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Manual on Fundamentals of Agronomy

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Fundamentals of Agronomy (A Pratical Manual)

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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)

Preface

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

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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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IDENTIFICATION OF CROPS AND THEIR SEEDS

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.