

5.3 Linear Move Sprinkler Irrigation Systems

Applicability

Linear Move Sprinkler Irrigation (linear move) Systems are an adaptation of center pivot sprinkler systems for use on fields which are not appropriate for center pivot systems due to shape or elevation changes (See Low Pressure Center Pivot Sprinkler Irrigation Systems BMP). Linear move systems are applicable for both arid and humid locations, for most soil types with flat to minimal slope, and for producing a wide variety of crops. Texas agricultural producers typically use linear move systems to irrigate cotton, alfalfa and other hays, pasture, chile, corn, silage, and other row type crops.

Description

The linear move sprinkler irrigation system is composed of a series of towers that suspend the irrigation system and move laterally in the direction of the rows. Water can be supplied to the towers from a open ditch adjacent to the 1st tower and parallel to the director of travel or by a flexible hose typically 100 to 200 feet in length. The flexible hose is supplied through risers connected to a buried pipeline. Use of a linear move system is normally limited to irrigating rectangular shaped fields. The four types of Linear Move Sprinkler Irrigation Systems that are addressed in the best management practices document and are commonly considered to be low-pressure system include:

- 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 farthest end of the sprinkler from the water source ranging from 10 to 35 psi) and use fixed sprinkler applicators/nozzles or drop tubes or a combination of both to apply water. Linear Move Sprinklers equipped with high or medium pressure (greater than 35 psi) impact sprinkler heads have lower water application efficiencies than low-pressure systems. Each of these linear move systems can or must be combined with cultural practices necessary to prevent runoff during irrigation or moderate rainfall events. LEPA systems can be combined with the Linear Move Systems BMP and with the Furrow Dikes BMP (See Section 4.3.1).

Implementation

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

Scope

The agricultural water user with multiple fields can implement the Linear Move Sprinkler BMP or other irrigation BMPs on each field in different years or growing seasons, if such timing is more cost-effective.

Documentation

To track 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; and
- 3) Water measurement records from the period both before and after conversion to the water efficient irrigation system.

Determination of Water Savings

The amount of water saved from converting from a conventional linear move sprinkler irrigation system to a BMP linear move sprinkler irrigation system can be estimated using the following equation:

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

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 linear move sprinkler system, and E_2 is the application efficiency of the BMP (linear move) 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	85	80	70
LESA	90	85	75
LPIC	90	85	75
LEPA (Drop Tube to Furrow Dike)	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 linear move systems is typically \$300 to \$700 per acre. The cost per acre-foot can be estimate by dividing the estimated quantity of water conserved (acre-feet per acre) by the cost per acre of the system (dollars per acre-foot).

References for Additional Information

1. New, Leon, and Guy Fipps, "*LEPA Conversion and Management*", B-1691, Texas Agricultural Extension Service.
2. Bordovsky, James, "*Comparison of Spray, LEPA, and Subsurface Drip Irrigated Cotton*", Texas Agricultural Experiment Station.
3. King, Bradley and Dennis Kincaid, "*Optimal Performance from Center Pivot Sprinkler Systems*", B-797, Idaho Cooperative Extension System.
4. Evans, R.O., et al., *Center Pivot and Linear Move Sprinkler Systems*, AG-553-3 North Carolina Cooperative Extension, 1997.