

Small Reservoirs for Drip Irrigation Systems

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Many growers in the Lower Rio Grande Valley (LRGV) and other parts of the world receive irrigation water only on a periodic basis through a complicated system of canals or pipelines. Water distribution through this network of channels is not continuous, and several independent irrigation districts regulate it. These systems are originally designed to deliver large amounts of water over a short period to supply water to flood irrigation crops. However, as water scarcity along the Rio Grande and many parts of the world has increased, there is a heightened incentive to move away from higher water use irrigation practices to more water conserving systems. One of the more notably efficient systems is drip irrigation. However, because the LRGV irrigation network was designed primarily for flood irrigation, growers are hesitant to implement the use of newer and low water volume systems. One obstacle preventing the adoption of drip irrigation is the difficulty in maintaining adequate water supply in the canal at the farm on a continual basis to provide sufficient water needed to irrigation crops on a more frequent schedule than is performed under traditional flood irrigation. This because a more noticeable problem the farther away the grower's land is relative to the canal and the irrigation districts. The construction of small reservoirs on a grower's land can help to alleviate these irrigation problems. On-farm reservoirs can be filled periodically when canals are flowing but store the water necessary to maintain drip irrigation lines throughout the growing season. This fact sheet has the objective to guide the farmer on how to design small reservoirs and point at the advantages of establishing one in his farm, so he can use systems such as drip to irrigate various vegetable crops.

One of the challenges for producers in the LRGV is decreasing water supplies from the Rio Grande River. For example, citrus requires about 33-48 inches of water annually, but only about 22-26 inches can be supplied by rainfall, supplemental irrigation is needed to make up the deficit. As most of the irrigation in the LRGV is performed using flooding methods (border or furrow irrigation), a single irrigation event will apply between 4 to 6 inches of water. With an average of 7 flood irrigation events annually (Enciso et al., 2005), a single grower may over-irrigate his citrus orchard by as much as 24 inches per year. Several strategies have been proposed to conserve water and at the same time increase citrus production and quality. One of these strategies is to convert previously flood irrigated citrus orchards to drip and microjet spray irrigation system to conserve water supplies. Similar, situations occur with vegetable crops which have shallow root systems and require multiple irrigations, benefiting the use of drip over furrow irrigation.

Designing a small reservoir

The design will need to start by understanding what lies below the soil surface. What kind of soil you must have to create your embankment and determine if the lining is required. Money spent in investigating the type of soil by excavating pits before construction will minimize the

risk before you start. It is essential to see if you have sandy soils, or soil with shallow clay layers, or limestone that may need to line your reservoir. In the LRGV most of the land present silty clay loam textures and lining of the reservoir with plastic is not required.

Clay is an excellent material for building stable, impermeable reservoirs. If the soil has only a clay texture, the reservoir can be constructed entirely in clay. Another method is to line the reservoir with a clay blanket some 0.5 m thick to stop seepage through embankments. Most plastic liners have a 20-year life guarantee.

The reservoir must be built in a cheap way trying to balance cut and fills. The soil excavated from the reservoir is balance with the amount needed to construct the embankments (Figure 1). Generally, for every foot of cut soil, the embankment raises one foot. Therefore, if the reservoir is dug to a depth of 4 ft, the embankment produced with the excavated earth can be used to add 4 ft of height, and the reservoir will be 8 ft deep. The slope generally created in the embankment is 3 to 1 slope to be able to shred the grass and maintain the reservoir with a gator. The shape of the reservoir can be rectangular or round. The embankment allows to store and retain more water. However, on some occasions, the farmer would like to avoid the embankment and disperse the dirt or hiding it for aesthetic purposes.



Figure 1 – Balancing cut and fill

Reservoirs lined with synthetic materials, should have ladders and ropes for security so people can climb the reservoir. Before digging in the property to building a reservoir is important to call utilities of the county to make sure that there are not underground gas or electrical lines buried on the property.



Figure 2. Round reservoir. Courtesy of B&J Dozer Work L.L.C.



Figure 3. A and B. The reservoir supplied by a pipe from the Irrigation District (A) with a small centrifugal pipe used to extract the water from the reservoir and supply water to the irrigation system.



Figure 4. A, B, C and D. Irrigation pump and filters used to apply irrigation to the citrus with water from the reservoir (C and D).

The cost to build an irrigation reservoir will depend on its size. For small acreage producer that have around 10 acres, if they sacrifice 0.25 acres, that may be a good tradeoff. If the size is more significant for example around 125 acres, a right size reservoir can be around 3 to 4 acres. In 2018, the cost of building the reservoir varied from \$1.5 to \$2.5 per cubic yard (1 cubic yard = 0.764555 m³). The reservoir should store some water to irrigate the field for at least 30 days without irrigation. Farmers must keep in mind that that irrigation district may want to have flexibility on delivering the water. This delivery can be every 2 to 4 weeks depending on the irrigation district. The reservoir can be built with scrapers or bulldozers



Figure 5. Scrappers used to build the reservoirs. Courtesy of B&J Dozer Work L.L.C.

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