Farmer Rancher Grant Program

Final Report Form

Please fill out the final report form and return it to the North Central Region-Sustainable Agriculture Research and Education (NCR-SARE) Missouri office. The report may be prepared on a computer or handwritten (please write or print clearly) but electronic reports are preferred. The final payment of your grant will be awarded when the final report and final budget report are received and approved.

Use as much space as needed to answer questions. You are not limited to the space on this form. The more details the better.

I. PROJECT IDENTIFICATION

- Name: Jo Ann Kuhlmann
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- City, State, Zip Code: Olpe, KS 66865

- Phone: 620.475.3812

- Project Title: 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.
- Project Number: FNC 10-829
- Project Duration: 2011-2012
- Date of Report: December 31, 2012

II. PROJECT BACKGROUND

1. Briefly describe your operation (i.e. how many acres, what crops, types of cropping systems, type of livestock or dairy production, grazing systems, family operation, etc.)

Eagle Creek Vineyards is a (very young) commercial vineyard located in the Kansas Flint Hills on fourth-generation farmland. Five winegrape variety blocks, plus a 2-acre experimental block, cover 18 acres; not all blocks are in production yet. All grapes are sold to Kansas Farm Wineries.

Our first plantings were in 2004 and 2005 and went into what is now our experimental block. Because there is not much "official" varietal research from Kansas, we have conducted our own on-site variety trials. Initially, we had 23 different varieties. Those have since been added/subtracted/reorganized down to 16 varieties. Variety retention decisions have been made based on site compatibility, disease susceptibility, and/or harvest timing.

Because grapes are a perennial crop we do not have the ability to take advantage of different types of cropping systems. Instead, we have to perform all agricultural practices around a permanent, non-movable crop.

2. Before receiving this grant, did you carry out any sustainable practices? If so, briefly describe what they were and how long you had been practicing them.

Soil

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-crops. 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:

- Fescue has been planted in the between-row strips to reduce much of the erosion.
- 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.
- 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

The fescue strips mentioned above account for 60% of the vineyard floor (6' out of every 10'). They have effectively controlled weeds in-between vine rows and have eliminated chemical weed control for that portion of the vineyard floor.

Irrigation

During the hot, dry summer months, irrigation is needed to supplement rainfall. We have always used drip irrigation to conserve the quantity of water used.

III. PROJECT DESCRIPTION

This is the core of the report. Consider what questions your neighbors or other farmers or ranchers would ask about what you did with this grant. Describe how you planned and conducted your research or education activities to meet your project goals and discuss the results.

GOALS

List your project goal(s) as identified in your grant application.

Wood chip mulch applied in 2010

31 semi-loads
172 tons

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

PROCESS

Describe the steps involved in conducting the project and the logic behind the choices you made. Please be specific so that other farmers and ranchers can consider what would apply to their operations and gain from your experience.

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.

Organic material	Nitrogen content	C/N ratio
Hay	2.10	15 - 32:1
Straw	0.70	80:1
Sawdust	0.24	442:1
Hardwood chips	0.09	560:1
Softwood chips	0.09	641:1

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 the 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.

Not even half of the mulch

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 hauled 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. This table summarizes the expense overages incurred.

	Budget	Actual	Over(under) Budget
Hauling	1,800	3,100	1,300
Labor to load and spread mulch	1,320	1,800	480
Equipment to load and spread mulch	1,100	1,086	(14)
Totals	4,220	5,986	1,766

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 measure - 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

List farmers, ranchers, or business people who assisted with the project and explain how they were involved. List any personnel from a public agency, such as the Extension Service, Natural Resources Conservation Services or Soil and Water Conservation Districts who assisted with this project. List people from non-profit organizations who helped you.

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!

RESULTS

What results did you achieve and how were they measured? For production projects, include yields, field analysis, and related data. How do these compare with conventional systems used previously? For education projects, include outcomes achieved and how you measured them through surveys, attendance, or other methods. Were these results what you expected? If not, why not? What would you do differently next time?

Soil tests	**2009**	**2012**		**2009**	**2012**		**2009**	**2012**	
	Chamb	Ch-control	Ch-trial	Vidal	V-control	V-trial	Tram	Tr-control	Tr-trial
pH	7.6	6.4	6.8	7.2	6.5	6.8	6.8	6.3	6.1
OM	2.1	1.8	2.0	1.7	1.8	2.1	1.8	2.0	2.4

Organic matter (OM)

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.

Petiole samples	**Target Range**	**2010**	**2012**		**2010**	**2012**		**2010**	**2012**	
		Chamb	Chamb-control	Chamb-trial	Vidal	Vidal-control	Vidal-trial	Tram	Tram-control	Tram-trial
N	.9-2.0	.798	.78	.63	.752	.47	.48	.618	.64	.52

Nitrogen (N)

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 ½ 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

What did you learn from this grant? How has this affected your farm or ranch operation? Did you overcome your identified barrier, and if so, how? What are the advantages and disadvantages of implementing a project such as yours? If asked for more information or a recommendation concerning what you examined in this project, what would you tell other farmers or ranchers?

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.

IV. PROJECT IMPACTS

Evaluate the economic, environmental and social impacts of this sustainable practice by completing the Benefits and Impacts form. Also, if possible, provide hard economic data.

V. OUTREACH

What methods did you use for telling others about: 1. Your project, 2. Project events or activities, 3. Project results? How and to whom did you communicate this information? Be sure to include details on how many people attended field days or demonstrations, and how information was further disseminated by media covering any events. What plans do you have for further communicating your results? Include press releases, news clippings, flyers, brochures, or publications developed during this project. Also include photos which might be helpful in telling your story to others. (Mail items separately if you cannot send them electronically.)

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.

VI. PROGRAM EVALUATION

This was the nineteenth year the North Central Region SARE Program sponsored a farmer rancher grant program. As a participant, do you have any recommendations to the regional Administrative Council about this program? Is there anything you would like to see changed? Please fill out the Evaluation form.

VII. BUDGET SUMMARY

Complete the final budget form and return it with your report. You will only be reimbursed for expenses incurred and items purchased for conducting your project. If you made significant changes (more than 10% of your grant total) to final expenses listed by budget category, please include an explanation for the changes. Call Joan Benjamin with questions at: 573-681-5545.

Submit your final report to:

E-mail: BenjaminJ@lincolnu.edu or mail to:

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