

Drip Irrigation Lateral and Submain Configurations for Field and Row Crops

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Abstract. Drip irrigation systems consist of lateral pipes that emit water directly to the root zones of crops, and submain pipeline networks that supply water to the laterals. Lateral and submain pipelines are available in a number of configurations that may be classified as season or permanent. Field crop (cotton, corn, alfalfa, soybeans, etc.) and row crop (fruits, vegetables, etc.) growers routinely use one or more of the following lateral and submain combinations: 1) Seasonal laterals with seasonal submains, 2) Seasonal laterals with permanent submains, 3) Permanent laterals with seasonal submains, and 4) Permanent laterals with permanent submains. Typical applications of each of these four combinations, and the relative pros and cons of each, will be reviewed. Discussion topics will include crop germination and/or transplant setting, labor, system maintenance, operational flexibility and the effect upon initial cost and yearly operating cost. Examples will show how each of these combinations are successfully deployed.

Keywords. *Subsurface Drip Irrigation (SDI), Drip Irrigation Economics, Drip Irrigation Design*

Introduction

The use of drip irrigation is growing rapidly in the United States. Drip not only increases resource-use efficiency, including water, fertilizer, labor and energy, but enhances yield and quality.

Drip irrigation has traditionally been implemented in higher value fruit, nut and vegetable crops. More recently, it has become very popular in field crop applications, including corn/soybean rotations and alfalfa, cotton and processing tomato fields. The U.S. Department of Agriculture's most recent Farm and Ranch Irrigation Survey reported 3.76 million acres of drip in the United States. Drip acreage is expected to be significantly higher in the 2013 report due in October of 2014.

One reason drip is gaining in popularity is because the systems are flexible and can accommodate diverse cropping and application demands. Drip irrigation systems consist of lateral pipes that emit water directly to the root zones of crops, and submain pipes that supply water to the laterals. For field and row crop applications, lateral and submain pipelines can be classified as seasonal or permanent and are available in a number of configurations.

Pros and Cons of Drip System Combinations

Drip irrigation systems rely on five major components:

- Drip tape is a “line source” drip irrigation lateral product that incorporates a continuously produced flowpath emission device into a thin- to medium-walled seamed or extruded tube. Toro’s Aqua-Traxx premium drip tape with the PBX advantage is an example of an extruded drip tape with rotary molded emitters using a polyethylene flowpath, while Toro’s Aqua-Traxx FC uses an elastomeric material.
- Flat emitter dripline is a “point-source” lateral product that incorporates injection molded emitters into a thin- to medium-walled extruded tube. Toro’s Neptune flat emitter dripline is an example of this type of lateral.
- Oval hose is a submain pipe made from polyethylene (PE) that is flattened to an oval shape during production to simplify transportation.
- Layflat is a submain pipe made from flexible PVC that is coiled flat.
- PVC pipe is rigid and available in various thicknesses and cut lengths.

Figure 1 illustrates three different types of drip tape and flat emitter dripline components:



Figure 1: Examples of drip tape and flat emitter dripline options from The Toro Company.

Figure 2 shows the seasonal and permanent options of the lateral and submain components combined with one another in four quadrants, and then lists the pros and cons of each combination. In addition, application examples are provided. Factors to consider when deciding upon permanent or seasonal submains and laterals include crop germination and/or transplant setting, labor, system maintenance requirements, operational flexibility, initial cost and annual operating cost. A summary of each quadrant of the matrix follows below.

Pros and Cons of Drip Irrigation Lateral and Submain Configurations for Field and Row Crop Applications*

	Seasonal Submain (Layflat, Oval Hose)		Permanent Submain (PVC)		
	Pros	Cons	Pros	Cons	
Seasonal Lateral (Drip Tape, Flat Emitter Dripline)	Portable with ability to follow crop	High flushing labor	Automate flushing	Winterization needed	Seasonal Lateral (Drip Tape, Flat Emitter Dripline)
	Germinate crop	High moving labor	No submain moving labor	Trenching required	
	Average maintenance	Disposal costs	Germinate crop	Repairs more difficult	
	Low initial cost	Seasonal lateral replacement cost	Average maintenance	Lateral replacement more difficult	
		Periodic submain replacement cost	Multi-year PVC use	Moderate lateral costs	
				Manifolds for various crops difficult	
	<i>Example: Onions, celery, vegies</i>		<i>Example: Some vegetable growing regions</i>		
	Seasonal Submain (Layflat, Oval Hose)		Permanent Submain (PVC)		
	Pros	Cons	Pros	Cons	
Permanent Lateral (Drip Tape, Flat Emitter Dripline)	Multi-year lateral use	Often need supplemental moisture for germination	Automate flushing	Often need supplemental moisture for germination	Permanent Lateral (Drip Tape, Flat Emitter Dripline)
	Portable submain	Lateral repairs more difficult	No submain moving labor	Lateral and submain repairs more difficult	
	Medium initial cost	Need excellent maintenance	Multi-year lateral and submain use	Need excellent maintenance	
		High flushing labor or need flushing manifolds		Winterization needed	
				Higher initial cost	
<i>Example: Processing tomatoes</i>		<i>Example: Corn/soybeans, alfalfa, cotton</i>			

* Based on information developed by Jim Klauzer, Clearwater Supply and Inge Bisconer, Toro Micro-Irrigation

Figure 2 - Pros and cons of drip irrigation lateral and submain configurations for field and row crops.

Seasonal Laterals and Seasonal Submains (upper left quadrant)

Systems with seasonal laterals and seasonal submains are popular in vegetable crops like celery or onions and fruit crops such as strawberries. They may be used to germinate the crop, are portable and have a low initial cost. Because they are expected to last only one season, they require only moderate maintenance. Drawbacks to this type of system include the labor needed to move submains and flush laterals, as well as lateral disposal and lateral replacement costs.

Permanent Laterals and Seasonal Submains (lower left quadrant)

Permanent laterals used with seasonal submains are popular in processing tomato production because the laterals can be used for multiple years, and yet the submains are portable. Drawbacks to this type of system include more difficult lateral repairs, the possible need for supplemental germination moisture, and heavier maintenance requirements since laterals are expected to last multiple seasons. Maintenance for these systems typically includes flushing manifolds and/or flushing labor, and chemical treatment. Initial system cost is higher compared to seasonal, portable

laterals used on vegetable and strawberry crops since the permanent laterals need to be more robust. However, the submain costs are about the same since both are seasonal.

Permanent Laterals and Permanent Submains (lower right quadrant)

Permanent laterals with permanent submains are used for field crops, such as corn, soybeans, alfalfa and cotton. System advantages include multi-year use and amortization of both the laterals and submains. Using permanent laterals with permanent submains also allows automated flushing and eliminates submain moving costs.

The drawbacks to this type of system include more difficult lateral and submain repairs, high maintenance requirements, the possible need for supplemental moisture for germination, and the need for winterization in cold climates. The initial cost is higher because the components must be durable enough for multiple year use and the system must be trenched in.

Seasonal Laterals and Permanent Submains (upper right quadrant)

Finally, seasonal laterals are sometimes combined with permanent submains in vegetable growing regions to avoid submain moving costs. Submain repairs for these systems are more difficult, as is lateral replacement.

Conclusion

Drip irrigation offers growers a number of benefits, but choosing the right system can be complex. Growers are encouraged to consult with reputable manufacturers, qualified dealers, consultants, farm advisors, government personnel, associations and irrigation service providers for help determining the best combination of components for their specific conditions. Drip irrigation education material is available at <http://driptips.toro.com>.

References

Toro.com and <http://driptips.toro.com>

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