5.5 Low Pressure Center Pivot Sprinkler Irrigation Systems

Applicability

Low Pressure Center Pivot ("LPCP") Sprinkler Irrigation Systems are applicable to both arid and humid locations, most soil types, and land with flat to modest slopes and can be used for irrigating a wide variety of crops. LPCP systems are typically used in Texas by agricultural producers of cotton, alfalfa and other hays, pasture, chile, corn, silage, and other non-orchard crops.

Description

The four types of Center Pivot Sprinkler Irrigation Systems that are commonly considered to be low-pressure systems and BMPs are:

1) Low Energy Precision Application ("LEPA")
2) Low Pressure In-Canopy ("LPIC")
3) Low Elevation Spray Application ("LESA")
4) Medium Elevation Spray Application ("MESA")

All four systems are low-pressure sprinkler systems (with typical pressures at the outer end of the center pivot ranging from 10 to 25 psig) and use fixed sprinkler applicators or nozzles or drop tubes or a combination of both to apply water. Center Pivots equipped with high or medium pressure (greater than 25 psig) impact sprinkler heads have lower water application efficiencies than low-pressure systems. Care should be taken to match water application rates to soil intake rates to minimize water runoff. Each of these LPCP systems can be combined with cultural practices necessary to prevent runoff during irrigation or moderate rainfall events. LEPA systems combine the LPCP system BMP with the Furrow Dikes BMP and the practice of farming with the row direction perpendicular to the direction of travel of the center pivot (i.e. farming in a circle).

Implementation

Conversion of a high or medium pressure center pivot to a low-pressure system is relatively inexpensive and can be completed in one to five days. Installation of a new center pivot on land that was previously irrigated using surface irrigation can take several weeks to several months and has significant cost. Implementation should be completed within one growing season of commencement of the BMP in order to achieve the maximum water efficiency benefit.

Schedule

To accomplish this BMP, the agricultural water user should, within two years of the implementation date, install and maintain a low-pressure center pivot sprinkler irrigation system.

Scope

The scope for MESA, LESA, and LPIC systems is complete when the system is installed or the conversion from a high or medium pressure system to a low-pressure system is complete. LEPA systems require installation of additional conservation practices (such as farming in a circle and use of furrow dikes) before the scope of the BMP is complete.

Documentation

To document this BMP, the agricultural water user shall gather and maintain the following documentation:

1) Copies of equipment invoices or other evidence of equipment purchase and installation;
2) Any USDA Farm Service Agency or other governmental agency evaluation and assistance reports that may relate to the project.
3) Water measurement records from both the period before and after conversion to the water efficient irrigation system.

Determination of Water Savings

The amount of water saved from converting a conventional center pivot sprinkler irrigation system to a BMP center pivot sprinkler irrigation system (i.e. LPCP system) can be estimated using the following equation:

$$\textbf{Water Saved (acre-feet per year)} = A_1 \times (1 - E_1/E_2)$$

Where A_1 is the annual amount of water pumped or delivered to the inlet of the non-BMP center pivot sprinkler system, E_1 is the application efficiency of the non-BMP center pivot sprinkler system, and E_2 is the application efficiency of the BMP center pivot sprinkler system. E_1 and E_2 can be directly measured or obtained from the estimated values in the table below.

Estimated Application Efficiency Percent

System Type	New Condition	Fair Condition	Poor Condition
Non-BMP Systems			
Spray	78	60	40
Regular Angle Impact	65	50	30
Low Angle Impact	80	60	40
BMP Systems			
MESA	80	85	70
LESA	90	85	75
LPIC	90	85	75
LEPA (Drop Tube to Furrow Dike, concentric rows)	95	90	80

The amount of water saved is also affected by environmental conditions during irrigation, the amount of runoff that occurs during irrigation (soil slopes, soil texture, cropping practices), and the time of irrigation (i.e. pre-plant irrigation versus irrigation once the crop canopy is established).

Cost-Effectiveness Considerations

The cost for purchase and installation of center pivot systems is typically $300 to $500 per acre. The cost per acre-foot can be estimated by dividing the estimated quantity of water conserved (acre-feet per acre) by the cost per acre of the system ($ per acre-foot).

References for Additional Information

1. *LEPA Conversion and Management*, B-1691, Texas Agricultural Extension Service, New, Leon, and Guy Fipps.
2. *Comparison of Spray, LEPA, and Subsurface Drip Irrigated Cotton*, Texas Agricultural Experiment Station, Bordovsky, James.
3. *Optimal Performance from Center Pivot Sprinkler Systems*, B-797, Idaho Cooperative Extension System, King, Bradley and Dennis Kincaid.
4. *Comparison of SDI, LEPA, and Spray Irrigation Efficiency*, Paper No. 12019, American Society of Agricultural Engineering, 2001 International Meeting, Schneider, A.D., T.A. Howell, S.R. Evett, July 2001.