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Using Flexible Pipe (poly-pipe) with Surface Irrigation

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Aimed at farmers and irrigators who want to irrigate their crops using flexible plastic pipes (commonly called "poly-pipe"), this publication highlights (1) advantages of using poly-pipe, (2) factors to consider in selecting such pipe, and (3) considerations for installing it.

Advantages of Using Pipes to Deliver Irrigation Water

Using pipe systems (rather than earthen ditches) to convey and distribute water to fields has several advantages:

- **Increases in on-farm irrigation efficiency**, by avoiding water loss due to deep percolation from earthen conveyance ditches.
- **Better irrigation control.** Fluctuations in irrigation-canal water levels are common. Using earthen ditches and siphon tubes requires intensive labor to avoid water spillage as a result of such fluctuations (for example, siphon tubes may lose their vacuums and stop working). In contrast, a pipe-irrigation system needs only to have an outlet opened to deliver water through the pipe to furrows; irrigation can be left unattended, even when fluctuations in water levels occur.
- **Labor savings.** In the Rio Grande Valley, water is distributed through canals coming from the river and is delivered at different outlets (called turnouts). Systems are designed to deliver one "head" of water at each turnout (one head equals approximately 3 cfs or 1,346 gpm). One turnout is installed for each 40-acre field. Farmers may have field-blocks larger than 40 acres, and sometimes farmers may irrigate several fields at the same time. With pipe-irrigation systems, one irrigator can control six to eight irrigation fronts.

Types of Pipes Used to Deliver Water

Both gated pipes and poly-pipes can convey and deliver irrigation water. Gated pipes are rigid, made of aluminum or PVC, and generally less than 12 inches in diameter. Poly-pipes are expensive but are flexible and expand when full, are made from polyethylene resins, and generally are used for the larger pipe diameters needed to irrigate furrow crops.

Selecting the Correct Type of Poly-pipe

The most important of several pipe-selection characteristics are thickness and diameter (see Table 1). Thickness determines pipe durability. Some farmers prefer thinner poly-pipe (6 mil); because poly-pipe is sold by weight, they can save money by economizing on thickness. Poly-pipes also come in larger thicknesses (15 mil), allowing more pressure to be contained (up to 5 feet of water head or 2.15 psi).

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Pipe diameter should be selected based on irrigation flow-rate. Table 1 provides some approximate diameters and thicknesses needed for selected flow-rates. Larger diameters will yield less friction with less head loss, permitting longer runs (1,320 feet or more). Pipe outlets for discharging water to fields are made with a hole puncher after the poly-pipe has been laid out (see illustrations), with outlet size influencing furrow stream-size. The most common outlet sizes are ½, 1 and 2 inches.

Table 1. Poly-Pipe Characteristics.

Diameter (inches)	Thickness (mil)	Maximum pressure (max psi)	Maximum head (ft)	Gallons/ Minute (gpm)
8	10	1.30	3	400
10	6	0.86	2	500
10	10	1.30	3	600
12	6	0.86	2	800
12	10	1.30	3	1,000
16	6	0.86	2	1,800
16	10	1.30	3	2,000
18	6	0.86	2	2,500
18	10	1.30	3	2,700
22	10	1.30	3	3,800

Economics of Poly-Pipe Irrigation

The main expense associated with poly-pipe is its initial cost. Labor costs are minimal, since installation takes two workers just half a day. Once installed, poly-pipe remains in position for an entire season. Poly-pipe can be used for as many as three irrigation seasons if it is handled carefully to avoid damage and stored between seasons in a dry place out of direct sunlight.

Poly-pipe prices vary according to manufacturer and depending on characteristics such as UV-resistance, diameter and thickness (see Table 2). Price also varies depending on amount of pipe purchased. Prices reported in Table 2 represent 2005 averages for three different manufacturers and are based on standard tubing length of 1,320 feet. Poly-pipe generally comes in one of two colors, white or blue.

Table 2. Prices for different poly-pipe diameters and thickness.

Diameter (inches)	Thickness (mil)	Price/1,320 ft unit (U.S. $)
5	9	115.20
10	10	215.69
12	9	203.00
12	10	231.66
15	9	262.96
15	10	278.00
18	9	296.42
18	10	340.53
22	9	383.30

Plugs are used to stop water discharge from pipe outlets. Plug prices vary according to opening size, ranging from 4 cents per unit for ½-inch plugs to 20 cents per unit for 2-inch plugs. Gate holes also are available ($1.25 per unit for 2-inch size) and permit better irrigation control. Larger outlet sizes allow larger stream-size and faster advance and may be preferable for irrigating long, sandy furrows or furrows containing considerable harvest residue.

Installing Poly-Pipe

Materials required for poly-pipe installation include

- Tractor with furrower tool and unspooling bracket
- Poly-pipe rolls
- Pump or valve for connection
- Clamps, rubber straps, or duct tape
- Shovel
- PVC connectors (if more than one roll is used)
- Hole puncher with plugs

Prior to poly-pipe installation, fields should be leveled. Poly-pipe should be installed only on flat surfaces or down-hill, never up-hill. A minimum of 6 inches of water head (water surface height above the pipe) is required for poly-pipe use.

Poly-pipe installation steps are as follows:

1. Open the box containing the poly-pipe roll and check pipe condition.
2. Use a furrower to dig a trench (Fig. 1). (A furrower is a V-shaped cutting blade with wings that deflect soil upward and away from the center point of the V to form a ridge or furrow.) The furrow should be deep enough to accommodate about 50% of the poly-pipe's diameter and 100% of its width to avoid any rolling to the side. The trench should be built up to an elevation slightly higher than that of the irrigated furrows to avoid water return. If the field block is curved along its edge, the curve should be no sharper than 70°, preferably with an 8-foot radius.

Figure 1. Making the trench with a furrower.

3. Mount poly-pipe on an unspooling bracket so it is ready to roll out (Fig. 2).

Figure 2. Poly-pipe set with an unspooling bracket.

4. Stretch the poly-pipe gently into its trench (until pulling tension disappears), while someone holds onto it at the supply-pipe end. Use a shovel to place dirt on top of the poly-pipe at 10-foot intervals (approximately) to keep it in place and prevent it from being moved by the wind. (Fig. 3). Allow a few extra inches of poly-pipe at any curves to avoid excessive tension as the pipe fills with water.

Figure 3. Placing dirt on poly-pipe at 10-foot intervals.

5. Use clamps, rubber straps, string, or even duct tape (Figs. 4a and 4b) to connect the poly-pipe tightly to valves or supply-pipe fittings. Discharge-pipe diameter does not have to match that of the poly-pipe, which can be larger. If the pipe supplying water is at a higher elevation than the ground on which the poly-pipe will rest, build a soil ramp to support the poly-pipe at the connection point so that the poly-pipe does not hang freely in the air. At the point where the poly-pipe connects to the supply pipe, turn the poly-pipe tubing back onto itself for a distance of about a foot. Pressure inside the poly-pipe is likely to be greatest at this connection point, so the extra tubing will provide resistance to prevent the poly-pipe from separating from the clamp. Whenever more than one roll of poly-pipe is needed, connect the rolls with a corrugated pipe (Figs. 5a, 5b and 5c). Be sure to roll each end back on itself (as previously described) before strapping it to the supply pipe (Fig. 4a).

Figure 4a. Poly-pipe connected tightly to the supplying pipe.

Figure 4b. Using rubber straps to connect the poly-pipe to the supplying pipe.

Figure 5a. Connecting two rolls of poly-pipe.

Figure 5b. Using a corrugated PVC pipe to connect two rolls of poly-pipe.

Figure 5c. Making a tight connection to avoid water leaks.

At the end of the poly-pipe, build a mount (or place an object) up to 2 feet high to stop water flow; that way, if too many poly-pipe outlets are closed, developing pressure, the water will just flow over the elevated mount without damaging the pipe.

6. Filling can now begin. Open valves slowly and gradually. As the poly-pipe fills with water, create a vent 10 feet from the discharge-pipe connection point by punching a small hole with a pencil in the top of the poly-pipe; additional holes may be necessary at spots further along the poly-pipe to avoid air build-up, which can limit water flow and increase pressures inside pipes.

7. Once the poly-pipe is completely full and has expanded, then the hole puncher can be used to punch holes in front of each row to be irrigated (Fig. 6 and 7), at points between the 2 and the 3 o'clock positions. If necessary, increase water flow in order to make the last holes.

Figure 6. Hole puncher, plugs, and gates for poly-pipe.

Figure 7. Using poly-pipe hole puncher.

8. To make new holes, install plugs in old holes, then continue to punch new holes until they all have been finished. When a set of new furrows needs to be irrigated, the holes used in previous irrigations should be closed with plugs (Fig. 8a and 8b). When irrigation is finished, leave plugs inserted in the poly-pipe. Always use plastic plugs larger than the poly-pipe holes.

Figure 8a. Inserting plugs in poly-pipe.

Figure 8b. Gate holes used to irrigate sugarcane.

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