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# Manual on Fundamentals of Agronomy

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Lokesh Kumar Jain • Ravindra Kumar Jain  
Hanuman Prasad Parewa • Sawai Dan Ratnoo





# **Fundamentals of Agronomy**

## **(A Practical Manual)**

## **The Authors**

**Sh. L.K. Jain** acquired his master degree in Agronomy from Rajasthan College of Agriculture (SKRAU, Bikaner), Udaipur with Gold Medal in 1999. Presently, he is associated in teaching UG students since last five years. He has contributed in publication of 3 books, 13 chapters and a number of research papers in national and international reputed journals. He has a vast experience of research as SRF in AICRPDA and extension services as SMS in KVK Barmer.

**Dr. Ravindra Kumar Jain** is presently working as Senior Research Fellow in organic farming project at Directorate of Research, Maharana Pratap University of Agriculture and Technology, Udaipur. He obtained Ph.D. degree from MPUAT Udaipur, specializing in Molecular Biology. He has to his credit 17 research papers in National and International Journals and attended 20 National and International Seminar / Symposia.

**Dr. Hanuman Prasad Parewa** a BHU alumnus is presently the faculty member at College of Agriculture (Agriculture University, Jodhpur) Sumerpur, Pali, Rajasthan. He got UGC scholarship for his Ph. D. programme in Soil Science & Agriculture Chemistry. He has five year 5 years of experience in undergraduate teaching in the field of soil science and more than 2 years of experience in extension and administration. He has published 4 practical manual, 10 papers, 5 book chapters, 17 popular articles, 5 folder and about 15 abstract and full papers including the proceeding of National and International seminars and conferences. He has specialized in Soil fertility, INM and PGPR.

**Dr. S.D. Ratnoo**, obtained his Ph.D. degree from the SKRAU Bikaner in 1995 in the field of Entomology. He has 25 years research, extension and teaching experience in the field of agriculture particularly in insect pest management of crops and stored grain pests. He has published many packages of practices for Zone II b of Rajasthan as an authority of Zonal Director Research. He also published more than 75 research paper and has actively participated in many national and international scientific conferences and seminar. He is the member of several organizations and societies. He is presently working as Dean and Faculty Chairman, Faculty of Agriculture, Agriculture University Jodhpur besides Zonal Director Research ARS, Jalore AU Jodhpur.

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## **Lokesh Kumar Jain**

Assistant Professor Agronomy  
College of Agriculture  
Sumerpur

## **Ravindra Jain**

Senior Research Fellow,  
Directorate of Research, MPUAT Udaipur

## **Hanuman Prasad Parewa**

Assistant Professor Soil Science  
College of Agriculture  
Sumerpur

## **Sawai Dan Ratnoo**

Dean  
College of Agriculture  
Sumerpur

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**Prof. Balraj Singh**

Vice Chancellor,  
Agriculture University, Jodhpur

## **FOREWORD**

The subject Agronomy deals with the principles and practices of crop production and soil management and an essential need is being realized that the students of Agriculture must have a sound knowledge of practical aspects of Agronomy. The manual on Fundamentals of Agronomy places a premium on ideas or perspectives both of an academic and students as it has wide coverage and cover all the prescribed topics such as identifications of crops, seeds, weeds, fertilizers and plant protection chemicals, weed management, water quality analysis and measurement. The authors approach to compile the experiments in a new form as suggested by Fifth Dean Committee, to enrich and strengthen the study wherever possible is highly appreciable. It is felt that this book meets a long felt need of students.

I congratulate Sh. L.K. Jain, Dr. R. Jain, Dr. H.P. Parewa and Dr. S.D. Ratnoo for scrupulous efforts in bringing out a textbook on Fundamentals of Agronomy. As it covers a core course totally modified recently and implemented during current session of 2017-18 for undergraduates in all Agriculture Universities in the country and it will serve a very useful purpose in this direction.

**(Prof. Balraj Singh)**



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# Preface

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This book is intended as a text for undergraduate students of Agriculture. It also be useful to research scholars and other professionals in the field of agriculture development and management especially under teaching stream.

Introductory Agronomy involves several basic subjects like agronomy, soil and water, farm machinery, engineering, soil science and plant breeding and genetics etc. For an integrated development and management of agriculture knowledge of all these subjects are necessary for undergraduate students. A sincere attempt is made to provide such prospective to the students.

A fundamental knowledge of identification of crops, seeds, weeds, fertilizers and plant protection chemicals, water quality analysis and measurement will be needed in crop planning under different situations. Therefore, an attempt has been to present the topics relevant to the needs of the agronomy. Thus, book is therefore, designed to fulfill the need for students of agriculture and serves as reference tool for the teachers in the field of Agronomy from all points of view.

A collage of material and text from different sources has been used to prepare this text book. The authors acknowledge their indebtedness to authors of books, manuals and internet media from which most of the materials have been drawn. In most of cases, it has obtained permission of reproduction, for which the authors and the publisher offer their apologies. At the end of the book and at footnotes of particular figures, references have been given from which most of the material has been taken.

The authors express their sincere gratitude to Hon'ble Vice Chancellor Prof, Balraj Singh and thanks to Dr. I.S. Naruka, Dr. R.L. Bhardwaj and other colleagues for their valuable suggestions in improving the quality from time to time during preparation of first edition of Fundamentals of Agronomy. The authors are highly

acknowledged to our all well wishers for their direct-indirect cooperation.

Last, but not the least, the authors would welcome critical suggestions if any received from the learned readers would be highly appreciated for further modifications and improvements in the text.

**Authors**

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# 1

## IDENTIFICATION OF CROPS AND THEIR SEEDS

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### Introduction

The identification of different crops and their seeds with knowledge of botany and visible characters is important for agriculture students. In systematic botany or taxonomy the closely related or similar type of plants are grouped into a single category and are: family, genus, species etc. In identification, the particular crop or seed in question must be identified up to the species level. There are so many field crops grown throughout the country in *Kharif*, *Rabi*, *Spring* and *Summer* season in respect of consumption, utilization, economics, productivity etc. In general, crop is defined as a group of identical plants grown in field for economic importance or aggregation of individual plant species grown in a unit area for economic purpose. Plants can usually be grouped together in respect of agronomic/commercial/economic classification such as cereals, pulses, oilseeds, fibre, sugar, tuber and fodder crops and identified on the basis of morphological description like root, stem, leaves, inflorescence and other basic characteristics. The seed is defined as a fertilized mature ovule and consists of an embryo, a protective covering (seed coat) and stored food (endosperm). The grain which is used for multiplication is called as seed while those used for human/animal consumption are called as grains. The identification of seed is usually by comparison, comparing the seeds with a mental image of what something should be, with specimens in a reference collection or with illustration of seeds. In most cases, the useful clues for the identification of seed came from the following characters:

- The size, shape and color of seeds
- The nature, arrangement and pattern of markings like lines, ridges, pits, projection on the seed surface
- The shape and position of the attachment scar
- The presence of wings, hair or scale, spines etc

- The internal structure, position and size of the embryo, presence or absence of the endosperm

Once the seed is characterized for a particular family, identification could easily be done by studying the above mentioned seed characters. Seeds particularly of an unknown and unconventional crop and weed are difficult to identify as such, growing it as a plant could help in identification of seeds.

The pictures or physical appearance of different crops and their seeds have been depicted in Sheet 1 to 5.

## Identification of crop plants

Some of the important crops have been summarized as under:

### Wheat

It is a major *rabi*/ winter crop and second staple food of Indians. The plant normally attains a height of 80-120 cm.

**Root system:** The plants have primary root system i.e. the roots arise when seed germinates at the depth where it is placed and secondary root system i.e. it arises at a point above the primary root system and act as the principal organ of absorption as the young seedling progresses to maturity.

**Shoot system:** It comprises of all plant parts visible above the ground and composed of stem, leaves and inflorescence.

- i. **Stem:** The stem of wheat plant is round or cylindrical and solid at nodes. Stem may be called as culm.
- ii. **Leaves:** Leaf consists of four parts.
  - a. **Leaf sheath:** It is the basal part of leaf, encircles the (culm) stem and protects the growing point and auxillary buds from the adverse weather and provides support to stem to some extent.
  - b. **Leaf blade:** The flattened, parallel veined portion of the leaf.
  - c. **Ligule:** A membranous or cartilaginous fringe at the junction of the sheath and blade on the side of leaf next to culm. The continuation of the sheath through the collar is known as ligule.
  - d. **Auricle:** Lobes of leaf blade which extend downward on each side at the junction of the blade and sheath. These are horn or claw like appendages projecting from collar of leaf.
- iii. **Inflorescence:** The flowering portion of wheat plant which is called ear or head or spike.
  - a. **Rachis:** The central zigzag axis is the rachis. Spikelets are borne on alternate sides of rachis, which gives it zigzag appearance.
  - b. **Spikelet:** It is composed of flowers called florets. The number of florets in a spikelet may vary from 1 to 6.