

# NCR-SARE Youth Educator Grant Project

## Final Report Form

Please use this form to write the final report on your project. Use as much space as necessary to answer the questions. You are not restricted to the space on this form. The report may be prepared on a computer or handwritten (please write or print clearly) and needs to be submitted on the MySARE reporting website or to the North Central Region - Sustainable Agriculture Research and Education (NCR-SARE) Office on or before your project end date. The final payment of your grant will be awarded when NCR-SARE receives and approves your final report and final budget summary.

### 1. PROJECT IDENTIFICATION

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- Project Title: Watching Food Grow: a small organic apple orchard at a rural elementary school
- Project Number: YENC 14-076
- Project Duration: 2 years
- Date of Report: June 2016

### 2. PROJECT DESCRIPTION AND RESULTS

**How did you educate youth about sustainable agriculture? What sustainable agriculture knowledge did they gain? Be specific and include the goals, audience, project activities, and results of your project as indicated on this form. Describe how you planned and conducted your project to meet your project goals. Consider what questions other educators would ask about your grant project and try to answer them.**

We felt that the best way to teach about sustainability was to involve the students in the actual production as much as possible. Since we covered 6 grades, we had to tailor the subjects taught to the appropriate level. The younger grades helped to plant the trees, took regular measurements of tree growth, and counted changes like leaves and branches that appeared over time. Older grades helped prune, learned to induce branching, and learned specifics about apple production, measuring apple characteristics that would be important to the consumer (taste, crispness, size), and, perhaps most importantly, the economics of conventional compared to more sustainable production methods. For example, we addressed the production of apples using animal fertilizer, without chemicals, how to prune for maximum effect, how to minimize pathogen exposure, and a session on the economics of each system of raising apples (obviously taught at the 5<sup>th</sup> grade level).

The most popular activity (as judged by student enthusiasm) was gauging how apples taste by biting into them, comparing that to sugar content and texture as judged objectively using a

refractometer or a penetrometer, respectively. These two tools were highly useful in teaching the students how to measure things they could guess at. The ones we purchased for use in these lessons can be found on amazon.com at [https://www.amazon.com/Refractometer-Automatic-Temperature-Compensation-0-32/dp/B0149IQFOI/ref=sr\\_1\\_2?ie=UTF8&qid=1466794091&sr=8-2&keywords=refractometer:](https://www.amazon.com/Refractometer-Automatic-Temperature-Compensation-0-32/dp/B0149IQFOI/ref=sr_1_2?ie=UTF8&qid=1466794091&sr=8-2&keywords=refractometer)



\$29.99

And [https://www.amazon.com/General-Purpose-Firmness-Penetrometer-Sclerometer/dp/B003H3VNQC/ref=sr\\_1\\_2?ie=UTF8&qid=1466793925&sr=8-2&keywords=penetrometer](https://www.amazon.com/General-Purpose-Firmness-Penetrometer-Sclerometer/dp/B003H3VNQC/ref=sr_1_2?ie=UTF8&qid=1466793925&sr=8-2&keywords=penetrometer)



\$129.99

The instructions on how to use these instruments are included and are easy to understand. Using these multiple times with different apples really helps to teach the lesson, as well as help the students learn about measurement precision and accuracy.

The lesson is outlined in section C below, entitled “**Testing the characteristics of various apples: diversity and environment**”

**A. BACKGROUND. Before receiving this grant, were you involved in teaching youth about sustainable agriculture? If so, briefly describe what type of sustainable agriculture training you did and the students you worked with.**

This was our first attempt at teaching about sustainable agriculture. We partnered with Wea Creek Orchard to gain a more realistic look at labor and production practices involved in growing fruit in our area of Indiana.

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

Our stated goal was be to teach organic apple production on a small scale in an educational and mentored setting.

**C. PROCESS. Describe the steps involved in conducting the project and the logic behind the choices you made. Why did you use this approach? Please be specific so that other educators can consider what would apply to their efforts and gain from your experiences.**

Recapitulated from our original proposal, modified to reflect actual activities, and including comments:

1. ***Summer, 2014. Professional Development and Lesson Planning:*** *Teachers will come together on two professional development half-days during the summer of 2014 to devise lessons plans that incorporate their trees into the standard curriculum. They will be paid for five hours. Wea Creek Orchard personnel will provide an initial outline of what happens to the trees during each time of the season so that the teachers can properly incorporate real-life examples for their lessons. Emphasis will be placed on watching bee pollination, temperature, insect and disease prevention, identification and use of beneficial insects, using natural and organic fertilizers, water conservation, input costs and potential profits, and community teamwork.*

In actually, we had to postpone the start of this SARE project due to the timing of the reception of the award and when apple trees can be planted. A committee was formed early in the fall of 2014 to identify the proper (age-appropriate) lessons, and to familiarize the committee with the overall goal of the proposal. Then, professional development and lesson planning involving all teachers from the school was done during winter break of 2015 on a full day immediately prior to beginning the second semester of classes. All of the original plans from the preceding paragraph were accomplished

Lessons learned:

- State the goal of the apple tree growing exercise in the context of educational activities many times in many ways up front. This gives the teachers time and context to truly grasp the possibilities. Once this happened, those who expressed the most reticence became the biggest fans of this project.
- Have full-sized pictures/drawings of the anticipated trees when they arrive and after one year, two years and three years of growth to give perspective and to plan out longitudinal activities.
- Ensure that each group of teachers has a lesson plan idea to start from, since none will likely have the full concept of what can be taught prior to starting to develop the full plans.
- Ensure that the learning objectives are completed prior to disbanding the professional development workshop, as momentum and perspective can be lost over time and especially when the “experts” in trees are not present.
- It is desirable to have subject matter experts in growing apples as well as in education present to help the teachers during these workshops.
- All lesson plans developed during this workshop are included in the attached appendix entitled lessonplans.pdf

2. *Fall, 2014. Delivery of pre-test to all students: a portion of the summer preparation by the teachers will be generation of specific objectives and an assessment plan, including pre- and post-tests for each unit taught.*

Pretest and posttest planning should be done during the professional development workshop. We did a small amount of this, but not enough. Would do it differently next time.

3. ***April, 2015. Tree planting: the trees will be planted on a 16' x 16' grid, allowing space for proper weed control and grass mowing. The students and teachers will be guided during the planting by Wea Creek Orchard mentors. Volunteers from Keep Stockwell Beautiful will be in attendance to learn and help. At this time tree height and trunk circumference will be taken to aid students in learning about measurement and plant growth over time.***

Each class came out separately and planted their own tree. The students loved identifying which was their tree and all were able to help during planting: digging 12x12 holes, holding the tree in the proper position (graft union away from the prevailing wind), throwing the dirt in, packing the dirt, giving the first gallon of water. Measurements were taken either at the time of planting or in the immediate days following. Each student drew and measured the tree assigned to their class, so each had a different idea of what was a branch, leaf or how tall or long a given part was. This was very interesting to compare (emphasizing that all were right depending on their definition!).

4. *April/May – August/September, 2015. Observation of how the environment interacts with the tree: Measurements and pictures will be taken during stages of tree bloom, tree growth, fruit production, and leafing. During this time lessons will be taught on pollination, beneficial and harmful insects, water frequency and quantity, disease impact, organic control methods, and labor costs. In June/July, volunteers will add one inch of water per week to trees. Mentors from Wea Creek Orchard will monitor disease and insect infestations during this time.*

Lessons learned:

- Encourage drawings and keep them available for comparison. Choose two or three that vary and discuss why each was different and what definition each respective student was using when the observation/measurement was being performed.
- Emphasize vocabulary, as these new words may have different meanings to them but each new word or phrase encourages thinking and discussion of other concepts
- Review often!

5. **Summer, 2015. Teacher Professional Development and Lesson Planning:** *Teachers come together for two half days to plan lessons regarding dormancy maintenance and bacterial and fungal infection treatments in organic farming.*

This workshop did not happen, in part due to lack of time and in part due to continued conversations throughout the spring season. This was not found to be a great hindrance to continued learning

6. **Autumn, 2015. Apple harvest:** *Despite their young age, the experience of Wea Creek Orchard experts is that even trees at this young age produce an average of two apples in the fall of the first year. The appearance of a mature and tasty fruit as the culmination of routine maintenance should excite the children, and will provide an excellent forum for discussion of the multitudes of apple colors, tastes and textures. At this point lessons on health and nutrition will become relevant and, hopefully, more memorable.*

The experience of the Wea Creek Orchard experts turned out to be lacking, as no apples were produced in any form on these particular trees. We made up for this lack of apples by having an apple crunch day where all students crunched an apple (all brought in by Wea Creek Orchard) at the same time. This event was recorded and posted on facebook. It also was written up in the Tippecanoe County Schools newsletter. Apple tasting using other apples substituted for their own apples during the year at various tasting events.

Lessons learned:

- If possible, it would have been great to have had the specific type of apple on hand that each of their trees would grow. This did not happen, but in future plans will be made to accomplish this.
- The lessons about nutrition, characteristics, health, and apple maturity could be and were still taught.

7. **Winter, 2015/16. Winter maintenance and pruning:** *Pruning and central leader selection will be initiated during dormancy. [At this point various organic methods for fire blight prevention will be discussed with Drs. Peter Hirst, Janna Beckerman, and Rick Foster (Purdue extension specialists) and introduced based on the latest information. These discussions will include the use of copper sulfate, oxytetracycline (currently still allowed by organic standards) biologicals such as yeast mixtures, and neem oil.] Discussion about bacterial and fungal infections of the tree will be incorporated into lesson plans on biological diversity and infection.*

After discussion among the teachers and the orchard staff, we felt that addressing all of the organic methods specifically was above the comprehension skills (and likely, above the interest) of the students in any of the grade, so one overall lesson on organic methods was given and emphasized during later lessons. Few specifics were given about the name of each treatment: general needs were discussed and possible methods to address these needs were given.

Lessons learned:

- Teaching the pruning methods prior to actually doing them outside was a good move, so that once we got outside the kids were asking questions they had thought about already.
- Having two pairs of pruning shears available (one hand-held and one for lopping) was a good idea, but both need to be controlled by the expert (lesson learned too late for the first class... should have known)
- The students asked many questions about what happened to certain branches that were already pruned. This was a good chance to talk about deer and winter damage.
- Use the opportunity to talk about bark and frozen leaf coloring, and take measurements again.

8. *Spring, 2016. Blossom time: Counting and characterizing blossoms on each tree, and observing the patterns of pollinators during blossom time, will generate discussion useful for lessons on plant/animal interactions, genetics (in older children), and fruit generation.*

Done as independent classroom time allowed.

Follow-ups will be done over the next few years by the Wea Creek Orchard staff with the various teachers. Most lessons will be repeated, using the natural growth of the tree to update the particular learning objective.

### **Testing the characteristics of various apples: diversity and environment** (Vocabulary words to be discussed are in bold)

**Introduction:** There are many qualities that go into the “likability” of a food, certainly including apples. With over 7000 named varieties, there are many different aspects going into apple choices. The two most obvious are taste (including sweetness and **tartness**, or **acidity**) and crispiness. Additional aspects like storage, look and **disease resistance** are the primary contributors to marketability in grocery stores, which is why the majority of consumers are only familiar with a few varieties (the ones that look good after being shipped for long distances). One goal in this whole tree effort is to show that local foods are often more likeable due to freshness, but that even among local (fresh) apples there is a tremendous diversity in taste.

Since we can’t really test the effect of freshness on the characteristics of apple likability, we can test the taste and crispness through **measurement**. Interestingly, taste and crispness are **subjective measurements**, meaning that each person will have a different view on how sweet or crispy a food is.

**Protocol:** First, look very carefully at each of the four apples we have on display. Write down what you think of each: what would be the most tasty? Which do you think would be the sweetest? Which would be the most crispy?

Secondly, taste a piece of each of these four different apples (sweet, tart, soft and crispy). Determine which is the most sweet and which is the crispiest. On a piece of paper, write down your findings, placing a “1” next to the sweetest and order them all down to a “4” as the tarest

(most sour). Do the same for crispness, using a “1” for the crispiest and a “4” for the softest.

Now that you have written down what you think of each apple, I am going to measure the sweetness and the crispness of each. Using a tool to get a score which represents a characteristic like sweetness or crispness is called an **objective measurement**. The first tool we will use is called a **refractometer**. It measures the percent of solids in each drop of juice that I squeeze from the apple. Though there are many solids in each apple, this is a pretty good indication of the amount of sugar in each. There is another method to do this using **iodine** (color change when the black iodine-stained **starch** of an unripe apple does not show up in a ripe apple that has changed the starch to **sugar**) that is more colorful, but we have decided to measure this way. For **comparison**, assume that the average apple juice you buy will have a **brix** score of 13, grape juice 21 and lemon around 9. Where do you think each apple would score when compared to these **standards**? Do you want to change your **predictions**?

A. Measuring sugar/solids/sweetness

- a. I will cut off a small bit of apple, only large enough for me to squeeze it onto this refractometer glass plane.
- b. Then I will close the door and read the percentage that it shows me on the gauge (instructions enclosed in the package when purchased)
- c. Write down on your paper, next to your predictions, what number I give you for each of these different apples
- d. I will repeat each apple to make sure the numbers are **precise**

B. Measuring crispness/hardness

- a. I will shave off the peeling from an area on the apple about the size of my fingernail.
- b. I will then place the penetrometer plunger on this bare spot and push down until the plunger is fully down
- c. The amount of pressure it takes to **penetrate** the apple is a measure of how crispy it is.
- d. Repeat this measurement in various places on the same apple, then again on a different apple of the same kind.
- e. Do the numbers I give you for each apple agree with your predictions? If not, that is ok. Predictions are fun to make – they don’t have to be right. Just be willing to be open-minded: if your predictions are wrong admit it and have fun with it. This is a part of the **scientific method**!

**D. PEOPLE. List people who assisted with the project and explain how they were involved. Please include educators, farmers and ranchers, parents or others who may have helped you. Also, list any personnel from a public agency, such as the Extension Service, Natural Resources Conservation Services or Soil and Water Conservation Districts who may have assisted with this project.**

Gary Kirkham – owner, Wea Creek Orchard; retired high school horticulture and ag teacher; leader for the development aspect of this Cole project

Perry Kirkham – orchard manager; Wea Creek Orchard; serves as the apple and orchard expert

Lisa Kirkham – owner, Wea Creek Orchard; former elementary teacher and principal, current educational researcher at Purdue University

**E. RESULTS. What results did you achieve and how were they measured? Sustainable agriculture is farming and ranching that is ecologically sound, profitable, and socially responsible. Which of these aspects of sustainable agriculture did the youth you were teaching learn about? Describe the youth audience you were trying to reach. Include outcomes you achieved and how you measured them through surveys, attendance, or other methods (if appropriate).**

Grades K-5 made visits to the Cole Outdoor Education Center and to the Apple Orchard. Grades K/1 were specific in their visits - offering chances in each season summer, fall, winter, and spring to look at the differences and similarities of the orchard in each season. They also looked at goods and services in terms of production of applesauce. Grade 5 was very active in the orchard; mapping out the trees, measuring them, and working with pruning. Grades 5 also had the taste testing day led by Wea Creek Orchards.

Lesson plans and pictures are included as attached appendices entitled binder.pdf and lessonplans.pdf

**F. DISCUSSION. What did you learn from this project? How has this affected you and the young people you are working with? Were the results what you expected? If not, why? Are there changes you would make if trying this project again or recommending it to others?**

Biggest takeaways: 1. Food does not just appear on the shelves at the grocery store. As hard as it is to believe for a school set in a rural area, children do not know the source of their food. They also do not understand the nuances of the agriculture that goes into its production. 2. Science of measurement. The scientific process was reiterated when the Wea Creek Orchards came out and offered the tastings. Students were exposed to a variety of measurement tools they didn't know existed previously and why they were need to be invented in the first place. 3. Consumerism. Even the principal learned that apples are not apples are not apples. They are not the same. Each person has individual tastes and each person's tastes should drive their purchasing. Buying an apple because it is red is simply not the best use of income or purchasing.

### **3. OUTREACH**

Cole Facebook and Twitter Pages were used to communicate this orchard. Parents also had opportunity to visit the orchard during monthly open-to-the public nights. The pumpkin carving evening was also an avenue to express the goals of the project.

We were also able to get some great public relations on the TSC Newsletter this spring:  
<http://www.tsc.k12.in.us/images-websites/file/www/Administration/Superintendent/TSC%20Spring%20Newsletter%202016.pdf>

Pictures from the school-wide apple day:





#### **4. PROGRAM EVALUATION**

**As a participant of the North Central Region SARE Program sponsored Youth Educator Grant program, do you have any recommendations for the regional Administrative Council about this program? Is there anything you would like to see changed?**

We love the program, as we were able to give some wonderful education to school-aged children about aspects of growing food that is not common knowledge. The dollars paid for vital aspects of the education, including materials and expertise, which can be donated or obtained through other means but not without a great degree of difficulty. One of the most important lessons we feel came from this continuing project is that students can see that they, too, can become apple growers!

One issue that could be made clearer would be to better communicate specific goals for this program from the SARE point of view. We have our own set of goals that we feel we reached, but we aren't sure if we attained what you would like for us to have attained!

#### **5. BUDGET SUMMARY**

Complete the Final Budget Summary form and email it to Joan Benjamin. The final budget form is similar to the budget form you turned in with your grant proposal. It has additional columns so you can show what you spent on project items compared to your proposed costs. Only show grant funds spent even if you spent more than that amount.

You can only use grant funds for expenses incurred and items purchased for conducting your project. If the amounts for items listed have changed significantly from the amounts listed in the proposal, please include an explanation with the final budget summary.

If you have questions, contact Joan Benjamin, NCR-SARE Associate Regional Coordinator. Please submit your final report on MySARE and send your final budget summary by email by to: [BenjaminJ@lincolnu.edu](mailto:BenjaminJ@lincolnu.edu)

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