

R. B. HINMAN  
COLLECTION



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PROFESSOR OF ANIMAL HUSBANDRY  
1921-1943

New York  
State College of Agriculture  
At Cornell University  
Ithaca, N. Y.

# **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

New York

THE MACMILLAN COMPANY

LONDON: MACMILLAN & CO., LTD.

1913

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Set up, electrotyped, and published July, 1895. Reprinted January, 1896; May, 1897; April, 1898; June, 1899; August, 1900; February, December, 1902; February, 1904; January, November, 1905; October, 1906; October, 1907; June, December, 1908; July, 1909; July, 1910; January, 1911; October, 1912; July, 1913.

@ 125,343

## 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.

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# 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











































































































































































































































































































































































































































































































































































































































































































