

# **FIRST PRINCIPLES OF AGRICULTURE**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649187911

First principles of agriculture by Edward B. Voorhees

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.  
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

[www.triestepublishing.com](http://www.triestepublishing.com)

**EDWARD B. VOORHEES**

**FIRST PRINCIPLES  
OF AGRICULTURE**



FIRST PRINCIPLES  
OF  
AGRICULTURE.

BY

EDWARD B. VOORHEES, A.M.

DIRECTOR OF THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION,  
AND PROFESSOR OF AGRICULTURE IN RUTGERS COLLEGE,  
NEW BRUNSWICK, N.J.



SILVER, BURDETT AND COMPANY.  
NEW YORK. BOSTON. CHICAGO.

## PREFACE.

---

THE purpose of this book is to state in logical order the elementary principles of scientific agriculture, and to show the relation of these scientific facts to farm practice. The need of such a book has been strongly felt by the author in his work as a teacher, not only of college students, but of those already engaged in farming.

His experience, both as a practical farmer and as a teacher of the theory and application of agricultural science, leads him to believe that the principles and relations of scientific agriculture, if set forth clearly and in a scientific manner, can be successfully taught in our country district schools. It is here that such education must begin, if it is to reach and influence the mass of farmers, upon whom rests the chief burden of irrational practice, and through whom must come any direct progress in the true development of the farming industry.

In the preparation of the book no attempt has been made to cover the whole field of the various sciences in their relations to agriculture; in many branches, only simple facts are stated, though it has been the aim to make the book scientific as far as it goes, and thus a safe guide to practical men in their farming operations, as well as a foundation upon which further study may be based.

The accomplishment of the work is due in no small degree to the endorsement of the plan by the New Jersey State Board of Agriculture and the New Jersey State Grange, as well as their hearty co-operation with, and cordial appreciation of, all genuine efforts made in behalf of agricultural education in the public schools of the State.

E. B. V.

NEW BRUNSWICK, N. J.

*November, 1895.*

## CONTENTS.

---

CHAPTER	PAGE
I. THE CONSTITUENTS OF PLANTS . . . . .	7
II. ORIGIN AND FORMATION OF SOILS . . . . .	18
III. COMPOSITION OF SOILS . . . . .	29
IV. THE IMPROVEMENT OF SOILS. . . . .	41
V. NATURAL MANURES . . . . .	52
VI. ARTIFICIAL AND CONCENTRATED MANURES; NI- TROGENOUS MATERIALS . . . . .	68
VII. ARTIFICIAL AND CONCENTRATED MANURES; PHOS- PHATES . . . . .	80
VIII. ARTIFICIAL AND CONCENTRATED MANURES; SU- PERPHOSPHATES AND POTASH SALTS . . . . .	90
IX. ARTIFICIAL MANURES OR FERTILIZERS; METHODS OF BUYING; VALUATION; FORMULAS. . . . .	101
X. THE ROTATION OF CROPS . . . . .	113
XI. THE SELECTION OF SEED; FARM CROPS AND THEIR CLASSIFICATION; CEREALS; GRASSES; PASTURES; ROOTS; TUBERS; AND MARKET- GARDEN CROPS . . . . .	122
XII. THE GROWTH OF ANIMALS; THE CONSTITUENTS OF ANIMALS AND ANIMAL FOOD; THE CHARAC- TER AND COMPOSITION OF FODDERS AND FEEDS, . . . . .	137



CHAPTER	PAGE
XIII. THE DIGESTIBILITY OF FODDERS AND FEEDS; FEEDING STANDARDS; NUTRITIVE RATIO; THE EXCHANGE OF FARM PRODUCTS FOR CONCEN- TRATED FEEDS . . . . .	154
XIV. PRINCIPLES OF BREEDING; THE PURE BREEDS OF FARM STOCK . . . . .	170
XV. THE PRODUCTS OF THE DAIRY; THEIR CHARACTER AND COMPOSITION; DAIRY MANAGEMENT . .	182
APPENDIX—	
TABLES . . . . .	199
INDEX . . . . .	200



# FIRST PRINCIPLES OF AGRICULTURE.

---

## CHAPTER I.

### The Constituents of Plants; Plant Growth.

**Parts of Plants.**—Most agricultural plants possess three distinct parts, — the root, the stem, and the leaf. The main uses of the root are to secure food from the soil, and to serve as a support to the plant during its period of life. The stem acts as a support for the leaves, as a medium for the circulation of food through the plant, from the leaf to the root and from the root to the leaf, and as a storehouse of nutriment for future growth. The leaves secure food from the atmosphere, and permit the escape into the air of the water taken up by the roots.

These different parts all co-operate, or work together, to secure and distribute the constituents necessary to the complete growth and development of the whole plant. What is plant food, or of what constituents is a plant composed, is a question of the first importance in a study of the growth of plants.

**The Water contained in Plants.**—A plant in the first place is composed of two distinct classes of substances, — water and dry matter. Water is contained in all growing plants; forest and fruit trees seldom contain

less than four-fifths, while vegetables and young plants are frequently nine-tenths water.

When plants are removed from the soil, and brought in contact with the air and warmth, a large part of the water contained in them escapes in the form of water vapor; they become what is termed "air dry." The proportion of water lost in this way, and the time or rapidity of loss, depend upon the moisture contained in them, and the warmth of the atmosphere; the drier and warmer the atmosphere, the greater the loss of water. This loss of water is nicely illustrated in hay-making, the time required to dry or cure depending upon the kind of plant and the character of the weather.

**Air-dry Plants.** — In temperate climates, air-dry plants still contain from eight to twelve per cent of water. To effect its complete removal they are heated to a temperature of 212° F., that of boiling water, until there is no further loss of weight. The portion remaining after the drying is termed the "dry matter." The dry matter of plants contains all the constituents of their growth; that is, all those necessary for perfect growth, no one of which can be removed without destroying it.

Water, while it is essential in the growth of plants and serves a useful purpose, is not a constituent in the same sense as those which are contained in the dry matter, since, as has already been noted, it can be removed without destroying the structure and form of the plant.

**The Total Dry Matter.** — The total dry matter of plants contains all those substances or compounds which are useful for the purposes for which they are grown. The constituents contained in it may also, for convenience