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Influence of the cross-section shape in the capillaries on the wetting properties demonstrated by the calculated wetting angles

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Hartge K.H., Bachmann J., Woche S.K.

Institute of Soil Science, University of Hannover, Herrenhaeuser Str. 2, 30419 Hannover, Germany

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abstract Earlier results had shown that the contracting force of water films between parallel solid surfaces increased when they were deformed to give longer menisci by subdividing the water volume. Since deformations of this kind will occur regularly when soils are tilled or wheeled with machinery the question was raised how such events would change soil capillary properties. Circular capillaries with a concave inner surface were compared to the ones with a convex inner surface. They were formed by the fixing of either three or four rods with circular diameter together. Perimeters and crosssectional areas were calculated and the height of capillary rise was measured by two independent methods. For comparison, the results of wetting angles were used. They were calculated from an average inner diameter of the capillaries and separately measured using the height of menisci. The present results showed that in the convex capillaries, higher angles were calculated in comparison to those independently measured at the outsides of rods and tubes. The angles calculated from the capillary height measured in the circular capillaries were smaller than those measured at the outside of the tubes. It was concluded that the wetting angles measured directly with an optical equipment were affected by the solid phase geometry. The above result emphasized that contact angles resulted from a combination of several distinct factors. The curvature of the contact line is one of them.

keywords capillary rise, capillary cross section, wetting angles