

MANAGEMENT CONSIDERATIONS FOR CENTER PIVOTS WHEN APPLYING WASTEWATER

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Summary:

How often in the news today do we ever hear anything positive about a waste water reuse project? This paper will briefly discuss the relationship of the three elements of a good wastewater reuse project, equipment, agronomic practices and management. The focus will then be on management concepts to be considered when using center pivots while applying wastewater. Particularly the paper will focus on the impact of management to the overall project performance. Examples of wastewater reuse management situations will be presented and discussed. From the discussion a list of parameters will be developed and discussed which are considered critical to a wastewater project's overall success to not only the livestock and farm but the general public as well. Only agricultural projects will be included in the discussion but many of the same drivers apply to industrial and municipal wastewater reuse projects.

Introduction:

To begin let's consider that using a center pivot for wastewater reuse is **not** the same as using a center pivot for crop production. All stakeholders – livestock operation, farm operation, neighbors and the public, must be considered if a project is to be a long term success. Land application of wastewater with mechanical move irrigation equipment – both center pivot and linear has been successfully used for many years. Mechanized irrigation, due to its characteristics, including limited labor input, application uniformity, ease in handling large volumes of effluent and particularly the ability to apply to an actively growing crop with minimal negative impact to the crop is considered to have advantages for wastewater reuse. Since the early 1980's the equipment and techniques for irrigating with fresh water have changed dramatically and many of these changes have been incorporated into mechanized equipment used for land application (Gilley, 1983). While these changes have brought significant improvements, in today's world we must take into account other issues and particularly public perception of a wastewater reuse application system. Equipment applications are important but equally so are the agronomic practices and management. If any of these three are not integrated together into the overall package, there is a strong potential for problems and/or project failures. How the irrigation equipment is selected has been discussed in more detail in a previous paper (LaRue, 2006). As an example it is possible to have runoff from a field if the equipment application, agronomic practices and management are not all integrated together.

Discussion:

Livestock operations producing meat or milk have little to no interest in crop production except as a possible spot to 'dump' their problem. In general they want to have no problems and minimize their expense in 'disposing' of their meat and milk production by-product, the wastewater stream. As stated earlier, to have a successful (defined as meeting all stakeholder expectations) wastewater reuse project requires the three key project elements to work together – equipment, agronomic practices and management. Poor application of any of these can lead to project failure and worse the potential for legal implications. An example would be the wastewater application package of the center pivot is designed so it does not exceed the soil intake rate but the agronomic practices do not maintain any residue on the surface and the farmer decides to apply a depth of 2 ½ inches per pass. No matter how well the center pivot equipment options were selected there is the strong potential for runoff and/or excessive wheel tracks leading to the center pivot becoming stuck. Either of these jeopardizes the overall performance of the wastewater reuse package and potentially could lead to legal action.

Besides the typical irrigation application parameters that need to be considered there are others as well particularly the wastewater storage, nutrient management plan, neighbors and maybe most importantly the expectations of the involved parties. All of these must be managed and not just casually. If the livestock owner is also the farm owner the situation is simplified and there is more chance for coordination of management. But if the livestock owner is not the farm operator, we have a different situation that will impact the management of the center pivot. Let us now discuss some specific situations.

- 1) Swine farrowing operation –
 - a. Hog operation does not own the land
 - b. Issue
 - i. Level of the lagoon in the spring and fall
 1. The farmer wants to get the field dried out as early as possible in the spring to allow tillage and planting operations and keep the field dry for harvest in the fall
 2. The hog operator needs to begin pumping as soon as possible in the spring to maintain free board on the lagoon and pump the lagoon down in the fall

Is this an equipment, agronomic or management problem?

Solution

- This requires a combination of the all of the above
- Management impact can be:

- In barn management of water and volumes going to a lagoon. Significant variations in the volumes of wastewater generated per sow are seen in the field.
- Management of communication with the farmer
 - Both sides need to be sensitive to the needs of the other
 - Structure of financial arrangements so both sides understand the impact.
 - If the lagoon 'runs over' and reaches a stream this could have significant financial impact to the livestock operation
 - Delayed planting and/or harvest may impact the yield potential of the crop

2) Swine finishing operation -

- a. Hog operation owns the land
- b. Issue
 - i. For the farm - Center pivot frequently gets stuck

Is this an equipment, agronomic or management problem?

Solution

- Equipment and management probably have the most potential for solutions
- Management suggestions:
 - Evaluate the relationship of center pivot options and agronomic practices
 - Does the wastewater application package make sense for the agronomic practices?
 - Try to apply the maximum application depth per pass that does not lead to runoff to maximize the time between wastewater application cycles to allow the wheel tracks to dry.
 - Consider varying the application depth or even shutting off portions of the center pivot for problem areas
 - Be sure to account for this area in the nutrient management plan

3) Dairy operation –

- a. Dairy operation owns the land
- b. Issue
 - i. For dairy and farm - Complaints from neighbors about odor when applying wastewater

Is this an equipment, agronomic or management problem?

Solution

- Equipment and management probably have the most potential for solutions
- Management suggestions:
 - Use common sense – do not apply when the wind is blowing sufficiently to cause drift and the direction is toward the neighbors
 - Talk with the neighbors so they understand you are sensitive to their concerns
 - Apply at night and early mornings

4) Beef operation –

- a. Beef operation does not own the land
- b. Issues
 - i. For the feed lot – The storage is primarily for storm water runoff and must keep the level in storage low to be able to handle potential storm events
 - ii. For the farm - Meeting crop water needs

Is this an equipment, agronomic or management problem?

Solution

- Management and agronomic practices probably have the most potential for a solution
- Management suggestions:
 - Try to balance wastewater applications as much as possible with the crop needs
 - Re-evaluate the storage size and design
 - Structure of financial arrangements so both sides understand the impact.
 - If the storm water storage ‘runs over’ and reaches a stream this could have significant financial impact to the feedlot operation
 - Lack of waste water may impact the yield potential of the crop

Conclusions:

Land application using mechanical move irrigation equipment has proven very beneficial to many reuse projects and can be cost effective over the life of the project. However not meeting the expectations of all stakeholders can lead to significant problems for the project and long term acceptance. One of the keys to successful waster water reuse projects is an integrated approach combining equipment, agronomic practices and management.

An analysis of the situations above would indicate some of the issues which management can impact to be:

- If the wastewater producer does not own the land, must manage the communication with the farmer.
- Management must be sensitive to the local concerns about odor, impact on visual landscape and other possible concerns.
- The management must be reviewed periodically to ensure operation is meeting the design basis and the nutrient management plan as well as any changing operating constraints.
- Management must take into account the financial impact to all involved parties.

Key management considerations for the center pivots would be:

- Use some common sense!
- Manage closely the soil moisture status and do not exceed what the soil and crop canopy can hold with the application depth.
- Manage applications to apply during the night and early morning whenever possible.
- Manage applications to avoid windy days that may tend to cause drift.
- Manage the center pivot to ensure the wheel tracks in the field have an opportunity to dry as much as possible between irrigation cycles.
- Manage the interactions of equipment, agronomic practices and management.
- Manage communication between all of the involved parties.

References:

Gilley, James R., 1983, Suitability of Reduced Pressure Center Pivots, Journal of Irrigation and Drainage Engineering, Vol 110, No. 1

LaRue, Jacob L, 2006, A Review of Mechanized Irrigation Performance for Agricultural Wastewater Reuse Projects, Central Plains Irrigation Association proceedings

Personal communication with wastewater reuse projects.