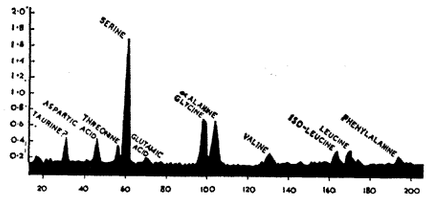

Fig. 1. Ion-exchange analysis of amino acids in an aliquot of crocidolite asbestos oil. Abscissa, effluent (ml); ordinate, absorbance.

Western Cape, Republic of South Africa.

Samples of fiber were taken from cobs of asbestos in such a way that contamination of any sort was extremely unlikely (*1*) and were extracted under reflux for 1 hour with boiling 80 percent (vol/vol) ethanol–water. The clear, faint yellow solution was then decanted and dried in a flash evaporator, giving a yield of 0.025 percent of the sample of asbestos taken. The final extract was a brownish-yellow, oily mass. Similar extractions of the country rock of crocidolite gave yields of virgin oil of 123 mg/100 g and 42 mg/100 g of pulverized material. Paper chromatography of samples of crocidolite and country rock extracts—downward development in butanol, acetic acid, and water (125:30:125)—showed the presence of three amino acids in both of the latter extracts and eight in the crocidolite extract. These have been tentatively identified as alanine, glycine, aspartic acid, leucine or isoleucine, glutamic acid, lysine, histidine, and cystine. A quantitative amino acid estimation by the column chromatographic method of Moore, Spackman, and Stein (*2*) was next undertaken (*3*) and gave the results shown in Table 1 and Fig. 1.

With the exception of serine, all of the amino acids found in crocidolite asbestos have been found by previous workers in various situations, for example, from fossils found from Pliocene to Devonian periods (*4*), from Oligocene marine mud (*5*), and from sedimentary rocks ranging in age from Ordovician to Tertiary periods (*6*). Virtually the same amino acids were found by Barghoorn (*7*) in samples of uncontaminated Gunflint chert. These last findings are particularly relevant because, like the crocidolite ones, they refer to a banded ironstone formation.

Table 1. Amino acid composition of organic extract of crocidolite asbestos.

Amino acid*	Concentration (mg/100 g of fiber)
Serine	0.095
α-Alanine	.038
Glycine	.035
Aspartic acid	.024
Threonine	.017
Leucine	.014
Isoleucine	.014
Valine	.014
Phenylalanine	.010
Glutamic acid	.007
Total	0.268†

* Amino N: 0.025 mg/100 of fiber. † This represents 0.00027 percent, or 0.027 μmole/g of fiber.

The concentration of amino acids found in crocidolite (0.00027 percent) is low compared with that found in other situations, for example, 0.0026 to 0.03 percent in various fossils from Pliocene to Devonian periods (*4*), 0.005 percent in Oligocene mud (*5*), and 0.02 percent from Middle Huronian ironstones (*7*).

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4 September 1962

Impedance to Water Movement in Soil and Plant

Abstract. The total impedance to water movement from the soil into the plant was compared with that predicted for the soil alone. When soil suction was below 0.6 bar, the impedance was largely in the plant. When suction was greater than 1 or 2 bars, the soil became the limiting factor. Water movement to the plant roots takes place primarily in the liquid phase.

Bonner has suggested that, during even moderate transpiration, a large portion of the water transfer from soil to plant roots takes place in the vapor phase, across a vapor gap (*1*). This conclusion is based upon calculations by Philip of the soil moisture gradients in the vicinity of the plant root (*2*). From a more extensive analysis along the lines of Philip's, Gardner concluded that the soil suction gradients near the plant root are probably small until the lower limit of available water is approached (*3*). We have now compared the impedance to water movement in the soil near the root with the impedance in the entire plant.

Impedance in the plant and soil is defined by the equation:

$$q = (\delta - \tau)/(I_s + I_p), \qquad (1)$$

where q is the volume of water taken up per unit time per unit volume of soil, δ is the potential energy,—that is, the diffusion pressure deficit—of the water at some point in the plant, τ is the total potential energy of water in the soil, and I_s and I_p are the impedance to water movement in the soil and plant, respectively (*3*). The total impedance I is

$$I = I_s + I_p = (\delta - \tau)/q. \qquad (2)$$

It has been shown that I_s can be represented by the expression

$$I_s = A/kL, \qquad (3)$$

where A is a constant, k is the conductivity of unsaturated soil, which is a function of the water content or soil suction, and L is a measure of the effective length of roots per unit volume (*3*). If we substitute Eq. 3 into Eq. 2,

$$I = I_p + A/kL. \qquad (4)$$

In question is the relative magnitude of the two terms on the right-hand side of Eq. 4. If this equation represents the water uptake process even approximately, then the relative importance of the impedance to water movement in the soil to that in the plant is reflected in the relative magnitudes of I_s and I_p. Equation 4 is based on the assumption that the water flux is proportional to the free energy gradient, and the impedance in the plant, for lack of data, is assumed to be constant. Neither assumption may be precisely correct.

Total impedance $I = I_s + I_p$ was measured for single pepper plants (*Capsicum frutescens* L. var. grossum, "California Wonder") growing in 3-gallon crocks of Pachappa sandy loam in a greenhouse. The diffusion pressure deficit of detached leaves was measured by the vapor pressure method of Richards and Ogata (*4*), as described by Ehlig (*5*). Soil suction was measured with tensiometers and gypsum resistance blocks. The transpiration rate was determined from daily weighings of the crocks. Values which had been obtained earlier by the outflow method were used for k (*6*).

In Fig. 1, the total impedance is plotted logarithmically as a function of k. The soil suction, in bars, is indicated at the top. One bar is 10^6 dyne/cm^2, or 0.987 atmosphere. The impedance was calculated from the diffusion pressure deficit (δ) and soil suction measurements made at about 9:00 A.M. The average daily transpiration rate was used as the value for q.

Two distinct regions are shown in Fig. 1. For values of conductivity above about 5×10^{-3} cm/day, the impedance is relatively independent of the conductivity. As the conductivity decreases below about 10^{-3} cm/day, the impedance tends to increase. As the lowest values for the conductivity decrease, the impedance tends to increase linearly on the log-log plot. If I_p were negligibly small, the data should lie on a straight line of the same slope as that shown.

It appears that when the soil suction is less than about 0.6 bar, virtually all of the total potential drop (initially about 10 bars) occurs at some point in the plant. We have presented evidence that the impedance in the roots is small compared with that in the soil (*7*). Therefore this impedance must occur elsewhere in the plant. As the soil suction increases, an increasingly greater proportion of the total potential difference occurs in the soil. When the suction is above a few bars, virtually all of the potential drop (about 20 bars) occurs in the soil. When the suction is low, movement of water to the roots must take place in the liquid phase since the conductivity is adequate to supply the necessary water with a very small suction gradient. When the suction is higher and the soil conductivity does become limiting, the agreement of the observed relation with the predicted relation between the impedance and the conductivity supports the conclusion that the water movement still takes place in the liquid phase. The nature of the water outflow process from the pressure membrane apparatus gives strong evidence that under isothermal conditions virtually all of the water movement takes place in the liquid phase when suction is less than 15 to 20 bars (*6*).

The suction at which the soil conductivity becomes limiting depends upon the plant and the texture of the soil. However, many soils of widely different textures exhibit about the same value of unsaturated conductivity when the suction is from 0.5 to 2 bars. Results similar to those shown in Fig. 1 are to be expected for many different soils.

An increase in I_s due to a decrease in the extent of the root system would shift the transition zone between plant limiting and soil limiting to the right, toward higher conductivity and lower suction. An increase in I_p would move the horizontal line upward and result in a shift of this point toward lower conductivity and higher suction. It is not possible to determine from Fig. 1 whether I_p is constant, for only very large changes in I_p would be apparent (*8*).

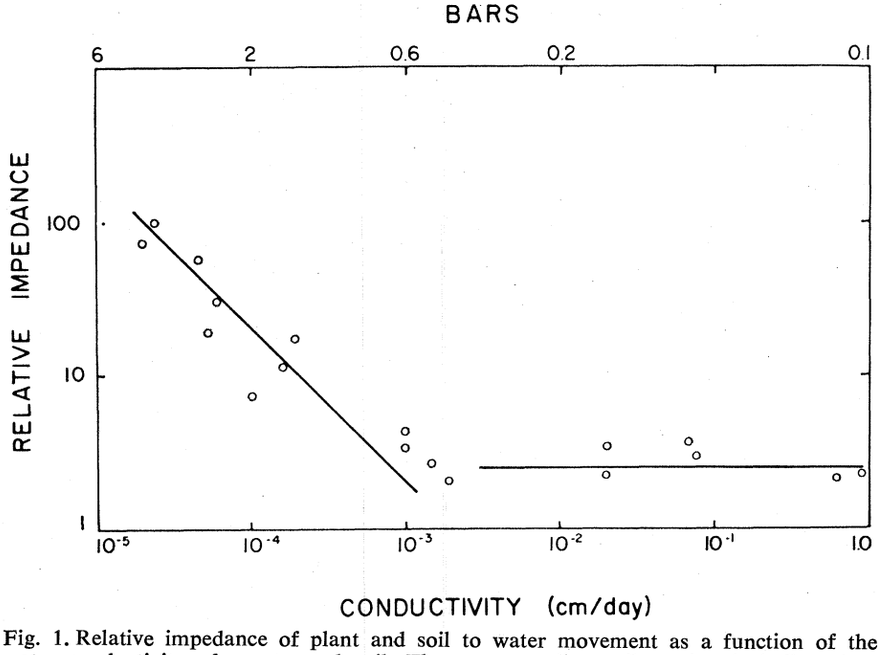

Fig. 1. Relative impedance of plant and soil to water movement as a function of the water conductivity of unsaturated soil. The corresponding soil suction is indicated at the top. Circles represent experimental data. The line on the left has a slope of 45 degrees and represents the expected relationship for negligible impedance in the plant. The horizontal line indicates constant plant and negligible soil impedance.

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Angiotensin II: Its Metabolic Fate

Abstract. Randomly labeled tritiated angiotensin has been prepared with a specific activity of 300 μc/mg and with undiminished pressor and oxytocic activity. After infusion, angiotensin accumulated in the kidneys, adrenal glands, and uterus. Thirty minutes after infusion high levels of radioactivity appeared in brain, but the electrophoretic mobility differed from that of angiotensin II. Incubation of angiotensin with hemolyzed human red blood cells or diluted human plasma rapidly inactivated the pressor activity with production of metabolic products separable by paper chromatography. But if undiluted plasma is used with incubation up to 6 hours, no loss of activity occurs.

The biological fate of a peptide labeled with iodine-131 on the tyrosyl residues may be determined in biological systems only if the peptide remains unhydrolyzed and if the addition of iodine to the tyrosyl ring does not alter its biological activity. The I^{131}-labeling technique has been applied to angiotensin II, the octapeptide L-aspartyl-L-arginyl-L-valyl-L-tyrosyl-L-isoleucyl (or L-valyl-)-L-histidyl-L-prolyl-L-phenylalanine (*1*). The biological half-life of about 10 hours obtained when I^{131}-labeled angiotensin II is used (*2*) seems unusually long compared with that reported for oxytocin, vasopressin, and bradykinin (*3*). Further, the pressor response to angiotensin II is completed in a few minutes.

Tritiation of a peptide, however, permits the introduction of a radioactive label which would not be expected