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# **The Rural Science Series**

EDITED BY L. H. BAILEY

## **THE SOIL**

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# THE SOIL

ITS NATURE, RELATIONS, AND FUNDAMENTAL  
PRINCIPLES OF MANAGEMENT

BY

F. H. KING

PROFESSOR OF AGRICULTURAL PHYSICS IN THE  
UNIVERSITY OF WISCONSIN

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## EDITOR'S PREFACE TO THE RURAL SCIENCE SERIES.



THE rural industries have taken on a new and quickened life in consequence of the recent teachings and applications of science. Agriculture is no longer a mere empiricism, not a congeries of detached experiences, but it rests upon an irrevocable foundation of laws. These fundamental laws or principles are numerous and often abstruse, and they are interwoven into a most complex fabric; but we are now able to understand their general purport, and we can often trace precisely the course of certain minor principles in problems which, a few years ago, seemed to be hopelessly obscure, and which, perhaps, were considered to lie outside the sphere of investigation. Agriculture has developed into a system of clear and correct thinking; and inasmuch as every man's habit of thought is determined greatly by the accuracy of his knowledge, it follows that the successful prosecution of rural pursuits is largely a subjective matter. It is therefore fundamentally important that every rural occupation should be contemplated from the point of view of its underlying reasons. It should be approached in a philosophic spirit. There was an attempt in the older

agricultural literature to discuss rural matters fundamentally; but the knowledge of the time was insufficient, and such writings fell into disrepute as being unpractical and theoretical. The revolt from this type of writing has given us the present rural literature, which deals mostly with the object, and which is too often wooden in its style. The time must certainly be at hand when the new teaching of agriculture can be put into books.

For many years the writer has conceived of an authoritative series of readable monographs, which shall treat every rural problem in the light of the undying principles and concepts upon which it rests. It is fit that such a series should be introduced by a discussion of the soil, from which everything ultimately derives its being. This initial volume is also an admirable illustration of the method of science, for the soil is no longer conceived to be an inert mixture, presenting only chemical and simple physical problems, but it is a scene of life, and its physical attributes are so complex that no amount of mere empirical or objective treatment can ever elucidate them. If the venture should prove that the opening century is ready for the unrestrained application of science to rural life, then it is hoped that the Rural Science Series, under the present direction or another's, may ultimately cover the whole field of agriculture.

L. H. BAILEY.

CORNELL UNIVERSITY,  
ITHACA, N.Y., June 1, 1895.

## PREFACE.

IN the preparation of the pages which follow, the writer has endeavored to have them bear to the reader a rational presentation of the fundamental principles of the soil as they relate to the immediately practical aspects of agriculture. The technicalities of the subject matter, and the lines of experimentation which have contributed the facts used, have been largely avoided, not because they are deemed unimportant, but in the hope that by so doing there might result a thirst for wider reading which would lead to a search for these matters in places where they are better presented than they could be here.

No effort has been made to treat subjects in an exhaustive manner, the aim being simply to use so much of recorded facts as shall sufficiently enforce those principles underlying the management of soils which it is needful to understand in order that a rational practice may follow. The soil has been considered as a scene of life, where altered sunshine maintains an endless cycle of changes, rather than as a mere chemical and



mechanical mixture, and so far as possible the problems have been given definiteness by treating them quantitatively.

A free use has been made of all available literature, and credit is usually given by author's name in the text where the reference is made.

Special acknowledgment is due to the United States Geological Survey for the use of cuts in Chapter I., and also to the National Geographic Society for Fig. 11.

F. H. KING.

UNIVERSITY OF WISCONSIN,  
MADISON, WIS., May, 1895.

# CONTENTS.

## INTRODUCTION.

	PAGE
<b>SUNSHINE AND ITS WORK.</b> Nature of sunshine — Absorption and transformation of sunshine — Sunshine the motive power in winds, in evaporation, and in plant growth — The work of sunshine expressed in horse power — Movement of water in the soil and the circulation of sap influenced by sunshine — The complex character of sunshine . . . . .	3
<b>THE ATMOSPHERE AND ITS WORK.</b> The weight of the atmosphere — Part played in physiologic processes — Depth and density of the atmosphere — Its composition — Influence of the atmosphere on the mean temperature of the earth — Selective power of the constituents of the atmosphere — The distribution of water and plant food through wind currents . . . . .	9
<b>WATER AND ITS WORK.</b> Part played in cooling the earth — Influence of tides upon the rate of rotation of the earth — Its work in corroding, dissolving, and transporting the materials of land areas — The part of water in the physiologic processes of plant and animal life . . . . .	15
<b>LIVING FORMS AND THEIR WORK.</b> The protective and destructive effects of life on land areas — Part life has played in rock building and in producing mineral deposits — The great number and variety of life forms immediately important to agriculture . . . . .	18
<b>OVER AND OVER AGAIN.</b> Cycles in nature — Conservation of energy — The circulation of the atmosphere — The magnitude and extent of water movement — Rotation of the materials of land areas . . . . .	21

CHAPTER I.

THE NATURE, FUNCTIONS, ORIGIN, AND WASTING OF SOILS.

	PAGE
Nature and general composition of soil — Soil and subsoil — Difference between subsoils of humid and arid regions — Effect of lime on arid soils — The functions of soil — Plants without true roots — Influence of soil in the processes of evolution — The soil a water reservoir — The soil a laboratory — Origin of soils — Agencies in the formation of soil — Transition from rocks to soil — Methods of rock disintegration — The action of streams in soil growth — Sediments moved by streams — The shifting of water courses — Mechanical action of rains — Bad lands of Mississippi — Overplacement of soils — Gla- cial action in soil production — Part played by animals in soil formation — Formation of humus — Origin of swamp soils — Wind-formed soils . . . . .	27

CHAPTER II.

TEXTURE, COMPOSITION, AND KINDS OF SOIL.

Mechanical analyses of soils — Importance of the size of soil grains in land values — Surface area of a cubic foot of soil — Influence of size of soil grains on the rate of solu- tion of plant food — Influence of texture on drainage and aëration — Chemical elements in soils — The composition of soils as shown by chemical analyses — Sandy soils compared with clay soils — The interpretation of chemical analyses of soils — Soils and subsoils contrasted — Soils of humid and arid regions compared — Chemical compo- sition and functions of humus — The nitrogen content of humus in arid and humid soils — The functions of certain chemical ingredients of soil — Kinds of soils — Relation of plants to different types of soils — Relation between plant food stored in the soil and that removed by crops — The “running out” of soils . . . . .	70
--	----

CHAPTER III.

NITROGEN OF THE SOIL.

	PAGE
Nitrogen content of soils of different regions — Nitrification in humus — Great importance of nitrogen, sulfur, and phosphorus in plant life — The quantitative relation of the nitrogen in crops compared with their ash ingredients, and these with the natural supplies in the soil — Forms in which nitrogen occurs in the soil — Distribution of nitrogen in the soil — Distribution of nitrates in the soil — Sources of soil nitrogen — Nitrogen compounds derived from the air — Sulfuric acid derived from the air compared with crop demands — Absorption of ammonia from the air by soils — Free-nitrogen-fixing germs — Different varieties or species of germs — Symbiosis — Observations of Frank, Schlösing, Jr., Laurent, and Kosswitsch on soil algæ — Processes of nitrification — Conditions which bring about denitrification . . . . .	107

CHAPTER IV.

CAPILLARITY, SOLUTION, DIFFUSION, AND OSMOSIS.

Illustrations of capillarity — Nature of capillarity and relation to surface tension — Strength of surface tension — Rise of liquids in capillary tubes — Capillary movement of water in soils — Measure of capillary work — Nature of solution — Solution of plant food from soil grains — Source of power in solution — Examples of osmosis — Measurement of osmotic pressure — Method of osmotic movement — Translocation of starch, etc., in plants — The so-called selective power of plants . . . . .	135
---	-----

CHAPTER V.

SOIL WATER.

Functions of soil water — Amounts of water demanded by crops — Rainfall in most countries insufficient for the largest

	PAGE
yields — Capacity of the soil for water — Rate of percolation from soils — Amount of soil water available to plants — The water table — Relation of water table to the surface — Wells — Contamination of well water by percolation — Movements of soil water — Rate of percolation through different kinds of soil — Capillary movements of soil water in field soils — Influence of fertilizers on the rate of capillary movement — Barometric oscillations of the ground water — Temperature oscillations of the ground water . . . .	154

## CHAPTER VI.

### CONSERVATION OF SOIL MOISTURE.

Amount of water retained by field soils — Influence of plowing land on the loss of soil water — Importance of early tillage — Importance of early seeding — Use of catch crops to diminish the loss of fertility — Danger in the use of catch crops — Comparative losses of water on land cultivated and land not cultivated — Comparison between soil mulches of different depths — Mulching effect of soils of different kinds — Translocation of soil moisture caused by rains — Effects of cultivation on translocation of soil moisture — Translocation produced by firming the soil — Deep tillage to conserve soil moisture — More water available on drained lands — Flat and ridge culture — Influence of wind breaks and grass lands on the rate of evaporation . . . .	184
---	-----

## CHAPTER VII.

### DISTRIBUTION OF ROOTS IN THE SOIL.

Distribution of corn roots under field conditions — Vertical distribution of roots — Extent of root foraging in soils — Influence of soil texture on symmetry of development . . . .	207
--	-----

CHAPTER VIII.

SOIL TEMPERATURE.

	PAGE
Importance of right soil temperature — Temperature at which vegetation becomes active — Observed soil temperatures at different depths — Influence of temperature on solution and diffusion in the soil — Influence of temperature on soil ventilation and upon osmosis — Temperatures favorable to germination — Influence of soil temperature on nitrification — Conditions which influence soil temperature — Specific heat of water and of soils — Influence of evaporation on soil temperature — Temperatures on drained and undrained soils — Variation of temperature with kinds of soil — Variation of temperature with direction and amount of slope — Influence of color on soil temperature — Influence of rolling and smoothing on soil temperatures — Temperature modified by depth of cultivation — Percolation after rains modifies soil temperature — Means of hastening the rise of soil temperatures early in the season — Thorough tillage — Rolling — Tillage to diminish the diurnal range of soil temperature . . . . .	218

CHAPTER IX.

RELATION OF AIR TO SOIL.

Need of air in soil — Floating gardens and water culture — Saltpetre farming — Aëration of soil to prevent denitrification — Warrington's experiments on water-logged soil — Soil ventilation to admit free nitrogen — Natural processes of soil ventilation — Blowing wells — Large ventilation of certain types of soils — Means of controlling soil ventilation — Flocculation increases soil ventilation — Influence of underdraining on soil ventilation — Aërating power of clover and other forms of vegetation — Soils may be too thoroughly ventilated — Hygroscopic moisture of soils . . . . .	239
---	-----

## CHAPTER X.

## FARM DRAINAGE.

	PAGE
Area of swamp lands in the United States — Reclamation of swamp lands in Holland — Lands which may be improved by draining — Drainage systems in Illinois — Necessity of draining water-logged soils — Depth to which the water table should be lowered — Provision to prevent too rapid loss of water through tile drains — Distance between tile drains — The gradient of the ground-water surface — Rate of lowering the level of the water table — Natural sub-irrigation — Value of such lands for intensive farming — Needs and methods of surface drainage — Celtic land beds — Draining basins without outlets — Example of field under-draining — Fall of drains — Cost of tile draining — Size of tile — Outlet of drains — Joining laterals with mains — Obstruction of tile drains by the roots of trees . . . .	253

## CHAPTER XI.

## IRRIGATION.

Encouragement for irrigating in humid climates — Results of sewage irrigation — Effect of irrigation on yield of corn in Wisconsin — Irrigation of grass lands in Europe — Development of irrigation in early times — Extent of irrigation at the present time — Amount of water used in irrigation — Methods of obtaining water for irrigation — Cost of irrigation — Irrigation of barren sands in Belgium . . . .	268
--	-----

## CHAPTER XII.

## PHYSICAL EFFECTS OF TILLAGE AND FERTILIZERS.

Importance of good tilth — Effect of cultivation on the texture of the soil — Seeding to grass tends to restore texture similar to that of virgin soil — Change of texture by puddling	
--	--

*Contents.*

XV

	PAGE
— The formation of clods — How plowing affects tilth — Early tillage after rains to preserve good tilth — Subsoiling in humid and semiarid regions — Winter weathering to improve tilth — Burning and paring — Influence of fertil- izers of different kinds in altering the texture of soils — Capillary power and rate of percolation affected by fertil- izers — Physical action of soils in retaining certain salts — Influence of farmyard manure on soil moisture — Influence of summer fallowing on the relation of soil to water — The Lois-Weedon system of tillage — Summer fallowing in humid and semihumid climates . . . . .	276



# THE SOIL.



## INTRODUCTION.

It was early one morning late in October after there had been several very severe frosts that a fox squirrel, either by chance or in deliberate search, passed under a large tree and found the ground thickly strewn with butternuts. All night these nuts had been falling by ones and by twos until now the ground was nearly covered with them. As some other squirrel had done, one, or maybe, two hundred years before, so did this one take a nut, and hurrying off to a secluded spot, bury it in the soil beneath the forest mold. Why this was done, whether with the intention of recovering it for a future meal, or whether, like a deliberate forester, he planted it that another tree might grow, only that squirrel knew. It lay there in the ground undisturbed the winter through; but in the spring, as with a thousand seeds of other kinds, its obstinate shell opened without a jar or sound. Water crept in, and the rich oil stored all winter in the thick meat rapidly changed into sugar, so that out of this and other materials borne along in streams of water which now were setting in from the soil, the tiniest cells began to form, some building a stem upward











































































































































































































































































































































































































































































































































































































































































































