

Figure 15.1 Change of surface temperature (dashed line) in response to change of environmental temperature (full line). (a) Step change (Eq. (15.10)); τ is the time for a fractional change of $1 - e^{-1}$ or 0.63. (b) Ramp change (Eq. (15.16)); τ is the constant time lag established after the term $\exp(-t/\tau)$ becomes negligible. (c) Harmonic oscillation for the case $\varphi = \pi/4$ (Eq. (15.20)) (from Monteith (1981b)).

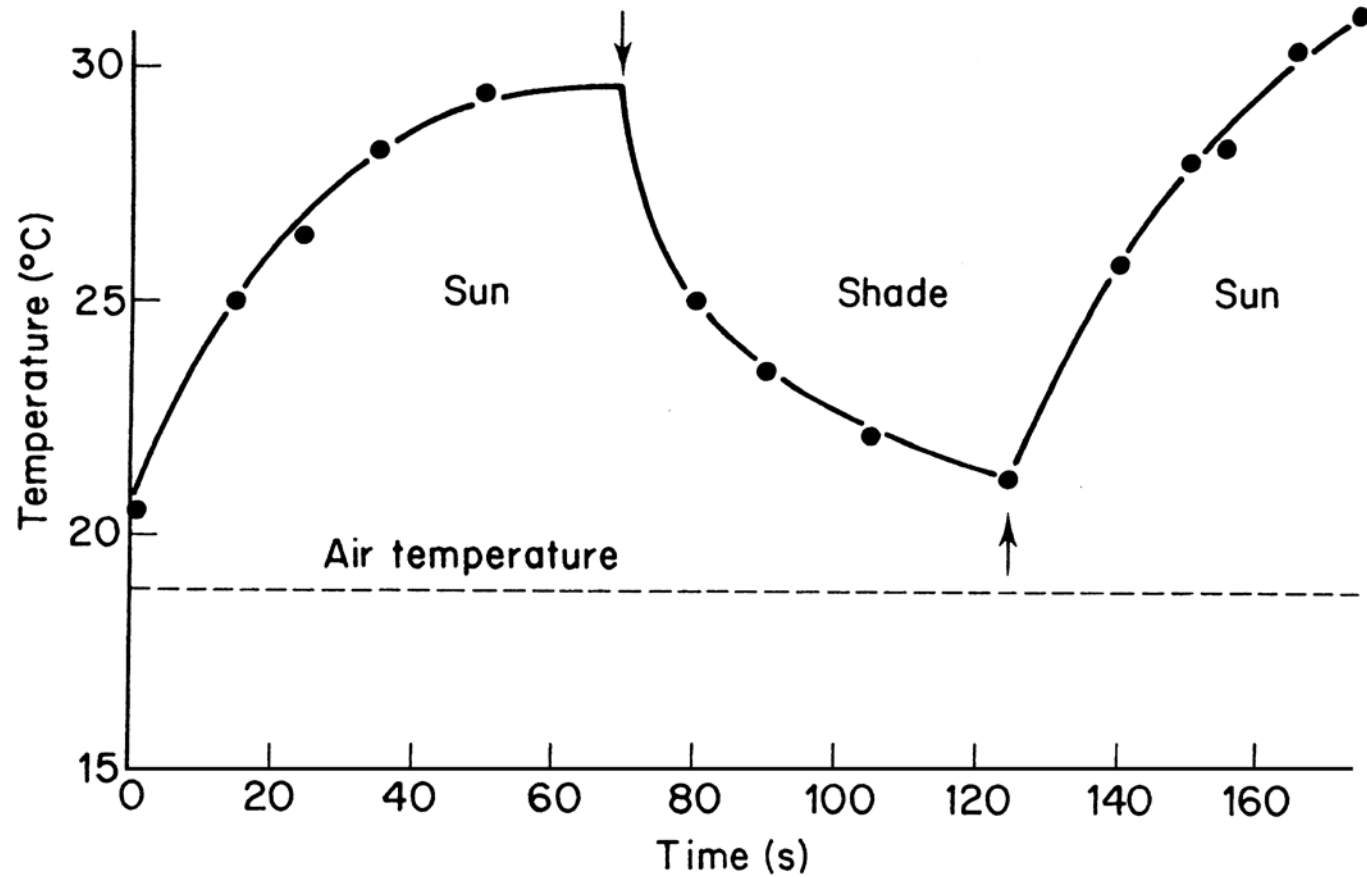


Figure 15.2 Heating and cooling of a pepper leaf in sun and shade. (Redrawn by Gates (1980) from an example by Ansari and Loomis.)

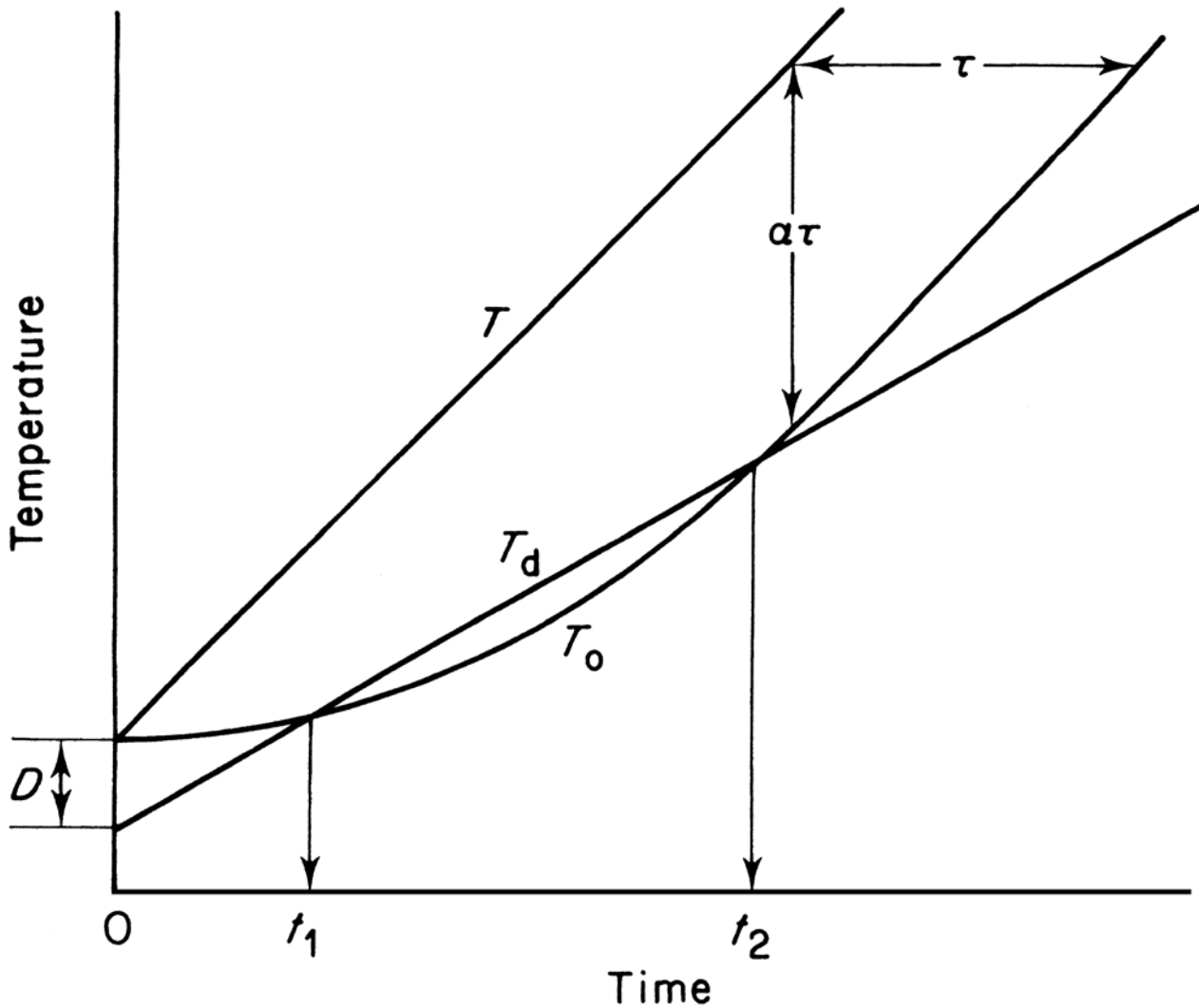


Figure 15.3 Idealized representation of the increase of air temperature (T), dew-point temperature (T_d), and pod temperature (T_o) when the dew-point depression is D at sunrise ($t = 0$). Condensation begins at t_1 and stops at t_2 . For other symbols, see text (from Monteith and Butler, 1979).

Table 15.1 Thermal Properties of Soils and Their Components (after van Wijk and de Vries, 1963).

		Density ρ (10^6 g m^{-3})	Specific heat c ($\text{J g}^{-1} \text{ K}^{-1}$)	Thermal conductivity k' ($\text{W m}^{-1} \text{ K}^{-1}$)	Thermal diffusivity κ' ($10^{-6} \text{ m}^2 \text{ s}^{-1}$)
<i>(a) Soil components</i>					
Quartz		2.66	0.80	8.80	4.18
Clay minerals		2.65	0.90	2.92	1.22
Organic matter		1.30	1.92	0.25	0.10
Water		1.00	4.18	0.57	0.14
Air (20 °C)		1.20×10^{-3}	1.01	0.025	20.50
<i>(b) Soils</i>					
	Water content x_1				
Sandy soil (40% pore space)	0.0	1.60	0.80	0.30	0.24
	0.2	1.80	1.18	1.80	0.85
	0.4	2.00	1.48	2.20	0.74
Clay soil (40% pore space)	0.0	1.60	0.89	0.25	0.18
	0.2	1.80	1.25	1.18	0.53
	0.4	2.00	1.55	1.58	0.51
Peat soil (80% pore space)	0.0	0.26	1.92	0.06	0.10
	0.4	0.66	3.30	0.29	0.13
	0.8	1.06	3.65	0.50	0.12

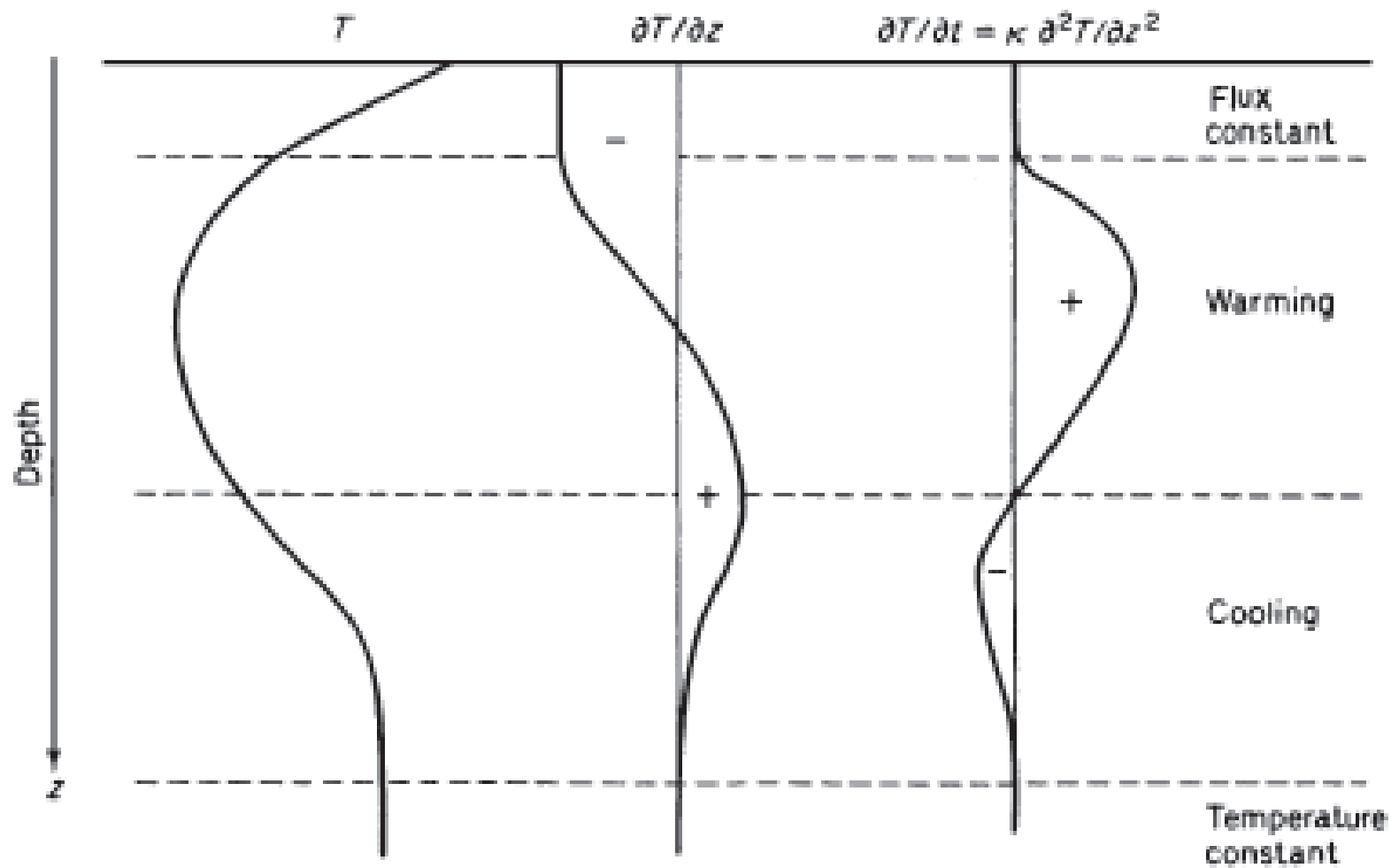


Figure 15.4 Imaginary temperature gradient in soil (left-hand curve), and the corresponding first and second differentials of temperature with respect to depth, i.e. $\partial T / \partial z$ and $\partial^2 T / \partial z^2$. The second differential is proportional to the rate of temperature change $\partial T / \partial t$.

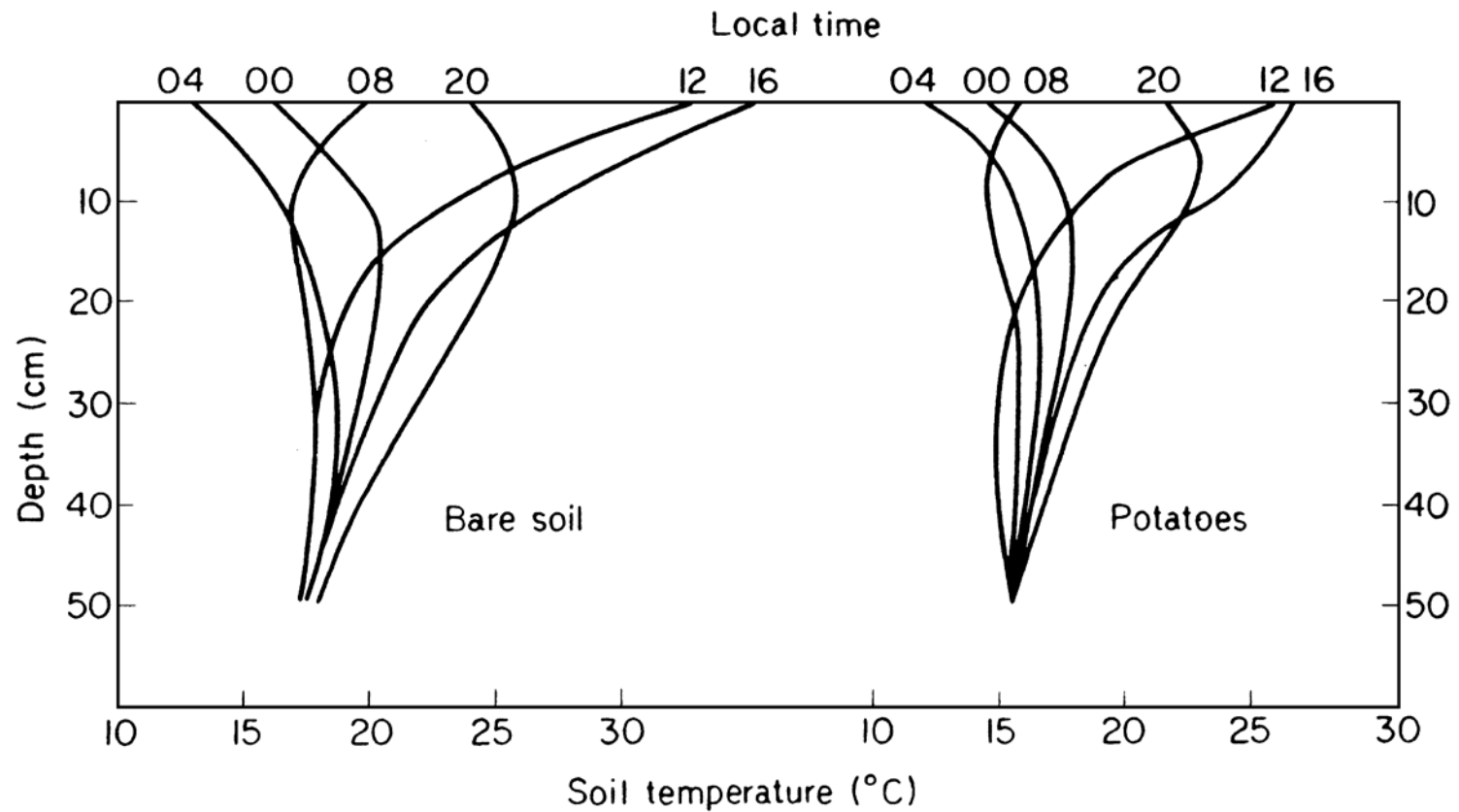


Figure 15.5 Diurnal change of soil temperature measured below a bare soil surface and below a crop of potatoes (from van Eimern, 1964).

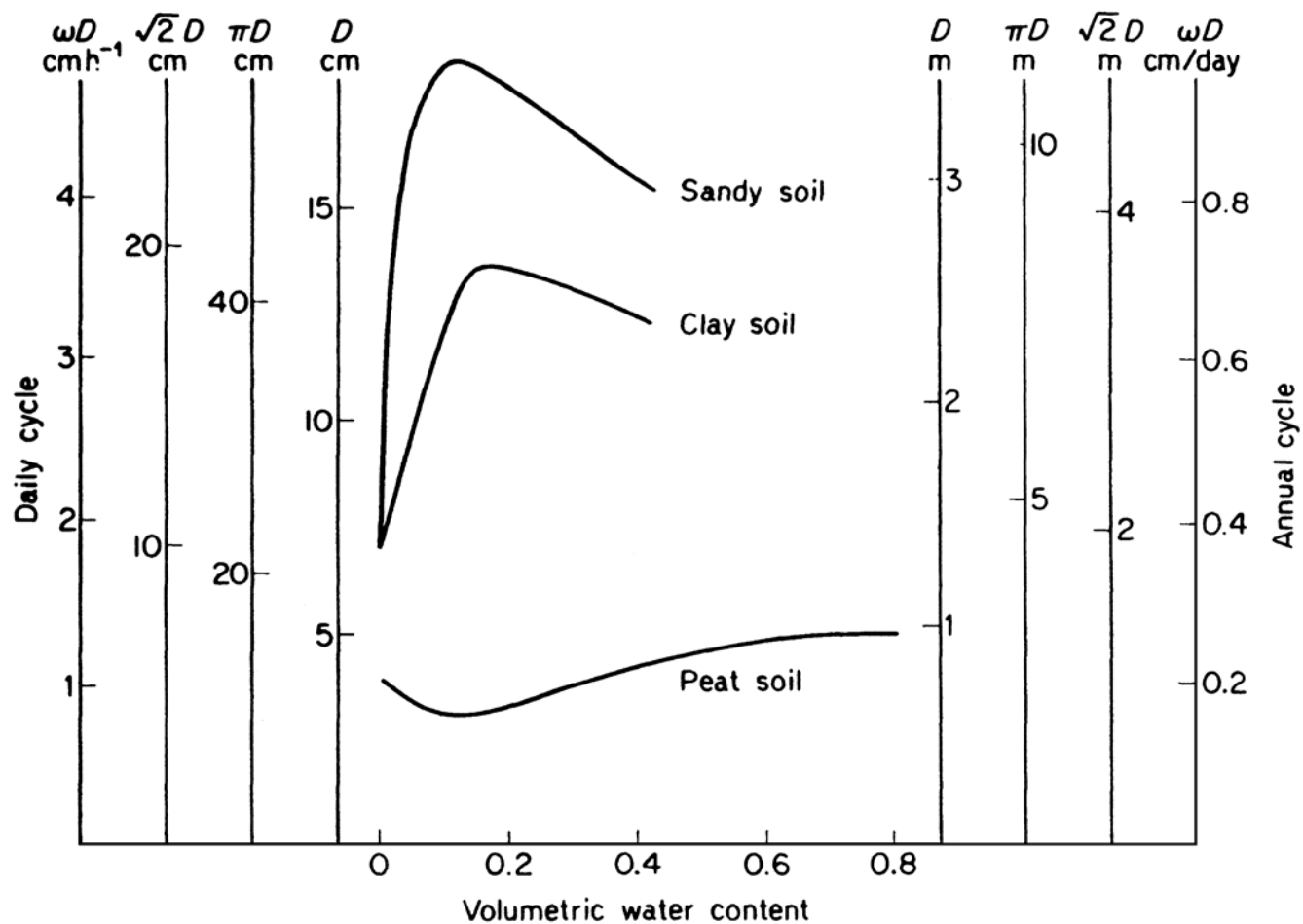


Figure 15.6 Change of damping depth and related quantities for three soils over a wide range of water contents. Left-hand axes refer to a daily and right-hand axes to an annual cycle (data from van Wijk and de Vries, 1963).

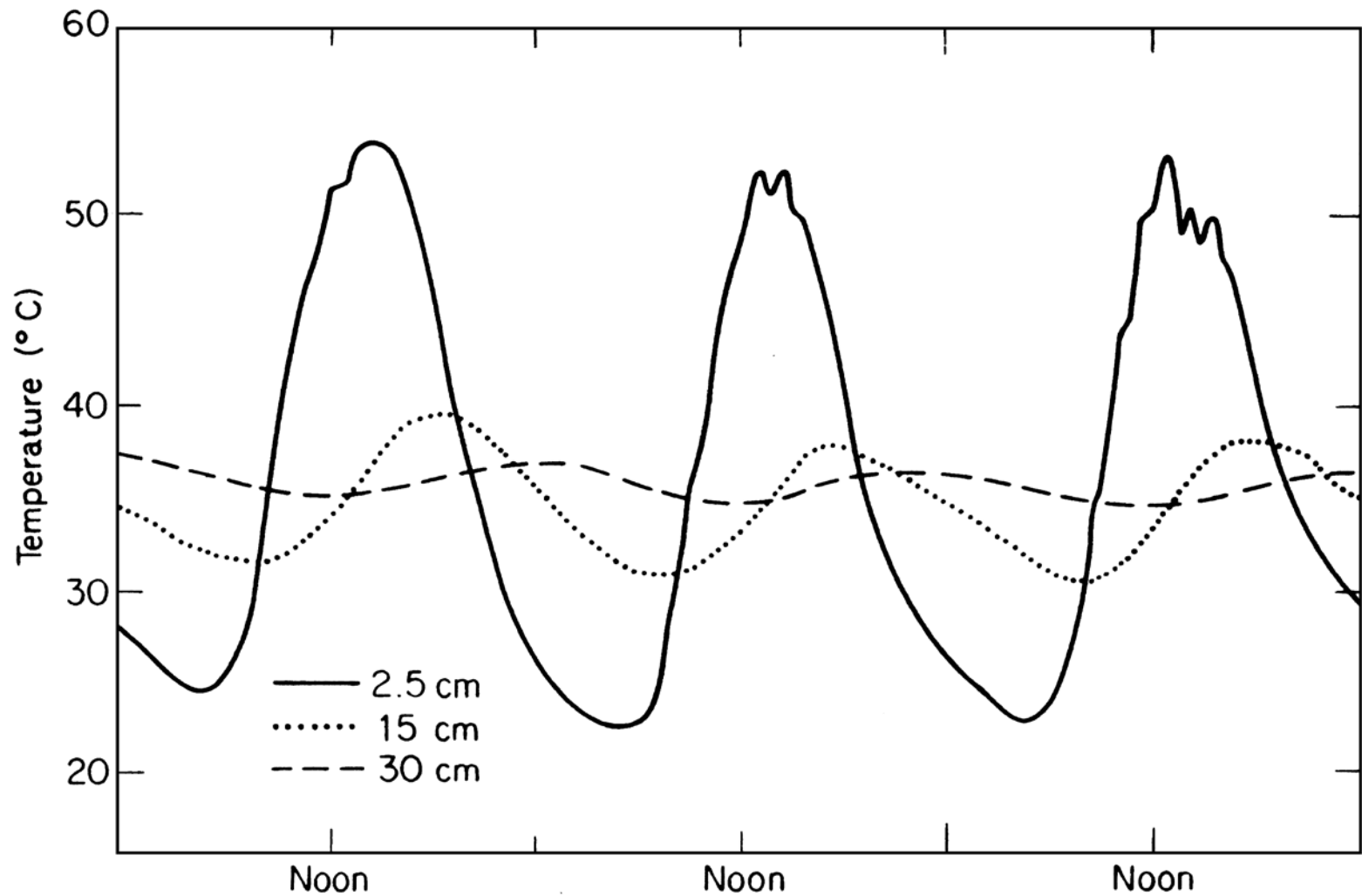


Figure 15.7 Diurnal course of temperature at three depths in a sandy loam beneath a bare uncultivated surface; Griffith, New South Wales, 17–19 January, 1939 (from Deacon, 1969).