Soil Profiles Identify Series

basic soil surveys establish classifying characteristics and indicate selection of most efficient agricultural use

Lloyd N. Brown

Differences in the surface 6′ of soil—in structure, color, texture, reaction, content of salts or humus, mineralogical composition—usually have agricultural significance and separate soils into different series or identifying units of classification. Nearly 500 soil series have been identified in California.

Soil series names are place names taken from the area where the series is first found such as Redding, Yolo, Fresno, Hanford, Ramona. When a new series is found, an official description is made and submitted for correlation on a national basis. By this method more than one name for the same soil in the various states is avoided. For instance, in an early survey a soil was found along the Columbia River in Oregon and Washington and was given the name Columbia; subsequently similar soil was found along the Sacramento River and through correlation was identified as Columbia.

The soil series have been divided into nine profile groups. Groups I to V are secondary or alluvial soils. Group I contains the most recent soils. Group II soils have a slight clay subsoil, those in Group III have a moderate clay subsoil and Group IV soils have a dense clay subsoil. Soils in Group V have a hardpan. Group VI is the smallest group and is made up principally of secondary soils and similar to those in Group IV. Groups VII, VIII, and IX are primary or residual soils formed on hard igneous rock, hard sedimentary rock, and softly consolidated material.

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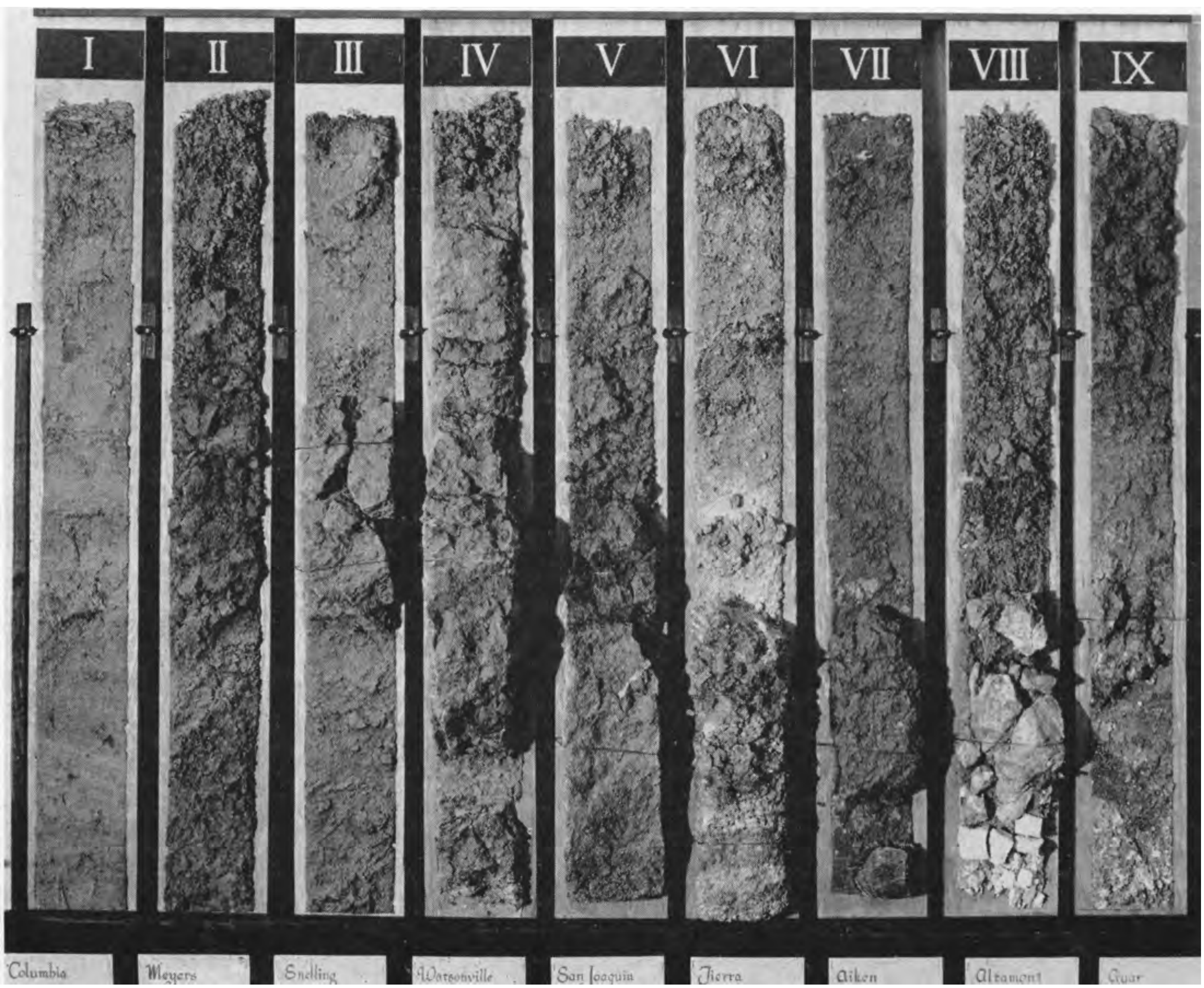
Soil monoliths representing the nine profile groups.



Soil Sterilized by Irradiation

sterilization of soil by exposure to an electron beam offers new tool for research on chemistry and microbiology of soil

A. D. McLaren and Lola Reshetko

Soil may be sterilized easily by an electron beam—of sufficient intensity and energy—without destroying the urease-enzyme activity.

Sterile soil is often desired for studies of the chemistry and microbiology of soil but—unfortunately—the use of heat or chemicals for sterilization tends to change the chemical and nutritional properties of soils rather markedly.

Experience with the irradiation of foods suggested that heatless sterilization of soils—by electron beam radiation—would leave the soil and its enzymes essentially unchanged.

Bacteria, as well as spores, are more sensitive to electron beam radiation than are viruses and enzymes. For example, to kill bacteria and bacterial spores in broth only about one-tenth as much radiation is required as for the inactivation of urease. Urease action converts urea into plant-usable ammonium carbonate.

Results of experiments with soil of the Dublin series show that doses comparable to those required to sterilize broth are required for killing microorganisms in soil.

Samples of Dublin clay-loam—100 grams, air-dried and sieved—were irradiated in sealed polyethylene bags placed around the rim of a turntable of 45 centimeters diameter, which turned under a 12 million volt electron beam at 20 revolutions per minute. The swept beam was wide enough to cover completely the width of each bag as it passed through the radiation field. By this technique heating was imperceptible to the touch. The bags were turned over after 50% of the dose had been received.

Analyses of the irradiated soil samples showed that doses of about two million rep—roentgen equivalent physical, a unit of energy in radiation dosimetry—will kill all bacteria and actinomycetes and one million rep will kill all fungi in soil. At a dose of one-fourth million rep the number of viable organisms is reduced to less than 1%.

With urea added, the rates of production of ammonia in slightly alkaline soil and in irradiation sterilized soil were nearly constant during the first ten hours of incubation. By contrast, autoclaved—steam sterilized—soil was devoid of urease activity.

The production of ammonia from benzoylarginineamide—BAA—by nonsterile soil proceeded to the extent of 45%–55% of the maximum possible release of nitrogen as ammonia in 80 hours. Thus more ammonia was released than was expected by tryptic activity alone, indicating the presence of some arginine decarboxylase or arginine dihydrolase activity. No ammonia was liberated from BAA in irradiated soil.

Electron penetration is limited by the energy, and for practical reasons this method of sterilization is only useful for laboratory and for greenhouse work—as with flats—or where the soil penetration need be only a few inches. Evidently soil so sterilized is virtually free from chemical change and should lend itself readily to studies with pure cultures of plant pathogens, nitrogen fixers, and soil-borne viruses.

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Lola Reshetko was Laboratory Technician, University of California, Berkeley, when the above reported study was conducted.

The staff of the Applied Radiation Corporation of Walnut Creek assisted in the experiment in soil sterilization by the electron beam.

SOIL SURVEYS

Continued from preceding page

A soil profile often can be seen in road cuts, stream banks, drainage ditches, excavations for pipe lines and other places where a bank of soil is exposed. When such open soil surfaces can not be found it is necessary to bore holes with a soil auger to locate a typical profile and then dig a hole about 3′ square and 5′ deep. The composition and characteristics of the soil determine its classification by series. For purposes of study, monoliths—as shown in the photograph on the preceding page—are taken from soil profiles.

Another, and a more involved rating system—known as the Storie Index—is based on soil characteristics that govern the soils' potential utilization and productive capacity. It is wholly independent of physical and economic factors such as climate and accessibility. Soils are rated on four factors: *A*, the soil profile; *B*, the texture of the surface soil; *C*, the slope; and *X*, consisting of the following six additional factors: drainage, alkali, nutrient—fertility—level, acidity, erosion, and microrelief.

In addition to establishing the various characteristics of soils and their best agricultural use, the basic information represented by soil surveys and ratings is used by many public agencies in their work with soils. The United States Bureau of Reclamation uses the information in setting up irrigability classifications of soils; the state engineer uses it in planning irrigation developments; the United States Soil Conservation Service uses it in developing their land-use capability system; and state and county assessors use soil surveys and ratings in setting up classifications for assessment purposes.

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The soil series profile group system of classification was developed by R. Earl Storie, Professor of Soils and Plant Nutrition, University of California, Berkeley.

SMOG

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posure to the synthetic smog. Even though injury was visible on some of the seedlings, it was apparently not sufficiently general to account for the pronounced dwarfing of the seedlings.

Experiments are being continued in an effort to determine the effect of natural occurring pollutants upon the growth and development of avocado trees.

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The arithmetical relationship between the destruction of chlorophyll and length of exposure to synthetic smog was reported by Louis C. Erickson, Associate Plant Physiologist, University of California, Riverside, and R. T. Wedding, Assistant Plant Physiologist, University of California, Riverside.