The volume is converted to depth of water infiltrated by subtracting the starting volume reading and dividing by the area of the disk on the infiltrometer, 7.94 cm^2. The result is shown in the 4th column of Table 2. An easy way to find C_1 and C_2 in eq. 1 is to use the square root of time as the independent variable and fit a quadratic equation to the data, constraining the solution to go through zero. The square root of time is in column 3 of Table 2. A quadratic is simple to fit in an Excel spreadsheet. Select columns 3 and 4 from the table and produce an XY (scatter) plot. Then double click on the graph and right click on one of the points on the line. Select "Trend Line" from the menu. Select the polynomial 2nd order from Type, and set intercept to zero, display equation, and display R square from Options. The result for the three infiltrometers is the graph below Table 2. From this the value of C_1 is read directly. The hydraulic conductivity is calculated for the silt loam soil using Table 1 and eq. 2:

	0.5 cm	2.0 cm	6.0 cm
k =	$\frac{0.0062}{9.1}$	$\frac{0.0054}{8.1}$	$\frac{0.0015}{6.0}$
k =	6.8×10^{-4}	6.7×10^{-4}	2.5×10^{-4} cm s^{-1}

References:

Carsel, R. F. and R. S. Parrish. 1988. "Developing joint probability distributions of soil water retention characteristics." Water Resour. Res. 24: 755-769.

Zhang, R. 1997. "Determination of soil sorptivity and hydraulic conductivity from the disk infiltrometer." Soil Sci. Soc. Am. J. 61: 1024-1030.

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Measuring Soil Hydraulic Conductivity with a Mini Disk Infiltrometer

A number of methods are available for measuring soil hydraulic conductivity with a Mini Disk Infiltrometer. We suggest using the method proposed by Zhang (1997). The method requires measuring cumulative infiltration vs. time and fitting the results with the function

$$I = (C_1 t + C_2 \sqrt{t}) \qquad (1)$$

The hydraulic conductivity of the soil is then computed from

$$k = \frac{C_1}{A} \qquad (2)$$

A is computed from:

$$A = \frac{11.65(n^{0.1} - 1)\, e^{[2.92(n-1.9)\alpha h_o]}}{(\alpha r_o)^{0.91}} \qquad n \geq 1.9$$

$$A = \frac{11.65(n^{0.1} - 1)\, e^{[7.5(n-1.9)\alpha h_o]}}{(\alpha r_o)^{0.91}} \qquad n < 1.9 \qquad (3)$$

where n and α are the van Genuchten parameters for the soil, r_o is the disk radius, and h_o is the suction at the disk surface. The van Genuchten parameters for the 12 texture classes of soil were obtained from Carsel and Parrish (1988). The Mini Disk Infiltrometer has a radius of 1.59 cm and three different suction rates 0.5, 2.0, and 6.0 cm. Values of A computed for the Mini Disk Infiltrometers are given in Table 1.

Table 1. van Genuchten Parameters for 12 Soil Texture Classes

Texture	α (cm^{-1})	*n*	A h_o = 0.5cm	A h_o = 2.0cm	A h_o = 6.0cm
sand	0.145	2.68	5.4	8.9	33.3
loamy sand	0.124	2.28	4.7	5.8	10.0
sandy loam	0.075	1.89	5.3	5.2	5.1
loam	0.036	1.56	6.8	6.0	4.1
silt	0.016	1.37	10.2	9.3	7.2
silt loam	0.020	1.41	9.1	8.1	6.0
sandy clay loam	0.059	1.48	3.7	2.8	1.3
clay loam	0.019	1.31	7.4	6.5	4.7
silty clay loam	0.010	1.23	10.3	9.5	7.8
sandy clay	0.027	1.23	4.0	3.3	1.9
silty clay	0.005	1.09	8.1	7.7	6.8
clay	0.008	1.09	5.2	4.9	4.0

Hydraulic conductivity is measured as follows:

1. Fill the infiltrometer. - Immerse in a container of water and replace the stopper while the infiltrometer is under water.

2. Record starting volume. - Use a ring stand and clamp to suspend the infiltrometer vertically over a smooth, level soil surface.

3. Start inflitration. - At time zero, slide the infiltrometer down to make solid contact with the soil surface.

4. Record volume and time. - Record volume at regular time intervals as the water infiltrates.

A typical data set for a 2.0 cm suction infiltrometer will look like the first and second columns of Table 2.

Table 2. Silt Loam Infiltration Experiment with 2.0 cm suction

Time (sec)	Volume (ml)	Square Root time	Infiltration (cm)
0	5	0.00	0.00
30	11	5.48	0.76
60	14	7.75	1.14
90	17	9.49	1.52
120	20	10.95	1.89
150	23	12.25	2.27
180	25	13.42	2.53
210	27	14.49	2.78
240	29	15.49	3.03
270	31	16.43	3.28
300	33	17.32	3.54