant precipitation during the fruit maturation period are chronic threats to grape yields and fruit quality. Currently, we have very few cultivars that can be endorsed for this region of the state, yet many requests for such information are originating from this region, particularly as traditional agricultural products, such as tobacco, are becoming less profitable.

Timely transfer of knowledge to growers and vintners will be achieved through:

- newsletters: *Viticulture-Notes* (http://www.ext.vt.edu/vce/anr/horticulture) and *Vintner's Corner* (http://www.fst.vt.edu/zoecklein/index.html)

- seminars and shortcourses (examples include VVA technical meeting 2/2003 and Wineries Unlimited 3/2003)

- trade and scientific publications

- informal industry wine "roundtables"

- electronic dissemination via a viticulture website (http://arecs.vaes.vt.edu/arec.cfm?webname=winchester&section=about_us&pid=vitis) and *Enology Notes* site (http:www.fst.vt.edu/extension/enology/index.html)

F. BACKGROUND: Virginia Winegrowers Advisory Board funding in 1987 provided for the establishment of a wine grape variety evaluation planting at the AHS Agricultural Research and Extension Center in Winchester, Virginia. Twenty-five varieties were evaluated over an eleven-year period. Varieties which generally performed well, both in the vineyard and in the winery, and which have gained some adoption by the Virginia industry or elsewhere, include Chardonel, Muscat Ottonel, Malvasia bianca, Norton, Petit Verdot, and Viognier. Varieties which may do well under more specific conditions include Sangiovese, Petit Manseng, Tannat, and Fer Servadau. We also learned of specific cultural problems and considerations with many of the varieties. Nebbiolo, for example, must be cane-pruned, owing to non-fruitful basal buds. Viognier suffers a high proportion of bud necrosis, which contributed to low yields at Winchester. The information and recommendations generated from the variety planting have been relayed to the region's vineyards and wineries through a number of media, including a symposium in 1995.

Prior to the 2001 grape harvest season, Virginia Tech's Department of Food Science and Technology completed a $180,000 renovation of the research winery. This renovation greatly expanded, and improved, our winemaking capability to support this proposed research effort.

G. PROCEDURES:

1. Chardonnay clone evaluations: Ten Chardonnay clones are being evaluated for viticultural and enological merits at the AHS Agricultural Research and Extension Center at Winchester, Virginia, over a six- to eight-year fruiting period. Clones #4, #5, #6, #15, #17, #25, #76, #95, #96, and #277, which span a range of yield and known differences in must/wine quality, were planted in 1998. All were grafted to C-3309 rootstock. Each clone is represented by 18 vines, planted in three-vine panels, integral to a training system comparison, as described in Section 2. As such, the clones are being compared under three different training systems: Vertical Shoot Positioned, Smart-Dyson, and Geneva Double Curtain. Vine spacing is eight feet in rows, with rows spaced ten feet apart.

2. Traminette, Cabernet Franc, and Viognier under three training systems: Traminette, Cabernet franc, and Viognier vines are being evaluated under three training systems at Winchester, Virginia: two divided canopy

systems (Geneva Double Curtain and Smart-Dyson) and the "standard" as used in Virginia, non-divided, Vertical Shoot-Positioned (VSP). The training system comparison was established in 1998 as a split-plot, randomized complete block design comprised of three blocks. Each block contains three main plots of training systems and four sub-plots of grape cultivars in a factorial treatment arrangement. Each cultivar/training system combination consists of three plots of three vines each. Row spacing is at ten feet, while vine spacing is at eight feet. There are three vines per panel, for a total of 27 vines per cultivar. Treatment vines are planted in the central row of three-row blocks; border rows are planted to Chardonnay clones, discussed in Section 1, above. Treatment cultivars are Traminette/own rooted, Traminette grafted to C-3309, Cabernet franc, clone #1, and Viognier, la Jota clone. Cabernet franc and Viognier are grafted to C-3309 rootstock. The rationale for the choice of cultivars is as follows: Traminette is a recently released, white-fruited, hybrid cultivar (Reisch et al., 1997). It has high fruit and wine aroma qualities similar to one of its parents, Gewürztraminer, but possesses much greater cold hardiness and bunch rot resistance than Gewürztraminer does. Preliminary data from our cultivar evaluation at Winchester (our unpublished data), as well as limited commercial experience, suggests that Traminette may be well suited, viticulturally and commercially, to Virginia and other mid-Atlantic states.

3. Wine grape cultivar evaluation in Virginia's southern Piedmont: Formal cultivar evaluations in Virginia have been performed only at Winchester, in northern Virginia. The southern and eastern Piedmont regions are warmer (day and night temperatures) and receive greater precipitation, particularly during the fruit ripening months of August-October (NOAA, 1985). The climatic uniqueness of the region warrants specific cultivar evaluations, to support the existing and potential grape and wine producers in southern Virginia and the northern Piedmont region of North Carolina. Accordingly, a wine grape cultivar evaluation was established at Virginia Tech's Southern Piedmont Agricultural Research and Extension Center in Blackstone, Virginia, in spring, 2001. Cultivars include NY73.0136.17, Vidal, Traminette, Norton, Tannat #1, Mourvedre, Viognier #1, Rousanne #1, Cabernet Sauvignon #7, Cabernet Sauvignon #337, Chardonnay #96, Tempranillo, Petit Manseng, Touriga Naçional, Tinta Cão, Aleatico, and Muscat blanc. Norton is ungrafted. All others are grafted either to C-3309, 5C, or 101-14. Plantings consist of three-vine plots (eight feet between plants), replicated six times in a

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completely randomized design. Drip irrigation and deer exclusion fencing are installed. Row width is 10 feet. Vines and vineyards are being managed, following commercially-recommended practices.

Fruit sampling and components of yield: A minimum of 50 berries will be randomly collected from each cultivar or clone replicate, as well as from the cultivars used in the training system comparison. Fruit samples will be collected at 7- to 10-day intervals, beginning at approximately 18°Brix, until and including harvest. To allow treatment comparison, clones, cultivars, and training system plots will be harvested at approximately 22 to 23°Brix (season permitting), rather than at a fixed time. Harvest decision will also be predicated upon disease incidence, fruit aroma and taste, and imminent climatic or wildlife threats. Yield components for all experiments will include clusters per vine, cluster weight, berries per cluster, berry weight, and fruit weight per vine.

Fruit chemistry: Basic fruit chemistry analyses will include the following: Soluble solids and pH will be determined on fresh (non-frozen) berry samples. Titratable acidity will be determined either on fresh juice, or on frozen, diluted juice samples. For Cabernet franc (training system comparison), copigmented colors will be determined. Tartaric and malic acid concentrations will be determined by reverse-phase HPLC, using a Hewlett-Packard solvent program system, model 1100, and a Phenomenex ion exclusion Synergi 4μ Hydro-RP 80A (250mm x 4.6mm) column. Alcohol % (v/v), extract and phenol polymerization will be determined as outlined by Zoecklein et al. (1995). Total, phenol-free and anthocyanin-free glycosides will be determined as described by Williams et al. (1995), Iland et al. (1996), and Zoecklein et al. (2000). Pre- and post-fermentation concentrations of fermentable nitrogen will be determined as described by Zoecklein et al. (2000). Immediately post-fermentation, free volatiles will be determined by solid-phase microextraction (SPME), as described by Whiton and Zoecklein (2000). Gas chromatography/mass spectrometry will be performed using a Hewlett-Packard (Richmond, VA) model 5890 GC and model 5972 mass selective detector.

Small-lot wine-making: Small lots of wine will be made from each cultivar or clone within each experiment, over multiple years at Virginia Tech's research winery in the Department of Food Science and Technology, Blacksburg, Virginia. This effort will be undertaken by Dr. Bruce Zoecklein, using standard micro-vinification procedures.

Sensory evaluation: Sensory analysis will be conducted on each wine lot at four and nine months post-fermentation, using duo-trio paired comparison analysis, as described by Amerine and Roessler (1976). If differences are noted among treatments, descriptive analysis will be conducted using 12 trained evaluators, as described by Meilgaard et al. (1991).

H. PERSONNEL AND FACILITIES: B.W. Zoecklein will oversee all enological aspects of work at the Enology-Grape Chemistry Laboratory and research winery, in the Department of Food Science and Technology, Virginia Tech, Blacksburg.

I. OTHER ENTITIES: None involved

J. SOURCE OF OTHER FUNDS: The enological and wine sensory portion of this project will be supplemented from research funds obtained from the California Competitive Grants Program.

K. BUDGET

Wage support	$12,000
Fringe (7.3%)	876
Travel	2,000
Materials and supplies	2,750
Total	$17,626

Submitted by:

Bruce W. Zoecklein
Professor of Food Science and Enology Specialist
Department of Food Science and Technology
Virginia Tech
Blacksburg, Virginia 24061

Literature cited:

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Wolf, T.K, I.E. Dami, B.W. Zoecklein, and M.K. Warren. 1999. Commercial grape varieties for Virginia. VA Cooperative Extension Public. #463-019, Blacksburg VA. 42 pp.

Zoecklein, B.W., K.C. Fugelsang, B.H. Gump, and F.S. Nury. 1995. Wine Analysis and Production. Aspen Publishers, New York, NY. 621 pp.

Zoecklein, B.W., L.S. Douglas, and Y.W. Jasinski. 2000. Evaluation of the phenol-free glycosyl glucose procedure. Am. J. Enol. Vitic. 51:420-423.

BRUCE W. ZOECKLEIN
Associate Professor
BRIEF PROFESSIONAL BIOGRAPHY

I.   Résumé

Educational Background:

Ph.D., Food Science and Technology, Virginia Tech. 1995.

M.S., Horticulture, Virginia Tech. 1993.

B.S., Microbiology, California State University-San Diego. 1972.

Previous Experience:

Associate Professor, Enology Specialist, Department of Food Science and Technology, Virginia Tech. 1999.

Assistant Professor, Enology Specialist, Department of Food Science and Technology, Virginia Tech. 1995.

Research Associate, Enology Specialist, Department of Food Science, Virginia Tech. 1994-1995.

Research Associate, Enology Specialist, Department of Horticulture, Virginia Tech. 1985-1994.

Extension Specialist-Enology, Department of Horticulture, University of Missouri. 1980-1985.

Research Specialist-Enology, Viticulture Research Station, California State University, Fresno. 1978-1980.

Instructor, Department of Food Science-Enology, California State University, Fresno. 1977-1980.

Production Manager, Oliver Wine Company, Bloomington, Indiana. 1975-1977.

Winemaker, A. Perelli-Minetti and Sons Winery (California Wine Association), Delano, California. 1973-1975.

Winemaker, Pleasant Products Food Corporation, San Diego, California. 1971-1973.

Honors and Awards:

Virginia Tech Gamma Sigma Delta Teaching Merit Award. 2000.

Napa Valley Wine Council Research Award, shared with K.C. Fugelsang. 1999

Virginia Tech Gamma Sigma Delta Extension Merit Award. 1999.

Virginia Tech Alumni Extension Excellence Award. 1997. The highest honor given by Virginia Tech for excellence in extension programs.