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Soil and Water Science
Research Brief

University of Florida Institute of Food and Agricultural Sciences

Alternative Subirrigation System May Solve Flatford Swamp Tree Mortality Problem

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The Southwest Florida Water Management District has documented increasing abnormal tree mortality in the Flatford Swamp in the Upper Myakka River watershed in eastern Manatee County over the past 12 years. U.S. Geological Service records show that dry season river flows have nearly tripled in the last 15 years leading to the conclusion that excessively wet conditions during the normal dry winter period as the probable cause. Because large volumes of surface runoff can occur from agricultural production fields that use seepage subirrigation in the watershed during the dry season, the District has identified the irrigation practice as a probable contributor to the problem. Seepage subirrigation for vegetable production on the flatwoods soils (fine sands with high natural water table) of south Florida has been used for many years because of its effectiveness and low management intensity, but has come under increased scrutiny because of its excessive use of water in amounts well above plant water requirements.

This irrigation system operates through augmentation and management of the natural water table to a level 45-60 cm below the surface of a production bed. Typically, field ditches spaced at approximately 12 m are used to convey the applied water within the field. Historically, irrigation water has been applied continuously throughout the growing season resulting in significant runoff losses. While very effective for vegetable production, the conventional seepage system is limited in controlling the water table level position and can cause uneven distribution in the field.

Conventional seepage subirrigation

Since agricultural producers in the Upper Myakka River watershed were faced with reducing surface runoff into the Flatford Swamp, the fully enclosed subirrigation (FES) system was been proposed as an alternative irrigation system. This system was originally designed to improve water table management while significantly reducing required amounts of water. This is made possible by using microirrigation technology to convey the water to the fields instead of using surface ditches. This system saves significant amounts of water primarily through the elimination of surface runoff of applied irrigation water.

Microirrigation tubing laterals are installed 40 to 45 cm below the soil surface spaced at 6 m intervals. Water is applied through microirrigation tubing to raise the natural water table level until the desired water table level (normally 45-50 cm below the top of the bed) is achieved. Figure 1 shows a cross-sectional diagram comparing FES to conventional seepage.

Ditches are still needed for surface runoff resulting from rainfall, but because water is applied subsurface, there is no water in the ditches during FES irrigation cycles and surface runoff is eliminated. Control of the system can be either automated (using float-

activated switches) or manual depending on the level of management intensity desired.

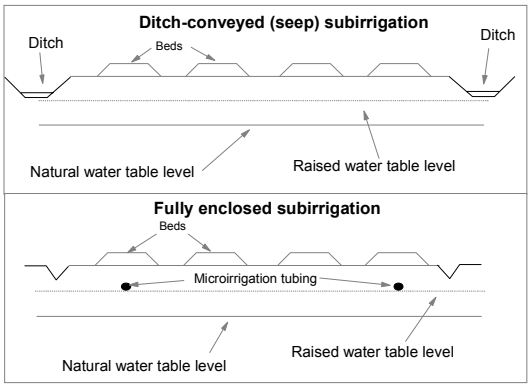

Figure 1. Cross-sectional diagram of Conventional Seep and Fully Enclosed Subirrigation Systems

Studies (Clark and Stanley, 1992; Stanley and Clark, 1995) have shown that very significant water savings can be achieved using the FES system compared to conventional seepage.

Manual water table monitoring device

Figure 2 shows the water applications from a three-year comparison of the two systems when used for tomato production with a 30 cm water table depth. Results showed that the FES system used less than 50% of the water used by the conventional seepage. This savings is achieved primarily through the elimination of surface runoff, but the FES system also has the advantage of providing much improved control over maintaining the desired water table depth. Since the FES system is a pressurized system, water is applied over the whole field at once, eliminating the distribution problems. Also, because a lower water table level can be maintained if desired, more soil water storage is available when rainfall events occur and improves the use of effective rainfall.

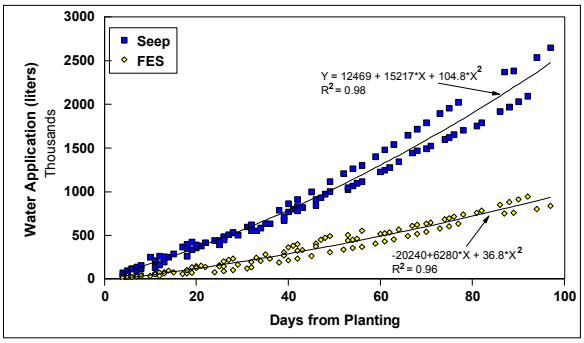

Figure 2. Cumulative water applications for tomato production using conventional seepage (Seep) subirrigation or fully-enclosed subirrigation with 30 cm water table depth (1999-2001).

A 3-year field evaluation (1999-2001) of the FES system on 36.5 ha site in the Flatford Swamp watershed by a commercial tomato producer resulted comparable fruit production to conventional seepage with an average water savings of 33 % (50% savings in the final year). The FES system is more costly and requires more maintenance that the seepage system since filtration and treatment to prevent clogging must be a part of management. However, since the tubing is installed at a depth below tillage practices, the costs can be spread out over several years.

References

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Stanley, C. D. and G. A. Clark. 1995. Effect of reduced water table and fertility levels on subirrigated tomato production. Applied Engin. in Agric. 11:385-388.

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