

USING AN INTEGRATED APPROACH TO UTILIZING CENTER PIVOTS FOR LIVESTOCK WASTE MANAGEMENT

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Summary:

The title says it all – using an integrated approach to utilizing center pivots for livestock waste management. What does integrated mean? It means considering the entire system from waste source to the application in the field. To achieve this, the discussion will focus not on center pivots, or separators, or pumps, or lagoon design or any one element of a livestock waste management system, but all of them together – integrated into one package so all parts work together and no one part is a constraint. Consideration will be given to planning for a new or updated system and what to do with an existing system.

Introduction:

Land application of wastewater with mechanical move irrigation equipment – both center pivot and linear – has been successfully used for many years. Since the early 1980's the equipment and techniques for irrigating with fresh water have changed dramatically. Many of these changes have been incorporated into mechanized equipment used for land application. While these changes have brought significant improvements, we must take into account other issues and particularly public perception of land application systems.

Today, too often phone calls are received by consultants, dealers and manufacturers from a farmer that goes something like this - "My pivot is plugged and I need it fixed." So how does one start when responding? Is the problem the sprinkler package, the pivot or something else? Where does one begin to look for a solution to the farmer's problem? And better yet how does one ensure this does not happen again? Today it is very common that the wastewater producer does not farm or own sufficient farmland. They rely on working with the irrigator who has little or no experience with confined livestock so collecting information from the irrigator may be a challenge. And if the wastewater producer does own the irrigation equipment they still may treat it as a separate enterprise and commonly will have separate management focused on crop production and meeting the grain and forage needs of the animal unit.

Discussion:

Whether looking at a new installation or trying to resolve an existing situation like the phone call, it is imperative that one considers the complete system and not just one specific component. There are a number of ways to look at a system. One example of how the system may be broken down into components is as follows:

- Waste source – hog, beef, dairy, other
- Collection – how is the waste collected
- Storage – how is the waste stored
- Pumping – how is the waste pumped and distributed
- Land application unit – for our discussion we will use the center pivot and its sprinkler package.

Briefly before we go into a more detailed discussion, let's consider what each party (producer and irrigator) wants out of the system:

- The wastewater producer wants:
 - Fast delivery of large volumes
 - Particularly important to beef feedlots after a rainfall event to ensure they have the capacity to contain another event
 - The possibility to eliminate large volumes early in the crop growing season and at the end of the season
 - Storage may be full after the winter and may need to be lowered as much as possible prior to winter
 - To 'dispose' of chunks and trash
 - No problems
 - The nutrient management plan to work as planned
- The irrigator wants:
 - Waste water only when crop needs it
 - A sprinkler package with good uniformity
 - No problems – eliminating sprinkler plugging is at the top of the list

Back to the situation of the phone call and how to proceed. Whether you are a farmer, consultant, dealer or manufacturer, there are suggested steps to follow to determine how well the system is integrated and how to proceed.

Typically the irrigator is asked to describe the system. Often there are long periods of silence as he does not know:

- The waste source – not critical but helps to know what to expect
 - He knows the species of livestock, but:
 - If hogs –
 - Farrowing, feeder or finisherImportant as farrowing units usually have plenty of water and is a dilute stream while feeder and finishers need to have a higher level of solids

- If dairy -
 - Type of bedding if any
Important for bedding is if sand is used is it collected and recycled or how will it be handled
 - Type of collection system in the confinement unit
Importance of collection is if flushing should have plenty of water for dilution and if scraping may have challenge of high solids content
- Collection (This is generally the area where the irrigator knows the least)
 - How the waste stream is moved to storage
 - Pipeline or open channel
 - Pumped
Important to understand if trash can get into the stream
 - Is separation used
 - Sand recovery for use as bedding
 - Removal of solids
Important to help understand what solids potentially could be expected at the center pivot. If lots of solids are coming to the pivot and a separator is being used would indicate a problem in this area
- Storage
 - He knows there is storage, but not sure of:
 - Numbers of units
 - Which unit his waste stream comes from
Important as if multiple cells should be pumping from the last cell which should have the least solids.
- Pumping
 - He knows there is a pump, but:
 - Does not know the waste producer's plan to send to the field?
 - Percent of solids
 - Size of solids
 - Volume
 - Frequency
 - If a single cell is the pump close to where the waste stream comes into the storage?
Important – moving away from where the waster stream comes into the lagoon can help minimize solids
 - Type of pump – commonly the irrigator will say he thinks it is a solids handling pump – not knowing that this means the

pump will deliver big chunks. This is *good* for the waste producer but *bad* for the irrigator.

- Position of the inlet to the pump in the lagoon – one of the big issues
 - Is it a floating inlet
 - On the bottom
 - Somewhere in betweenImportant as where the inlet is positioned generally relates to the waste producers expectations as to the solids they plan to pump.
- Land application unit
 - He knows the center pivot, but may not be well aware of how it applies wastewater
 - Says he has pressure regulators
 - Uses spray nozzlesImportant to guide the change to the sprinkler package to minimize the problems

At this stage the consultant, dealer, or manufacturer needs to really dig into what is happening. There are some questions that must be answered.

The most important questions to get answered are (working back upstream):

- 1) What is the sprinkler package and where is it plugging?
 - a. If the irrigator has pressure regulators this needs to be evaluated to determine if regulators are really needed or if an alternative such as flow control nozzles would be a solution. Or if the pump intake is moved would that minimize the amount of solids in the liquid stream so regulators could be used?
 - b. If the nozzles are plugging in the first spans of the center pivot consider a wider spacing even if the uniformity may not be optimum. Remember the uniformity of plugged nozzles is poor!
 - c. If the plugging is occurring on the pad consider a different pad configuration that provides less opportunities for trash to 'catch'.
- 2) What type of pump is being used?
 - a. A solids handling pump is going to send large chunks to the center pivot. Consider the location of the inlet to minimize chunks getting into the pump
- 3) Intake to the pump location
 - a. Position so it is not on the bottom or top of the storage in a zone that is as free of trash and solids as possible unless the overall plan is to pump high amounts of solids.
- 4) What are the waste producer's expectations of what is sent to the field?

- a. Percent of solids
- b. Size of solids
- c. Volume
- d. Frequency

- e. There may be a complete mis-match of ideas as to what is going to happen. On an existing system the costs to fix can be substantial.

- f. If the irrigator and wastewater producing cannot agree the producer will need to find another area to use and amend the nutrient management plan.

When one is starting a new wastewater system it is necessary to integrate (combined in a logical way) all of the following items to meet the overall system needs. Hopefully the wastewater producer and the irrigator can work together in a partnering that is mutually beneficial to both. If these items are not integrated, it could jeopardize one partner or the other or only meet one partner's needs.

Permitting – Both partners must agree on a nutrient management plan and crops need to match nutrient loading for the land area. The farmer may be pushed to change his cropping plan by adding winter forage. This may work well as long as the livestock operation is willing to buy the forage, but if not, it creates marketing challenges for the farmer.

Design – Waste producer may want rapid disposal of large volumes any time during the season while the irrigator wants even volume over the season and no plugging. Both want no problems. The design is critical to identify and outline the solutions to try to satisfy both parties.

Construction – The construction cycle may interfere with crop production while installing pipelines and mechanical move irrigation equipment.

Operation – If the design was balanced to meet both parties' needs, there should not be operational issues. If however the design is oriented to meet only one, then someone is going to be unhappy.

Conclusions:

For a land application project to be successful, all parts of the project need to be integrated together – planning, design, collection, storage, pumping and the land application equipment. Mechanical move irrigation equipment can be beneficial to the reuse of wastewater if it is integrated with the entire project.

Both the wastewater producer and the irrigator need to understand the needs and expectations of the other.

When problems arise within a system, one needs to look at the entire stream from where it is produced to the land application equipment to determine the best course of action. Often several different parts of the system will need to be reviewed and changes considered to meet both the irrigator and livestock producer's expectations.

References:

Personal communication with a number of waste water projects.