Advances in Using Center Pivots for Resource Management

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Summary: Significant changes have occurred in how irrigators are using center pivots and their expectations. In addition constraints on available water are beginning to change irrigators' management processes. This paper will focus on changes within the center pivot industry to meet both wants and needs of irrigators to provide optimum resource management. Data will be presented on some specific examples of how irrigators are using new center pivot technology to minimize input of labor and variable expenses and additionally improve their quality of life. Generalized costs associated with center pivot options for resource management will be compared with potential annual savings. Finally the paper will contain a brief discussion of the direction commercial center pivot technology is moving.

Objective: To discuss specific examples of advances in center pivot irrigation for providing better resource management options for operators.

Introduction: Since the early 1980's center pivots have seen a dramatic increase in improved irrigation efficiencies with changes in the sprinkler packages, pipeline diameters and structural design while little has been done to address farmers' needs for integrated resource management tools.

Besides the irrigation water, resources requiring management consideration include but are not limited to power to pump the water, labor, equipment to management such as a pickup truck, fertilizer, seed and herbicide. With the rising costs of capital purchases and operation, more consideration is being given to tools to help manage these resources. This coupled with farm consolidation has made a dramatic change in the costs for an irrigator to manage their operation efficiently and effectively. In addition, many irrigated farm operations need to be able to rapidly adjust their cropping strategy due to changing commodity prices, available water and production costs which requires maximum flexibility in resource management.

To help address the labor required to monitor, center pivot manufacturers have offered some tools for remote communication such as phone communication or VHF and UHF radios either for direct or base station applications. These tools have been offered for over ten years but have met with limited acceptance with 5% or less of growers using them. Part

of the reason for limited acceptance has been the cost, reliability and durability. Plus in most cases the communications devices provided only limited monitoring or control information without providing an integrated platform for resource management. Lastly many of the products offered did not work on older 'orphan' center pivots.

With energy costs rising for both the pumping plant and for vehicles to check the center pivot and consolidation of farms – more center pivots being operated by single operations, the need and want for improved monitor and control is rapidly increasing.

Discussion: Recent changes in technology have facilitated improvements in the tools being offered for resource management. These changes include improved design and construction of automated control panels such as the TLC Pivot Manager™, RAMS 2000™, GrowSmart FieldBOSS™ and cams Pro2™, improved cellular communications options such as Field Sentry and the cams Tracker, data instead of voice radios for Base Stations and a variety of sensors along with the software to provide expanded monitoring and control capabilities.

Today, reliable tools are available to monitor specific functions of the center pivot such as position, pressure, voltage, safety circuit, direction, water on/off and others. In addition, monitoring of a variety of environmental sensors has become common place. These include but are not limited to water pressure, water flowrate, water volume, temperature, rainfall, wind speed, wind direction and soil moisture. Data is consolidated at the center pivot control panel and/or sent via state of the art communication devices to cell phones, direct to the farm's computer or the internet.

Let us look at some generalized scenarios that may not reflect actual situations but are designed to be instructive. In each case the costs for the monitoring and communications is spread over a three year life.

Scenario 1 – Grower owns two center pivots and is renting three more for row crop production and farms 2,500 acres more dryland. These pivots are scattered with ten miles (16 km) between them and the farthest being twelve miles (19km) from the farm house. The grower's pumping cost (natural gas) is running about $275/day/pivot (August 2005). While rainfall is limited, rainfall events do occur during the growing season. He estimates the cost (labor and pickup fuel) to check the pivots at $60 per trip not including wear and tear on his pickup. Typically he will operate the pivots about 1,800 hours and make about 100 trips to check the pivots.

Situation 1 – The resource concern is labor and energy costs. If it rains, did all or some of his pivots receive rain and was the rain sufficient that he can stop the pump for a period of time. Does he stop his activity and drive to check each of the pivots? To check the pivots costs about $60 but it is also costing $57/hour to run all of the pivots. If he could shut them all down for one day, he could save $1,375.

Solution 1a – By adding a rain shutoff, the pivot can be set to stop at a set amount of rainfall, stop the pump and a remote monitoring device will call and alert the farmer when the pivot has stopped. Depending on the device, he will only know that the pivot and pump have stopped and not specifically why.

Costs 1a - Basic rain shutoff and remote monitoring only - $525 annual (costs spread over three years).

Payback 1a – If he can save two days of pumping for a pivot plus two trips to the field, this will more than cover his costs for the monitoring package.

Solution 1b - His other alternative is to have a complete Base Station package which will provide monitoring, control and reporting of what is happening in the field.

Costs 1b - Complete monitor, control and report package, VHF radio - $1,600 annual (costs spread over three years).

Payback 1b – While this package cost more in initial investment, its more advanced capabilities providing more information such as specific pivot status may also well be worth consideration. By reducing trips to check the pivots by 20 could save about $1,200 plus if he can save operating the pivots five days, will more than payback his investment. This also does not consider any wear and tear on the equipment to check the irrigation equipment and his ability to control the irrigation equipemtn.

Scenario 2 – Grower owns two center pivots for row crop production and farms another 4,000 acres. These pivots are scattered with five miles (8km) between them and the farthest being six miles (9km) from the farm house. The grower’s pumping cost (electric) is running about $61/day/pivot (August 2005). His monthly demand charge is $750/pivot. He is in an area of supplemental irrigation with rainfall events occurring during the growing season. He estimates the cost (labor and pickup fuel) to check the pivots at $40.

Situation 2 – The primary resource concern is cost of the demand charge when he will not have a chance to operate sufficient hours to use power to offset the demand charge. In the early and late part of the season, it is difficult to decide if he should irrigate or not. It is quite expensive to apply one inch due to the demand charge. Does he stop his activity on the other fields and spend time walking the pivots to determine soil moisture? Often in the fall, he is already into harvest on some of his crops. To check one pivot's soil moisture status costs him more time than he is willing to give up but not applying one more irrigation can impact his crop quality. If he has to start the pivot to apply one more irrigation, it will cost him $750 per pivot.

Solution 2 – By adding a moisture monitoring device integrated into the control panel, he can go to the pivot point and immediately have a good idea of the current moisture status without taking the time to scout the field. In addition he can see the changes in soil moisture over a period of time and know if the area of the soil moisture sensor is becoming wetter or dryer. Based on this information he can make a decision as to how critical one more irrigation would be.

Costs 2 – Soil moisture monitoring package - $950 annual (costs spread over three years).

Payback 2 – If he can save the demand charge both in the spring and fall, it will more than pay for the cost of soil moisture monitoring plus the added benefit of using the soil moisture monitoring to help him determine during the growing season if irrigation is required.

Scenario 3 – Grower owns five center pivots for forage production and runs a large dairy. His pivots are about three miles (5km) away from his milkhouse. The grower's pumping cost (electric) is running about $125/day/pivot (August 2005). He is in an area that is water limited with some rainfall events occurring during the growing season. He estimates the cost (labor and pickup fuel) to check the pivots at $97 due to the high cost of labor. He runs forage crops continuously under the pivots and contracts his harvest. Typically the pivots run about 2,500 hours per year. With checking the pivots and changes during harvest he figures he makes about 250 trips per year.

Situation 3 – His primary resource management concern is labor and water is also important. His focus is the dairy and does not believe he has a sufficient number of pivots to justify someone to operate and watch just them. Often when harvest is in progress he needs to be moving the pivots out of the way as the custom harvester does not want the responsibility of operating the pivots. Does he stop his activity in the dairy to run out and check the pivots and move them out of the way? Also the pivots need to be running as soon as harvest is complete to maximize his yields.

Solution 3 - His solution is a complete Base Station package which will provide monitoring, control and reporting of what is happening in the field. At a glance in the milkhouse, he can see the location of the pivots on his computer screen, maintain notes on cropping and harvest status and control what pivots are irrigating where without having to be in the field all of the time.

Costs 3 - Complete Base Station package for monitor, control and reporting, VHF radio - $ 1,600 annual (costs spread over three years).

Payback 3 – Quickly by looking at a computer screen he knows what is happening and with a few mouse clicks he can be moving his pivots, changing directions and applications depths. By reducing his trips to the field by a third (80) would save him $7,760 plus help him maintain focus on the dairy and allow more timely irrigations behind the harvest. Certainly within three years he has more than saved what the cost of the Base Station system is and this also does not consider any wear and tear on the equipment to check the irrigation equipment.

Conclusion: In many more cases than farmers and growers realize, an investment in remote monitoring, control and/or reporting for their center pivot can have a very rapid payback. Traditionally less than 5% of growers considered any type of ancillary equipment other than just the center pivot for resource management.

Each of the above scenarios is built around specific customer situations.

All of the major manufacturers are moving to more and better integrated control packages to meet the changing needs of agriculture. With the automated control panels, functions specific to the operation of the center pivot such as position, pressure, safety circuit, direction, water on/off and others are included. In addition, monitoring of a variety of environmental sensors is becoming common place. These include but are not limited to water pressure, water flowrate, water volume, temperature, rainfall, wind speed, wind direction and soil moisture. Information is

collected at the center pivot control panel and stored for review or sent via state of the art communication devices to cell phones, direct to the farm's computer or the internet.

With rapidly rising energy costs, the challenges of finding adequate labor and general changes in cropping strategies, the need is here now and is being met by the center pivot manufacturers.

Reliability and durability have been addressed and the challenges of the 1990's have been overcome to offer products meeting most grower situations. Today due to changes in design and manufacture in many cases the maintenance costs for an automated panel are similar to a manual panel.

As shown by the three examples above in many cases farmers can see a very rapid payback, less than two or three years, for the additional investment in equipment offered by the center pivot manufacturers for resource management. In many cases, it is justified to upgrade existing center panels and add ancillary hardware to better manage their available water resource and fertilizer.

An area requiring more work is helping farmers and growers recognize the advantages of the newer resource management tools for center pivots. Also 'selling' farmers on the reliability and durability of the new tools will require effort by manufacturers.

It is anticipated we will continue to see more integrated monitoring, control and reporting packages available utilizing the latest communication options available to help farmers best manage their resources at a cost providing excellent value.

Also the center pivot manufacturers are moving to providing better and more economical precision application solutions to address better resource management within a particular field by crop, soils or topography.

As water resources for food, fiber and forage production continues to be a world concern and available time growers have to manage their resources is a challenge, more will move to mechanical move irrigation and integrated monitoring, control and reporting packages to provide the flexibility they require. Other irrigation technologies may offer water savings but do not allow cost effective operation as growers move to more closely manage their fields and cropping strategies.

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