is held as surface film, in the other, which contains no solid particles, the liquid manifests full hydrostatic properties.

Cinders and gravel, which can not provide the properties required of soilless culture media, are large-sized particles, hence their water-holding capacity is low. The pores are of good size, hence drainage is rapid. Frequent application of nutrient solution is necessary, which is usually obtained by flooding the beds in which the plants are set. For convenience and economy the drained solution is used over and over. Basins are necessary to hold these low water-retaining materials so as to check the too rapid drainage of the frequently added nutrient solution. But the imperative need for drainage to open the pore spaces to air necessary for growth of crops in this type of culture media emphasizes the soil characteristics of the material. The removal of the excess solution completes the picture of the true characters of a soil—water held as films by solid particles, also some water held in the free state and its flow retarded by friction, with air space between the particles arising from drainage, following saturation by rain or irrigation.

Another basic difference between the soil and the soilless types of culture media is in the amounts of water and nutrients a given volume of each provides vegetation and in the consequent effect thereof in the magnitude of production. A unit volume of culture media that contains no solids provides more water and nutrients than does one in which space is occupied by solids. In these premises are found the explanations for the markedly greater productive potentiality of hydroponics, which is obviously soilless, than that of agriculture. Those who contend that if ample amounts of nutrients were supplied to a good soil the productive potentiality per unit area thereof would equal that of hydroponics have failed to provide evidence. Because hydroponics permits denser stands of vegetation than is possible with soils, therefore larger yields are obtained. For example, a basin—1/220 acre—carrying three crops at once for part of their growth periods, the stand of each denser than that of agriculture, yielded 8.6 bushels (60 pounds per bushel) of potatoes, more than 1,000 pounds of tomatoes and celery not yet matured. Another basin of the same size planted to potatoes and corn yielded 6.8 bushels of potatoes, and although the corn is not yet mature for harvest, nevertheless the indicated yield predicts production far in excess of that known to agriculture. Experimental evidence is also at hand showing that two crops of potatoes can be so grown as to be harvested together with yield markedly exceeding the above-mentioned large yield of a single crop. The second crop is planted at such a growth stage of the first crop that when the latter has passed the period of full light requirement the former enters therein. Also evidence is at hand that the two and three crops grown together as mentioned do not constitute the full productive potentiality of hydroponics in regions having long seasons of favorable climate.

Terminology of languages does not convey the same meaning and distinctions. "Soil" in English has a synonym, "dirt—something that pollutes, such as loose earth, dust, muck, manure." These, however, are materials that enrich land—that is, build soil. The absence of these in land could in a sense be construed to mean soilless. But is it becoming to the dignity of land to call dirtless soil "soilless"? In other languages, the concept of ground and foundation has not been taken away in the terminology commonly applied to the earth's crust which supports vegetation. Earth materials like sand or gravel, if used for the culture of plants, are not classed as "soilless."

W. F. GERICKE

UNIVERSITY OF CALIFORNIA,
BERKELEY

ARE THERE DIFFERENT CRITICAL OXYGEN CONCENTRATIONS FOR THE DIFFERENT PHASES OF ROOT ACTIVITY?

RECENT investigations with apple tree roots under field and greenhouse conditions have indicated that there may be different critical oxygen concentrations for different phases of root activity.

(1) *Subsistence.* Evidence from field studies now in progress indicates that apple tree roots larger than 1 mm in diameter are able to subsist in soil atmospheres containing less than 0.1 per cent. to 3.0 per cent. oxygen for considerable periods of time when the tree as a whole is in active growth. Controlled greenhouse experiments with apple seedlings[1] point to the probability that when the oxygen in the soil atmosphere is maintained at 3 per cent., the roots are at a "subsistence level" with respect to oxygen, that is, they continue to live but grow slowly if at all. At oxygen pressures below 1 per cent. they seem actually to lose weight. This "subsistence level" probably coincides with the lower critical concentration as defined by Cannon.[2]

(2) *Initiation of new roots.* Recently Tukey and Brase[3] have found that during wet years newly planted apple trees have produced larger root systems and tops when German granulated peat moss has been incorporated with the soil in the tree hole than when topsoil alone was used. During dry years there was little or no beneficial effect from the peat. Through the cour-

[1] J. DeVilliers. Unpublished data.

[2] William Austin Cannon, *Carnegie Inst. Wash. Pub.* 368, 1925.

[3] H. B. Tukey and K. D. Brase, *N. Y. State (Geneva) Agr. Exp. Sta. Bull.* 682, 1938.

tesy of Dr. H. B. Tukey, analyses of soil gases in boxes containing newly planted apple trees, kept under controlled conditions, were made by the authors at the Geneva Agricultural Experiment Station, and present a possible explanation of this situation—namely, that a high oxygen level may be necessary for initiation of new roots from an existing root system. In this case, a soil atmosphere containing about 12 per cent. oxygen appeared to reduce the size of the root systems and tops considerably.

(3) *Growth of existing root tips.* Normal growth of existing root tips occurs at the upper critical concentration of oxygen, as defined by Cannon. The greenhouse study with apple seedlings indicates that normal growth does not occur at oxygen concentrations below 10 per cent., even though there may be considerable growth at percentages between 5 per cent. and 10 per cent.

(4) *Absorption and accumulation.* The experiments of Hoagland and Broyer[4] have emphasized the dependence of the processes resulting in absorption and accumulation on aeration. In this connection it is noted that the ash content (as percentage dry weight) of apple seedlings grown at different oxygen pressures decreased uniformly as the oxygen percentage was decreased below 15 per cent. Since the dry weight of the root tissue was less at oxygen percentages below 10 per cent., it is probable that absorption and accumulation were inhibited at oxygen pressures below 10 per cent. This happens to coincide with the apparent upper critical concentration and may mean that maximum accumulation occurs at the upper critical concentration of oxygen.

DAMON BOYNTON
J. DEVILLIERS
WALTER REUTHER

DEPARTMENT OF POMOLOGY,
CORNELL UNIVERSITY

A PECULIARITY OF PIGMENTATION OF THE UPPER ARM OF NEGROES

DURING the routine examination of Negroes in the Johns Hopkins Hospital, Baltimore, Maryland, we have recently observed a peculiarity of pigmentation common to a significant proportion of the patients. At a point on the antero-lateral surface of the upper arm the darker color of the outer aspect of the extremity abuts on the less heavily pigmented flexor surface. In the subjects referred to, this change is not a gradual fading of the dark pigment as the eye passes medianward over the flexor surface, but the transition is an abrupt one, producing a very definite linear appearance. Usually this margin between the darker dorso-lateral and the lighter antero-median surfaces begins to be obvious a little below the greater tubercle of the humerus and follows the lateral edge of the belly of the biceps muscle distally, disappearing again just below the middle of the humerus; it averages about ten centimeters in length. The line tends to parallel and superimpose itself over the course of the cephalic vein; however, it bears no constant relation to this vessel, its course lying lateral to that of the vein in one subject and medial to it in another. The mark is usually bilateral and more or less symmetrical in the two arms, but is occasionally present on one arm and absent on the other.

A total of two hundred Negroes of both sexes, aged eleven to seventy-four years, in the hospital wards for adult patients, were examined for the presence of the line. It was sharp and distinct bilaterally in thirty-five patients, or 17.5 per cent.; in another 2 per cent., it was present unilaterally. The incidence was the same in both sexes and at all ages. The occurrence of the line was relatively as frequent in light-skinned as in dark-skinned Negroes; it has been seen in young children. In emaciated subjects with relaxation of the skin the line was usually more striking than in well-nourished patients; this was to be expected. In a colored male Jamaican the line was particularly marked and could be followed upward to the point of the shoulder bilaterally, higher than usual. This latter subject volunteered that his father had the same mark. However, there were encountered no other patients who had noted the phenomenon in relatives; the very few who had been aware of its presence on their own persons stated that it had been there as long as they could remember. Biopsy of the skin of one Negro was taken across the line; microscopically there could be observed no variation between the two sides of the line either in morphology or in the amount of pigment in the epidermis. No similar line has been encountered on the inner side of the arm, the trunk or the lower extremities of a Negro or anywhere on the body of a white subject.

Probably this observation has been made before, but we have been unable to find any reference to it. Texts such as Cockayne's "Inherited Abnormalities of the Skin and Its Appendages"[1] one would not expect to discuss apparently so common and insignificant a variation as the one under consideration. Dr. Adolf Schultz, of the Department of Anatomy of the Johns Hopkins Medical School, when consulted on the subject, stated that it is a well-known anthropological tenet that in general the dorsal and extensor surfaces of the body are somewhat more heavily pigmented than the ventral and flexor areas. It is the abruptness of

[4] D. R. Hoagland and T. C. Broyer, *Plant Phys.*, 11: 471–507, 1936.

[1] E. A. Cockayne, "Inherited Abnormalities of the Skin and Its Appendages." London, Oxford University Press, 1933.