CIR1188

Simple Water Level Indicator for Seepage Irrigation[1]

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The use, construction, calibration, installation and maintenance of a simple, low-cost field water level indicator for seepage irrigation management is presented in this publication. When seepage irrigation (subirrigation) is used, field water tables must be accurately controlled near the soil surface so that water can flow into the plant root zone by capillarity.

Because water movement in the soil pores occurs by capillary forces, it is important that the water table be accurately maintained just below the plant root zone to avoid plant water stress. For most Florida crops, the water table should be maintained within 18 to 24 inches below the soil surface. See the appropriate crop production guide for water table recommendations for a specific crop.

A water table that is too low will stress plants by not providing sufficient water for the crop needs. A water table that is too high will stress plants by limiting root growth and providing a root zone that is too wet. Also, runoff from rainfall will increase when the water table is too high, reducing rainfall effectiveness and possibly increasing the loss of nutrients or other chemicals from the field.

USE

The simple water level indicator described in this publication (Figure 1) is used to directly read the depth from the ground surface down to the field water table level. The water level indicator serves as a shallow water table well and monitoring instrument which is installed in the field and can be left in the field throughout the irrigation season. The plastic float and 1/2-inch PVC pipe continuously moves up or down with the water table. Thus, if the water level indicator is properly calibrated and installed, the user can read the field water table level directly from the scale on the length of 1/2-inch PVC pipe that extends above the 4-inch diameter pipe cap.

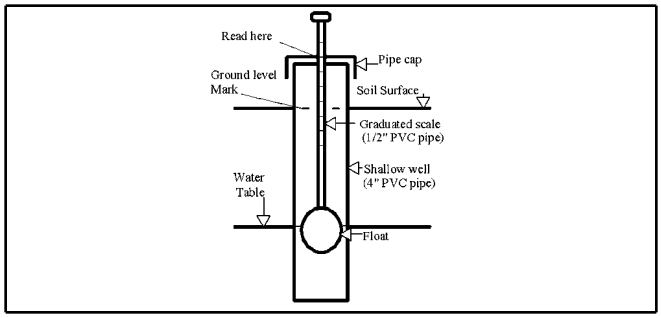

Figure 1.

1. This document is CIR1188, one of a series of the Agricultural and Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date June 1997. Reviewed December 2005. Visit the EDIS Web Site at http://edis.ifas.ufl.edu.
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Because it permits a direct reading of the field water table level to be made, this instrument allows growers or other irrigators to quickly and easily check field water table levels. This allows growers to save time and labor costs, while improving the management of their irrigation systems. Readings can be taken by walking up to the instrument, rather than stopping to insert a probe into the shallow wells. If these instruments are located near the edge of a field, they can be read by simply driving by the field site. Surveying tape or other flags can be tied on the 1/2-inch PVC pipe to improve its visibility, or the pipe can be painted so that the desired water table level can easily be seen.

Because this instrument is constructed of PVC pipe with few moving parts, it can be installed in the field for extended periods of time with little maintenance. The well is designed to provide a low profile for easy clearance by farm equipment. If necessary, the 1/2-inch PVC indicator scale and the 4-inch PVC pipe cap can easily be removed to provide additional equipment clearance. If the indicator scale is removed, a spare PVC pipe cap can be used to cover the well during field operations to prevent debris from falling into the well.

CONSTRUCTION

The water level indicator described in this publication can be constructed of readily available parts, obtainable from most hardware or building supply stores. A materials list is given below. The materials cost is estimated to be $15 to $20 for each water level indicator.

Materials list for seepage irrigation water level indicator: • 4 ft length of 4-inch diameter thin-wall PVC pipe

• 4 ft length of 1/2-inch diameter PVC pipe

• 4-inch diameter PVC pipe cap

• 1/2-inch diameter PVC pipe cap

• plastic toilet-bowl float

• 1-inch length cotter pin

The water level indicator can be constructed using the following steps: 1. Cut a 4-ft length of 4-inch diameter PVC pipe. This will serve as a shallow well to monitor the field water table level. Longer or shorter pipe lengths can be used if desired, however, 4 ft is often best for typical Florida water table levels. Thin wall pipe is adequate since it will not be required to withstand high pressures. Drill several 1/4-inch diameter holes through the pipe wall to allow water from the surrounding field to flow into the well.

2. Sand or mill the inside of the 4-inch pipe cap so that it easily slips over the end of the 4-inch diameter well pipe. This will permit the cap to easily be removed and replaced in the field if desired. This may be necessary so that the well can be inspected or so that the indicator scale can be removed to provide clearance for field equipment.

3. Drill a 1-inch diameter hole through the top of the 4-inch diameter pipe cap. This size will allow the 1/2-inch diameter PVC pipe to be inserted through the pipe cap and to freely move without binding.

4. Cut a 4-ft length of 1/2-inch diameter PVC pipe. This pipe will serve as a scale or ruler to directly indicate the field water table level. A calibration procedure for constructing the scale is given later in this report.

5. Attach the plastic float to the PVC pipe with a cotter key. Slip the PVC pipe over the plastic nipple on the float and drill a small hole through the PVC pipe and float nipple. Then insert a cotter key through the hole.

6. Slip the 1/2-inch PVC pipe through the hole in the 4-inch PVC pipe cap so that the float is downward as shown in Figure 1. Then tap the 1/2-inch PVC pipe cap firmly onto the 1/2-inch PVC pipe. If necessary, a small set screw can be used to keep the 1/2-inch cap from slipping off. Drill a small hole through the walls of the pipe and pipe cap, and thread the screw into the hole. The water level indicator is now ready to be calibrated to read field water levels directly.

CALIBRATION

After the field water level indicator has been constructed, it must be calibrated so that field water table levels can be read by direct inspection of a scale drawn on the 1/2-inch PVC pipe. An easy and accurate way to calibrate this instrument is:

1. Assemble the water level indicator as shown in Figure 1 .

2. Make a permanent mark on the outside of the 4-inch PVC well pipe to indicate the depth that the well should be inserted into the ground (ground level mark) when the well is installed. A permanent marking pen or paint can be used, or the mark can be permanently scratched into the PVC pipe. When installed, the well will be placed so that this mark is at the ground surface. This ground level mark should be near the upper end of the 4-inch PVC well pipe, just below the PVC pipe cap. The actual location can be varied, depending on how far the well can be allowed to stick up above the ground. Normally, the mark is made about 4-inches below the top of the well pipe, so that the instrument will present a low profile, and equipment clearance will not be a problem.

3. Fill a bucket or tub with several inches of water, and stand the water level indicator assembly upright in the bucket or tub. Use enough water so that the float assembly (float and 1/2-inch PVC pipe) float freely.

4. Using a carpenter's tape or yard stick, measure the distance from the permanent ground level mark made on the 4-inch PVC well pipe in Step #2 down to the water level in the bucket or tub. At the same time, make a permanent mark on the 1/2-inch PVC pipe where it protrudes through the hole in the 4-inch PVC pipe cap. For convenience, add or remove small amounts of water from the bucket or tub until the measured distance is a "round" number, such as a whole number of inches or centimeters, rather than a fraction of inches or centimeters.

5. Using a permanent marking pen, write the measured water table depth (from Step #4) directly onto the 1/2-inch PVC pipe where it was marked in Step #4. This is a direct reading of the water level in the well, and it will be used as a reference for the scale to be marked on the 1/2-inch PVC pipe.

6. Using a permanent marking pen and a ruler or yard stick, make additional scale marks along the length of the 1/2-inch PVC pipe, beginning at the calibration point marked in Step #5. Marks should probably be made and labeled at each inch or centimeter. Notice that the numbers must get larger near the top of the 1/2-inch PVC pipe, and smaller near the plastic float, since the scale will read distance from the ground surface down to the water table.

INSTALLATION

The water level indicator can easily be installed in the field using only a manual post-hole digger. If the instrument is constructed following the specifications given in this publication, the total length of the well pipe will be 4 ft. The hole to be dug will be about 3-ft, 8-inches deep, since approximately the upper 4 inches covered by the pipe cap will extend above the ground. Note that these dimensions can be changed, depending on site-specific conditions such as normal depth to the water table and clearance of field equipment.

In row crop production systems, the instrument can be located on the plant beds so that it will be out of the way of most field equipment operations. The well only protrudes a short distance above the ground surface so that clearance by field equipment should not be a problem.

If the dimensions suggested in this publication are used, dig a hole approximately 3-ft, 8-inches deep and place the 4-inch diameter well pipe vertically in the hole. Adjust the depth of the hole until the upper indicator mark on the 4-inch diameter well pipe is flush with the ground surface. Then backfill around the well pipe with the soil removed from the well. Normally, only a few minutes should be required to install each water level indicator.

The indicator will begin to operate as soon as the water level in the well reaches the level in the surrounding soil. Normally, this will only take a few minutes. To speed response time, more 1/4-inch holes should be drilled in the wall of the 4-inch diameter well pipe when the instrument is constructed.

Since the exterior of the instrument is relatively smooth PVC pipe, it can easily be removed from the field at the end of the season or before major tillage operations. First, remove the 4-inch PVC pipe cap and water level indicator, then grasp the edge of the 4-inch PVC well pipe and pull it upward. It is sometimes helpful to use vice grip pliers to grasp the edge of the PVC pipe in order to provide a better grip on the pipe.

MAINTENANCE

The water level indicator described in this publication has very low maintenance requirements. The only moving part is the float-actuated indicator scale. It will move smoothly upward and downward if the guide hole in the 4-inch PVC pipe cap is large enough so that the parts do not bind up from blowing sand or debris in the field. This potential problem can be avoided by drilling an oversized 1-inch diameter hole in the pipe cap as recommended.

With time, the scale and reference markings may fade and require marking again. If permanent marking pens are used, this maintenance need will probably not occur more often than each season.

With time, soil may begin to fill the well so that the float hits the bottom of the well. If this occurs, the well can be cleaned with a soil auger which can be inserted into the well. The well could also be moved a short distance and reconstructed. Normally, wells would not be expected to fill up in less than one crop season unless the saturated soil is extremely unstable.

SUMMARY

The use, construction, calibration, installation and maintenance of a simple, low-cost water level indicator for seepage irrigation management was presented in this publication. This instrument can be used to continuously indicate field water table levels to improve the management of seepage irrigation systems. It can be constructed of readily available parts, obtainable from most hardware or building supply stores. A materials list and instructions for construction were presented. The materials cost is estimated to be $15 to $20 per instrument. Calibration can be accurately done with no specialized equipment. Because this instrument is constructed of PVC pipe with few moving parts, it can be installed in the field for extended periods of time with little maintenance. Installation and removal time and labor requirements are expected to be small, and the low profile of the instrument should not be an obstacle to most field equipment operations.