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Introduction

On March 5, 2009, the Arizona Department of Agriculture (ADA) entered into a cooperative agreement with the United States Department of Agriculture (USDA), Agricultural Marketing Service (AMS) in the amount of $159,294.43 in FY08 Specialty Crop Block Grant Program funds to fund five projects specifically designed to increase the consumption and enhance the competitiveness of Arizona Specialty Crops. Projects within the Arizona State Plan included three education projects, one marketing project, and one research project and were six months to three years in duration. The expiration date of the grant period was March 29, 2012.

In October 2010, the State Plan was amended to replace the Hopi Garden Project with the On-line Course for Educators project.

On-line Course for Educators

This portion of the project was completed on March 29, 2012. *(The project will continue until September 30, 2012 with SCBGP-FB2009 funding.)*

Project Summary

The Agricultural Literacy online course was designed to allow Kindergarten through Twelfth grade classroom teachers to increase their knowledge about Arizona's Specialty Crop industry while meeting Arizona's Academic Standards in Mathematics, Language Arts, and Science which includes nutrition. The course content provides teachers with research-based strategies to implement agricultural concepts into their current curriculum. This increase in knowledge about the industry will help enhance the competitiveness of the industry since the teachers and their students will be more aware of the opportunity to purchase and consume Arizona specialty crop commodities.

The need to develop an online course is especially relevant in today's internet based world. Research demonstrates that many people choose to further their education through courses available on the internet and this allows working adults to achieve their educational goals.

This project is important and timely because there is a demand by teachers to implement lessons in their classrooms that are relevant to their students, which are aligned to the academic standards, and enhance the curriculum, the teachers are required to use. Online courses allow teachers to participate in professional development activities at a time and place easily accessible by them. This course was designed so participants will utilize what they are learning in the course by teaching lessons in their classroom as part of the course completion requirement. This format has been implemented successfully in other state Agriculture in the Classroom programs. Research on the Utah State Ag in the Classroom online course has shown that even five years after completing the course, teachers are still utilizing what they learned in the online course.

Project Approach

Project workers met with The University of Arizona Outreach College and The University of Arizona Office of Instruction and Assessment. From these meetings, it was determined that the online course would be offered through the Outreach College utilizing the D2L platform.

Project workers developed an online survey to assess teachers' interest and distributed it to 524 individuals who subscribe to our Ag Literacy ListServ. One question asked, "Given the following online course options, which would you choose?" Of the 68 who responded to the survey, 29.4% selected $165 for a certificate of completion, 50% selected $230 for forty-five continuing education units (CEUs), none selected $1,800 for three undergraduate credits towards a degree, and 20.6% selected $2,000 for three graduate credits towards a degree. Furthermore, of the 73 teachers who participated in the assessment, 23 expressed interest in participating as pilots. Ten were selected (seven completed) based upon criterion that allowed for a variety of grades, a broad range of teaching backgrounds, and various counties throughout the state.

Project workers met with Outreach College personnel on the development of a successful online course. A course syllabus and learning objectives were developed. An online pilot course was developed and launched. Information from participants was gathered on ways to improve course. A reoccurring theme in their feedback was the sequential ease from which the course layout is designed. One of the participants stated, "I am taking another course online and the ease of your course is amazing. The link to each section is wonderful. Everything has been very clear. The other course is very confusing, [I] spend lots of time clicking back and forth to find out where I have been and where I need to go. Not so with this course." Suggestions for improvement were integrated and a consistent structure for each of the modules was developed. Participants were stipend $200 for their participation.

The online pilot course was expanded into the full online course, entitled *Incorporating Agriculture Education into Your Classroom*, and launched. The course was heavily advertised for four months which resulted in expressed interest, but no one enrolled in the course. It was hypothesized that this was due to the lack of hands-on, personal experience from teachers who could attest to the benefits of the course. Therefore, budgeted funds were shifted which allowed for 21 teachers to be reimbursed for taking the course and promoting it within their school and district.

Currently, these 21 teachers are taking the course which is scheduled from March 1, 2012 to March 1, 2013. It is anticipated that the promotional efforts of these teachers will result in the enrollment of other teachers who will take the course one-year course beginning October 1.

Goals and Outcomes Achieved

Participating teachers have been given access to numerous classroom materials including lesson plans on a variety of topics, such as soils, seeds, plants, animals, geography, and nutrition. Each of these has a focus on specialty crops grown in Arizona. The well-defined objectives on each of the lessons have enhanced instructional strategies and content knowledge concerning science, mathematics, writing and reading, and healthy lifestyles.

It was anticipated that a maximum of 30 teachers would participate in the first offered online course and that these teachers would teach a minimum of five lessons that incorporate specialty crop agricultural concepts into their curriculum. However, due to the lateness in which teachers began enrolling in the course, and the subsequent shift in the course's term (from beginning in September to beginning in March), by the date of this report, teachers were unable to complete these five lessons or the course final which is designed to demonstrate that their students have

increased their understanding of the specialty crop industry in Arizona. Yet, for those lessons that teachers have been able to complete to date, the teachers have provided documentation (including photos) that proves each lesson was taught including assessments of their students' gain in knowledge, verification of classroom instructional hours, and reflections on the utilized teaching strategies.

Beneficiaries

The beneficiaries of this project include the pilot teachers and their students. The seven pilot teachers included four elementary teachers and two high-school agriculture teachers and one high-school English teacher. Beneficiaries also include the twenty-one currently-enrolled teachers and their students. These are K-12 teachers, some of which includes a special education teacher, agriculture teachers, a physical education teacher, an art teacher, and middle-school and high-school math and science teachers.

Each of the teachers have benefited by obtaining access to numerous classroom materials, each of which has a focus on specialty crops grown in Arizona. Additionally, each of these students has increased their understanding of the specialty crop industry.

Since the funds for this project were used to design and implement the first term of the online course, future teachers who enroll in the course and their students will also benefit from this project. Furthermore, the teachers listed above will continue to teach future students and access these lessons to increase their understanding of the specialty crop industry.

Lessons Learned

The most surprising aspect of this project was the high number of teachers who expressed interest in taking the course compared to the low number of teachers who enrolled (specifically zero enrollments until the reimbursement process was adopted). The teacher's schedule seems to be so busy that it proved difficult to catch those who were interested in the course at a time when they were able to actually take the steps to enroll.

Marketing also proved difficult. We learned that it is the school district and not the state that has the authority to accept or reject the course in which a teacher participates in order to fulfill state requirements for teachers to receive continuing education towards their degrees. Compounding the issue is that there are hundreds of school districts within Arizona in addition to the popularly expanding charter schools. As such, there is not a central advertising location or website where all of the continuing education courses can be posted to which teachers can enroll. Therefore, it stands to reason that in order for continuing education courses to be successful in reaching massive numbers, the course must be promoted within the district. Coordinating with a district's Professional Development Coordinator would see essential. However, it may prove difficult to gain this person's support without having one advocating the benefits of the course. For these reasons we have pursued reimbursing teachers for taking the course, gaining personal experience with it, and promoting the course within their school and district.

Finally, the time investment for the instructor of the course is greater than anticipated. In addition to the regular communication with enrolled teachers and following up with their requests, there are constant changes that need to be made to a newly developed course. No matter how clear it is believed that instructions are communicated, a question arises or a procedure isn't

followed that requires modifications in hopes of preventing further misunderstandings and mistakes.

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Additional Information
Appendix A contains a list of content information accessible by those teachers enrolled in the course.

In the Field with Arizona Agriculture

This project was completed on July 31, 2010.

Project Summary
The lack of nutrition education and low consumption of specialty crops such as fruits and vegetables, are two factors that contribute to the growing childhood obesity rate in Arizona. The University of Arizona Cooperative Extension, Maricopa County and Arizona specialty crop agribusinesses have designed "In the Field with Arizona Agriculture", a program that consists of two field day sessions that focus on agriculture education and encourage increased consumption. A thousand students from public, private and charter schools will be given the opportunity to learn about the health benefits of consuming specialty crops, product development, food safety, and "buy local" programs and will even get to taste a variety of AZ grown specialty crops. Teachers will not only took part in the education experience at the field day, but also received all of the Specialty Crop Lessons which were correlated to Arizona Academic Standards, so they can replicate lessons for years to come.

The strategies within this 1-year plan were designed to coincide with the mission of the Arizona Department of Agriculture by supporting Arizona agriculture while protecting the Arizona economy.

Project Approach
- Hired Brandon Moak as a part-time Program Coordinator who was responsible for the coordination of this project.
- Coordinated with Redbird and Washington Elementary schools for the fall educational session.
- Coordinated with specialty crop agriculture organizations and businesses and designed the fall educational session.
- Designed the survey to measure the effectiveness of the educational sessions.
- Conducted pre-surveys for 413 students from Redbird and Washington Elementary schools (see attached fall survey questions & answers).
- Held fall session at Redbird Elementary on November 23, 2009 for 429 students, 18 teachers, and 2 principals.

- Conducted post-surveys for 409 students.
- Distributed Arizona Specialty Crop Lessons (available online cals.arizona.edu/agliteracy/lessons.htm) to 18 teachers and 2 principals.
- Analyzed survey data (see attached statistical report).
- Obtained letters of program recommendation from Redbird & Washington principals (see attached letters).
- Coordinated with Keller Elementary to host the spring educational session and for Alma Elementary to visit.
- Presented In the Field with Arizona Agriculture at the 2010 Western Regional Agriculture in the Classroom conference (see attached powerpoint). Received helpful feedback for adjusting the survey which was reflected in the surveys for the spring event.
- Coordinated spring session with specialty crop agriculture organizations and businesses.
- Conducted pre-surveys for 389 students from Keller and Alma Elementary schools (see attached spring survey questions & answers).
- Held spring session of the Agriculture Fair at Keller Elementary for 441 students, 18 teachers, and 2 principals.
- Conducted post-surveys for 343 students from Keller and Alma Elementary schools.
- Distribute Arizona Specialty Crop Lessons to 17 teachers and 2 principals
- Analyze data from spring event (see attached statistical report)
- Developed survey to assess teachers' use and intended use of Arizona Specialty Crop Lessons (see attached data)

Goals and Outcomes Achieved

- Participants learned the following at each of the agriculture events:
  - The essential components of what a plant needs to grow.
  - A basic overview of the different types of farms.
  - How farms are irrigated.
  - The function of roots, stems, and leaves of plants.
  - The process of photosynthesis.
  - The factual differences between fruits and vegetables.
  - Nutritional information about fruits and vegetables and their consumption as a better food choice.
  - Historical content and present-day usage of pecans.
  - The parts of a seed and the germination process.
- Students participated in hands-on activities at the educational booths comprising the agriculture fair. Participants were able to do each of the following:
  - Make a bracelet with a farmer with each color representing what a plant needs to grow.
  - Hear a farmer read a story on agriculture.
  - Practice irrigation and siphoning with a tube and bucket of water.
  - Observe leaves emitting oxygen bubbles underwater.
  - Take home foil and leaves to observe the effects of prolonged withholding of sunlight. The foil was cut into small shapes and paper clipped to the leaf.
  - Sort and categorize a variety of artificial fruits and vegetables.
  - Try a specialty crop fruit and vegetable (date and cauliflower).

  - Observe how pecan shells are made into ink.
  - Practice calligraphic writing with pecan ink.
  - Dissect a lima bean.
- MEASURABLE OUTCOMES:
  - Conduct two field days, one in the fall of 2009 and one in the spring of 2010.
    - Fall field day was held November 23, 2009
    - Spring field day was held March 30, 2010
  - Impact 1000 students and 34 teachers
    - Impacted 870 students
    - Impacted 36 teachers
    - Impacted 4 principals
  - 80% of student participants will have increased knowledge about the Specialty Crop agriculture industry in Arizona
    - 90% of the survey items showed a statistically significant increase in the mean responses (see attached statistical reports for a full accounting)
  - 25% of the students will consume more specialty crops
    - Impossible to measure without performing longitudinal research which is beyond the scope of the project
    - An attempt to measure a change in participants' desire to consume more specialty crops is discussed in the attached statistical reports (results are inconclusive)
  - 50% of the teacher participants will continue the lessons in their classrooms
    - Participation in teacher surveys was poor which leads to inconclusive conclusions.
      - Of the 26 teachers who turned in a survey, only 17 fully completed the survey (65.4% completion rate)
    - Teachers who reported already using the lessons (8 out of 26 reporting = 30.8%)
      - Accounting for likelihood of participant skipping this section of the survey shifts data to 8 out of 17 = 47.1%
    - Teachers who reported intent to use the lessons in the 2010-2011 school year (9 out of 26 reporting = 34.6%)
      - Accounting for likelihood of participant skipping this section of the survey shifts data to 9 out of 17 = 52.9%

Beneficiaries

The beneficiaries of this project included each of the participants in the agriculture fairs (870 students, 36 teachers, and 4 principals). Students were able to visit eight booths over a two hour time-period and participate in hands-on activities that taught about our connection to agriculture and Arizona's specialty crops. Although these events were powerful in and of themselves, the teachers were also able to witness ways they can incorporate the booth lessons into their own classroom curriculum. Since teachers were supplied with their own copy of the Arizona Specialty Crop Lessons, they are now able to impact students for years to come. The principals were also supplied with the Arizona Specialty Crop Lessons and are able to encourage their use among the other teachers of the school that did not participate in the agriculture fair.

Lessons Learned

- The following are suggestions to consider if building upon this project:
  - Have a school host the event on their playground.
  - Minimize costs by selecting schools within close proximity to each other and within a district that rents out their buses for such events.
  - Know the following before scheduling the event with the school
    - Bus availability
    - Lunch and bell schedules
    - District testing dates
    - It was our experience that we couldn't include more than two schools per event in a school day
  - If planning on gathering data (i.e. surveys):
    - Understand the schools' policy for gather data from students.
    - Mark surveys with pre-assigned numbers (pre and post). Give the pre-surveys to the teacher along with an unnamed record sheet for the teacher to assign a student to the provided number. Have the teacher retain this record to ensure student anonymity. The teacher passes out the post-survey with the pre-assigned number to the corresponding student. This would make it possible to see changes within each student without requiring parent permission.
    - Explain the data gathering process to the teachers in person instead of in a letter.
  - Inform which class will be at which booth prior to their arrival. We sent an agriculture picture on a colored paper to the teachers to bring with them. When they arrived, we held that same paper up high when the teachers and students exited the bus.
  - Utilize the local FFA students via the high schools for volunteers to assist with the event. We had them assist with set up, take down, and teaching alongside agribusiness volunteers.
  - Utilize your county's cooperative extension and their master gardeners.

Contact Persons

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Additional Information

- The following documents have been included in this report as mentioned in the Project Approach and Goals and Outcomes Achieved sections (Appendix B):
  - Fall Survey Questions
  - Fall Survey Answers
  - Fall Statistical Report
  - Letter of Support (Redbird Elementary)
  - Letter of Support (Washington Elementary)

- Powerpoint Presentation
- Spring Survey Questions
- Spring Survey Answers
- Spring Statistical Report
- Teacher Survey Data

Arizona Fruits and Veggies

This project was completed on March 1, 2010.

Project Approach

With the Fruits and Veggies Project the partner organization, Arizona Farm Bureau Agriculture in the Classroom (AITC) Program was able to duplicate their existing Pumpkin and Apple Curriculum Kits and give 1 copy of each kit to every County Farm Bureau. The increase in the number of kits allowed for more students and teachers to have access to the kits. By having the kits housed in the counties we were also able to accommodate teacher requests with less coordination for kit delivery and pick-up. The AITC Program was also able to create an Arizona Fruit and Veggies Kit. This kit has become very popular with the teachers.

Goals and Outcomes Achieved

Apple Kits

We were able to reach 30 teachers and 714 students with the Apple Kit. This was nearly a 275% increase from last year's usage. Apple Kits are still being reserved for the spring.

Fruits and Veggies

We were able to reach 40 teachers and 994 students with the Fruit and Veggies Kit. This kit was created from the Fruits and Veggies Kit and made its debut in August 2009. We do not have any numbers to compare as this kit was not available during the last school year. We do already have 12 of the 24 Fruit and Veggie Kits reserved by teachers for the spring.

Pumpkin Kits

We were able to reach 142 teachers and 2,163 students with the Pumpkin Kits. This was nearly a 500% increase from last year's usage. Most pumpkin kits are checked out in the months of August-November though we still have a few kits trickling out to schools.

Trivia Wheel

With the addition of the new trivia wheel we are able to have Ag trivia at events that occur on the same day at different locations around the state. The trivia wheel has already been spun by nearly 5,000 adults and children across the state.

The increased number of curriculum kits has allowed us to reach our goal of increasing awareness of the Ag in the Classroom Program and its materials. We can see that by the increase in the number of students and teachers that use our program resources. We had hoped that the kits would be used by at least 90 teachers in the first year that the kits were completed. We have already surpassed that goal with 212 teachers having used our kits in the first 5 months that they

were available, also reaching nearly 4,000 students. We are half way to reaching our goal of 10,000 individuals spinning the trivia wheel, already having nearly 5,000 in the first 5 months.

Beneficiaries

There are many people across our industry that have benefited from the completion and implementation of this project. Students and teachers now have a better understanding of where their food comes from and how hard producers work to make their products the safest and most affordable products. The community now has seen a glimpse of what the agricultural industry in Arizona is doing and has dispelled a few of the many misconceptions that uneducated people have about agriculture.

Lessons Learned

This project has allowed our program and impact among the community to grow leaps and bounds over last year. We anticipated that the materials produced through this grant would increase participation in our AITC Program, however we were not anticipating how much participation would increase. To accommodate the increase in kit use and presentations that were scheduled we were able to acquire 3 interns from Arizona State University. Having the interns made the increase in presentations and kit replenishing manageable.

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Additional Information

Information on the curriculum kits can be found at….
http://www.azfb.org/programs/aitc/index.cfm?fuseaction=curriculum Teachers can visit the website to get a preview of program materials.

This is the photo (left) we used to promote all of the new kits that were supplied by the grant.

Students at a local elementary school learned about the life cycle of a pumpkin during Halloween.

Students participate in one of the activities included in the Arizona Fruit and Veggie Kit and take their turn at the trivia wheel at the Phoenix Zoo's Boo at the Zoo event.

Fill Your Plate

This project was completed on December 31, 2009.

Project Approach

The partner organization, the Arizona Farm Bureau, has completed this project. During the final quarter most work was done on the last video "Let's Eat" and final work on the Forum.

Video Vignettes

All video vignettes are complete and loaded onto Fill Your Plate (www.fillyourplate.org). In two weeks, the final video "Let's Eat" has already had more than ***70 views on YouTube*** and this does not count the views on Fill Your Plate. However, we've had a nearly 10% increase in page views to www.fillyourplate.org in the last two weeks since posting all the videos and launching the "Chat with a Farmer" forum. We can average anywhere from 20 page views to 40 page views a day on www.fillyourplate.org

"Greetings from Arizona" Brochure Update and Reprint

The brochure is complete and is now being distributed into Arizona schools and at special events. Of the 5,000 printed we've already distributed ***more than 2,500***. They are popular and very well received by the public. With our upcoming events and future Ag in the Classroom work we anticipate that all 5,000 will be distributed by the end of 2010.

Forum on Fill Your Plate

The Forum is now up on Fill Your Plate and we're beginning to solicit farmer and ranchers and chefs and consumers to use it to stay in touch with producers. Go to www.fillyourplate.org and select the link called "Chat with a Farmer" to review our forum and see the topics including comments posted. We've had a nearly 10% increase in page views to www.fillyourplate.org in the last two weeks since posting all the videos and launching the "Chat with a Farmer" forum. We can average anywhere from ***20 page views*** to ***40 page views*** a day on www.fillyourplate.org

Goals and Outcomes Achieved

Fill Your Plate Discussion Forums

1. Increase use of Fill Your Plate by 100%. – *While we've had a 10% increase in use of Fill Your Plate in the last 2 weeks, we've had a 273% increase from last year. The Specialty crop videos started posting three months ago on Fill Your Plate, during the timeframe when we've had some of our best growth. So we believe that the Specialty crop videos have helped us exceed our goal to increase use by 100%. We will also be targeting more promotion and publicity on the new videos and our forum including advertising on the radio (KEZ 99.9) and media reporting on what's on Fill Your Plate.*

2. Number of forum discussion posts by consumers and farmers & ranchers = **increased producer and consumer interaction**. – *Will be ongoing. We will continue to promote the forum along with Fill Your Plate.*

Video Vignettes

1. Double the number of profiles of specialty crop farmers and ranchers from the current 5 to 10. *The number of profiles was increased to 11*.
2. Further participation by farmers and ranchers on Fill Your Plate. – *The forum has already shown this as most registering on the forum are farmers and the majority of those registered are farmers and ranchers.*

Goals

1. To extend our reach to the public by featuring our specialty crop production and our specialty crop farmers and ranchers. – *Done*
2. To provide tools that can be regularly used by consumers to connect with farmers and ranchers to expand their knowledge of Arizona specialty crop agriculture. – *Done*
3. Develop public advocates on behalf of agriculture. – *Ongoing*

Beneficiaries

The biggest beneficiaries are the public, students, chefs and our specialty crop farmers. It is our special outreach to engage the public and teach them more about fruits and vegetables. We're delighted in the opportunity and honored to have been awarded this grant to reach out to the public.

Lessons Learned

One pleasant surprise in this project is how educational in nature we could develop the videos especially illustrated with "Let's Eat." Additionally, cooperation by farmers and ranchers to help make this project happen was inspiring and encouraging. Finally, the Arizona Department of Agriculture staff was extremely helpful and encouraging. They made the process much easier to move forward on.

Finally, the tools produced from this project – videos, forum and brochures – will have an ongoing impact in promoting specialty crops for Arizona. We will push the use of these tools in the next several years and extend to other uses. Arizona Farm Bureau's Ag Education department intends to use the videos in the classroom and the Let's Eat video will be used to help adults teach young kids how to eat more fruits and vegetables.

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Integrating Organic Production with Subsurface Drip Irrigation: Meeting the Challenge

This project was completed on October 31, 2011.

Project Summary

Scarcity of water in the Southwest combined with a strong demand for local and organic specialty crops has created a need for making subsurface drip irrigation (SDI) compatible with organic production protocols. SDI provides the ultimate in water use efficiency for open-field agriculture, often resulting in water savings of 25-50% compared to flood irrigation. In addition, SDI offers higher yields, a dry soil surface for improved weed control and crop health, and the ability to apply water and nutrients to the most active portion of the root zone. Adoption of organic production generally provides growers better market access and higher prices. A marriage of these two sustainable technologies, SDI and organic agriculture, could be of great benefit to both growers and consumers. Nevertheless, significant technical and management barriers exist to combining these two production techniques, notably the difficulty of supplying nutrients using organic fertilizers with SDI. We proposed to conduct a two-year replicated field experiment in central Arizona, with the following treatments: 1) SDI with nutrients supplies by fertigation with organic fertilizers, 2) conventional (i.e. non-organic) production with SDI and, 3) conventional production with furrow irrigation. Our objectives were to evaluate crop yield and quality, post-harvest characteristics, and economic outcomes for organic vs. conventional production.

Project Approach

In a controlled field experiment, we intended to evaluate organic vegetable production using subsurface drip irrigation (SDI) with respect to crop yields and quality, nutritional quality, and sustainability. We planned to use 'micronized' composted manure with individual particles 5 to 20 µM in size for delivering nutrients (nitrogen and phosphorus) via SDI and 5 to 10 µM silica for scouring drip lines to maintain orifice openings. Unfortunately, the manufacturer of the micronized manure was unable to provide the promised product. Therefore, the project goal was shifted to comparing organic pelletized chicken manure to conventional fertilizer for SDI irrigated vegetables.

Multiple vegetable crops were grown with the two systems. Vegetables will be grown with two SDI tape spacings (drip lines 19" or 40" apart) to evaluate irrigation configuration. A furrow irrigated treatment was included for comparison. Plant nutrient levels were monitored, as were water use, water use efficiency, and marketable yield.

The subsurface drip irrigation system was substantially modified for this study. Several vegetable crops were grown, as summarized below.

2009-10 Cabbage

The first crop of cabbage (var. Gregorian, Syngenta) was planted on November 5 and 6, 2009 and harvested March 29, 2010. The organic plots received 186 lbs/a of N prior to planting. The conventional plots received 150 lbs/a of N spread out over the growing season.

Nitrate-nitrogen in the plant petiole tissue was measured on February 18, 2010. The values for the organic treatments were 10,400 ppm versus 8,700 ppm in the conventional treatments. This compares to a critical value (minimum acceptable nitrate level) of 4,000 to 5,000 ppm, indicating that both conventionally and organically cabbage was adequately fertilized with nitrogen.

Yields, measured in marketable cabbage heads were not significantly affected by fertilizer treatments or bed configuration (Table 1). Water use, expressed in inches of water applied to the crop, was also not significantly affected by nutrient source. However, less water was used in the beds with two irrigation lines (21.7 inches) than in the beds with three irrigation lines (24.5 inches). Water use efficiency, which is the yield (lbs/acre) per inch of water applied (acre-inches), did not vary significantly between individual treatments. Water use efficiency was, however, significantly greater in plots receiving conventional fertilizer (1475 lbs/acre-in) than in organic plots (1335 lbs/acre-in). Water use efficiency values are not available for furrow irrigated cabbage because this treatment did not produce marketable heads.

Table 1. SDI cabbage harvest data, water consumption, and water use efficiency.

Treatment	Head Diameter (inches)	Head Weight (lbs)	Yield (lbs/ac)	Water applied (inches)	WUE (lbs/acre-in)
Conventional 2 line/bed	6.0	2.5	27,751	22.25	1249
Conventional 3 lines/bed	6.2	4.3	42,305	25.30	1701
Organic 2 lines/bed	6.1	2.7	36,381	21.15	1716
Organic 3 lines/bed	5.9	2.4	22,616	23.75	953
Statistical significance	ns	ns	ns	ns	ns

2010 Cantaloupe

Chicken manure was applied on August 2, 2010 to organic plots to supply 187 lbs N/a. Cantaloupe, variety Olympic Gold (Syngenta) was planted August 8, 2010. Conventionally fertilized plots received a total of 95 lbs N/a during the growing season. A final N application was not made to the conventional plots because the crop was destroyed by hail on November 5, 2010.

Following stand establishment petiole samples were collected on August 26, 2010 and analyzed for nitrate-N. Organic cantaloupes contained 3,090 ppm NO_3-N versus 4,360 ppm in the conventional cantaloupes. Subsurface drip irrigated cantaloupes contained 3,260 ppm NO_3-N compared to 3,650 ppm in those irrigated by furrow. All levels were well above minimum recommended petiole nitrate levels. At the early bloom stage, additional petiole samples were collected on September 13, 2010. Organic melons contained 3,460 ppm, conventional 3,620

ppm, drip irrigated 3,120, and furrow-irrigated 3,700 ppm. All levels were above accepted minimums for this stage of growth.

Although the crop was not harvested, water use prior to the hail storm was recorded. We estimate that an additional 1.5 to 2.0 inches of water would have been applied had the crop been grown to maturity. Water use in the conventional plots was 23.9 inches, compared to 23.6 in the organic plots. Three line beds used 24.6 inches versus 22.9 in the two line beds. None of these values were significantly different from one another. In contrast, furrow irrigated cantaloupe received 27.1 inches of water.

2010-2011 Broccoli

On November 9-10, 2010 all organic plots received chicken manure at a rate equivalent to 218 lbs N/a. On November 23, 2010 broccoli, var. Preakness (Syngenta) was planted. During the the emergence phase, this crop was destroyed by bird predation. Broccoli was re-planted on December 20, 2010. Despite the use of propane canons to scare birds away, this crop also suffered significant bird damage. In January 2011, a hard freeze caused irreparable damage to this broccoli crop, and it was plowed under.

2011 Cantaloupe

Soil samples collected on March 23, 2011 indicated that soil N levels were higher in the organic (782 ppm) than in the conventional (782 ppm) plots. Although this test is not a reliable indicator of *available* N because it is not possible to predict the rate at which organic N will become available to plants, these values along with the fact that the previous broccoli crops were destroyed before they could use substantial N, led to the decision not to re-apply chicken manure to the organic plots.

Melons were planted on March 24-25, 2011. These melons were overtaken by volunteer seed left over from the late summer 2010 planting that was destroyed by hail. A stand count on April 4, 2011 indicated that there were approximately 30 times more cantaloupe plants than we had seeded. We had expected the volunteer seed would have been killed by the hard freezes over the winter, but they survived, and the volunteer melons could not be removed from the new planting. Therefore this crop tilled under. The field was replanted May 19, 2011.

Petiole tissue samples were collected on June 28, July 8, and July 27, 2011. The conventionally fertilized cantaloupes, which received 130 lbs N/a during the growing season, generally had adequate nitrate-N concentrations (Table 2). In contrast, the organic cantaloupes had nitrate-N levels well below the minimum accepted threshold. Although the previous broccoli crops did not survive long enough to deplete soil N, this nutrient was apparently lost during the fallow period preceding establishment of this cantaloupe crop. Nevertheless, analysis of soil samples collected after harvest, on August 16, 2011, indicated that the organic plots still had more N (665 ppm) than the conventional plots (530 ppm).

Interestingly, bed configuration also had an effect on petiole nitrate (Table 3). Melons growing on beds with three irrigation lines always had higher petiole nitrate levels than those on two line

beds (although the difference was significant only on June 28). The reason for this pattern is unknown.

Table 2. Petiole nitrate in conventional and organic SDI cantaloupes in 2011. Numbers in a column with different letters are significantly different at the 95% confidence level.

	June 28, 2011	July 8, 2011	July 27, 2011
Conventional	14,243 a	6,973 a	5,977 a
Organic	1,625 b	1,127 b	1,566 b
Minimum acceptable value	14,000	8,000	6,000

Table 3. Petiole nitrate in cantaloupes grown on SDI beds with 2 or 3 irrigation lines. Numbers in a column with different letters are significantly different at the 95% confidence level.

	June 28, 2011	July 8, 2011	July 27, 2011
2 line beds	6,346 b	3,219 a	2,102 a
3 line beds	9,521 a	4,881 a	5,441 a

Cantaloupes were harvested on August 8, and again on August 12. Melons were graded to determine marketable yield. Yields were considerably lower in the organic than in the conventional cantaloupes plots because of the inadequate supply of N in the organic melons, but the water applied was nearly identical (Table 4). The water use efficiency, therefore, was approximately twice as high in the conventional as in the organic plots.

Yield was greater in the three irrigation line beds than in the two irrigation line beds, although this difference was significant at the 90% confidence level, and not at the 95% level (Table 5). Although water use was slightly (but not significantly) greater in the three line bed (26.2 inches) than in the two line bed (23.0 inches), water use efficiency was greater in the three line beds. This difference was significant at the 90% confidence level, but not at the 95% level.

The furrow irrigated plots each received 24.5 inches of water. Water use efficiency in the organically fertilized furrow irrigated plots was 678 lbs/acre-in and 1,252 lbs/acre-in in the conventionally fertilized furrow irrigated plots. Because of the experimental design, water use efficiency of furrow irrigated plots cannot be statistically compared to the subsurface drip plots. However, it is worth noting that the values for furrow irrigated organic plots are nearly identical to those of subsurface drip organic plots (681 lbs/acre-in), whereas the conventional subsurface drip water use efficiency (1,407 lbs/acre-in) was considerably higher than the furrow irrigated counterparts.

Table 4. Yield, water use, and water use efficiency in organic and conventional SDI 2011 cantaloupes. Numbers in a column with different letters are significantly different at the 95% confidence level.

Treatment	Yield (lbs/ac)	Water applied (inches)	WUE (lbs/acre-in)
Conventional	34,510 a	24.5 a	1,407 a
Organic	17,129 b	24.8 a	681 b

Table 5. Yield, water use, and water use effiency in SDI 2011 cantaloupes grown in 2 irrigation line or 3 irrigation line beds. Numbers in a column with different letters are significantly different at the 95% confidence level.

Treatment	Yield (lbs/ac)	Water applied (inches)	WUE (lbs/acre-in)
2 line beds	21,570 a	23.0 a	928 a
3 line beds	30,069 a	26.2 a	1,160 a

The original partner in this project dropped out when it became apparent that they could not supply micronized manure that met promised specifications. Subsequently Hickman's Family Farms in Buckeye, AZ donated pelletized chicken manure. Syngenta supplied all vegetable seed.

Goals and Outcomes Achieved

Over the course of this study, five vegetable crops were planted. Only two were harvested. One cantaloupe crop was destroyed by a hail storm shortly before it was mature. Two broccoli crops were destroyed by birds and hard frost. Data, including nutrient status, water applied, water use efficiency, and yield were collected on the crops that were not destroyed.

Despite the numerous problems encountered in this study, some valid comparisons are possible. Yields were comparable when adequate N was supplied by the chicken manure, but correcting inadequate fertilization during the growing season was not possible, emphasizing the importance of supplying adequate pre-plant manure. We documented difficulties in supplying adequate nitrogen with pelletized chicken manure; specifically we demonstrated the critical importance of applying adequate manure prior to crop establishment. Unlike the conventionally fertilized vegetables, there was no way of supplementing the nitrogen supply during the growing season in SDI organic vegetables.

Water use was comparable in organic versus conventional vegetables, but the water use efficiency (the crop produced per unit of irrigation water) was slightly higher in the conventional vegetables. Water use efficiency was slightly lower in organic, even when the organic vegetables were well fertilized, differences which may still have been associated with the difficulty of supplying adequate N from organic sources. When organic vegetables did not receive adequate nitrogen, the difference in water use efficiency was amplified.

Water use efficiency was greater in conventionally fertilized cantaloupe than in organic cantaloupe. This was true in 2009 (water use efficiency of conventional = 1475 lbs/acre-in; organic = 1335 lbs/acre-in) even though yields were only slightly lower for the organic cantaloupes. The difference was much more striking in 2011 (1407 lbs/acre-in for conventional; 681 lbs/acre-in for organic) when organic yields were greatly reduce due to N deficiency.

In general, differences between organic and conventionally fertilized vegetable crops were small. The greatest exception, and a significant concern associated with organic vegetable production, is N fertilization. The organically fertilized cantaloupes in the 2011 crop were clearly N deficient, even though soil N values were relatively high. Because it is difficult to adjust organic N during the growing season, this points to the importance of supplying adequate N prior to crop establishment. Conventionally fertilized crops irrigated with subsurface drip, in contrast, can be 'spoonfed' N (and other nutrients) as required allowing nutrient adjustments at any time during the growing season.

This project suffered from numerous unforeseen problems. The initial goals were unattainable because the original cooperator could not supply micronized manure as promised. No suitable replacement could be found. After the goals of the study were adjusted, the project encountered severe problems associated with hail, volunteer seedlings from the unharvested hail-damaged crop, bird predation, and an unusually hard freeze.

The results of these problems were that 1) the original goals had to be substantially altered and that 2) the revised goals were not adequately met.

We gathered data that show that properly managed organic vegetables perform as well with SDI as conventionally fertilized SDI vegetables. We highlighted potential shortcomings with organically fertilized SDI vegetables that are a result of lack of flexibility regarding in-season fertilizer adjustments with this system. Our data indicate the sensitivity of water use efficiency to adequate fertilization, but also illustrate that organic SDI production uses water nearly as efficiently as conventional SDI production.

On October 19, 2010 our research project was part of the Maricopa Agricultural Center Tri-County Farmer Field Day. There were approximately 50 participants. Results are also shared at the following link: http://cals.arizona.edu/crops/irrigation/azdrip/azdripindex.html

Beneficiaries

The impact of this project on the agricultural community in Arizona was limited by the problems encountered. It was originally designed to provide growers with a way of combining the benefits of subsurface drip irrigation with those of organic fertilizers by demonstrating use of SDI to deliver organic nutrients. That did not happen because the soluble organic material was not available. The study does illustrate some potential pitfalls associated with the use of solid organic fertilizers in combination with SDI. Vegetable growers desiring to combine SDI with organic production benefit by our experiences.

We do not have data quantifying the economic impact of our study.

Lessons Learned

Although we had hoped to demonstrate an economical management system that would allow organic nutrients to be delivered via SDI, we found that micronized organic fertilizers that would permit this are not at this time available in an economically viable form. We also learned the critical importance of providing timely and adequate nutrition through organic fertilizer

application, and that the need for fertilizer application cannot be determined through standard soil tests.

In retrospect, when it became clear that our supplier could not provide micronized manure suitable for delivery through the SDI system, the project probably should have been terminated. Nonetheless, the re-designed project could have still provided considerable information had not additional problems (hail, freeze, predation, etc.) limited data collection. Some of these problems could have been foreseen and perhaps avoided, but most were completely beyond our control.

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Additional Information

http://cals.arizona.edu/crops/irrigation/azdrip/azdripindex.html

The first bullet indicates the lesson title, each of which comes from the Arizona Specialty Crop Lessons (http://cals.arizona.edu/agliteracy/lessons.htm), followed by a video and article that are associated with each lesson, in addition to further resources teacher can access to learn more.

- A is for Apple
  - *Video*: Apple Sorting Sizing and Grading from Compac Sorting Equipment (http://youtu.be/Qu-vb5O61rI)
  - *Article*: Apple Processing (http://www.appleproducts.org/pandt.html)
  - Resources
    - Arizona Orchard Listing http://www.allaboutapples.com/orchard/az.htm
    - Harvesting Nature's Popular Fruits http://www.americasheartland.org/episodes/episode_612/harvesting_nature.htm
    - Arizona Apples http://www.arizonaedventures.com/articles/arizona/arizona-apples
    - Apple Trees in Arizona http://www.ehow.com/list_7370608_apple-trees-arizona.html
    - Apple Harvesting Google image search

- From Mashed to Riches
  - *Video*: Idaho Potato Harvest (http://www.americasheartland.org/episodes/episode_613/potatoes.htm)
  - *Article*: 2011 Potandon Arizona Potato Operations Underway (http://www.perishablenews.com/index.php?article=0015658)
  - Resources
    - The Idaho Center for Potato Research and Education http://www.cals.uidaho.edu/potatoes/FAQ.htm

- To Bee or Not to Bee
  - *Video*: Pollination in Tennessee (http://youtu.be/0LTcT4bALKE)
  - *Article*: Questions and Answers: Colony Collapse Disorder (http://www.ars.usda.gov/News/docs.htm?docid=15572)
  - Resources
    - Buzz About Bees http://www.buzzaboutbees.net/about-bees.html
    - Dancing Honeybee Using Vector Calculus to Communicate http://www.youtube.com/watch?v=4NtegAOQpSs
    - Honeybee Waggle Dance Experiment http://www.youtube.com/watch?v=ywdTfEBVcSY
    - Unsolved Mystery: Vanishing Bees Stump Scientists http://www.cbn.com/media/player/index.aspx?s=/mp4/MMA219v1_WS
    - The Plight of the Bumblebee: Why are they Disappearing? http://www.ars.usda.gov/is/pr/2011/110811.htm

- How Do Plants Make Food?
  - *Video*: Assignment Discovery: Photosynthesis (http://videos.howstuffworks.com/discovery/29603-assignment-discovery-photosynthesis-video.htm)
  - *Article*: Center for Bioenergy & Photosynthesis Why Study Photosynthesis? (http://photoscience.la.asu.edu/photosyn/study.html)
  - Resources
    - Photosynthesis in Action http://www.mofb.org/WebQuest.aspx/Photosynthesis.aspx
    - Photosynthesis Videos
      - Chapter 8 http://vimeo.com/18561766
      - Chapter 9 http://vimeo.com/18561943
    - Photosynthesis Bioflix Animation http://www.blinkx.com/watch-video/photosynthesis-bioflix-animation/zWVQ8TsGQEG7FGsd2MWPTw
    - "Solar Fuel" Research Mimics Photosynthesis http://news.cnet.com/8301-11128_3-20052710-54.html
    - Green Machine: Artificial Leaf Mimics Photosynthesis http://www.newscientist.com/blogs/onepercent/2011/03/green-machine.html

- Pecan Power!
  - *Video*: Sahuarita Pecan Harvest Produces High Yield (http://www.kvoa.com/player/?video_id=4388)
  - *Video*: Pecan Harvesting (http://youtu.be/yTbKhnp0wH0)
  - *Article*: Pecan - Carya illinoensis (http://fruit-crops.com/pecan)
  - Resources
    - The Pecan Store -Why Pecans? http://www.pecanstore.com/whypecan.asp
    - National Pecan Shellers Association http://www.ilovepecans.org/history.html & http://www.ilovepecans.org/industry_profile.html
    - Going Nuts http://www.azcentral.com/video/33893908001
    - A New Beginning http://www.americasheartland.org/episodes/episode_503/a_new_beginning.htm
    - Homegrown with Melanie Ohmes: Pecan Oil http://www.youtube.com/watch?v=kknEqNmIMpA&feature=BFa&list=PL81A6B72208531117&index=18
    - Pecan Tree Trimmer http://www.youtube.com/watch?v=_9dq9h_yz08&feature=BFa&list=PL81A6B72208531117&index=42

- Plant Seedling
  - *Video*: Doomsday Vault Protects World's Seeds (http://www.youtube.com/watch?v=lXW_vzQppGI&feature=related)

- *Article*: Desert Plant Seeds Added to International Vault (http://www.uanews.org/node/39144)
- Resources
  - Botany: Plant Parts and Functions http://ag.arizona.edu/pubs/garden/mg/botany/plantparts.html

- Let Us Learn About Lettuce
  - *Video*: Lettuce in January (http://youtu.be/N1UzqqlLPIk)
  - *Video*: Harvesting iceburg lettuce (http://youtu.be/Ec-0KZBb1PM)
  - *Article*: On the Move (http://www.growingproduce.com/recognition/coverstories/?storyid=3753)
  - Resources
    - Vegetable Garden: Selected Vegetable Crops http://ag.arizona.edu/pubs/garden/mg/vegetable/lettuce.html
    - Guidelines for Head Lettuce Production in Arizona http://ag.arizona.edu/crops/vegetables/cropmgt/az1099.html
    - Dole Superkids Encyclopedia of Fruits and Vegetables http://www.dole.com/SuperKids/Encyclopedia/Facts/tabid/831/Default.aspx?contentid=2519
    - Off the Shelf - Lettuce http://www.americasheartland.org/video/off_the_shelf/ah602_off_the_shelf_lettuce.htm
    - Cash Crop http://www.americasheartland.org/episodes/episode_316/cash_crop.html
    - Salad Days in Yuma http://www.youtube.com/watch?v=YTOP2w9a5c8&NR=1
    - Salinas Lettuce Harvest http://www.youtube.com/watch?v=pz5YKNO4Og8&feature=related
    - Salinas Lettuce Fields (en español y muy bueno) http://www.youtube.com/watch?v=GgAZJ66_9bk&feature=related
    - Mistakes in Handling E. Coli Outbreak Causes Furor http://dailyqi.com/?p=35606
    - Arizona Commodity Specific Food Safety Guidelines for the Production and Harvest of Lettuce and Leafy Greens http://www.leafygreenguidance.com/book/export/html/58

- What to Do with Malus Domesticus, Cultivated Apples?
  - *Video*: Pink Lady Apples appearing at Harrods (http://youtu.be/N0WE9LfN_u0)
  - *Article*: How Would You Market an Apple? (http://integratesocial.com/2011/02/18/how-would-you-market-an-apple)
  - Resources
    - Apple - Malus Domesticus http://fruit-crops.com/apple
    - McIntosh Apple Development http://www.botany.org/bsa/misc/mcintosh/mcintosh.html

        - Challenges and Opportunities for Marketing Fruit from the Western Slope of Colorado http://www.coopext.colostate.edu/boulder/ag/pdf/Marketing fruit W CO.thesis.Adrian Card.pdf

- If it Smells Good, is Edible, and Attracts Wildlife, then it's a Practical Garden
    - *Video*: Desert Plants that Attract Hummingbirds (http://youtu.be/3Vtq210Q0C0)
    - *Article*: How to Attract Hummingbirds and Butterflies to your Backyard (http://www.desertusa.com/mag08/jun08/how-to-attract-hummingbirds.html)
    - Resources
        - Arizona Master Gardener Manual http://ag.arizona.edu/pubs/garden/mg
        - Plants in Your Garden http://plantsinyourgarden.com/design.html
        - Digital Learning http://www.dbg.org/education-programs/digital-learning
        - Working the Land - Horticulturalist http://www.americasheartland.org/video/working_the_land/ah622_working_the_land_horticulturist.htm
        - Desert Plants Adaptations http://www.youtube.com/watch?v=px-oPMf5e5c&feature=related
        - Tips on How to Design a Fabulous, Drought-tolerant Garden with a Desert Theme http://www.infobarrel.com/Desert_Landscape_Designing

- Plants, Plants, and More Plants
    - *Video*: Desert Plants – Desert Landscaping (http://youtu.be/nwy1GN73Nv8)
    - *Article*: How Plants Cope with the Desert Climate (http://www.desertmuseum.org/programs/succulents_adaptation.php)
    - Resources
        - Desert Plants and Wildflowers http://www.desertusa.com/flora.html
        - Landscaping for Desert Wildlife http://www.azgfd.gov/w_c/landscaping_desert_wildlife.shtml
        - Shrubs for the Desert and Southwest Gardens http://www.gardening-for-wildlife.com/shrubs-of-the-desert.html

- Where Do they Grow?
    - *Images*: unique-landscapes.com
        - (http://www.unique-landscapes.com/gallery/Design-CAD.html)
        - (http://www.unique-landscapes.com/gallery/Design-3D.html)
    - *Video*: Front Yard - 3D Landscape Design (http://youtu.be/ySoLpZbFuas)
    - *Article*: Arizona Plant Climate Zones (http://aztrees.org/c_az-climate-zones.html)
    - Resources
        - The Land Lovers http://www.thelandlovers.org/index.asp
        - Sunset Plant Finder http://plantfinder.sunset.com/sunset/plant-home.jsp
        - Unique Landscapes http://www.unique-landscapes.com/landscape-portfolio.htm
        - Landscape Architects http://www.bls.gov/oco/ocos039.htm
        - How to Become a Landscape Designer http://www.thebestdegrees.org/how-to-become-a-landscape-designer

- Course Final
  - *Video*: Ed Curry: Meet a Cochise, AZ Specialty Crop (Chili) Farmer (http://youtu.be/G5G4ALvZyfg)
  - *Video*: Jim Graham: Meet a Cochise, AZ Specialty Crop (Pistachios) Farmer (http://youtu.be/jYAirX96L5g)
  - *Video*: Tim Dunn: Meet a Yuma, AZ Specialty Crop Farmer (http://youtu.be/V2g2xPZ-kRE)
  - *Video*: John Boelts: Meet a Yuma, AZ Specialty Crop Farmer (http://youtu.be/ZHYfm9xUm98)
  - *Video*: DeWayne Justice: Meet a Waddell, AZ Specialty Crop Farmer (http://youtu.be/96vvC5c2p68)
  - *Article*: Definition of Specialty Crops (http://www.ams.usda.gov/AMSv1.0/scbgpdefinitions)

Appendix B

In the Field Pre-Survey Questions

1. What does the word silo mean?
    a. Tall, round buildings to store food for animals on a farm
    b. Machines used to milk cows
    c. To plow up dirt
    d. I don't know

2. What is the process called that brings water from rivers and lakes to the farms through ditches?
    a. Harvesting
    b. Irrigation
    c. Transportation
    d. I don't know

3. What physics process gets water out of a ditch, through a tube, and onto a field?
    a. Gravity
    b. Centrifugal force
    c. Equalization of air pressure
    d. I don't know

4. All fruits…
    a. are sweet.
    b. grow on trees.
    c. have seeds.
    d. I don't know

5. All vegetables…
    a. grow on vines.
    b. are the root, stem, or leaf parts of a plant.
    c. do not have seeds.
    d. Answers b and c
    e. I don't know

6. Lettuce, oranges, and apples…
    a. all grow in Arizona.
    b. are all fruit.
    c. grow on trees.
    d. I don't know

7. Chlorophyll gives leaves their green color and…
    a. makes roots strong.
    b. absorbs water into the leaf.
    c. absorbs energy from sunlight.
    d. I don't know

8. Photosynthesis is the process used to develop film before digital photos.
    a. True
    b. False
    c. I don't know

9. How can you tell if a plant is not getting enough sunlight?
    a. Its leaves turn yellow.
    b. Its roots grow deeper.
    c. It gives off lots of oxygen.
    d. I don't know

10. What are the three main parts of a plant?
    a. Root, stem, and leaf
    b. Vine, branch, and tree
    c. Bush, thorn, and flower
    d. I don't know

11. Roots…
    a. are not edible.
    b. produce pollen.
    c. transport nutrients and water to the plant.
    d. I don't know

12. Broccoli, cauliflower, and dandelions are examples of what part of the plant?
    a. Stem
    b. Flower
    c. Leaf
    d. I don't know

13. Seeds store all the food that they need to start a plant.
    a. True
    b. False
    c. I don't know

14. The epicotyl is the…
    a. shell exterior of a seed.
    b. embryonic leaf inside the seed.
    c. leaf at the apex of a plant.
    d. I don't know

15. Germination refers to…
    a. an illness or defect in a seed.
    b. bugs eating the seed instead of growing.
    c. when the plant emerges from the seed.
    d. I don't know

16. *Pecan* is an Algonquian (Native American tribe) word that means…
    a. a nut growing on a vine.
    b. a nut requiring a stone to crack.
    c. a nut tasting good.
    d. I don't know

17. Pecans grow…
    a. on vines.
    b. on trees.
    c. underground
    d. I don't know

18. Who used pecans to make ink for writing?
    a. Navajos
    b. Cave dwellers
    c. Colonist
    d. I don't know

19. Plants must have at least these four things to grow.
    a. Carbon dioxide, light, nutrients, and water
    b. Dirt, oxygen, water, and wind
    c. Farmer, sun, tools, and water
    d. I don't know

20. Which of the following are common nutrients that could be added to soil to help plants grow?
    a. Oxygen and water
    b. Manure and worm castings
    c. Metal and wood
    d. I don't know

21. Plants and people have the same basic needs for survival.
    a. True
    b. False
    c. I don't know

22. How many cups of fruit do I need each day?
    a. 1½ – 2 cups
    b. 2½ – 3 cups
    c. 3½ cups or more
    d. I don't know

23. How many cups of vegetables do I need each day?
    a. 1 – 1½ cups
    b. 2 – 3 cups
    c. 3½ cups or more
    d. I don't know

24. Why is a fruit (like an apple) or a vegetable (like a carrot) a better snack choice than Hot Cheetos®?
    a. Fruits & vegetables make us feel less hungry after eating them.
    b. Fruits & vegetables have more vitamins & minerals which make our bodies work properly.
    c. Fruits & vegetables are give us more energy and less fat & calories.
    d. All the above
    e. I don't know

25. How likely are you to choose to eat fruit?

Not at all likely		Likely		Very likely
1	2	3	4	5

26. How likely are you to choose to eat a vegetable?

Not at all likely		Likely		Very likely
1	2	3	4	5

27. How likely are you to try a *new* fruit?

Not at all likely		Likely		Very likely
1	2	3	4	5

28. How likely are you to try a *new* vegetable?

Not at all likely		Likely		Very likely
1	2	3	4	5

29. How likely are you to ask your parent/guardian to provide you fruits to eat?

Not at all likely		Likely		Very likely
1	2	3	4	5

30. How likely are you to ask your parent/guardian to provide you vegetables to eat?

Not at all likely		Likely		Very likely
1	2	3	4	5

In the Field Survey Answers

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    c. Colonist
    d. I don't know

19. Plants must have at least these four things to grow.
    a. Carbon dioxide, light, nutrients, and water
    b. Dirt, oxygen, water, and wind
    c. Farmer, sun, tools, and water
    d. I don't know

20. Which of the following are common nutrients that could be added to soil to help plants grow?
    a. Oxygen and water
    b. Manure and worm castings
    c. Metal and wood
    d. I don't know

21. Plants and people have the same basic needs for survival.
    a. True
    b. False
    c. I don't know

22. How many cups of fruit do I need each day?
    a. 1½ – 2 cups
    b. 2½ – 3 cups
    c. 3½ cups or more
    d. I don't know

23. How many cups of vegetables do I need each day?
    a. 1 – 1½ cups
    b. 2 – 3 cups
    c. 3½ cups or more
    d. I don't know

24. Why is a fruit (like an apple) or a vegetable (like a carrot) a better snack choice than Hot Cheetos®?
    a. Fruits & vegetables make us feel less hungry after eating them.
    b. Fruits & vegetables have more vitamins & minerals which make our bodies work properly.
    c. Fruits & vegetables are give us more energy and less fat & calories.
    d. All the above
    e. I don't know

25. How likely are you to choose to eat fruit?

Not at all likely		Likely		Very likely
1	2	3	4	5

26. How likely are you to choose to eat a vegetable?

Not at all likely		Likely		Very likely
1	2	3	4	5

27. How likely are you to try a *new* fruit?

Not at all likely		Likely		Very likely
1	2	3	4	5

28. How likely are you to try a *new* vegetable?

Not at all likely		Likely		Very likely
1	2	3	4	5

29. How likely are you to ask your parent/guardian to provide you fruits to eat?

Not at all likely		Likely		Very likely
1	2	3	4	5

30. How likely are you to ask your parent/guardian to provide you vegetables to eat?

Not at all likely		Likely		Very likely
1	2	3	4	5

In the Field with Arizona Agriculture Survey Analysis
Fall 2009

Surveys were given to the fourth, fifth, and sixth graders from two elementary schools one week prior to the agriculture fair and again one week after the event to those students who participated in the event. Respondents were asked 24 multiple choice questions to ascertain their agricultural knowledge and six questions designed to measure their desire and likelihood of eating fruits and vegetables. The event consisted of students participating at eight agriculture related booths for approximately 15 minutes each. Three multiple choice questions were generated based upon the information taught at each of the eight individual booths. Together, these questions comprised the 24 knowledge-based questions in the survey.

Demographics:
Since respondents are minors, parental permission would be required if any personal identification were to be gathered. Obtaining parental permission proves to be a lengthy process and potentially decreases the number of student respondents. In order to retain as many respondents as possible, students were not asked to report any personal identifying information. Demographic data comes from those who participated in the agriculture fair.

There were a total of 429 student participants; 126 were 4^{th} graders, 173 were 5^{th} graders, and 130 were 6^{th} graders. Racial/Ethnic breakdown for each grade is as follows:
4^{th} grade 53 Hispanic, 45 white, 17 black, 9 Native American, & 2 Asian American;
5^{th} grade 80 Hispanic, 64 white, 11 black, 14 Native American, & 4 Asian American;
6^{th} grade 64 Hispanic, 48 white, 10 black, 6 Native American, & 2 Asian American.

Results:
The following questions are *very highly* statistically significant ($p < .000$ at the $\alpha=.05$ level). This is to say that there is less than a 0.1% chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is greater than a 99.9% chance that the change in students' mean scores is attributed to the agriculture fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
1	What does the word silo mean?	*Tall, round buildings to store food for animals on a farm*	.000	0.33	0.63	90.9%
2	What is the process called that brings water from rivers and lakes to the farms through ditches?	*Irrigation*	.000	0.49	0.66	34.7%
3	What physics process gets water out of a ditch, through a tube, and onto a field?	*Equalization of air pressure*	.000	0.28	0.47	67.9%
4	All fruits…	*have seeds.*	.000	0.59	0.88	49.2%
6	Lettuce, oranges, and apples…	*all grow in Arizona.*	.000	0.40	0.57	42.5%
7	Chlorophyll gives leaves their green color and…	*absorbs energy from sunlight.*	.000	0.28	0.51	82.1%
8	Photosynthesis is the process used to develop film before digital photos.	*False*	.000	0.37	0.61	64.9%

9	How can you tell if a plant is not getting enough sunlight?	*Its leaves turn yellow.*	.000	0.64	0.88	37.5%
12	Broccoli, cauliflower, and dandelions are examples of what part of the plant?	*Flower*	.000	0.39	0.58	48.7%
13	Seeds store all the food that they need to start a plant.	*True*	.000	0.60	0.75	25.0%
15	Germination refers to…	*when the plant emerges from the seed.*	.000	0.23	0.47	104.3%
16	*Pecan* is an Algonquian (Native American tribe) word that means…	*a nut requiring a stone to crack.*	.000	0.24	0.64	166.7%
17	Pecans grow…	*on trees.*	.000	0.28	0.55	96.4%
18	Who used pecans to make ink for writing?	*Colonist*	.000	0.17	0.63	270.6%
21	Plants and people have the same basic needs for survival.	*True*	.000	0.59	0.77	30.5%
22	How many cups of fruit do I need each day?	*1½ – 2 cups*	.000	0.20	0.55	175.0%
23	How many cups of vegetables do I need each day?	*2 – 3 cups*	.000	0.33	0.56	69.7%

***

The following questions are *highly* statistically significant ($p \leq .010$ at the $\alpha=.05$ level). This is to say that there is a 1% chance or less that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is a 99% chance or greater that the change in students' mean scores is attributed to the agriculture fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
11	Roots…	*transport nutrients and water to the plant.*	.005	0.71	0.80	12.7%
14	The epicotyl is the…	*embryonic leaf inside the seed.*	.008	0.16	0.24	50.0%
19	Plants must have at least these four things to grow.	*Carbon dioxide, light, nutrients, and water*	.010	0.62	0.70	12.9%
25	How likely are you to choose to eat fruit?	Not at all likely 1 2 Likely 3 4 Very likely 5	.005	3.92	4.14	5.6%

***

In the Field with Arizona Agriculture Survey Analysis
Fall 2009

The following questions are statistically significant ($p < .050$ at the $\alpha=.05$ level). This is to say that there is less than a 5% chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is greater than a 95% chance that the change in students' mean scores is attributed to the agricultural fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
10	What are the three main parts of a plant?	*Root, stem, and leaf*	.036	0.85	0.90	5.9%
29	How likely are you to ask your parent/guardian to provide you fruits to eat?	Not at all likely 1 2 Likely 3 4 Very likely 5	.023	3.68	3.88	5.4%

***

The following question is *close* to being statistically significant ($.050 < p < .100$ at the $\alpha=.05$ level) but mathematically speaking, there is too great of a possibility that the change in mean scores is due to chance and not the agriculture fair alone. This is to say that there is less than a 10% chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is greater than a 90% chance that the change in students' mean scores is attributed to the agricultural fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
30	How likely are you to ask your parent/guardian to provide you vegetables to eat?	Not at all likely 1 2 Likely 3 4 Very likely 5	.065	2.74	2.94	7.3%

***

The following questions are *not* statistically significant ($p > .100$ at the $\alpha=.05$ level). This is to say that there is greater than a 10% chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is less than a 90% chance that the change in students' mean scores is attributed to the agricultural fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
20	Which of the following are common nutrients that could be added to soil to help plants grow?	*Manure and worm castings*	.163	0.36	0.42	16.7%
27	How likely are you to try a *new* fruit?	Not at all likely 1 2 Likely 3 4 Very likely 5	.159	3.51	3.66	4.3%

***

In the Field with Arizona Agriculture Survey Analysis
Fall 2009

The following questions are *extremely* statistically *in*significant ($p > .700$ at the $\alpha=.05$ level) inferring that the changes in mean scores are completely due to chance. This is to say that there is greater than a 70% chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is less than a 30% chance that the change in students' mean scores is attributed to the agriculture fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
5	All vegetables…	a. grow on vines. b. are the root, stem, or leaf parts of a plant. c. do not have seeds. **d. Answers b and c** *e.* I don't know	.886	0.36	0.37	2.8%
24	Why is a fruit (like an apple) or a vegetable (like a carrot) a better snack choice than Hot Cheetos®?	a. Fruits & vegetables make us feel less hungry after eating them. b. Fruits & vegetables have more vitamins & minerals which make our bodies work properly. c. Fruits & vegetables are give us more energy and less fat & calories. **d. All the above** e. I don't know	.829	0.31	0.32	3.2%
26	How likely are you to choose to eat a vegetable?	Not at all likely 1 2 Likely 3 4 Very likely 5	.763	3.11	3.07	-1.3%
28	How likely are you to try a *new* vegetable?	Not at all likely 1 2 Likely 3 4 Very likely 5	.727	2.77	2.75	-0.7%

Conclusion:
All but three of the 24 knowledge-based questions (5, 20, & 24) were statistically significant. This means that 1) the students as a whole were able to answer these 21 questions more correctly, that 2) this increased ability was substantial, and that 3) their ability to do so is due to what they learned at the agriculture fair.

In regards to consuming fruits, the data infers that students' likelihood of choosing to eat a fruit and asking their parents to provide them with fruit to eat increased substantially due to their participation in the agriculture fair. There was no statistical difference in the change of students' choices regarding vegetables; although, the question asking *How likely are you to ask your*

parent/guardian to provide you vegetables to eat? was close to being statistically significant. There is a 93.5% chance that the change in students' mean scores for this question is attributed to the agricultural fair.

For question 5 (*see above table*), which asks respondents to complete the sentence in regards to all vegetables, it is believed that the answer was too complex as it required two statements to make the answer correct. Most respondents who did not mark 'd' did mark either 'b' or 'c;' therefore, it can be concluded that a partial understanding of the concepts as to what makes a vegetable a vegetable was obtained.

For question 24 (*see above table*), which asks respondents to identify *why a fruit or a vegetable is a better snack choice than Hot Cheetos* may be a function of time limitation. Each of the correct answers comes from separate discussion material that may not have been addressed in appropriate depth.

Questions 5 and 24 will need to be re-examined for future usage.

The agriculture fair proves to have been a successful event in increasing student's knowledge of agriculture and important health choices. As such, it is a worthwhile event to provide to more elementary school students and should be explored to older and younger participants.

MESA
PUBLIC SCHOOLS

February 2, 2010

Dear Colleague,

Nicolas Z. Parker
Principal
Ida Redbird
Elementary School

1020 South Extension Road
Mesa, Arizona
85210-3498
www.mpsaz.org

(480) 472-1200
Fax (480) 472-1290

I am happy to endorse the *In the Field with Arizona Agriculture* program and highly recommend it to your school, students, and teachers. This free program was made possible through a grant received by the University of Arizona. Redbird Elementary School fourth, fifth, and sixth grade students participated in an agricultural fair designed to educate students and teachers about our connection to agriculture.

Over the course of two hours, students and teachers visited eight interactive booths and learned about 1) the different parts of a plant, 2) what a plant needs to grow, 3) photosynthesis, 4) the parts of a seed and how it germinates, 5) the differences between fruits and vegetables, 6) nutritional decision making – *they were also able to taste a locally grown fruit & vegetable*, 7) Arizona's connection to pecans – *students also practiced calligraphic writing with real pecan ink*, and 8) what takes place on modern-day farms – *participants were also able to siphon water similarly to how fields are irrigated.* The program personnel were well organized and provided our students a highly educational opportunity with very little disruption to Redbird's normal schedule.

One week prior to the agriculture fair, the agricultural knowledge of our students was assessed via a 30 item questionnaire and measured again one week after the event. I am pleased to report that students' understanding of agriculture and the components taught at the fair increased significantly.

Our students not only had a wonderful time at this event, but they also learned a great deal about an important component of life in a highly hands-on fashion. I strongly encourage your school to participate in this educational fair.

Sincerely,

Nicolas Parker

MESA
PUBLIC SCHOOLS

January 31st, 2010

Dear Colleague,

I would like to take this opportunity to highly recommend the project In the Field with Arizona Agriculture. Our school, Washington Elementary in the Mesa Public School District was offered the chance to have 4th, 5th, and 6th grade students participate in a unique field trip to educate students on aspects of Agriculture.

Michele Grimaldi
Principal
Washington Elementary School

2260 West Isabella Avenue
Mesa, Arizona
85202-5599
www2.mpsaz.org

(480) 472-4100

The event was an "agriculture fair" sponsored by a grant through the University of Arizona, and held at nearby Redbird Elementary. At the fair, Washington students participated in eight stations that included:

1) Parts of a the plant
2) Pecan Power
3) Soggy Seeds/Germination
4) Photosynthesis
5) Cultivating
6) Nutrition
7) Irrigation/Farmer story time
8) Sorting fruit vs. vegetables

Before the day of the event students participated in taking a pre test to judge their perception of Agriculture, and after the event a post test of their perceptions. Representatives of the grant made the event, transportation, planning, and materials easy to implement.

Our students enjoyed participating in the event and learned a great deal about the importance of Agriculture. We would eagerly take advantage of another opportunity provided by the grant, and recommend that other elementary schools participate.

Sincerely,

Michele Grimaldi

In the Field with Arizona Agriculture

Brandon Moak

Agriculture Literacy Program

University of Arizona

Cooperative Extension, Maricopa County

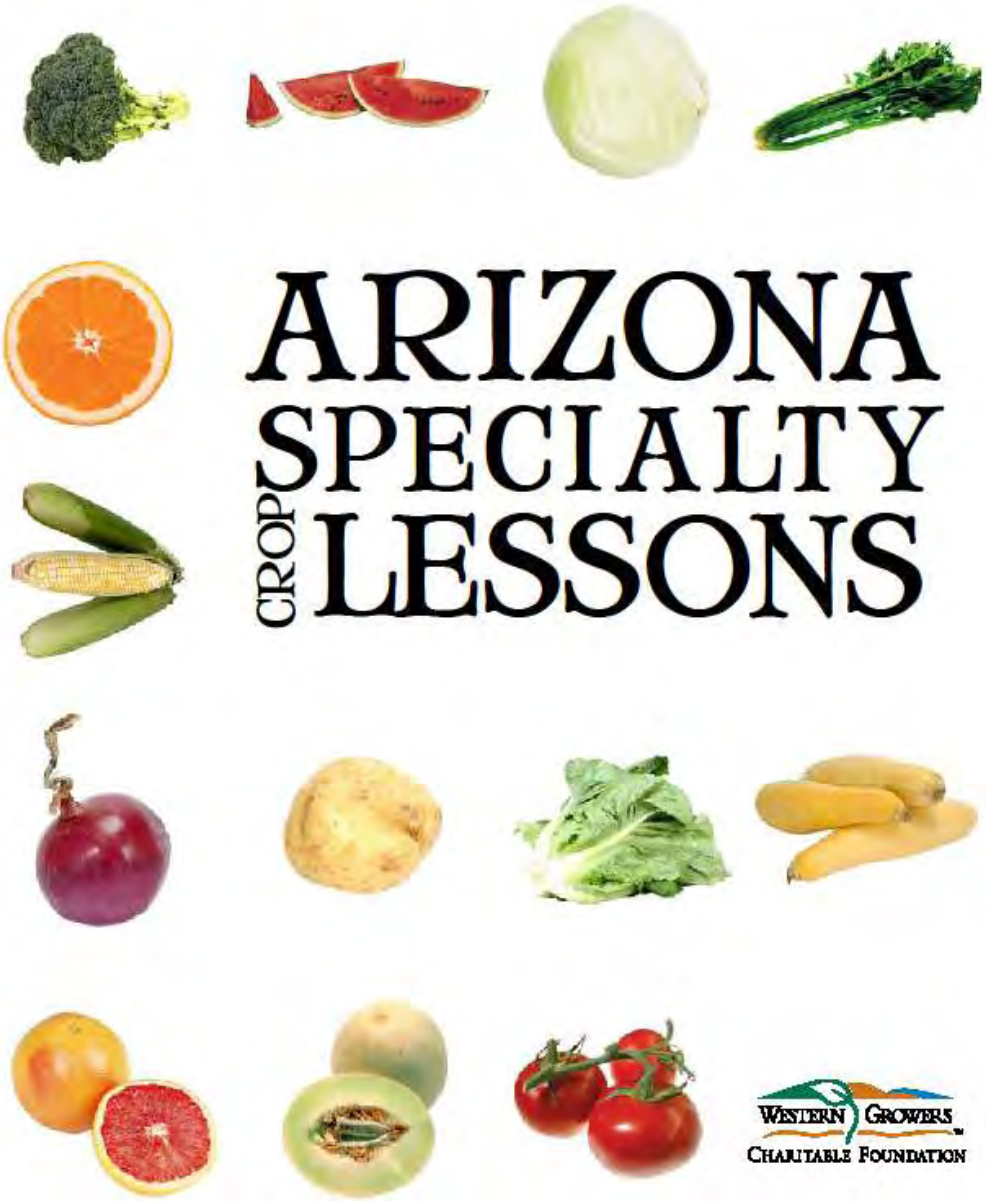
Program Funding

- Arizona Department of Agriculture
  - Specialty Crop Block Grant

- $20,000 (one year)
  - Salaries & Benefits
  - In-Sate Travel
  - Operating Expenses

Project Purpose

- Educate students and teachers
  - Connection to agriculture
  - Importance of healthy eating
- Provide agricultural education resources to teachers



ARIZONA SPECIALTY CROP LESSONS

Western Growers Charitable Foundation

Arizona Specialty Crop Lessons

- Developed by
  - UA Cooperative Extension, Maricopa Co.
  - AZ Foundation for Agriculture Literacy
  - AZ Teachers (participants of Summer Ag Inst)
    - 5-day tour of AZ agriculture operations & research lab
    - Incorporate experiences & knowledge into the classroom
- Lessons aligned to Arizona's Academic Standards
  - Math, Science, Language Arts

Agriculture Fair

8 Experiential Booths

1. Living on Farms
2. Pecan Power
3. Soggy Seeds
4. It All Starts with ‘A’
5. Parts of a Plant
6. How Do Plants Make Food?
7. Fruits and Veggies
8. Arizona Grown Nutrition

Living on Farms

- Local farmers
- Read *Living on Farms*
- Practiced irrigation

Pecan Power

- Uses of pecans
- How to make pecan ink
- Calligraphic writing

Soggy Seeds

- Dissected soaked lima beans
- Germination
- *Lima Babies*

It All Starts with 'A'

- Agriculture's connection to survival
- What a plant needs to grow
- Plant Bracelets
  - Sun
  - Soil
  - Air
  - Water
  - Seed
  - Love (farmer)

Parts of a Plant

- Three main parts of a plant
- Functions of the root, stem, and leaf
- Flowers are where fruit develops on a plant

How Do Plants Make Food?

- Photosynthesis
- Oxygen bubbles on leaves
- Foil on leaves

Fruits and Veggies

- Differences between fruits & vegetables
- Sorting activity
- Daily recommended servings for fruits and vegetables

Arizona Grown Nutrition

- Nutritional decision making
- Food pyramid Jeopardy
- Eat a fig & a cauliflower

Evaluation

- Participants
- Pre- and Post Test
- Test Analysis

Participants

- 2 Elementary Schools (AM *then* PM)
- 4th, 5th, and 6th graders
- 429 students
  - 46% Hispanic
  - 37% White
  - 9% Black
  - 7% Native American
  - 2% Asian American

Pre- and Post-Test

- Two parts

1. 24 questions – agriculture knowledge
   - 3 questions on each of the 8 booths

2. 6 questions – assess desire to eat fruits & veggies

- Understanding *p* values
  - .000 – .050 is statistically significant
  - 95% – 100% chance that hypothesis is correct

Test Analysis

Living on Farms

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
What does the word silo mean?	*Tall, round buildings to store food for animals on a farm*	.000	0.33	0.63	90.9%
What is the process called that brings water from rivers and lakes to the farms through ditches?	*Irrigation*	.000	0.49	0.66	34.7%
What physics process gets water out of a ditch, through a tube, and onto a field?	*Equalization of air pressure*	.000	0.28	0.47	67.9%

Test Analysis

Pecan Power

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
Pecan is an Algonquian (Native American tribe) word that means…	*a nut requiring a stone to crack.*	.000	0.24	0.64	166.7%
Pecans grow…	*on trees.*	.000	0.28	0.55	96.4%
Who used pecans to make ink for writing?	*Colonist*	.000	0.17	0.63	270.6%

Test Analysis

Soggy Seeds

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
Seeds store all the food that they need to start a plant.	*True*	**.000**	0.60	0.75	25.0%
The epicotyl is the…	*embryonic leaf inside the seed.*	**.008**	0.16	0.24	50.0%
Germination refers to…	*when the plant emerges from the seed.*	**.000**	0.23	0.47	104.3%

Test Analysis
It All Starts with 'A'

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
Plants must have at least these four things to grow.	*Carbon dioxide, light, nutrients, and water*	**.010**	0.62	0.70	12.9%
Which of the following are common nutrients that could be added to soil to help plants grow?	a) *Oxygen & water* **b) *Manure & worm castings*** c) *Metal & wood* d) *I don't know*	.163	0.36	0.42	16.7%
Plants and people have the same basic needs for survival.	*True*	**.000**	0.59	0.77	30.5%

Test Analysis

Parts of a Plant

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
What are the three main parts of a plant?	*Root, stem, and leaf*	**.036**	0.85	0.90	5.9%
Roots…	*transport nutrients and water to the plant.*	**.005**	0.71	0.80	12.7%
Broccoli, cauliflower, and dandelions are examples of what part of the plant?	*Flower*	**.000**	0.39	0.58	48.7%

Test Analysis

How Do Plants Make Food?

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
Chlorophyll gives leaves their green color and…	*absorbs energy from sunlight.*	.000	0.28	0.51	82.1%
Photosynthesis is the process used to develop film before digital photos.	*False*	.000	0.37	0.61	64.9%
How can you tell if a plant is not getting enough sunlight?	*Its leaves turn yellow.*	.000	0.64	0.88	37.5%

Test Analysis
Fruits and Veggies

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
All fruits…	*have seeds.*	**.000**	0.59	0.88	49.2%
All vegetables…	a) grow on vines. b) are the root, stem, or leaf parts of a plant. c) do not have seeds. **d) Both b and c** e) I don't know	.886	0.36	0.37	2.8%
Lettuce, oranges, and apples…	*all grow in Arizona.*	**.000**	0.40	0.57	42.5%

Test Analysis

Arizona Grown Nutrition

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
How many cups of fruit do I need each day?	*1½ – 2 cups*	**.000**	0.20	0.55	175.0%
How many cups of vegetables do I need each day?	*2 – 3 cups*	**.000**	0.33	0.56	69.7%
Why is a fruit (like an apple) or a vegetable (like a carrot) a better snack choice than Hot Cheetos®?	a) *They make us feel less hungry after eating them.* b) *They have more vitamins & minerals which make our bodies work properly.* c) *They are give us more energy and less fat & calories.* **d) *All the above*** e) *I don't know*	.829	0.31	0.32	3.2%

Test Analysis

Desire to eat FRUIT

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
How likely are you to choose to eat fruit?	Not at all likely 1 2 Likely 3 4 Very likely 5	.005	3.92	4.14	5.6%
How likely are you to try a *new* fruit?	Not at all likely 1 2 Likely 3 4 Very likely 5	.159	3.51	3.66	4.3%
How likely are you to ask your parent/guardian to provide you fruits to eat?	Not at all likely 1 2 Likely 3 4 Very likely 5	.023	3.68	3.88	5.4%

Test Analysis

Desire to eat a VEGETABLE

Question	Answer	*p* value	Pre-test Mean	Post-test Mean	Mean % Change
How likely are you to choose to eat a vegetable?	Not at all likely 1 2 Likely 3 4 Very likely 5	.763	3.11	3.07	-1.3%
How likely are you to try a *new* a vegetable?	Not at all likely 1 2 Likely 3 4 Very likely 5	.727	2.77	3.66	-0.7%
How likely are you to ask your parent/guardian to provide you vegetables to eat?	Not at all likely 1 2 Likely 3 4 Very likely 5	.065	2.74	2.75	7.3%

QUESTIONS?

Brandon Moak
BMoak@cals.arizona.edu
602-827-8200 x 389

In the Field Pre-Survey Questions

1. What does the word silo mean?
    a. Tall, round buildings to store food for animals on a farm
    b. Machines used to milk cows
    c. To plow up dirt
    d. I don't know

2. What is the process called that brings water from rivers and lakes to the farms through ditches?
    a. Harvesting
    b. Irrigation
    c. Transportation
    d. I don't know

3. What physics process gets water out of a ditch, through a tube, and onto a field?
    a. Gravity
    b. Centrifugal force
    c. Equalization of air pressure
    d. I don't know

4. All fruits…
    a. are sweet.
    b. grow on trees.
    c. have seeds.
    d. I don't know

5. All vegetables…
    a. grow on vines.
    b. are the root, stem, or leaf parts of a plant.
    c. grow above the ground.
    d. I don't know

6. Lettuce, oranges, and apples…
    a. all grow in Arizona.
    b. are all fruit.
    c. grow on trees.
    d. I don't know

7. Chlorophyll gives leaves their green color and…
    a. makes roots strong.
    b. absorbs water into the leaf.
    c. absorbs energy from sunlight.
    d. I don't know

8. Photosynthesis is the process used to develop film before digital photos.
    a. True
    b. False
    c. I don't know

9. How can you tell if a plant is not getting enough sunlight?
    a. Its leaves turn yellow.
    b. Its roots grow deeper.
    c. It gives off lots of oxygen.
    d. I don't know

10. What are the three main parts of a plant?
    a. Root, stem, and leaf
    b. Branch, pod, and seed
    c. Bush, thorn, and flower
    d. I don't know

11. Roots…
    a. are not edible.
    b. produce pollen.
    c. transport nutrients and water to the plant.
    d. I don't know

12. Broccoli, cauliflower, and dandelions are examples of what part of the plant?
    a. Stem
    b. Flower
    c. Leaf
    d. I don't know

13. Seeds store all the food that they need to start a plant.
    a. True
    b. False
    c. I don't know

14. The epicotyl is the…
    a. shell exterior of a seed.
    b. embryonic leaf inside the seed.
    c. leaf at the apex of a plant.
    d. I don't know

15. Germination refers to…
    a. an illness or defect in a seed.
    b. bugs eating the seed instead of growing.
    c. when the plant emerges from the seed.
    d. I don't know

16. *Pecan* is an Algonquian (Native American tribe) word that means…
    a. a nut growing on a vine.
    b. a nut requiring a stone to crack.
    c. a nut tasting good.
    d. I don't know

17. Pecans grow…
    a. on vines.
    b. on trees.
    c. underground
    d. I don't know

18. Who used pecans to make ink for writing?
    a. Navajos
    b. Cave dwellers
    c. Colonist
    d. I don't know

19. Plants must have at least these four things to grow.
    a. Carbon dioxide, light, nutrients, and water
    b. Soil, oxygen, water, and wind
    c. Farmer, sun, tools, and water
    d. I don't know

20. Which of the following are common nutrients that could be added to soil to help plants grow?
    a. Oxygen and water
    b. Manure and worm castings
    c. Metal and wood
    d. I don't know

21. Plants and people have the same basic needs for survival.
    a. True
    b. False
    c. I don't know

22. How many cups of fruit do I need each day?
    a. 1½ – 2 cups
    b. 2½ – 3 cups
    c. 3½ cups or more
    d. I don't know

23. How many cups of vegetables do I need each day?
    a. 1 – 1½ cups
    b. 2 – 3 cups
    c. 3½ cups or more
    d. I don't know

24. Why is a fruit or a vegetable a better snack choice than fried potato chips?
    a. Fruits & vegetables make my body want to drink more water.
    b. Fruits & vegetables have very little fiber.
    c. Fruits & vegetables give us more energy and less fat & calories.
    d. I don't know

25. How likely are you to choose to eat a <u>fruit</u>?

Not at all likely		Likely		Very likely
1	2	3	4	5

26. How likely are you to choose to eat a <u>vegetable</u>?

Not at all likely		Likely		Very likely
1	2	3	4	5

27. How likely are you to try a *new* <u>fruit</u>?

Not at all likely		Likely		Very likely
1	2	3	4	5

28. How likely are you to try a *new* <u>vegetable</u>?

Not at all likely		Likely		Very likely
1	2	3	4	5

29. How likely are you to ask your parent/guardian to provide you <u>fruits</u> to eat?

Not at all likely		Likely		Very likely
1	2	3	4	5

30. How likely are you to ask your parent/guardian to provide you <u>vegetables</u> to eat?

Not at all likely		Likely		Very likely
1	2	3	4	5

31. What is a <u>fruit</u> you like to eat?

    Please legibly print your answer on your scantron to the right of the letter E for question number 31.

32. What is a <u>vegetable</u> you like to eat?

    Please legibly print your answer on your scantron to the right of the letter E for question number 32.

In the Field Survey Answers

1. What does the word silo mean?
    a. Tall, round buildings to store food for animals on a farm
    b. Machines used to milk cows
    c. To plow up dirt
    d. I don't know

2. What is the process called that brings water from rivers and lakes to the farms through ditches?
    a. Harvesting
    b. Irrigation
    c. Transportation
    d. I don't know

3. What physics process gets water out of a ditch, through a tube, and onto a field?
    a. Gravity
    b. Centrifugal force
    c. Equalization of air pressure
    d. I don't know

4. All fruits…
    a. are sweet.
    b. grow on trees.
    c. have seeds.
    d. I don't know

5. All vegetables…
    a. grow on vines.
    b. are the root, stem, or leaf parts of a plant.
    c. grow above the ground.
    d. I don't know

6. Lettuce, oranges, and apples…
    a. all grow in Arizona.
    b. are all fruit.
    c. grow on trees.
    d. I don't know

7. Chlorophyll gives leaves their green color and…
    a. makes roots strong.
    b. absorbs water into the leaf.
    c. absorbs energy from sunlight.
    d. I don't know

8. Photosynthesis is the process used to develop film before digital photos.
    a. True
    b. False
    c. I don't know

9. How can you tell if a plant is not getting enough sunlight?
    a. Its leaves turn yellow.
    b. Its roots grow deeper.
    c. It gives off lots of oxygen.
    d. I don't know

10. What are the three main parts of a plant?
    a. Root, stem, and leaf
    b. Branch, pod, and seed
    c. Bush, thorn, and flower
    d. I don't know

11. Roots…
    a. are not edible.
    b. produce pollen.
    c. transport nutrients and water to the plant.
    d. I don't know

12. Broccoli, cauliflower, and dandelions are examples of what part of the plant?
    a. Stem
    b. Flower
    c. Leaf
    d. I don't know

13. Seeds store all the food that they need to start a plant.
    a. True
    b. False
    c. I don't know

14. The epicotyl is the…
    a. shell exterior of a seed.
    b. embryonic leaf inside the seed.
    c. leaf at the apex of a plant.
    d. I don't know

15. Germination refers to…
    a. an illness or defect in a seed.
    b. bugs eating the seed instead of growing.
    c. when the plant emerges from the seed.
    d. I don't know

16. *Pecan* is an Algonquian (Native American tribe) word that means…
    a. a nut growing on a vine.
    b. a nut requiring a stone to crack.
    c. a nut tasting good.
    d. I don't know

In the Field Survey Answers

17. Pecans grow…
    a. on vines.
    b. on trees.
    c. underground
    d. I don't know

18. Who used pecans to make ink for writing?
    a. Navajos
    b. Cave dwellers
    c. Colonist
    d. I don't know

19. Plants must have at least these four things to grow.
    a. Carbon dioxide, light, nutrients, and water
    b. Soil, oxygen, water, and wind
    c. Farmer, sun, tools, and water
    d. I don't know

20. Which of the following are common nutrients that could be added to soil to help plants grow?
    a. Oxygen and water
    b. Manure and worm castings
    c. Metal and wood
    d. I don't know

21. Plants and people have the same basic needs for survival.
    a. True
    b. False
    c. I don't know

22. How many cups of fruit do I need each day?
    a. 1½ – 2 cups
    b. 2½ – 3 cups
    c. 3½ cups or more
    d. I don't know

23. How many cups of vegetables do I need each day?
    a. 1 – 1½ cups
    b. 2 – 3 cups
    c. 3½ cups or more
    d. I don't know

24. Why is a fruit or a vegetable a better snack choice than fried potato chips?
    a. Fruits & vegetables make my body want to drink more water.
    b. Fruits & vegetables have very little fiber.
    c. Fruits & vegetables give us more energy and less fat & calories.
    d. I don't know

25. How likely are you to choose to eat a fruit?

Not at all likely		Likely		Very likely
1	2	3	4	5

26. How likely are you to choose to eat a vegetable?

Not at all likely		Likely		Very likely
1	2	3	4	5

27. How likely are you to try a *new* fruit?

Not at all likely		Likely		Very likely
1	2	3	4	5

28. How likely are you to try a *new* vegetable?

Not at all likely		Likely		Very likely
1	2	3	4	5

29. How likely are you to ask your parent/guardian to provide you fruits to eat?

Not at all likely		Likely		Very likely
1	2	3	4	5

30. How likely are you to ask your parent/guardian to provide you vegetables to eat?

Not at all likely		Likely		Very likely
1	2	3	4	5

31. What is a fruit you like to eat?

Please legibly print your answer on your scantron to the right of the letter E for question number 31.

32. What is a vegetable you like to eat?

Please legibly print your answer on your scantron to the right of the letter E for question number 32.

In the Field with Arizona Agriculture Survey Analysis
Spring 2010

Surveys were given to the fourth, fifth, and sixth graders from two elementary schools one week prior to the agriculture fair and again to participating students one week after the event. Respondents were asked 24 multiple choice questions to ascertain their agricultural knowledge, six questions designed to measure their likelihood of eating fruits and vegetables, and two open-ended questions asking them to list a fruit and vegetable they like to eat. The event consisted of students participating at eight agriculture related booths for approximately 15 minutes each. Three multiple choice questions were generated based upon the information taught at each of the eight individual booths. Together, these questions comprised the 24 knowledge-based questions in the survey.

Demographics:
Since respondents are minors, parental permission would be required if any personal identification were to be gathered. Obtaining parental permission proves to be a lengthy process and potentially decreases the number of student respondents. In order to retain as many respondents as possible, students were not asked to report any personal identifying information. Demographic data comes from those who participated in the agriculture fair as supplied by the schools.

There were a total of 441 student participants (4^{th} graders – 149; 5^{th} graders – 147; 6^{th} graders – 145). Race/Ethnicity and gender are broken down in the table below.

GRADE	GENDER	ETHNICITY					
		Hispanic	White	Black	Native American	Asian American	TOTAL
4th	Male	48	24	4	2		78
	Female	34	27	1	5	4	71
5th	Male	46	22	6	1	1	76
	Female	46	17	6	1	1	71
6th	Male	42	24	8	2	1	77
	Female	38	21	7		2	68
TOTAL		254	135	32	11	9	441

Results:
The following questions are *very highly* statistically significant ($p \leq .001$ at the α=.05 level). This is to say that there is a 0.1% or less chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is a 99.9% or greater chance that the change in students' mean scores is attributed to the agriculture fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
1	What does the word silo mean?	*Tall, round buildings to store food for animals on a farm*	.000	0.491	0.670	36.5%

In the Field with Arizona Agriculture Survey Analysis
Spring 2010

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
2	What is the process called that brings water from rivers and lakes to the farms through ditches?	*Irrigation*	.000	0.494	0.696	40.9%
3	What physics process gets water out of a ditch, through a tube, and onto a field?	*Equalization of air pressure*	.000	0.334	0.564	68.9%
4	All fruits…	*have seeds.*	.000	0.581	0.886	52.5%
5	All vegetables…	*are the root, stem, or leaf parts of a plant.*	.000	0.473	0.830	75.5%
6	Lettuce, oranges, and apples…	*all grow in Arizona.*	.000	0.542	0.673	24.2%
7	Chlorophyll gives leaves their green color and…	*absorbs energy from sunlight.*	.000	0.260	0.611	135.0%
8	Photosynthesis is the process used to develop film before digital photos.	*False*	.000	0.388	0.626	61.3%
9	How can you tell if a plant is not getting enough sunlight?	*Its leaves turn yellow.*	.000	0.730	0.842	15.3%
11	Roots…	*transport nutrients and water to the plant.*	.001	0.710	0.813	14.5%
12	Broccoli, cauliflower, and dandelions are examples of what part of the plant?	*Flower*	.000	0.455	0.643	41.3%
13	Seeds store all the food that they need to start a plant.	*True*	.000	0.522	0.719	37.7%
15	Germination refers to…	*when the plant emerges from the seed.*	.000	0.216	0.447	106.9%
16	*Pecan* is an Algonquian (Native American tribe) word that means…	*a nut requiring a stone to crack.*	.000	0.262	0.675	157.6%
17	Pecans grow…	*on trees.*	.000	0.410	0.566	38.0%
18	Who used pecans to make ink for writing?	*Colonist*	.000	0.207	0.444	114.5%
19	Plants must have at least these four things to grow.	*Carbon dioxide, light, nutrients, and water*	.000	0.593	0.743	25.3%
20	Which of the following are common nutrients that could be added to soil to help plants grow?	*Manure and worm castings*	.000	0.308	0.538	74.7%
21	Plants and people have the same basic needs for survival.	*True*	.000	0.604	0.774	28.1%
22	How many cups of fruit do I need each day?	*1½ – 2 cups*	.000	0.295	0.594	101.4%
23	How many cups of vegetables do I need each day?	*2 – 3 cups*	.000	0.311	0.565	81.7%

***

In the Field with Arizona Agriculture Survey Analysis
Spring 2010

The following questions are statistically significant ($.002 \leq p \leq .050$ at the $\alpha=.05$ level). This is to say that there is a 0.2% to 5% chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is a 95% to 99.8% chance that the change in students' mean scores is attributed to the agricultural fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
10	What are the three main parts of a plant?	*Root, stem, and leaf*	.022	0.794	0.860	8.3%
25	How likely are you to choose to eat a <u>fruit</u>?	Not at all likely 1 2 Likely 3 4 Very likely 5	.019	3.697	3.907	5.7%

***

The following questions are *close* to being statistically significant ($.051 \leq p \leq .100$ at the $\alpha=.05$ level) but mathematically speaking, there is too great of a possibility that the change in mean scores is due to chance and not the agriculture fair alone. This is to say that there is a 5.1% to 10% chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is a 90% to 94.9% chance that the change in students' mean scores is attributed to the agricultural fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
14	The epicotyl is the…	*embryonic leaf inside the seed.*	.055	0.131	0.178	35.9%
29	How likely are you to ask your parent/guardian to provide you <u>fruits</u> to eat?	Not at all likely 1 2 Likely 3 4 Very likely 5	.081	3.371	3.583	6.3%

***

The following questions are *not* statistically significant ($p > .100$ at the $\alpha=.05$ level). This is to say that there is greater than a 10% chance that the change in students' mean scores is attributed to something other than the agriculture fair. The converse of this is that there is less than a 90% chance that the change in students' mean scores is attributed to the agricultural fair.

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
24	Why is a fruit or a vegetable a better snack choice than fried potato chips?	a. Fruits & vegetables make my body want to drink more water. b. Fruits & vegetables have very little fiber. c. Fruits & vegetables give us more energy and less fat & calories. d. I don't know	.756	0.844	0.829	-1.8%

In the Field with Arizona Agriculture Survey Analysis
Spring 2010

#	QUESTION	ANSWER	*p* value	Pre-survey Mean	Post-Survey Mean	% Change
26	How likely are you to choose to eat a vegetable?	Not at all likely 1 2 Likely 3 4 Very likely 5	.623	2.875	2.974	3.4%
27	How likely are you to try a *new* fruit?	Not at all likely 1 2 Likely 3 4 Very likely 5	.718	3.574	3.511	-1.8%
28	How likely are you to try a *new* vegetable?	Not at all likely 1 2 Likely 3 4 Very likely 5	.633	2.726	2.670	-2.1%
30	How likely are you to ask your parent/guardian to provide you vegetables to eat?	Not at all likely 1 2 Likely 3 4 Very likely 5	.201	2.650	2.847	7.4%
31	What is a fruit you like to eat?	*any botanical fruit*	1.000	0.994	0.997	0.3%
32	What is a vegetable you like to eat?	*any botanical vegetable*	.601	0.703	0.750	6.7%

Conclusion:
All but two of the 24 knowledge-based questions (14 & 24) were statistically significant. This means that 1) the students as a whole were able to answer these 22 questions more correctly, that 2) this increased ability was substantial, and that 3) their ability to do so is due to what they learned at the agriculture fair.

In regards to question 14 (*see above table for question*), the *p* value of .055 was only .005 from being statistically significant. Additionally, data from the Fall 2009 Statistical Report indicates that this item, for those participating schools, was highly significant ($p = .008$); therefore, this question should continue to be used as an item to assess participants knowledge in future fairs.

In regards to question 24, 84.4% of the participants correctly answered this question on the pre-survey indicating an extremely high initial knowledge. Statistically speaking, the difference between the pre- and post-mean (.829) scores is virtually non-existent. Since the mean scores were so high, this indicates that the question is too easy and should no longer be used as an item to assess participants knowledge in future fairs.

Questions 25, 27, & 29 sought to measure a change in students' likelihood to consume fruit. For question 25, the data infers that students' likelihood of choosing to eat a fruit increased substantially due to their participation in the agriculture fair. For question 27, the difference between the pre- (3.574) and post-mean (3.511) scores is virtually non-existent, meaning that the fair had no impact on their likelihood of trying a new fruit. For question 29, the likelihood that the students would ask their parent/guardian to provide them with fruits to eat did not increase enough to infer that the fair led to this increase; however, it was close ($p = .081$ when it needed to be at least .05), meaning that there is a 91.9% chance that the change in students' mean scores for this question is attributed to the agricultural fair.

Questions 26, 28, & 30 sought to measure a change in students' likelihood to consume vegetables. For question 26, the difference between the pre- (2.875) and post-mean (2.974) scores is virtually non-existent, meaning that the fair had no impact on their likelihood of

choosing to eat a vegetable. For question 28, the difference between the pre- (2.726) and post-mean (2.670) scores is virtually non-existent, meaning that the fair had no impact on their likelihood of trying a new vegetable. For question 30, the likelihood that the students would ask their parent/guardian to provide them with vegetables to eat did not increase enough to infer that the fair led to this increase. This increase was not enough to be even close to being significant; however, it was a measurable change, but the interpretation of this change is that there is a 20.1% chance it was due to chance alone. The converse of this is to say that there is a 79.9% chance that the change is attributed to the agricultural fair.

Questions 31 & 32 sought to provide additional meaning to questions 25-30. After analyzing data from the 2009 fall fair, it was hypothesized that students' criterion for categorizing fruits and vegetables when taking the pre-survey was different from their criterion when taking the post-survey – a reasonable hypothesis since one of the booths specifically taught how to categorize fruits and vegetables. If this were true, then it would also stand to reason that the post-survey questions that sought to measure a change in students' likelihood to consume fruits and vegetables were not the same things as the pre-survey was measuring. Therefore, questions 31 & 32 were used to test this hypothesis. If there was a significant difference between the pre- and post-survey mean scores for correctly listing a fruit (question 31) and correctly list a vegetable (question 32), then this would indicate a change in their conception of what a fruit and a vegetable is, thus supporting the hypothesis. If there was not a significant difference, that would disprove the hypothesis. For question 31, the difference between the pre- (.994) and post-mean (.997) scores is virtually non-existent, meaning that the fair had no impact on the students' ability to correctly list a fruit. However, it is noteworthy that only two of the participants for both the pre- and post-survey incorrectly listed a fruit, indicating an extremely high initial knowledge. For question 32 the difference between the pre- (.703) and post-mean (.750) scores is also virtually non-existent, meaning that the fair had no impact on the students' ability to correctly list a vegetable. The data infers that the above described hypothesis is not correct. However, it is noteworthy that there was a reduction in the number of times specific fruits were given as answers for vegetables [Apple (pre:4, n=317; post:2, n=280); Cucumber (pre:5, n=317; post:2, n=280); Peppers (pre:4, n=317; post:1, n=280); Tomato (pre:20, n=317; post:13, n=280); None (pre:19, n=336; post:8, n=288)].

Further research is needed to accurately measure a change in students' likelihood to consume fruits and vegetables. Perhaps utilizing real fruits and vegetables during the fair and dissecting them during the categorizing booth will help the students make the connection between what they cognitively understand to be a fruit and a vegetable and what they eat.

The agriculture fair proves to have been a successful event in increasing student's knowledge of agriculture and important health choices. As such, it is a worthwhile event to provide to more elementary school students and should be explored to older and younger participants.

Agriculture Fair Teacher Survey

1. I attended the _____ Agriculture Fair.
   a. November 23, 2009
   b. March 30, 2010

2. The Agriculture Fair was valuable to me as a teacher.

Strongly Disagree		Undecided		Strongly Agree
1	2	3	4	5

3. The Agriculture Fair gave me practical ideas on how I could incorporate agriculture into the classroom.

Strongly Disagree		Undecided		Strongly Agree
1	2	3	4	5

4. My students benefited from participating in the Agriculture Fair.

Strongly Disagree		Undecided		Strongly Agree
1	2	3	4	5

5. The content of the Agriculture Fair was consistent with the Arizona Academic Standards.

Strongly Disagree		Undecided		Strongly Agree
1	2	3	4	5

6. Overall, participating in the Agriculture Fair was worth the time spent.

Strongly Disagree		Undecided		Strongly Agree
1	2	3	4	5

7. I have read through the following lessons.
   a. Arizona!!! How the Heck Did I End Up Here?
   b. Can You Walk on Eggs?
   c. Getting to the Root of the Matter
   d. I'm Here, I'm There, I'm Everywhere – I'm Super Spud!
   e. Let's Make Stew
   f. Mmmmm, I'm Good! But am I Good for You?
   g. Pecan Power!
   h. Plant Seedling
   i. Soggy Seeds
   j. Survival of the Fittest
   k. The Day an Egg Solved the Mystery of the Cell
   l. This Can't be a Plant
   m. Which Came First, the Chicken or the Egg?

8. I have already utilized components of the following lessons.
   a. Arizona!!! How the Heck Did I End Up Here?
   b. Can You Walk on Eggs?
   c. Getting to the Root of the Matter
   d. I'm Here, I'm There, I'm Everywhere – I'm Super Spud!
   e. Let's Make Stew
   f. Mmmmm, I'm Good! But am I Good for You?
   g. Pecan Power!
   h. Plant Seedling
   i. Soggy Seeds
   j. Survival of the Fittest
   k. The Day an Egg Solved the Mystery of the Cell
   l. This Can't be a Plant
   m. Which Came First, the Chicken or the Egg?

9. I intend to use the following lessons during the 2010-2011 school year.
   a. Arizona!!! How the Heck Did I End Up Here?
   b. Can You Walk on Eggs?
   c. Getting to the Root of the Matter
   d. I'm Here, I'm There, I'm Everywhere – I'm Super Spud!
   e. Let's Make Stew
   f. Mmmmm, I'm Good! But am I Good for You?
   g. Pecan Power!
   h. Plant Seedling
   i. Soggy Seeds
   j. Survival of the Fittest
   k. The Day an Egg Solved the Mystery of the Cell
   l. This Can't be a Plant
   m. Which Came First, the Chicken or the Egg?

10. Please indicate other lessons that you have either read, used, or intend to use.

EX: Buzzing Bee's Wardrobe (read & intend to use)

_____
_____
_____
_____
_____
_____
_____
_____
_____

11. Please indicate ways in which these lessons could be easier for teacher to use in the classroom.

12. Please share any additional ideas that you have that can improve the Agriculture Fair.

13. Please share any additional ideas that you have that can improve the Arizona Specialty Crop Lessons.

14. Please share any other comments.

15. If you are interested in receiving additional information related to incorporating agriculture into the classroom, please provide us with your email address. _____

In the Field with Arizona Agriculture
2009-2010 Teacher Survey

1. I attended the *blank* Agriculture Fair.	2. The Agriculture Fair was valuable to me as a teacher.	3. The Agriculture Fair gave me practical ideas on how I could incorporate agriculture into the classroom.	4. My students benefited from participating in the Agriculture Fair.	5. The content of the Agriculture Fair was consistent with the Arizona Academic Standards.	6. Overall, participating in the Agriculture Fair was worth the time spent.
Q1	Q2	Q3	Q4	Q5	Q6
11/23/09	5	5	5	5	5
11/23/09	5	5	5	5	5
11/23/09	4	4	4	4	4
11/23/09	3	3	4	3	4
11/23/09	4	3	4	4	4
11/23/09	4	2	4	3	4
11/23/09	4	4	4	4	5
11/23/09	4	4	4	4	4
11/23/09	4	4	4	4	4
11/23/09	4	4	4	4	5
11/23/09	4	4	4	4	4
AVG	4.09	3.82	4.18	4.00	4.36
3/30/10	2	3	1	2	2
3/30/10	4	4	4	4	4
3/30/10	5	5	5	4	5
3/30/10	4	4	4	4	4
3/30/10	4	4	5	5	5
3/30/10	4	3	4	4	4
3/30/10	5	5	5	5	5
3/30/10	3	4	4	3	4
3/30/10	3	3	4	4	4
3/30/10	4	3	4	4	4
3/30/10	4	4	4	4	4
3/30/10	4	4	3	5	4
3/30/10	4	4	5	5	5
3/30/10	5	3	5	4	4
3/30/10	5	4	4	4	4
AVG	4.00	3.80	4.07	4.07	4.13
BOTH	4.04	3.81	4.12	4.04	4.24

Although a statistical analysis could be perform and determine if there is a significant difference between the two groups, it's impossible to determine what the reason(s) is/are for that difference.
It could not be infered that the difference is due to the fair that they participated in, but may be due to an unknown and unmeasured factor, such as a characteristic of the teachers or school policies.

In the Field with Arizona Agriculture
2009-2010 Teacher Survey

LESSON TITLE		7. I have read through the following lessons. Q7 # of Teachers who Marked	Q7 % of Respodents to Q7 who Marked	8. I have already utilized components of the following lessons. Q8 # of Teachers who Marked	Q8 % of Respodents to Q8 who Marked	9. I intend to use the following lessons during the 2010-2011 school year. Q9 # of Teachers who Marked	Q9 % of Respodents to Q9 who Marked
Arizona!!! How the Heck Did I End Up Here?	A	4	36.36%	2	25.00%	5	62.50%
Can You Walk on Eggs?	B	2	18.18%	0	0.00%	2	25.00%
Getting to the Root of the Matter	C	4	36.36%	2	25.00%	2	25.00%
I'm Here, I'm There, I'm Everywhere – I'm Super Spud!	D	3	27.27%	1	12.50%	2	25.00%
Let's Make Stew	E	2	18.18%	1	12.50%	1	12.50%
Mmmmm, I'm Good! But am I Good for You?	F	2	18.18%	0	0.00%	0	0.00%
Pecan Power!	G	5	45.45%	1	12.50%	4	50.00%
Plant Seedling	H	4	36.36%	1	12.50%	1	12.50%
Soggy Seeds	I	4	36.36%	2	25.00%	1	12.50%
Survival of the Fittest	J	2	18.18%	3	37.50%	2	25.00%
The Day an Egg Solved the Mystery of the Cell	K	3	27.27%	2	25.00%	3	37.50%
This Can't be a Plant	L	5	45.45%	1	12.50%	3	37.50%
Which Came First, the Chicken or the Egg?	M	1	9.09%	0	0.00%	0	0.00%

In the Field with Arizona Agriculture
2009-2010 Teacher Survey

10. Please indicate other lessons that you have either read, used, or intend to use.	11. Please indicate ways in which these lessons could be easier for teacher to use in the classroom.	12. Please share any additional ideas that you have that can improve the Agriculture Fair.		14. Please share any other comments.	
Q10	Q11	Q12	Q13	Q14	Q15
	Honestly, if I would have gone through the notebook right after rec'ing I could have incorporated more in my classroom this year.				LALiving@mpsaz.org
	The meet the "Mesa Reads" curriculum so I can transition right into it. Due to Mesa Reads I have to make sure all of my history & science activities will integrate into it.				
I'd like to use all I'm not sure at the moment Does not go with 5th grade S.S or science curriculum		It went very well great job!			
	Materials supplied	Much shorter, cooler time of the year			
I have not used or read any at this time. I am busy with packing boxes closing school and preparing to move				The day was valuable and my kids enjoyed all the activities. I am SWAMPED with lots of things now - can not use extra lessons at this time Maybe later! :) Sorry!	
	I will have more time this summer to read & evaluate.	Student really enjoyed the activities. I love the hand-on activities on visuals kids took home.		Thank you so much.	KMCorbet@mpsaz.org