AGENDA

Napa County Resource Conservation District

Special Meeting of the Huichica Creek Sustainable Vineyard and Orchard Advisory Committee

When: Thursday, July 18, 2019 at 8:00 A.M.
Where: Huichica Creek Sustainable Vineyard and Orchard, Napa, CA

Jim Lincoln	Ashley Anderson Bennett	Bill Pramuk	Margaret Woodbury	Bob Zlomke
President	**Vice President**	**Director**	**Associate Director**	**Associate Director**

Lucas Patzek	Miguel Garcia
Executive Director	**Sustainable Agriculture Program Manager**

COMMITTEE PURPOSE

Resolution 2016-07 of the Board of Directors of the Napa County Resource Conservation District (RCD or District) established the Huichica Creek Sustainable Vineyard and Orchard Advisory Committee (Committee) to provide input related to the operation and long-term goals of the RCD's program.

GENERAL INFORMATION

The RCD will hold a special meeting of the Committee on Thursday, July 18, 2019 at 8:00 A.M. The meeting will be held at the Huichica Creek Sustainable Vineyard and Orchard property off of Duhig Rd. (corner of Duhig & Ramal Rd.), Napa, CA 94559. The site is not wheelchair accessible. Assistive listening devices and interpreters are available through the Secretary of the Board. Requests for disability related modifications or accommodations, aids or services must be made to the District office no less than 72 hours prior to the meeting date by contacting 707-690-3110, anna@naparcd.org. Time for public commentary will be provided prior to Consent Calendar. Time limitations for individual speakers may be set at the discretion of the Chair. All materials relating to the agenda are available for public inspection at the District office Monday through Friday, between the hours of 8:00 A.M. and 5:00 P.M., except for District Holidays. The agenda is available online at: http://naparcd.org/

DRIVING DIRECTIONS

West on Hwy 12/121 (toward Sonoma), Left on Duhig Rd. (at Domaine Carneros), the entrance to the property is at located at the corner gravel pullout where Duhig Rd. takes a sharp right turn and becomes Ramal Rd. There are mailboxes and a HCV sign on the fence line. Proceed down the driveway heading south and park on the left on the grass, before crossing over the bridge.

1. CALL TO ORDER, ROLL CALL

A. Roll Call – The meeting is to be called to order and attendance taken by the Chair at 8:00 A.M.

B. Approval of the Agenda – The Committee will consider approval of the agenda for this meeting.

2. PUBLIC COMMENTS

In this time-period, anyone may comment to the Board regarding any subject over which the District has jurisdiction. No comments will be allowed involving any subject matter scheduled for hearing, action, or discussion as part of the current agenda other than to request discussion on a specific consent item. Individuals are requested to limit their comment to three minutes. No action will be taken by the Board as a result of any item presented at this time.

3. UNFINISHED BUSINESS

There is no unfinished business scheduled.

4. NEW BUSINESS

A. Current Activities at HCV. *Miguel Garcia & Lucas Patzek*

Discuss items including: installation of soil moisture probes, woody mulch trial, sheep grazing study implementation, finding new winemaker, strategic visioning and stakeholder engagement process.

B. HCV Operating Budget and Winegrape Sales. *Miguel Garcia & Lucas Patzek*

Discuss the current operating budget for the property, and the history of winegrape sales.

C. Potential Near-term Activities at HCV. *Miguel Garcia & Lucas Patzek*

Discuss potential improvements to and projects implemented on the property, including: irrigation system upgrades, plan for removing Block D, increasing biodiversity on the property, improving the aesthetics of the property.

D. Presentation on the Potential for Using Earth Blocks at HCV. *Brian Poirier, Watershed Materials*

Napa-based Watershed Materials received a Small Business Innovation Research Program Phase II grant from the USDA to improve on a Mobile Masonry Manufacturing Plant to produce durable structural earth blocks using available local materials. Watershed Materials wishes to partner with the RCD to apply durable earth blocks in various small-scale agricultural projects at the HCV.

5. ADJOURNMENT

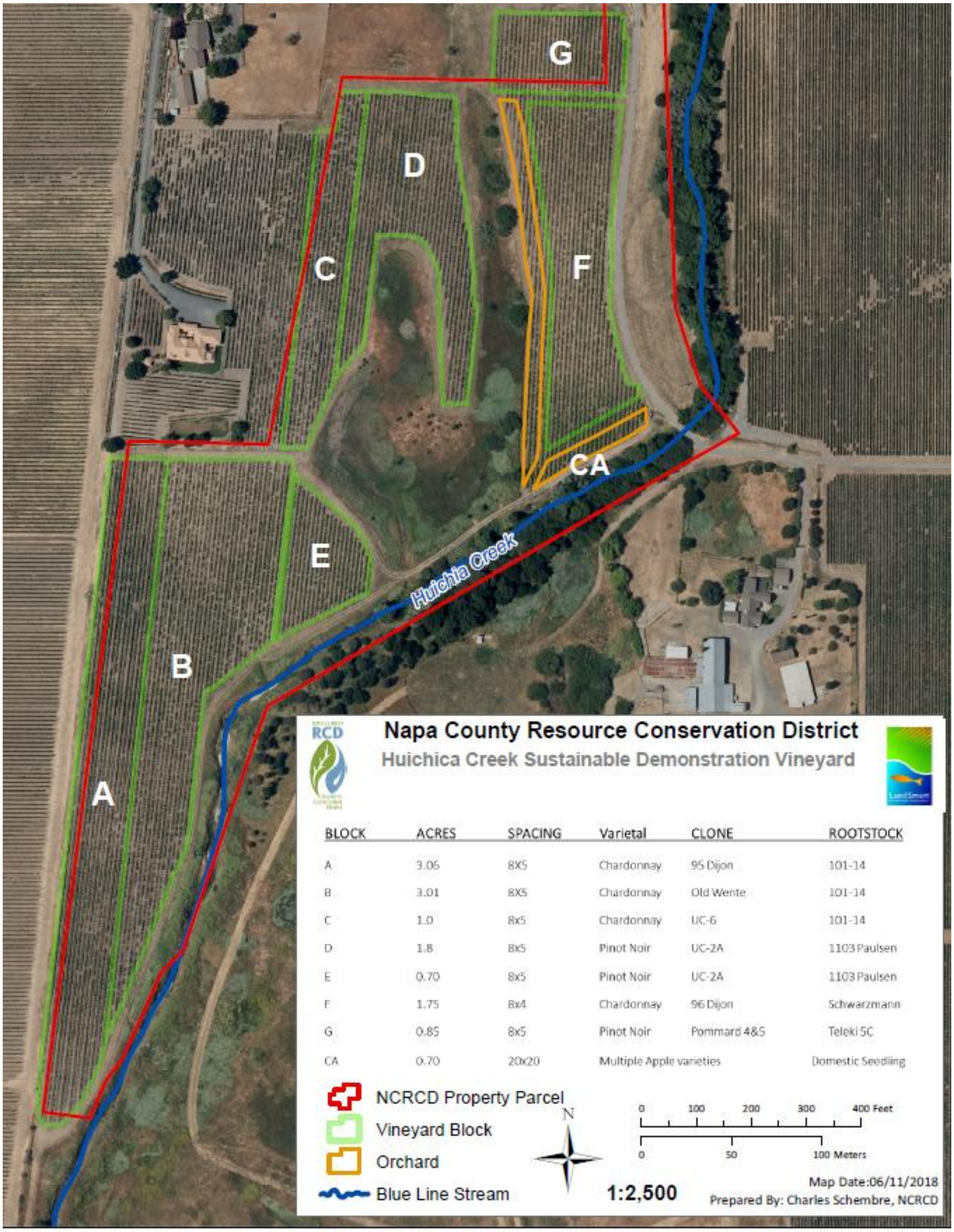
Updates

- (Miguel) 15 soil moisture probes were installed in blocks G, D, and E to better track soil moisture.
- (Miguel) In the next couple of weeks, we will begin a new trial in block G.
    - Woody mulch will be applied under the vine to half of the block to assess the benefits of undervine mulching for weed suppression and moisture retention.
- (Miguel) Miguel is working with Advance Viticulture to connect the rest of irrigation system to remote sensing.
- (Miguel) Sheep grazing study implementation: what was finished last season and what's next.
- (Lucas) Actively looking for a new grape buyer.
    - Searching for a winemaker willing to buy our grapes and make a single batch with them to showcase our sustainable practices.
- (Lucas) Strategic visioning and stakeholder engagement process

Thinks to consider for the future of HCV

- Irrigation system will need to be updated in the older blocks.
- What to do with block D after removal?
- Miguel recommends relocating the mix and load station further from the Creek.
- Increase biodiversity at HCV
    - Eric secured 1600 milkweed plants from Xerces Society, some of which will be planted at HCV.
    - Consider planting olive trees/fruit trees along the west boarder of the vineyard.
    - Establish an insectary along the wetland area.
    - Plant oaks in the east end of the vineyard (current Beckstoffer property along the creek).
- Improve overall aesthetics of the vineyard.
    - Work closer with management company to keep the front of the vineyard clean.
    - Establish native vegetation in the vineyard front.
    - Relocate signs currently in the back of the vineyard to the front to better indicate HCV is a sustainable demonstration vineyard.
- Build some kind of structure to host events.

HCV Block Map



To till or not to till – does no-till improve soil health and, if so, do roots prefer growing in healthy soils?

Background and rationale: Current conventional agricultural practices frequently use tillage to facilitate water infiltration to the soil profile and decrease weed competition, yet in many soils tillage also leads to erosion, depletion of organic matter (OM), and associated nutrient loss (Ramos et al., 2011) – reducing overall soil health. It is well known that tillage interrupts soil community networks (hyphal networks in particular), reduces aeration in the long term, and reduces carbon sequestration, however, it is an important tool for weed management and fertilizer incorporation (Gruber and Claupein, 2009). Tilling the soil can also decrease soil health by decreasing earthworm populations and reducing soil structure quality (Lehman et al., 2015; Riley et al., 2008).

Healthy soils are generally defined as soils rich in OM, high microbial diversity of both bacteria and fungi, abundant soil fauna, and high stability of soil aggregates (improving both soil water holding capacity and drainage by increasing overall porosity and adding a range of meso and macropores) (Lehman et al., 2015). Mycorrhizae can aid in this process by providing benefits via uptake and transfer of nutrients to plant roots as well as enhancing soil stability, forming hyphal networks critical to stabilizing soil aggregates, preventing erosion and run-off, and creating physical protection for nitrogen and carbon (Beare et al., 1997; Finlay 2008; Mitchell et al., 2017). Having a no-till option for roots may be able to aid in more effectively mitigating stresses such as drought and nutrient deficiencies in a reduced till system compared to a tilled system where continued disturbance disrupts the physical soil health parameters and the stability of symbiotic relationships formed with soil organisms. If tillage practices alter grapevine root growth, microbial composition, and soil health parameters (organic matter, CEC, pH, soil structure) as this study aims to evaluate, this research can contribute to existing knowledge, the development of new management practices, and will be important to vineyard owners, managers, and environmental regulatory agencies. Per the most recent American Vineyard Foundation survey (AVF 2018), vineyard sustainability (including soil fertility and carbon sequestration in vineyard soils and improving floor management practices) is a research priority.

The study vineyard is located at the Napa County Resource Conservation District's Huichica Creek Sustainable Agriculture Demonstration Vineyard in the Carneros Region of Napa County, California. The soil type is a Haire loam (clayey, mixed, superactive, thermic Typic Haploxerults). This vineyard study site has been practicing every other alleyway tillage, to an average depth of 8”, (not alternating the tilled alleyways) annually for 25 years, allowing comparisons and observations to be made with the same soil type, watering regime, and vine age. It is important to note that although conclusions cannot be made regarding the effects of these treatments on production of individual vines (as individual vines are receiving both the till and no-till treatment), this will provide unique insight to the potential preferential allocation of roots into soils perceived as “healthier” and more hospitable to root growth.

This research is testing which soil health parameters in vineyards are altered by no-till practices, including effects on microbial diversity and activity of soil organisms. Identifying diversity existing in the soil surrounding and interacting with grapevine roots will help aid in grape production, and understanding mechanisms by which the complexity that exists, can benefit agriculture and assist with adaptation to climatic changes (Fierer et al., 2017). This research is an integral component for improving our farming techniques by quantifying root architecture in a till/no-till system and quantifying microbial organisms interacting with the grapevine roots in the rhizosphere and rhizoplane. *Our goal is to test whether a no- tillage system will improve soil health through an increase in soil OM, soil water content, soil carbon, OM cycling (nutrient availability), soil microbial diversity, and soil microbial activity, additionally, evaluating how root architecture responds to tillage systems.*

Hypotheses and specific objectives: We hypothesize that, if no-till provides a more hospitable soil environment for root growth, vines will preferentially allocate resources to roots growing on that side of the vine, leading to greater root mass density, root length density, and altered root traits (e.g., reduced tissue density, increased lateral branching rates, and/or increased length per mass).

Specific objectives are to determine if: (1) No-till increases soil OM, soil carbon content, and nutrient cycling compared to the tilled side. (2) Greater OM and increased ground cover on the no-tillage side will lead to greater water holding capacity, (deep) water storage, available water, and reduced temperature fluctuations. (2a) Alternatively, greater root density on the no-till side may reduce available water. (3) Greater OM content and greater root density will increase labile carbon flow into the soil and will enhance microbial activity and diversity.

(4) Lack of repeated disturbance of hyphal networks on the no-tillage side will lead to greater fungal presence and fungal diversity on the no tillage side. (5) Both reduced disturbance and an improved environment for root growth (Obj. 1 & 2) will lead to much greater root density on the no-tillage side. (6) Greater amounts of OM, roots, and microbes will lead to increased soil biological activity. (7) Specific effects of tillage will have a greater effect on microbial diversity in the bulk soil than in the rhizosphere and rhizoplane where the root is expected to exert more influence.

Summary of methods: A total of 12 soil cores were collected in May 2017 to a total depth of 100 cm and samples collected at 10 cm deep increments at a distance of 50 cm from the vine trunk in both directions (6 samples from the no-till alleyways and 6 samples from the tilled alleyways). Total depth of 100 cm was chosen because only a few microbial studies have sampled in the subsoil, and most studies sample in the main rooting zone of 10-30 cm soil depth only (Bever *et al.,* 2001; Douds *et al.,* 1995; Guadarrama and Alvarez-Sanchez, 1999; Oehl et al., 2005; Stutz and Morton, 1995). Yet, sampling in the subsoil should be included as changes in the shallow soil layer can affect processes in the subsoil below (Van Der Heijden *et al.,* 1998; Mäder *et al.,* 2002; Oehl et al., 2005). There was 1 sampling vine per row with 6 rows total, yielding 12 sampling locations and a total of 120 samples (60 tilled samples and 60 untilled samples). The individual vines were selected using a randomized complete block design in the 3.01 acre Chardonnay vineyard block (Clone Old Wente on 101-14 rootstock) with 8 foot row spacing and 5 foot vine spacing (with samples at least 20 vines from the edge of the vineyard block). The roots collected from the tilled and untilled sides of the 6 randomly assigned vines results in 3 vines with tilled roots downslope and untilled roots upslope and 3 vines vice versa, eliminating any potential bias due to different shading patterns or slope. The roots were extracted to determine the root density distribution across the ten depths. New samples will be collected at the depth of highest root density above and below 50 cm depth on both tilled and untilled sides. Chemical and physical soil properties will be analyzed (CEC, clay content, pH, organic carbon, nitrogen, and phosphorus) using the methods described by Oehl et al. (2005) and Burns et al. (2015). Utilizing Biolog Ecoplates, the soil microbial functional diversity will be determined in the rhizoplane, rhizosphere, and surrounding bulk soil. Additionally, the total number of cultured bacteria, fungi, and actinomycetes will be determined as colony forming units (CFUs) on agar plates using dilution plate methods described by Qin et al. (2017) and Marques et al. (2019).

Results: Using α=0.05, there is an interaction between management (till and no-till) and depth (p-val= 0.006416) and management and slope orientation (upslope and downslope) (p-val=0.001405) on root length (cm), these interactions are currently being investigated.

We anticipate finding that (1) Tillage causes frequent disturbance in the topsoil and will disrupt hyphal and root networks – reducing the presence of both fungi and roots in the topsoil and reducing AMF infection of the root system. (2) Tillage reduces the presence of OM in the soil and changes the soil environment to exhibit higher temperatures and reduced water availability. These changes will reduce microbial presence and alter species composition (and likely diversity) as some species will be favored over others. (3) Microbial density mimics root density and diversity varies with soil depth. Microbial density and species variation will be greater on the tilled side of the vines as soil conditions and root presence will differ more prominently with depth. (4) Improved soil health on the untilled side and altered root properties, including reduced root diameter, reduced tissue density, increased nutrient uptake activity and root length per mass. (5) There will be different bacterial composition in the tilled and untilled alleyways and the microbial composition will exhibit vertical variability through the soil profile concurrent with the density of the vine roots. (6) Roots will strongly influence bacterial populations on the root surface and thus we expect that bacterial populations will be less affected by tillage when collected directly from the rhizosphere and rhizoplane, and greater effects of tillage on bacterial community composition of the bulk soil.

We anticipate data collection, processing, analysis, and write up to continue through the summer of 2020.

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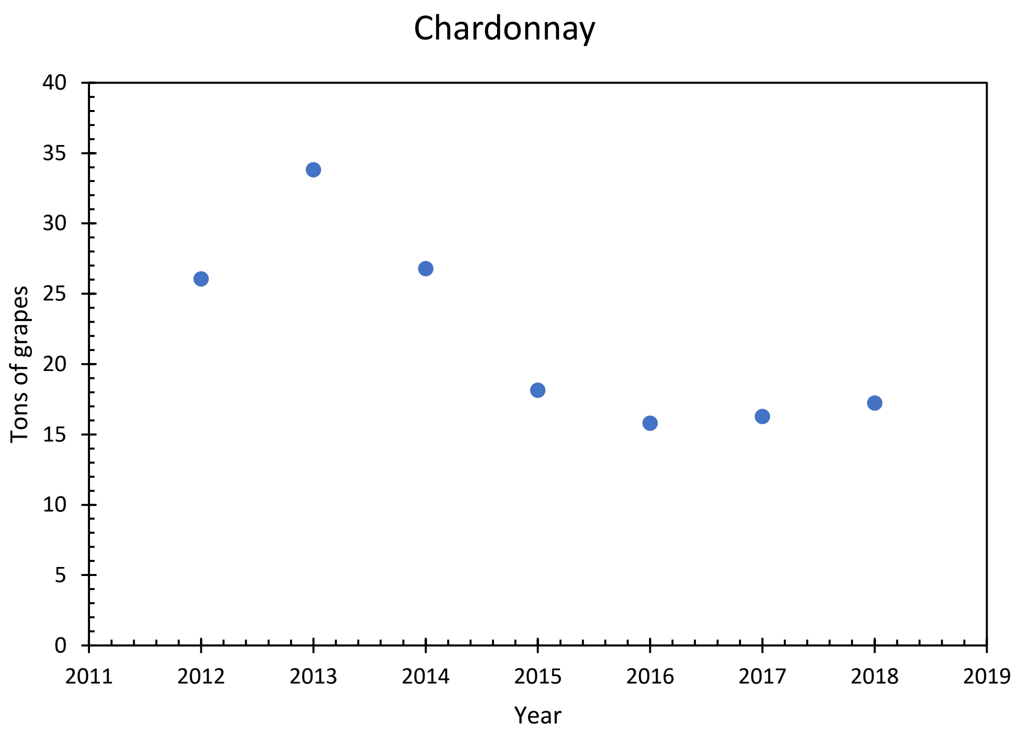
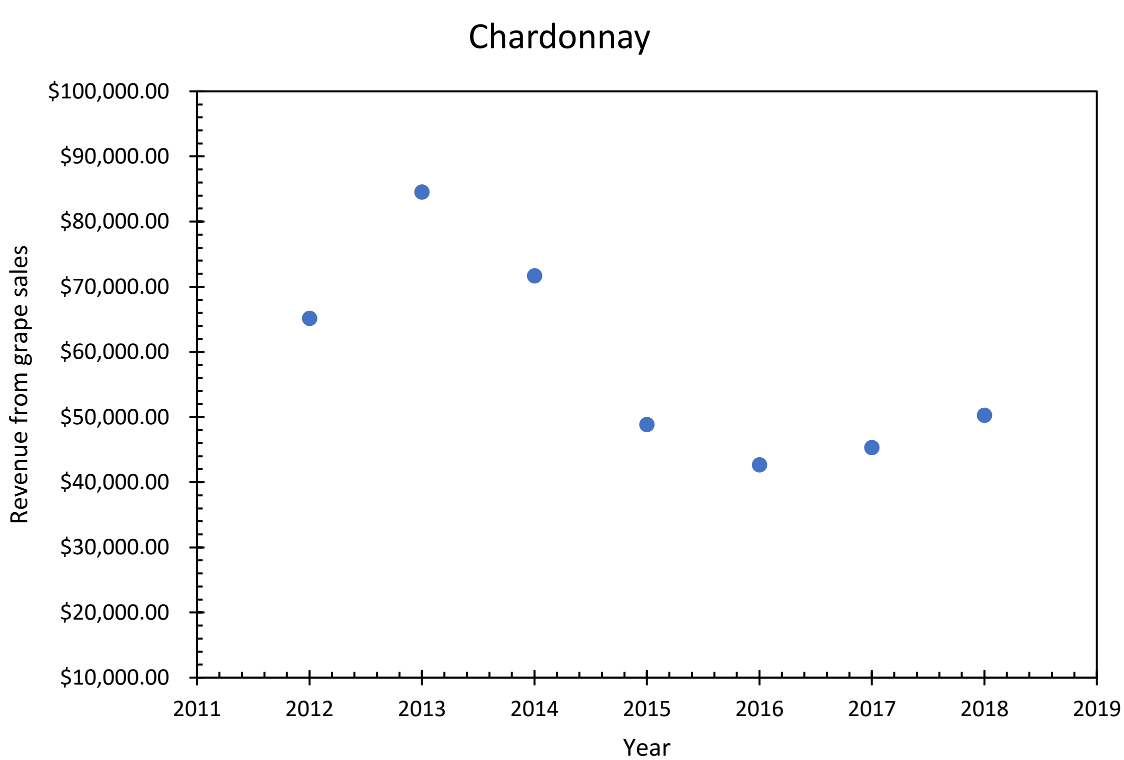
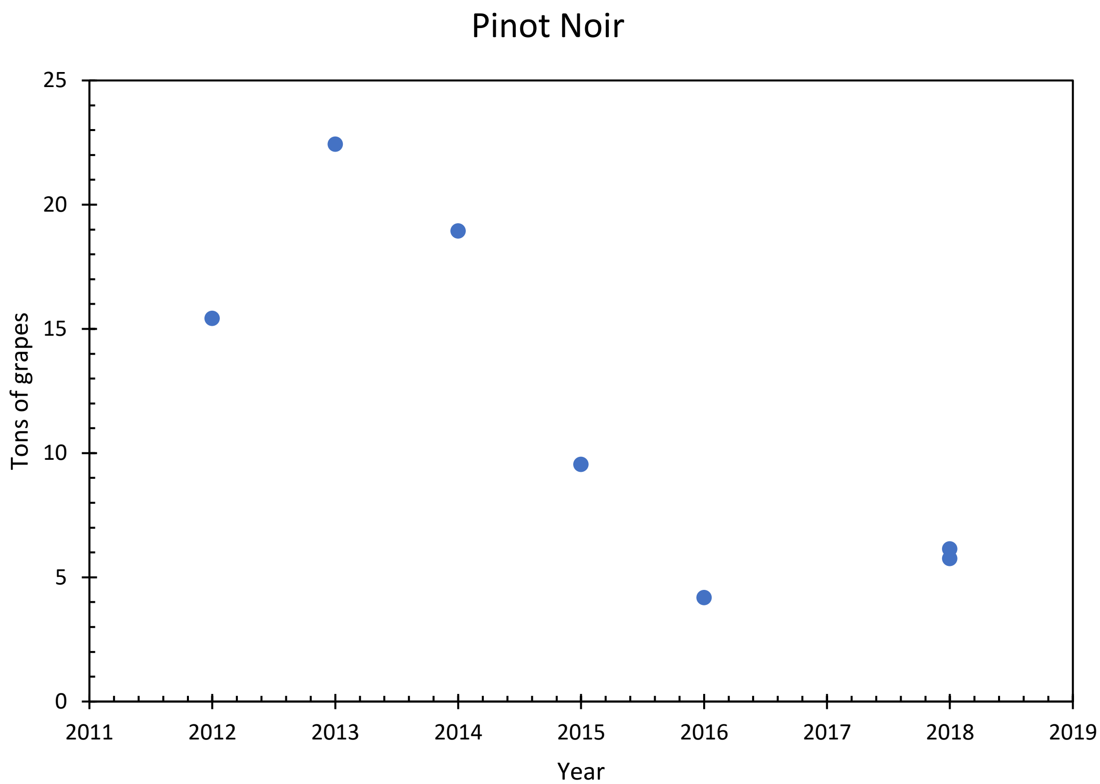
HCV Grape Sales






Pinot Noir
25
20
15
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Tons of grapes
2011
2012
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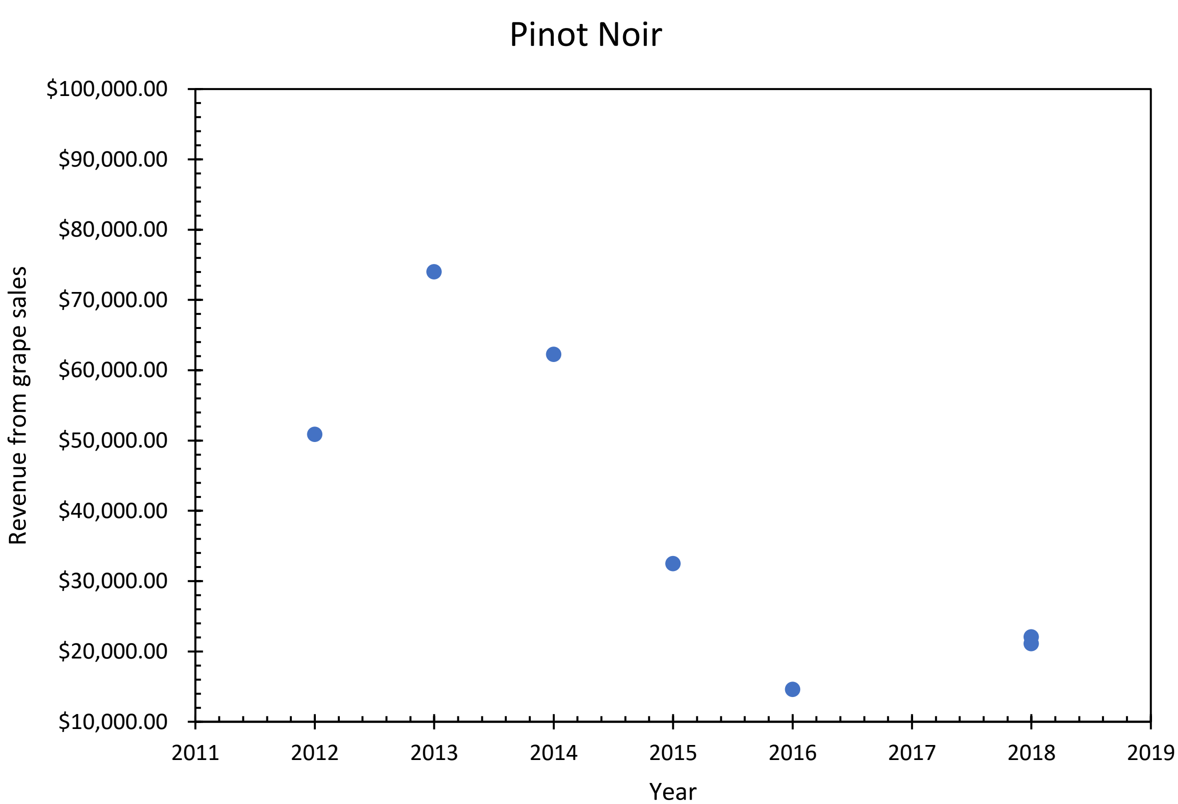
Year


Pinot Noir
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$10,000.00
Revenue from grape sales
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year

WATERSHED MATERIALS

Mobile Earth Masonry Manufacturing
Work Plan: USDA SBIR Phase II
Updated: 06/23/2019

I. Assemble and test the Mobile Masonry Manufacturing Plant designed in Phase I.

Fabricate the mixing machine and press, implement the mechatronic control system, and link hydraulics and power supply to allow for a close inspection of all components. The intent is to predict possible failure zones before they fully manifest. This evaluation will generate data for synchronizing all the components, resulting in greater durability, efficiency, and faster cycle time.

Apply modifications or re-designs deemed necessary based on data collected during assessment. Launch full-shift production runs to simulate plant operations using a standard soil mix design previously tested by Watershed Materials LLC. Monitor all aspects of the block press running at target cycle times. "Acceptable wear" standards will be established that will estimate performance without replacement or major maintenance for a period of one year at full production capacity.

Objective: demonstrate the reliability of the MMMP over a prolonged period of continuous operation in the production of the standard 10 x 20 x 40 cm (4" x 8" x 16") hollow-celled HPEB at an average rate of 3 - 4 blocks per minute over an eight hour shift.

Variables:

- Hydraulic pressure from 2000 psi to 2700 psi. Pressure has a direct impact on cycle time.
- Continuous versus intermittent mixing. Higher compression forces will draw power resources from the mixing augers with the possible consequence that mixing and block production will need to be cycled.

Tasks:

- Set up for a full eight-hour production shift to produce a maximum number of HPEBs with 95% of the blocks meeting cosmetic requirements and 85% of blocks meeting structural target metrics of 1400 psi (ASTM C90), water absorption 15 pcf (ASTM C90), linear drying shrinkage ≤ 0.1% (ASTM C426).
- Adjust hydraulic force output as required to either (1) increase production speed or (2) improve block density and cosmetic appearance.

II. <u>Evaluate the performance of the Mobile Masonry Manufacturing Plant using available local materials.</u>

The mix designs using available local materials in project areas will be tested in the Mobile Masonry Manufacturing Plant to produce durable structural earth blocks. Conduct production-scale testing to validate that the plant is capable of long hours of operation under simulated field conditions. The Mobile Masonry Manufacturing Plant must demonstrate durability and minimum maintenance requirements over prolonged operation.

Objective: evaluate the capacity of the Mobile Masonry Manufacturing Plant to produce durable structural earth blocks under varying site conditions.

Variables:
- Eight hour shift at a six cycles per minute rate of production.
- Run the mix designs developed in Objective II.

Tasks:
- Produce 1000 - 15 x 20 x 40 cm (6" x 8" x 16") structural earth blocks per mix design.
- Confirm that 95% of structural earth blocks should meet cosmetic specifications
- Confirm that 85% of structural earth blocks have compressive strength 1400 psi (ASTM C90), water absorption 15 pcf (ASTM C90), linear drying shrinkage ≤0.1% (ASTM C426).

III. Develop HPEB mix designs with local materials in Butte County, CA.

The fundamental knowledge acquired during Phase I regarding the soil characteristics responsible for producing quality HPEBs will be applied to create three mix designs at a laboratory scale from local materials in Butte County, CA. In particular, the analytical protocols based on quantitative X-ray analysis developed in Phase I will be used to understand the initial mineralogical composition of the locally available soils and materials. Based on the results, the soils would be amended using locally available quarry by-products to create HPEB mix designs. This approach will ensure future production of consistently strong and durable HPEB, regardless of the geomorphologic variations in the soils. Thus, allowing extrapolation of the same production model to virtually any location nationwide.

Objective: create three different mix designs using local materials in Butte County, CA to produce HPEB with a maximum cement content of 5% by wt.

Variables:

- Variation in local soil mineralogy (type and quantity of clay minerals and feldspars).
- Final fine material content of the HPEB mix designs.

Tasks:

- Inventory locally available soils and materials such as quarry by-products (fine materials, pond fines, baghouse fines, etc.) and unwanted non-hazardous excavated soils.
- Analysis of the type and quantity of clay minerals and feldspar in selected soils and materials using quantitative X-ray methodology developed in Phase I.
- Amend candidate soils to create three different HPEB mix designs with K/F of 1 and a fine material content at 25, 30 and 35% by wt.
- Stabilize HPEB mix designs with 5% by wt. of cement and evaluate the dry density, compressive strength, water absorption, drying shrinkage, and freeze-thaw durability.
- Confirm that 85% of HPEB have compressive strength > 1900 psi (ASTM C90), water absorption ≤13 pcf (ASTM C90), linear drying shrinkage ≤0.065% (ASTM C426) and freeze-thaw durability ≤0.05% of mass lost per cycle after 20 cycles (ASTM 1262) as defined in table 5.1 above.
- Determine the MBV and MMBV values of the resulting HPEB mix designs and correlate them with mechanical and durability performance results.

IV. Deployment of the Mobile Masonry Manufacturing Plant

A two-stage deployment is proposed to closely monitor the overall production process of the masonry units. Firstly, Watershed Materials will partner with the Napa County Resource Conservation District (NCRCD) to apply durable earth blocks in various small-scale agricultural projects. Such projects may include, but are not limited to: raised planting beds, greenhouses, and short walls for soil erosion control. . This partnership will seek the involvement of conservation and youth outreach groups to develop apprenticeship programs. This first stage of the deployment will serve to increase public awareness and expand opportunities for deploying multiple MMMPs to a wide spectrum of rural communities across the United States.

Tasks:

- Deploy MMMP proximate to Watershed Materials headquarters for ease of mechanical modification if required.
- Produce blocks for non-permitted structures such as planter beds, low walls, and small buildings.
- Develop training programs that fit within the existing program objectives of the NCRCD.

Upon successful completion of the demonstration project in Napa County with the Resource Conservation District described above, the MMMP will be relocated to a specific fire-damaged community (Butte, Lake, Calaveras, Napa, Sonoma, or other Northern California site) for the purpose of manufacturing masonry units to be used in the local rebuilding campaign(s). Establishment of localized manufacturing of resilient building materials serves three important functions:

1. The production of the masonry materials themselves which represent a cost savings over purchased and imported alternatives.
2. The creation of new jobs within the community in both manufacturing and construction as the re-building effort gains momentum.
3. The anticipated positive impact on the spirit and attitudes of the community members as they work together to rebuild their homes and their lives.

Tasks:

- Cooperate with the Paradise rebuilding committee to identity adequate recipient of pilot building project and assist in obtaining building permits.
- Ship and set-up plant.
- Stockpile mineral feedstock on site.
- Produce blocks.
- Test blocks for structural compliance.
- Refine economic models for future block production using data from the pilot project.
- Implement training program.
- Order materials for construction and hire subcontractors.
- Enlist local builders and tradesmen to conduct training program and construct pilot building.
- Oversee construction of pilot building.
- QC testing of product and performance assessment of production runs and finished building.