Low Energy Precision Application

and the Senninger Quad-Spray®

Table of Contents

What LEPA Does

Low Energy Precision Application (LEPA) is a proven water management practice that originated in West Texas in the late 1970's. Dr. Bill Lyle and James Bordovsky of the Lubbock-Halfway Texas Agricultural Experiment Station did the original experimental work. Today, after many advances, LEPA is making big waves in semi-arid regions worldwide. A properly managed LEPA system:

- Cuts Water Losses
- Uses Less Energy
- Irrigates Each Plant More Frequently

LEPA Cuts Water Losses

With a LEPA-equipped pivot, 95-98 percent of the water being pumped is being delivered directly to the soil surface. Canopy evaporation losses are virtually eliminated and soil surface evaporation losses are cut by more than 50 percent *(see photo next page)*. The table below shows how water losses in several areas are kept in check.

Area of Water Loss	Conventional Above-Canopy Irrigation	LEPA
Soil Surface Evaporation	entire soil surface wetted, high evaporation	less than one-half soil surface is wetted, reduced evaporation
Canopy Evaporation	wet canopy has large surface area, high evaporation	canopy stays dry
Wind Drift	misting very susceptible to wind drift	no misting
Runoff	topography, poor tillage and overirrigating increase runoff losses	LEPA tillage practices and system management reduce runoff
Deep Percolation	overwatering can result in losses below the soil surface	soil moisture monitoring helps eliminate loss

With LEPA, the plant canopy remains dry and less than one-half of the soil surface is wetted — surface evaporation losses are dramatically cut.

LEPA Uses Less Energy

LEPA uses very low pressures (6 - 10 psi at the nozzle). This, along with the fact that less water per acre needs to be pumped, can lead to substantial energy savings.

LEPA Irrigates Each Plant More Frequently

Conventional pivot systems need to travel at a relatively slow rate in order to put down enough water over a given area before moving on. LEPA systems, on the other hand, deposit water at a high rate directly into furrow storage basins. The pivot doesn't need to be around as the water gradually soaks in from these basins. This means quicker trips around the circle and less time between when a plant sees water.

How LEPA is Accomplished

Precision is a key aspect of LEPA. An efficient LEPA operator knows how much water his crop is demanding at a particular time and is able to precisely apply that amount, no more and no less. He also spoonfeeds pesticides, herbicides and fertilizers directly to the crop.

Low Energy Precision Application significantly cuts waste by allowing precise application of water and chemicals to a crop.

In order to be precise, strict management, specific tillage practices and special irrigation equipment are required. The following pages look at each of these in more detail.

1) LEPA Management

Soil Moisture Monitoring

Soil moisture should be monitored two to three times each week in order to know when and if irrigation is needed. This helps to reduce deep percolation losses and avoid plant stress.

Checking soil moisture at one, two and three foot depths.

Adjusting Pivot Speed

Because of LEPA's high application rate, pivot speed may need to be adjusted. The speed needed can be determined by watching the outer span of the pivot. If the furrow basins are filling up and spilling over before the system moves, the system's speed should be increased. If the basins are not filling up enough, pivot speed should be slowed.

Maintaining System Pressure

It is critical that proper system pressure be maintained. Slight changes in pressure can result in relatively large fluctuations in flow.

For many quarter-mile systems on flat land, 10 to 15 psi pivot pressure (at the top of the main-line at the first outlet) can be used. Half-mile pivots that carry 2,000 to 3,000 gpm can be designed for 25 to 40 psi pivot pressure.

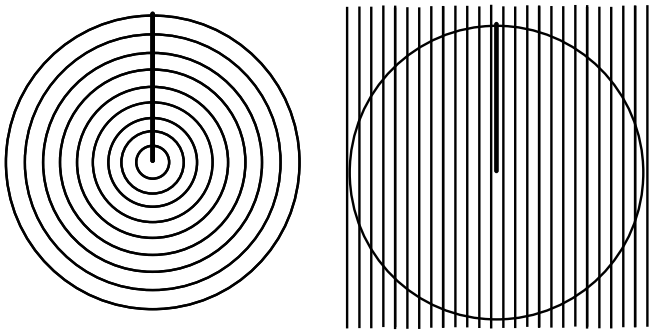
The Quad-Spray's 6 psi pressure regulators require at least 9 psi at the inlet to operate properly. To ensure adequate pressure, a pressure gauge should be installed in a pipe T on the last drop at the end of the pivot. For easy monitoring, the gauge should be installed just above the LEPA head (*see photo at right*). This should maintain a minimum pressure of 9 psi when the end of the system is at the highest point in the field.

A pressure gauge should be mounted above the last LEPA head at the end of the pivot.

2) LEPA Tillage

Circle Planting

Planting in circular rows is recommended for center pivot systems; straight rows for linear/lateral-move systems. This is necessary to keep the applicator head centered in the furrow. Circular rows play an important role in reducing runoff. If water does run, it will not run far. Also, when crops are planted in a circle, the pivot never dumps all the water in a few furrows as it can when it parallels straight planted rows.



When crops are planted in a circle, the pivot never dumps all the water in a few furrows as it can when it parallels straight planted rows.

Slope

LEPA is primarily for use on relatively flat land. The maximum recommended slope is 2 percent. In high-intensity rainfall climates, circular rows should not be used on more than 1 to 1.5 percent slopes.

Furrow Diking

Diking furrows creates the small storage basins that are an integral part of LEPA. The LEPA applicator deposits the water in the basin at a high application rate. The basin will hold the water until it infiltrates the soil.

Creating water storage basins by furrow diking. These basins hold irrigation water and rain water, allowing the pivot to move along at a higher speed.

Deep Chiseling or Ripping

Deep chiseling or ripping is used to loosen the soil and improve infiltration.

Soft Middles

Because a LEPA applicator is located in every other furrow, it is recommended that these furrows be left as uncompacted as possible.

Crop Residue

Crop residue left on top of the soil increases surface storage capacity and helps prevent surface soil redistribution.

3) LEPA Irrigation Equipment

LEPA irrigation equipment includes a center pivot or linear/lateral-move system along with LEPA applicators attached from long drops. There are two different types of LEPA applicators currently in use: (1) a nozzle/shroud assembly (Senninger Quad-Spray) that travels 8 to 18 inches above the soil and (2) a drag sock which travels along the soil surface.

Senninger Quad-Spray™

The Senninger Quad-Spray is a nozzle/shroud type LEPA applicator. It offers high application efficiency along with these four modes of operation:

Bubble (LEPA 1)

The Bubble Mode deposits water at a low velocity directly into the furrow basin.

Aerated Bubble (LEPA 2)

The Aerated Bubble Mode offers an even gentler application directly to the furrow basin.

Spray Irrigate

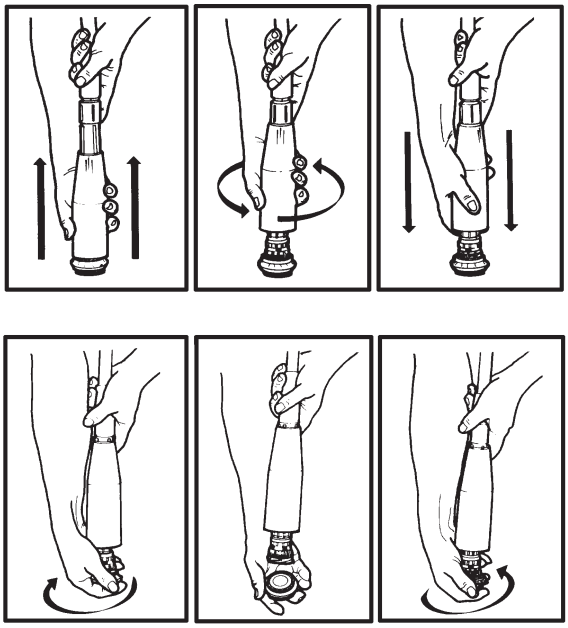
The Spray Irrigate Mode is used to wet the entire soil surface. This is desirable for seed germination, some chemical applications and irrigation of close-seeded crops.

Chemigate

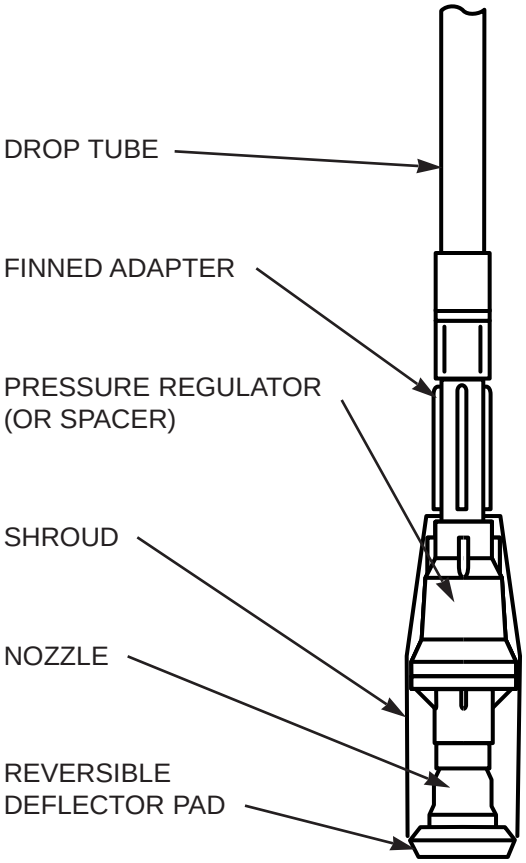
The Chemigate Mode offers an upward spray to wash the underside of the plant. There are two types of chemigation pads available: ***Corn Chemigate*** *(58° upward throw) and* ***Cotton Chemigate*** *(15° - 30° multi-level upward throw).*

Quad-Spray Components

The Quad-Spray consists of a Finned Adapter, a Pressure Regulator or Spacer, Nozzle, Reversible Deflector Pad and a Shroud.



The finned adapter and shroud (top row), along with the reversible deflector pad (bottom row) are used to set the Quad-Spray to the desired mode of operation.



Drag Socks

Drag socks deposit water directly into the furrow basins with minimal erosion to the furrow dikes. Drag socks should be attached to a spray nozzle (using a drag hose adapter) so that wetting the entire soil surface is possible when needed.

Drop Tube Spacing

Drop tubes are usually located in every other furrow (keeping out of wheel tracks). For row spacings of 30 inches, drops are needed every 60 inches or five feet. Likewise, for 36-inch row spacing, drops are spaced every 72 inches or every six feet. Sometimes drops are placed in every row toward the outer end of higher gallonage systems. This is done in order to place enough water down without flooding a row or exceeding recommended LEPA head flow.

On many older pivots, outlets are spaced too far apart and additional plumbing is needed (see *adding additional outlets* below). The cost for converting an older pivot to LEPA typically runs about $ _____ .

Most newer pivots are now offered with outlets spaced 30, 40, 60 or 80 inches apart. Any of these spacings fit conveniently into 160-foot span lengths. These pivots can be equipped with LEPA components for about $ _____ more than the cost of a new system equipped with spray heads attached to drops.

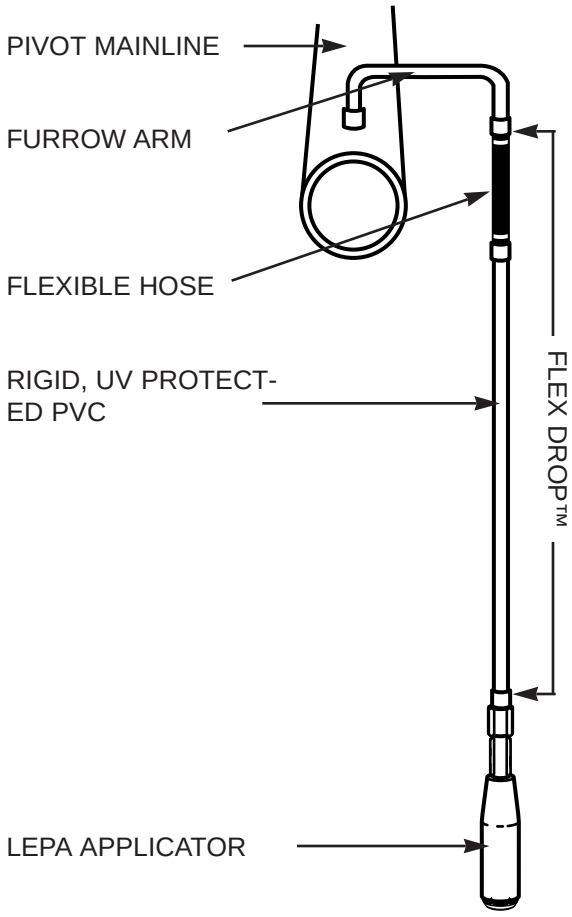
Adding Additional Outlets

New outlets can be installed using metal alloy couplings sold through many irrigation dealers. An 11/16" hole is drilled into the pivot mainline at the correct spacing. The coupling is inserted into the hole and a special hydraulic press (body hydraulic punch equipped with a pull-type cylinder) is used to compress the coupler against the inside of the pipe, making a water-tight seal. A small amount of sealant is recommended for extra insurance. Furrow arms are then screwed into the coupling. Some irrigation dealers have the hydraulic presses available on a rental basis. The special fittings are also available at many irrigation dealers.

IMPORTANT: Consult your local Senninger dealer or county extension agent regarding LEPA. For maximum efficiency, it is important that your LEPA system be designed and installed by experienced personnel. Proper design and installation are critical with LEPA systems.

Drop Assembly

A drop is connected to the center pivot mainline by a gooseneck or furrow arm. (The longer radius of the furrow arm is useful for horizontally aligning the LEPA applicator in the center of the furrow.) Senninger Irrigation recommends the drop assembly pictured at the right. A small piece of flexible hose allows the drop to move around objects it encounters without breaking. This also can be used as a shutoff by raising the drop which kinks the hose in two places. The majority of the tube consists of rigid, UV protected PVC which helps keep the applicator head positioned correctly in the furrow. A slip weight of poly material may be added to help maintain this position. A Senninger Quad-Spray is attached at the bottom of the assembly.



Drop Length

The length of the drops should be adjusted so that all of the Quad-Sprays are the same height (approximately 8 to 18 inches above the ground) when the system is running. When water is pumped into a center pivot, the weight of the water causes the machine to squat. For 160-foot spans, the pivot mainline will be lowered approximately four inches at the center of the span. A 185-foot span likewise will be six inches lower at the center once the system fills with water. The length of the drop should be cut to account for this change. If a wheel track is anticipated, the depth of the wheel track should be added to the amount cut off of a drop length. This is done to prevent the LEPA head from dragging on the ground.

Portions of this book were adapted from:

LEPA Conversion and Management . . . . . Dr. Guy Fipps and Leon New
LEPA: Saving Water for Future Producers (video) . . . . . Pam Alspaugh - Texas Tech University
Planning, Design, Operation and Management of Low Energy Precision Application Irrigation Systems . . . . . ASAE

Senninger
Irrigation Inc.

• 6416 Old Winter Garden Road, Orlando, FL 32835 USA - Phone: (407) 293-5555 •
• 5810 50th Street, Lubbock, TX 79424 USA - Phone: (806) 793-3010 •
• 3721 Arch Avenue Grand Island, NE 68803 USA - Phone: (308) 381-8558 •
Website: www.senninger.com - E-mail: info@senninger.com