

Economic feasibility of using wood chip mulching to address the combined vineyard issues of 1) low organic matter, 2) weed control, and 3) irrigation costs

Final Report for FNC10-829

Project Type: Farmer/Rancher

Funds awarded in 2010: \$5,880.00

Projected End Date: 12/31/2011

Region: North Central

State: Kansas

Project Coordinator:

[Jo Ann Kuhlmann](#)

Project Information

Summary:

[Editor's Note: To see the entire report, including charts and photos, see the attached PDF version.]

PROJECT BACKGROUND

Eagle Creek Vineyards is a (very young) commercial vineyard located in the Kansas Flint Hills. Five specific winegrape variety blocks, plus a 2-acre experimental block, cover 18 acres. 2010 - we harvested grapes from 10 of the 18 acres. 2011 - we will harvest grapes from 14 of the 18 acres.

From 2003 to present I have self-educated myself through observation, on-line research, meetings, conferences, workshops, and talking to recognized regional industry experts. I have also trialed various items in my vineyard. This fall I successfully completed a formal viticulture course.

Variety Trials

Our first plantings were in 2004 and 2005 and went into what is now our experimental block. It is important to note that not much "official" varietal research has been conducted in Kansas. We, therefore, conduct our own variety trials on-site. Initially, we had 23 different varieties in our experimental block. Varieties have since been added/subtracted/reorganized and we are now down to 16 varieties. Decisions to keep/move/replace have been based on site compatibility, disease susceptibility, and/or harvest timing.

Soil Challenges

The soil of the Flint Hills presents challenges to all area farmers. Our vineyard sits on ground that was native grass prairie until thirty years ago, at which time it was converted to row-cropped land. At best, it can only be considered marginal farm ground.

Our challenges include:

? Erosion - wind, water

? High pH

? Low fertility

? Low organic matter

We have researched these issues and taken the following steps:

1. Fescue has been planted in the between-row strips to reduce much of the erosion.
2. Our integrated approach to lower the soil pH includes: 1) incorporating sulfur as a soil amendment, 2) applying sulfur pesticides when feasible, and 3) no longer using urea as our nitrogen source.
3. We make annual nitrogen (and other nutrient) applications to combat the fertility issue.

Thus, our remaining “soil” challenge to address is the low organic matter content.

Weed Control

Weed control is an issue in every vineyard, not just ours. To date, we have used cultivation and herbicides. Our cultivator created soil ditches along both sides of the vines, which then increased water erosion over the vine roots. Coupled with ? the cost of fossil fuels, ? societal concerns about dependence on fossil fuels, ? soil compaction from the tractor tires, and ? the inadvertent development of “resistant” weeds, we would like to see if we can get better results using organic matter mulch for weed control.

Irrigation

During the hot, dry summer months, irrigation is needed to supplement rainfall. We currently use drip to conserve the quantity of water used, but would like to further decrease those amounts.

PROJECT DESCRIPTION

Goals

We applied wood chip mulch to observe:

- Increases in soil organic matter
- Potential increases to nitrogen costs
- Reductions to weed control costs
- Reductions to irrigation costs
- Improved erosion control

OUR PLAN

Eagle Creek Vineyards is not unique - all vineyards have weeds, many vineyards have low organic matter, and all Kansas vineyards have hot, dry, windy summers. Our plan was to take one action (applying wood chips as organic mulch in the “clean” floor around the grape vines) to address the combined issues of low organic matter, erosion, weed control, and irrigation.

Why choose wood chips? Our county has a growing mountain of wood chips, which they have collected from multiple sources. For only the cost of transportation, there was an unlimited supply of wood chips for this project. These chips would be partially composted because of the length of time they sat in the county pile. Also, they would not add to the weed seed bed like hay or straw could. Note: we did not choose living mulch (green manure) because we felt it would compete with the vines for water and nutrients, resulting in depressed vine growth.

The problem with wood chips is they have a high C/N ratio (see table) that could immobilize N during decomposition; one way to compensate for this immobilized N is to apply additional N fertilizer. For us the question then became: how much N is required to both 1) maintain vine nutrition and 2) accommodate for the immobilized nitrogen.

PROJECT IMPLEMENTATION

1. Varietal blocks were divided into two groups: wood chips (trial) vs no wood chips

(control).

2. Nitrogen was applied similarly to both groups. Petiole analyses at veraison were used to determine the extra nitrogen that would be needed in future years to accommodate for the immobilized N. As we progressed with this project we chose this method over the original plan (apply different rates to the trial and control blocks). We felt using the same application rates and measuring the uptake differences would provide faster and more accurate results than the trial-and-error method proposed in the original plan.

3. Herbicides were applied similarly to both groups. Again, this was a departure from the original plan - not because we planned it that way, but because Mother Nature decided to give us two drought years in a row and, as a result of that, very little herbicides were needed anywhere.

4. Soil tests and petiole analyses were used to document OM and N results.

APPLICATION OF MULCH

A total of thirty-one semi-loads of mulch (172 tons) were delivered to the vineyard by a contracted hauler. The county said a machine would probably be available at the dump to load trucks. It was not, so the hauler provided loading equipment and charged extra for loading the truck.

Once delivered, the mulch was loaded into the spreader and applied to the vineyard.

It is simple to say "the mulch was applied", but the reality was that it was extremely challenging. The mulch

hailed from the county pile was full of trash. We found un-ground stumps and limbs, plastic drink bottles and oil containers, glass bottles, car floor mats, construction material, etc. There were also large concrete chunks, large asphalt chunks, a chain saw blade, and an 8" piece of railroad iron. These items caused many breakdowns on the spreader. In fact, in the middle of the project, we changed the spreader from an auger-driven delivery system to a belt-driven delivery system.

The end result is we went over budget hauling and spreading the mulch. (**Graph shown in uploads)

WEATHER COMPLICATIONS

2011 and 2012 were two of the worst drought years in recent history. In 2011 I postponed pulling samples because I thought the drought would skew the results.

Specifically, I thought the nitrogen immobilization would be slowed because the hot, dry conditions would keep the chip decomposition rate down.

WAIT, WATCH, AND WEATHER - THE FINAL STEP

Soil samples were taken after harvest 2012 for both the control and trial areas. We also had 2009 soil sample results for comparison. Petiole samples were taken at veraison, 2012. Again, separate samples were taken for both the control and trial areas. We also had 2010 petiole sample results for comparison purposes.

PEOPLE INVOLVED

County agricultural agent, Lyon County Extension office

- resource person and sounding board for interpreting soil and petiole sample results

Highland Community College, viticulture and enology program director

Highland Community College, viticulture and enology instructor

- support for project

- vehicle for education efforts. One of their 2012 monthly on-site workshops was held at our vineyard. At that time we talked about the project and shared the to-date results.

Area farmer

- provided suggestions to improve project

- provided necessary mechanical skills to keep the spreader working to project

completion

- Thanks, Dad!

ORGANIC MATTER (OM)(**Graph included in uploads)

2012 - OM in the mulched sections was higher than OM in the control sections - across the board (11%, 17%, and 20%). In 2012 only the section closest to the road had lower OM than in 2009. My speculation is that has something to do with the blasts of road dust in 2011 and 2012.

**As a side note unrelated to this particular project, you will note that pH is also moving in the right direction. Target is 5.5-6.5.

NITROGEN (N)(**Graph included in uploads)

Generally speaking, N needs to be increased 25% to compensate for the N immobilization. You will also note that the 2012 levels are below both the 2010 levels and the target range. I generally apply N in split applications. This year's 2nd application was not applied because the weather was already too hot and dry to allow a N application to be taken up and used by the crop.

(Opinion: In years of average rainfall, the mulch will probably compost faster, thus increasing the N need.)

WEED CONTROL

Increased weed control due to mulching was not recordable during this project. The drought made herbicide applications unnecessary throughout the vineyard.

However, existing science has many examples of mulch increasing weed control.

Of interest to readers, however, is the fact that the mulch applications did not completely cover the non-grass areas of the vineyard (2' on either side of the vines for a total of 4' per row). We chose to leave a 6" band immediately around the vines as bare dirt. That narrow band of dirt was left so that rodents couldn't nestle up against vines and be tempted to dine on bark. To date, we have observed no rodent damage. However, in future years, with average rainfall there will surely be a need to provide some form of weed control in the 6" band of dirt.

IRRIGATION

We have a drip irrigation system using rural water. Because rural water is expensive we irrigated sparingly (considering the drought); our primary goal was to keep the plants alive. Because of the ongoing drought, we watered all blocks equally. Thus we didn't have water quantity differences to measure. We, also, didn't measure the yield differences between the control and trial blocks.

We did, however, make observations. Because this project extended into the second year, we were able to observe the carryover effects of the 2011 drought. As expected, the mulched vines (trial) wintered over better than the unmulched vines (control). Both years we observed moisture under the mulched rows, while the control block rows were bone dry.

EROSION

In the past we used cultivation to control weeds under the vines. Our cultivator created soil ditches along both sides of the vines, which then increased water erosion over the vine roots. Added into the mix, the vineyard is planted on terraced land. In some spots the terraces run parallel with the rows. Consequently, we have quite deep erosion cuts in some spots. (See photos)

The mulch completely healed most of the erosion cuts and at least partially filled in the deepest cuts. Observation shows that the wood chip mulch provided good armor for all erosion cuts and that dirt is actually backed up from the individual mulch pieces. The dirt backup means dirt is staying where needed and not exposing roots to the air.

OTHER MANAGEMENT CONSIDERATIONS

Quantity calculation - Mulch was applied to a 4" depth and a total swath of approx 3 1/2 ft. We could mulch 1600 ft of vineyard row with one semi-load.

Durability - It appears each wood chip mulch application will be good for 3-4 years before it will need to be refreshed. At that time, less mulch will be needed per running foot than was needed initially.

Walnut wood chips - Many people who heard about this project expressed concerns that the mulch would contain enough walnut chips to endanger the vines. That was not our experience.

Quality of work life - One aspect we didn't even consider when designing this project was how this mulch would improve the footing while working on the vines.

The mulch creates a much better walking surface than bare dirt, especially under wet conditions. It also has leveled the walking surface where erosion had made cuts. All these created a much more enjoyable and safer work environment

DISCUSSION

My opinion is that any vineyard with "clean tilled" soil under the vines needs some form of "armor" under the vines. I also feel that any organic mulch helps build "living soil". We chose wood chip mulch for all the reasons previously discussed in this report - and it met expectations.

Pros and Cons

Wood chip mulch also has a longer life than straw or hay mulches and does not have potential weed seeds in the material. From a cash outlay perspective, we were able to repurpose a "Grainovator" into a mulch layer, whereas straw or hay mulch choppers would have cost more. However, it probably cost more to get wood chips delivered to the vineyard than it would to get sufficient quantities of straw or hay delivered.

Part of this project was to look at dollars. We were able to determine hard numbers for the N increase needed if using wood chip mulch. Additionally, we know from observation that both weed control costs and irrigation costs would decrease, but we were unable to provide hard numbers for those two cost centers. The drought kept us from obtaining those measurements.

OUTREACH

Formal outreach - June 2012, we hosted a vineyard field day conducted by Highland Community College (HCC), Viticulture and Enology Department. As part of the vineyard walk-through I discussed the expectations and observable results of this project.

Informal outreach - I have talked about this project and results with a number of industry farmers. These discussions continue, as appropriate, in either group settings or one-on-one discussions. I have also discussed the project and results with our local agricultural agent and the viticulture people at HCC. I'm sure they will also find ways to share this project's results.

- [Budget Issues, Organic Matter, and Nitrogen Charts](#)
- [Final report with charts and photos, Jo Ann Kuhlmann, FNC10-829](#)

Research

Participation Summary

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or SARE.



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