\[
\exp\left(-\frac{R^2}{4}\right) = \left(\frac{Q}{2D_0}\right) \cdot E_0\left(\frac{R_1}{4}\right). \quad [6]
\]

If \((Q/D_0)\) is known, Eq. [6] determines in a unique fashion the distance of the saturation front \(R\).

**Limitation of Optimization Results**—In the lines following Eq. [12], Parlange et al. (this issue) state that the results of Sawhney and Parlange (1976) are far more general whenever a rapidly changing \(D[\theta]\) is utilized. It should be emphasized here again that \(n\) and \(\beta\) have to be reasonably large for their statements to hold true. Indeed, in a more recent paper by Parlange et al. (1981), certain results concerning exact solutions are presented. It is observed in Table 4 of this paper (Parlange et al., 1981) that, already when \(n = 2\), errors are introduced into the optimization results, especially at low values of the flux.

**Comparison of Perturbation and Optimization Results with Exact Solutions**—Parlange et al. (1981 this issue) state that my second-order approximation is not accurate enough, and hence it is doubtful if third approximations in the expansion would be of any value at all. I have most recently computed the first, second, and third approximations of \((\theta, \eta)\) profiles for several of the values of \((Q/D_0)\) indicated in Tables 1 and 3 of the recent paper by Parlange et al. (1981). The results derived on the basis of perturbation methods of my paper (Babu, 1980) exhibit considerable accuracy. In addition to the extreme values of \(n = 10\) and \(n = 2\) employed in their paper, I have also computed the flow quantities for the limiting case of \(n = 0\). Even for this extreme value, the perturbation scheme yielded quite accurate results for the location of the saturation fronts \((\eta = \Psi/\sqrt{D_0})\). For this case \((n = 0)\), comparison is made with the exact, analytical results from Eq. [6] given earlier in this Reply.

The distances of the saturation fronts and wetting fronts as obtained through optimization and perturbation schemes, and the associated percentages of errors, are presented in Tables 1 and 2. It is apparent from these tables that the perturbation scheme yields highly accurate results and that the range of validity of these methods is greater than that of the optimization results of Sawhney and Parlange (1976).

**First Integrals and Analytical Content**—Authors Parlange, Bradock, and Chu (1980) and Parlange, Braddock, and Voss (1981) are to be congratulated for their work on first integrals and certain exact solutions of the diffusion equation. However, it must be noted that in this type of work, the resulting first-order differential equation has to be integrated numerically to locate the saturation front position \(\Psi_2\) and \(u_2\) (see statements following Eq. [28] in Parlange et al. (1981). After obtaining \(\Psi_n\), the diffusion equation is again integrated numerically, this time with the initial data:

\[
\theta = \theta_s, \text{ and } D_0 \Psi \frac{d\theta}{d\Psi} = -Q, \text{ at } \Psi = \Psi_s.
\]

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**Literature Cited**


**Comments on “Nitrogen Mineralization as Affected by Soil Moisture, Temperature, and Depth”**

In their paper Cassman and Munns (1981) state that they know of only one report concerning interactive effects of soil moisture and temperature on the rate of native soil N mineralization. The report that they refer to is by Justice and Smith (1962). I would like to point out to the general readership of this journal that there was another study published in 1976 showing an interactive effect of soil moisture and temperature on net mineralization (Kowalenko and Cameron, 1976). Besides the interactive effect on net mineralization, an effect of soil moisture on nitrification was shown on nitrification. Mathematical models can be used to derive the following relationships:

\[
10^{-6} \left[-2.655 - 0.2064 T + 0.1606 \Theta + 0.1403 \Theta^2 \right]
\]

where \(T = \text{temperature in } ^\circ\text{C and } \Theta = \text{water content in percent by weight} \) (Cameron and Kowalenko, 1980). The correlation coefficient \((r)\) was 0.89. Kowalenko and Cameron (1976) examined a wider range of temperatures than did Cassman and Munns (1980); 15 to 35%, respectively. The soil textures of the two studies were similar (clay loam and silty loam).

Cameron et al. (1977) derived net ammonification rate coefficients for clay and sandy loam soils in Ontario from incubation data similar to the one used by Cassman and Munns.