SECTION 686.141

Tensiometer Example Problem

Example of developing a graph for estimating when and how much water to apply.

(1) Given

a. Tensiometers which are located in the second and third quarter of a 4-foot root zone.

b. Tensiometer for the third quarter is selected for tension readings.

c. The following data was collected.

Soil Texture	Depth (inches)	AWC (in/ft)
Loam	0-24	2.0
Vfs1	24-48	0.95

Total AWC – 5.90 inches

Tensiometer reading (centibars)	SWC for 4-foot profile (inches)	SWD for 4-foot profile (inches)	-
60	2.36	3.54	
55	2.94	2.96	MAD
50	3.54	2.36	
45	4.12	1.78	
40	4.72	1.18	

*SWD = AWC - SWC

d. The following additional data shows why the tensiometer in the third quarter was selected (driest quarter). The soil water content is for the quarter of the root zone in which the tensiometer is located.

Soil Suction (centibars	Second Quarter loam SWC (in/ft)	Third Quarter vfsl SWC (in/ft)
33	1.97	0.95
100	1.21	0.43
1500	0	0

2. Find
   a. Develop a graph to estimate the soil water content (SWC) and soil water deficiency (SWD) for a 4-foot profile.
   b. Show how to use the graph to estimate when-and how much to apply.
   c. Show why the third quarter of the root zone was selected for determining when and how much to apply.
3. Solution
   a. On graph paper (preferable--semi-logarithmic) plot SWC versus tensiometer readings and connect the points. If necessary, extend the line to cover a range from field capacity to the MAD level set for the crop being irrigated. Indicate the MAD point on the graph. Figure 686-8 was developed for the data given (refer to SWC-curve).
   b. To use the SWC-curve, enter a given tensiometer reading and move vertically upward and intersect the SWC-curve; go left and read SWC for the soil profile.

   Example:

   Tensiometer reading = 48 centibars

   SWC = 3.7 inches

   To determine how much to apply or the soil water deficiency, subtract the SWC from AWC.

   F_n = SWD = AWC – SWC

   = 5.90 - 3.70

   = 2.20 inches

   In this example the SWC has not reached the MAD point which is set at about 2.95 inches (5.90 x 50/100 = 2.95). The irrigator can wait several days before he needs to irrigate.

   c. As an alternative, plot soil water deficiency against tensiometer readings. Figure 686-8 (b) was developed for the data given. This gives an estimate of soil water deficiency directly.

   Example:

   Tensiometer reading = 57 centibars
   SWD = 3.2 inches

   In this case, MAD level has been exceeded and an irrigation is needed. The net amount to he applied (F_n) is 3.2 inches.

   d. Figure 686-9 was developed from the additional data which was collected. The second quarter of the root zone is a loam with a moderate water holding capacity. The third quarter is a very fine sandy loam with a low water holding capacity. From the study, it was determined the soil profile would reach a 50 percent MAD level when the loam was at a SWC of 1.0 inches/ foot and the vfsl. at a SWC of 0.47 inches/foot. If the tensiometer in the second quarter was used to predict irrigation needs, the tensiometer would become inoperable because the soil suction would reach about 150 centibars before an irrigation is required. This tensiometer will be of little use because the suction will be broken between each irrigation. At the same time, the soil suction in the third quarter would reach about 83 centibars which is within the operating range of the tensiometer. Thus, the tensiometer in the third quarter should be used to predict when and how much to apply.