Enhancing Water Quality Education Using Demonstration Sites

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What do we mean by Demo site?

Any project where a team works with an individual, company, or organization for the purpose of learning and teaching about a technology, practice, or process that has the potential to significantly impact the target client group or industry.

What are some of the characteristics of a Demo?

Focused on a specific, important, topic or issue.

Typically involves an interdisciplinary team.

We generally can do nothing significant on our own.

It typically involves some aspect of discovery.

It always results in some kind of teaching.

Demos provide information for extension & research publications, case studies, DVD's, video tapes, grant proposals, etc ...

REMOVAL OF SOLIDS AND MAJOR PLANT NUTRIENTS FROM SWINE MANURE USING A SCREW PRESS SEPARATOR

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ABSTRACT. A screw press separator was temporarily installed on a commercial swine farm in Horry County, South Carolina. The separator had a 0.5 mm screen and was operated with a single 40 kg weight on each pressure plate arm. Prediction equations were developed from the data to describe the removal of total solids (TS), total volatile solids (VS), chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), ammonium nitrogen (NH_4-N), organic nitrogen (organic-N), and total phosphorus (TP). Separated solids were analyzed to determine the percent total solids and the concentration of major plant nutrients. The concentration of total potassium (TK) in the separator influent and effluent was the same within measurement error. The removal of TS, VS, N, and P was found to vary significantly with the TS concentration of the influent manure. Therefore, building management and the methods used to implement the machine in the manure handling system would have a significant impact on separator performance. The prediction equations were used to calculate separator performance for a typical pit-recharge swine building based on observed characteristics on the cooperator's farm. The screw press would be capable of removing 14.9% of the TS, 19.6% of the VS, 34.9% of the COD, 9.2% of the TKN, 16.0% of the organic-N, and 14.8% of the TP from the manure added by housed swine.

Keywords. *Manure, Liquid-solid separation, Nutrient management.*

Most swine production facilities in the United States, Canada, and Europe use liquid or slurry manure handling systems to facilitate the mechanization of collection, transfer, storage, and land application tasks. In cold climates, slurry swine manure is often stored until conditions are favorable for land application in lined earthen basins, below or above ground storage tanks, or in pits below slotted floors. In temperate and warm climates, it is common to treat and store swine manure in anaerobic or facultative lagoons. Liquid-solid separation has traditionally been viewed as a method to improve the pumping and irrigation characteristics of liquid manure, to generate solids for composting, and to use separated solids for refeeding (Lindley, 1982; Fedler et al., 1985; McClaskey, 1985).

Liquid-solid separation via gravity settling has been used extensively to reduce the solids content in feedlot runoff and flushed dairy manure. Mechanical separation techniques have been widely used with flush manure handling systems in dairy housing facilities. However, liquid-solid separation techniques have not been widely used in swine manure handling systems.

The odor generation potential from lagoons and storage structures has increased public concern over the use of liquid manure storage systems. Liquid-solid separation is not only being viewed as a method to improve the handling characteristics of manure, but as a method to reduce the volatile solid loading rate on lagoons, and as the first step in a swine manure treatment system.

An article by Zhang and Westerman (1997) reviewed the published data on gravity and mechanical liquid-solid separation techniques and the particle size distributions of animal manure. Their review concluded that the large particles in manure take a relatively long time to degrade and do not contribute greatly to odor production. However, the large particles do contribute to the accumulation of sludge in anaerobic lagoons. Over time, the sludge volume can decrease the treatment volume and cause excessive odors. Swine manure particles with an average diameter of 0.25 mm or less are the fastest to biologically degrade and must be removed with coarse particles to greatly reduce the odor generation potential of liquid swine manure.

Gravity settling of swine manure can remove as much as 60% of the total solids from swine manure (Lorimore et al., 1995). However, the separated solids have a high water content and must be handled as slurry. Zhang and

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Clemson University and Clemson University Extension does not endorse or recommend the FAN screw press over any other type of screw press separator that may be available.

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EFFECTIVENESS OF LIQUID-SOLID SEPARATION FOR TREATMENT OF FLUSHED DAIRY MANURE: A CASE STUDY

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ABSTRACT. Sunny Day Farm was the home of the highest producing registered Jersey herd in the world at the time this study was conducted. The cows are housed in a freestall barn and manure is removed from the barn using a flush system. The manure treatment system on this farm includes the following components in series: an inclined stationary screen separator, a two-chambered settling basin, and a lagoon. Samples were taken to quantify the performance of the existing manure treatment system. The inclined stationary screen separator removed 60.9% of the total solids, 62.8% of the volatile solids, 49.2% of the TKN, 52.2% of the organic-N, and 53.1% of the total P. The complete on-farm manure treatment system removed 93.0% of the TS, 95.6% of the VS, 74.0% of the TKN, 91.1% of the organic-N, and 86.1% of the total P. In addition, settling experiments were carried out with flushed manure (unscreened) and effluent from the mechanical separator (screened) to determine how well settling of dairy manure could be enhanced with a polymer (PAM) and aluminum sulfate. Addition of 250 to 400 mg PAM/L to screened and unscreened dairy manure significantly increased the removal of total and volatile solids, organic-N, total P, Cu, and Zn. The optimum amount of PAM to add was 300 mg/L for screened and unscreened manure. Settling of flushed dairy manure for 60 min following an application of 300 mg PAM/L removed 76.1% of the TS, 80.3% of the VS, 80.8% of the COD, 45.7% of the TKN, 72.3% of the organic-N, and 61.8% of the total P. The largest amount of TKN and total P was removed by a two-stage separation process that combined the stationary inclined screen separator followed by gravity settling with a polymer or aluminum sulfate. Enhancing the gravity stage with 300 mg PAM/L removed 71.1% of the TKN and 86.0% of the P. Application of 3,194 mg alum/L removed 71.1% of the TKN and 99.0% of the total P.

Keywords. *Manure treatment, Dairy, Solid-liquid separation.*

Sunny Day Farm located in Chester, South Carolina, was home to the highest producing, registered Jersey herd in the world at the time this study was conducted. On the average, 54 cows are milked each day. As of May 1998, the rolling herd averages for this Jersey herd were 9,422-kg milk, 428-kg fat, and 339-kg protein per cow each year. The cows are housed in a naturally ventilated, two-row freestall barn with two concrete alleys. The 54 freestalls are arranged in a tail-to-tail arrangement. Therefore, one alley provides access to the stall area and one alley serves the feeding area. A total mixed ration is fed using a drive-by feeding fence located along the south side of the building. Large amounts of organic bedding (about 0.5 m^3 per stall per week) are used in the freestalls and a generous amount of feed is available for the cows all of the time. The cows are milked twice each day in a parlor and manure is flushed from the freestall alleys each time the cows are milked.

Each alley was flushed with 5,670 L of fresh water from a farm pond and the alley floor slope is 1.5%. The flushed manure was collected in a concrete channel along the end of the barn. The channel contained the manure as it was processed by an AgPro® stationary inclined screen separator that had a screen size of 1.5 mm. The AgPro® separator was installed in one end of the channel and lifts the manure onto the screen using flight-elevator type paddles. The separated solids were conveyed up the inclined screen to the top where they fall onto a concrete storage pad where they form a pile that can be as high as 3.0 m tall (fig. 1). The liquid fraction, or effluent, flows through the screen and is collected and transferred by pipe to a two-chamber settling basin (fig. 2). The effluent from the two-chambered settling basin flows into an anaerobic lagoon. The steps in the manure treatment and handling system are shown in figure 3.

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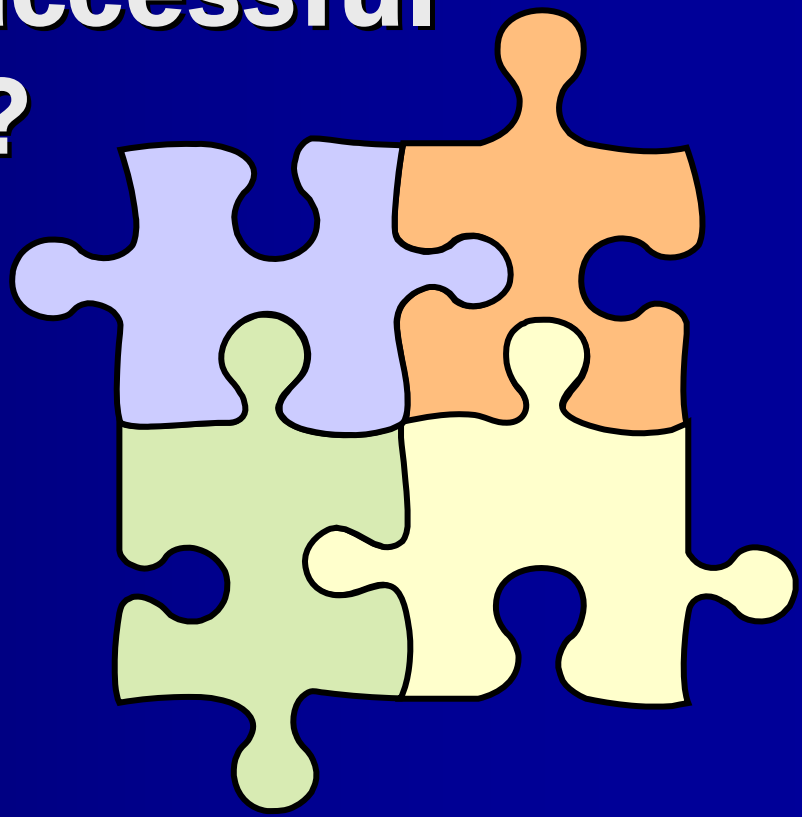
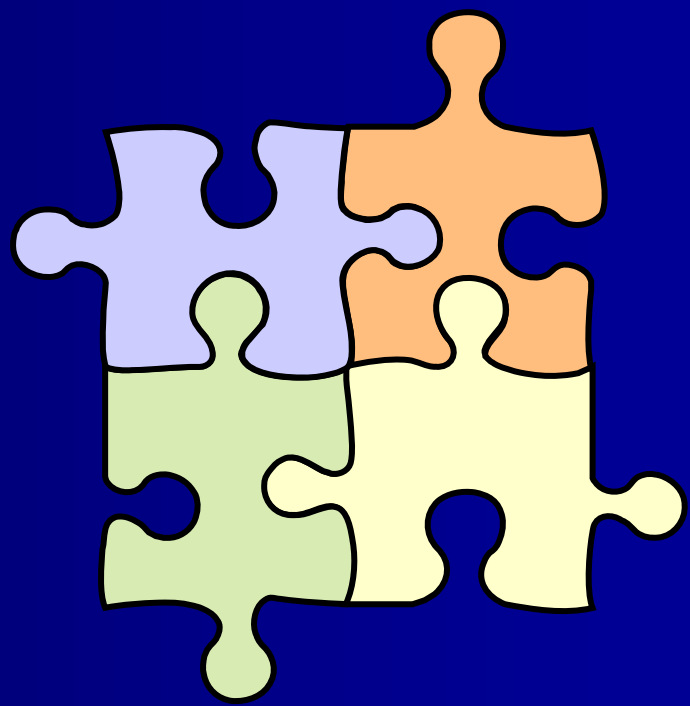
So what are the pieces needed for a successful demonstration?

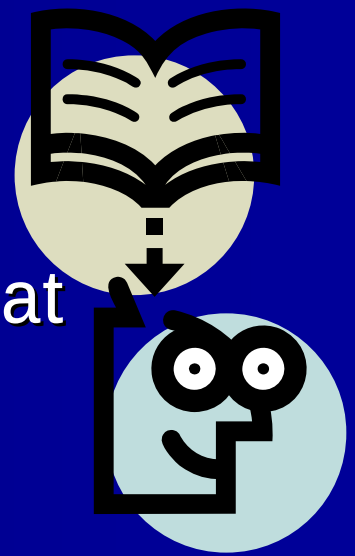


It’s like a jigsaw puzzle. You need to begin putting it together with the end in mind!



What are the important issues for the target audience?

- Make a list of your ideas.
- Meet with other extension professionals to get their ideas.
- Ask key members of the target audience for input.
- Narrow the issues down to those that match available skills.

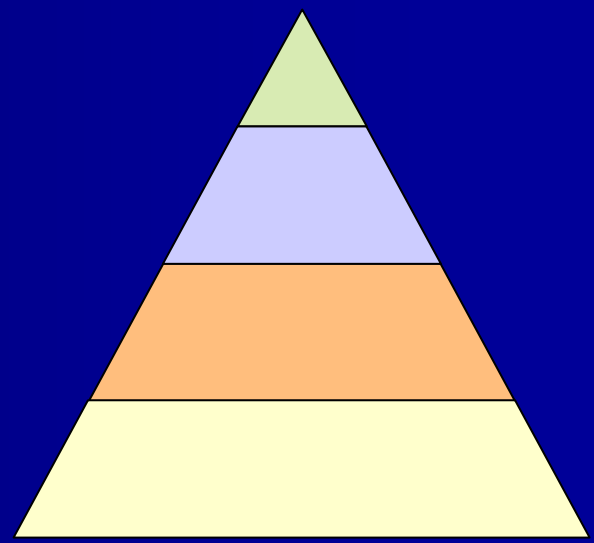


Now continue team building.

- Seek out a few individuals who have common interests.
- Make sure these people bring important skills that you do not have.
- The core team members need to be identified now.
- Others can be added later as needed.

Define the project goal & ...

- Begin developing the objectives.
- Develop a rough work plan.
- What are the desired outcomes?
- What kind of analyses will be needed?

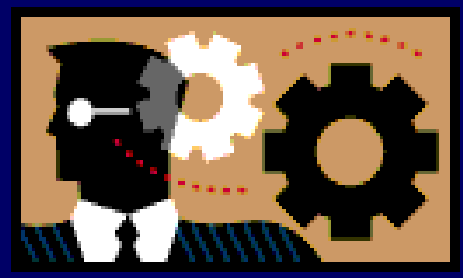


Do not forget to evaluate the time commitment!

Find the right cooperator and site (if needed).

- Find out about all potential cooperators before you propose the demonstration project.
- Make site visits and have meetings - without telling them why you are there!
- Many will want to participate but, not all are suitable cooperators.

Be picky!



- Learn about the person.
  - Evaluate character.
  - Do they have an “educator” mentality.
  - Do they care about the process and learning or are they “just in it for themselves” ?
- Are there site constraints that will prevent success?

Once you have selected the person and/or site...

- Present the project goal, objectives, rough work plan, and desired outcomes.
- Be able to clearly define what you are asking them to do.
- Get their input.
- Modify the objectives and work plan to accommodate the needs of the cooperator and site constraints.
- Make sure the project is a win-win. If not you will probably loose.

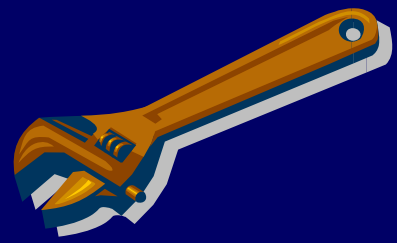
Evaluate resources needed.

- Have your cooperator(s) help define needed resources.
- Do you have what you need in terms of people, equipment, and money to carry out your plan?
- If not, it may be time for the team to write a grant.
- Always consider a revised, simplified plan that will allow you to get started now.

Some do's and don'ts

- Don't start the planning process and worrying about funding. If you do you will loose your creativity.
- Don't criticize others ideas. Some people serve the group best by thinking out loud.
- Do separate the "idea" phase from the "funding" phase.
- Do consider a small project that can be done on a shoe-string budgets.
- Do make sure the plan is a win-win for all team members.

Now work the plan!



- Expect delays and difficulties.
- Remember, the road blocks and difficulties you experience often teach you and the cooperator more than anything else.
- You may have to alter the plan objectives to “work around” a problem but stay true to the goal.
- You may have to make up some things as you go along!

This sounds like a lot of work…..and it can be.

So why do it?

What are the benefits?

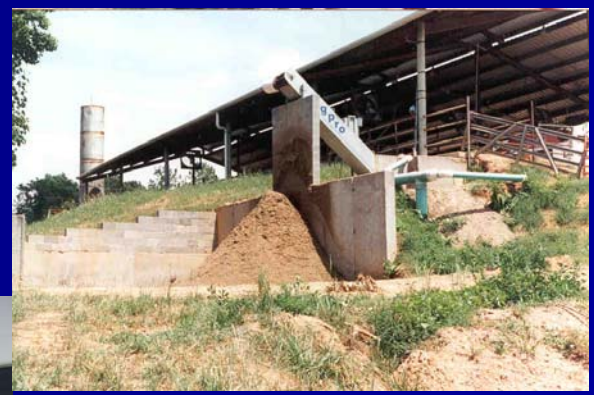
Don’t we already have enough to do?

I like using demonstration sites because…

- It keeps me learning and developing as a professional.
- It expands my background.
- It helps me to use my time and resources more effectively since I can use the results to teach or impact hundreds instead of just a few.

- Demonstration meets the needs of all learning styles.
- I am often able to use the same project for extension, research, and teaching students.
- It gives me more credibility when I teach.
- It helps me to do things that are important to my client group.

Anything that I know or learn only has value if it helps people.



Demonstration is the most fundamental way of putting knowledge to work … *for people*.

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