

## DISCUSSION

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*R. J. Hodek*<sup>1</sup> (*written discussion*)—Please explain the installation technique used for single-ring field test.

*S. R. Day and D. E. Daniel* (*authors' closure*)—The installation of a ring infiltrometer into a clay liner may be compared to the trimming of a soil sample into a consolidation ring. Care and patience are the primary attributes required. The installation procedure found most effective was discovered by trial and error. After a location was chosen, an impression of the cutting edge on the ground was made. The ring, once set, was maintained level and round. The ring was then pushed by hand and driven with a hammer into the liner. A board was used to cushion the blow of the hammer and protect the ring. Frequent checks were required to maintain the ring level. When the driving became difficult or threatened to damage the ring, a narrow trench was excavated along the entire outside of the ring wall. The trench was not extended below the bottom level of the ring. After the trench was excavated, the ring drove with less resistance. This procedure continued until the desired depth of embedment was reached. The trench was then backfilled with a mixture of clay and bentonite. The backfill was carefully compacted into 2.5 to 5-cm (1 to 2-in.) lifts using a board or a tamping iron. A berm of native soil was compacted around and up against the ring to minimize piping.

I used 208-L (55-gal) steel barrels and 570-L (150-gal) stock tanks, modified for testing purposes, to serve as the single-ring infiltrometer. The steel barrels were modified by cutting off the bottom of the barrel and sharpening the lip at the open end. The stock tanks were modified by cutting off the top lip. This provided a ring with one open end and a thin-walled [less than 1.3 mm (0.05 in.)] cutting edge. Both the barrels and the stock tanks retained one closed end to minimize evaporation. A small opening in the top of the infiltrometer allowed measurements to be made but made it difficult to inspect the inside edge of the ring after it was embedded.

I believe that the installation could be simplified and the performance improved if a specially constructed single-ring infiltrometer was developed. The improved ring would have a removable lid (for ease of installation), which could be sealed onto the ring to minimize evaporation and permit the use of a standpipe. The standpipe would allow finer resolution and permit the use of higher hydraulic heads. This should decrease testing time and permit the timely measurement of hydraulic conductivity below  $1 \times 10^{-7}$  cm/s.

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