Irrigages – A Useful Tool for Irrigation and Rainfall Water Measurement

Figure 1: Irrigage built from thin-walled PVC pipe and plastic bottle

Irrigage Description:

The Irrigage, Figure 1, is a modified raingage. It features a large sharp-edged collection barrel made of thin-wall, 4-inch PVC pipe. This provides a large opening for accurate catch of rainfall or irrigation events. Water collected in the barrel drains into a storage bottle attached to the bottom of the collection barrel through a small diameter hole. Once in the storage bottle, the water is retained with minimal losses over time. Many types of raingages can have substantial water loss due to evaporation in just a few hours. Water in an Irrigage could be retained for a week with less than 1 percent loss. This eliminates the need to immediately read and record the rainfall after a rain event.

The Irrigage is constructed with a small diameter support tube mounted on the outside of the barrel. This allows the Irrigage to be easily mounted on a length of electrical conduct, e-bar, or electric fence post. The mounting posts can be easily driven into the ground at the desired measurement location.

Irrigage Uses:

Rainfall Measurement

The Irrigage can be used to measure rainfall. The density of rainfall measurement network on a farm might be increased with time since immediate reading of the gage is not necessary for accuracy.

Irrigation Application Depth Measurement

Approximately 75 percent of irrigation systems in Kansas are center pivots. While these systems have specific design operating parameters (pressure and flow rate), the Irrigage can allow the operator to obtain an independent verification of the application depth by placement of Irrigages under the wetted area of a sprinkler system. Since sprinklers packages are not 100 percent uniform, at least three Irrigages should be used to obtain an estimate of the application depth. The top of the Irrigage should also be at least three foot below the water release point or nozzle height. The Irrigages also need to be positioned above the canopy or in an open area when the crop canopy does not interface with the water pattern. These restrictions may mean only early growing season Irrigage measurements are possible.

Center Pivot Nozzle Package Uniformity Measurement

Nozzle package uniformity is a measurement of how close to the desired application depth each location along the pivot lateral receives. Well designed, maintained, and operated packages should be able to obtain 90 percent uniformity. Recent uniformity evaluation of full sized center pivot packages have revealed a number of systems not performing at this level. Irrigages can be used to measure the uniformity of the nozzle package by placement of a row of Irrigages along a pivot lateral. The Irrigages should be placed at approximately 80 percent of the nozzle spacing. So a 10-foot nozzle spacing would be tested using an eight-foot Irrigage spacing. Irrigages should be placed in the field far enough away from the lateral so that no water initially falls into an irrigage. The lateral is passed over the gages until water no longer falls into the Irrigages. These measurements can be plotted to visually show the uniformity problem areas. This information can also be used to calculate the overall uniformity, using a center pivot uniformity computer spreadsheet.

Irrigages can be placed in the field well in advance of the irrigation event. The data collection can also be delayed until the field surface has dried enough to be convenient for retrieval.

Irrigage Construction

A schematic diagram of an irrigage is shown in Figure 2a and b. The storage bottle lid can be either glued (Figure 2a) or screwed (Figure 2b) to the collection barrel. Thin-walled pipe is used primarily to minimize costs. There is a slight variation of inside diameter pipe products which must be accounted for when calibrating the irrigages.

A calibrated scale can be etched or taped to the bottle. Some bottle manufacturers have scaled bottles available for purchase. In Figure 1, a bottle was purchased that had a millimeter (ml) scale manufactured into the bottle wall. The green pipe volume calibration was calculated to be 200 ml per inch. Therefore, the bottle scale could be marked with an inch line at the 200 ml mark.

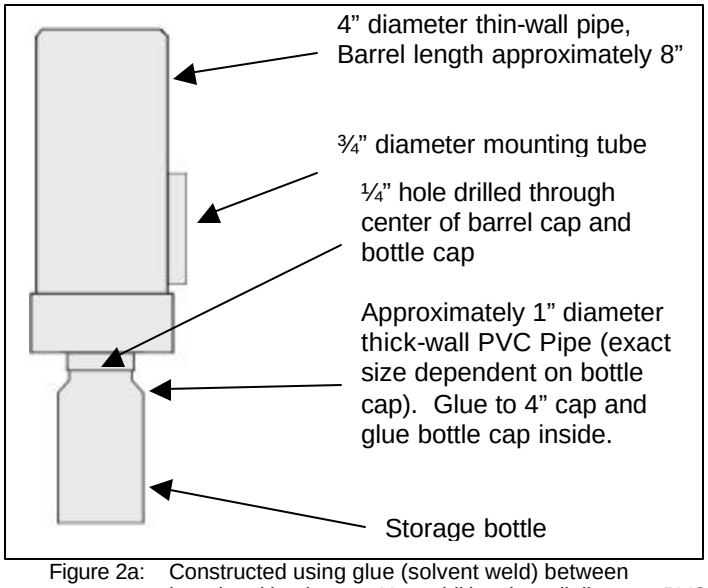

Figure 2a: Constructed using glue (solvent weld) between barrel and bottle cap. Use additional small diameter PVC pipe to reinforce cap connection.

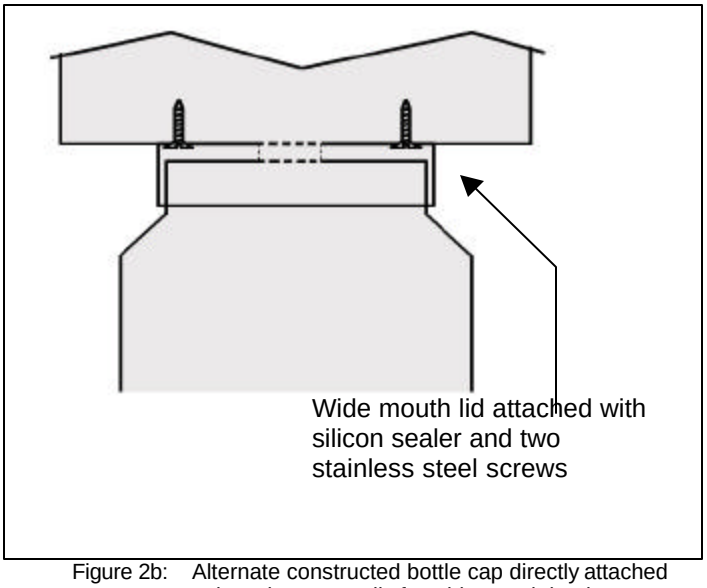

Figure 2b: Alternate constructed bottle cap directly attached to barrel cap; usually for wide mouth bottles

Steps to Calibrate Irrigage

1. Measure inside diameter to the nearest 1/16 or 1/32 of an inch and convert to decimal equivalent.

2. Calculate volume for 1 inch of depth in the irrigage barrel as follow
   Volume (ml) / 1 inch of water =

   $$\text{Volume / inch} = (\pi\ (\text{diameter(inch)})^2(1\text{ inch depth}) / 4) \text{ X } (16.39\ \text{ml/in}^3)$$

3. Determine fractional quantities for the desired scale on storage bottle. For example, a 1/4 inch measurement scale might be satisfactory scale for the storage bottle.
   1/4 x(Volume Step 2) = Fractional scale quantity

4. Obtain a graduated cylinder with milliliter markings, measure out Step 3 volume and pour into storage bottle. Permanently mark or etch scale onto bottle.

5. Repeat Step 4 as many times as desired, adding the new quantity to the existing level in the bottle

Table 1: Calibration Volumes for Various Inside Diameter of Irrigages

Diameter (inches)	3 3/4	3 13/16	3 7/8	3 15/16
Volume for 1 inch (ml.)	181	187	193	200

For more information, contact your local County Research and Extension Office.
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