# Chapter - 1

## Physiology of Plant Seed Development

**Shraddha Singh, Sumant Pratap Singh, Saurabh Singh and Alok Kumar Singh**

**Abstract**

Seeds are the product of the ripened ovule, after fertilization by pollen. The embryo develops from zygote and the seed coat from the integuments of the ovule. The embryo is made up of a radicle, an embryonal axis and one (wheat, maize) or two cotyledons (gram and pea). The ovules after fertilization develop into seeds. Seed is a very important and valuable thing for carrying out next generation of plants. Seeds are broadly classified into 2 main types based on the number of cotyledons in the embryo. A Monocotyledonous seed has only one cotyledon and one layer of the seed coat and a dicotyledonous seed has two cotyledons. There are five main classes of seeds *i.e,* Nucleus seeds, Breeder seeds, Foundation seeds, registered seeds and certified seeds.

**Keywords:** Seeds, embryo, cotyledons, monocotyledonous, dicotyledonous, valuable, generation.

### Introduction

Seed is the small and hard part of a plant from which a new plant grows. The term "seed" also has a general meaning of "anything that can be sown. Seed is mainly classified into five major classes *i.e.*, Nucleus, Breeder, Foundation, Registered and Certified seeds. On the basis of the number of cotyledons in the embryo the angiosperms have been divided into two large groups that are Monocotyledons and Dicotyledons. Seeds are consists mainly of three components which is Embryo, Endosperm (somines calles as perisperm) and seed coat. Seed dormancy is defined as the condition in which seeds are prevented from germinating even under the favourable environmental conditions for germination including, temperature, water, light, gas, seed coats, and other mechanical restrictions. There are various methods to break dormancy are Scarification, Stratification, Impaction, Inhibitors, Inhibitor Promoter ratio and Temperature treatment. Seed viability the ability of seed to germinate and the ability of seedling to

# Chapter - 1
# Physiology of Plant Seed Development

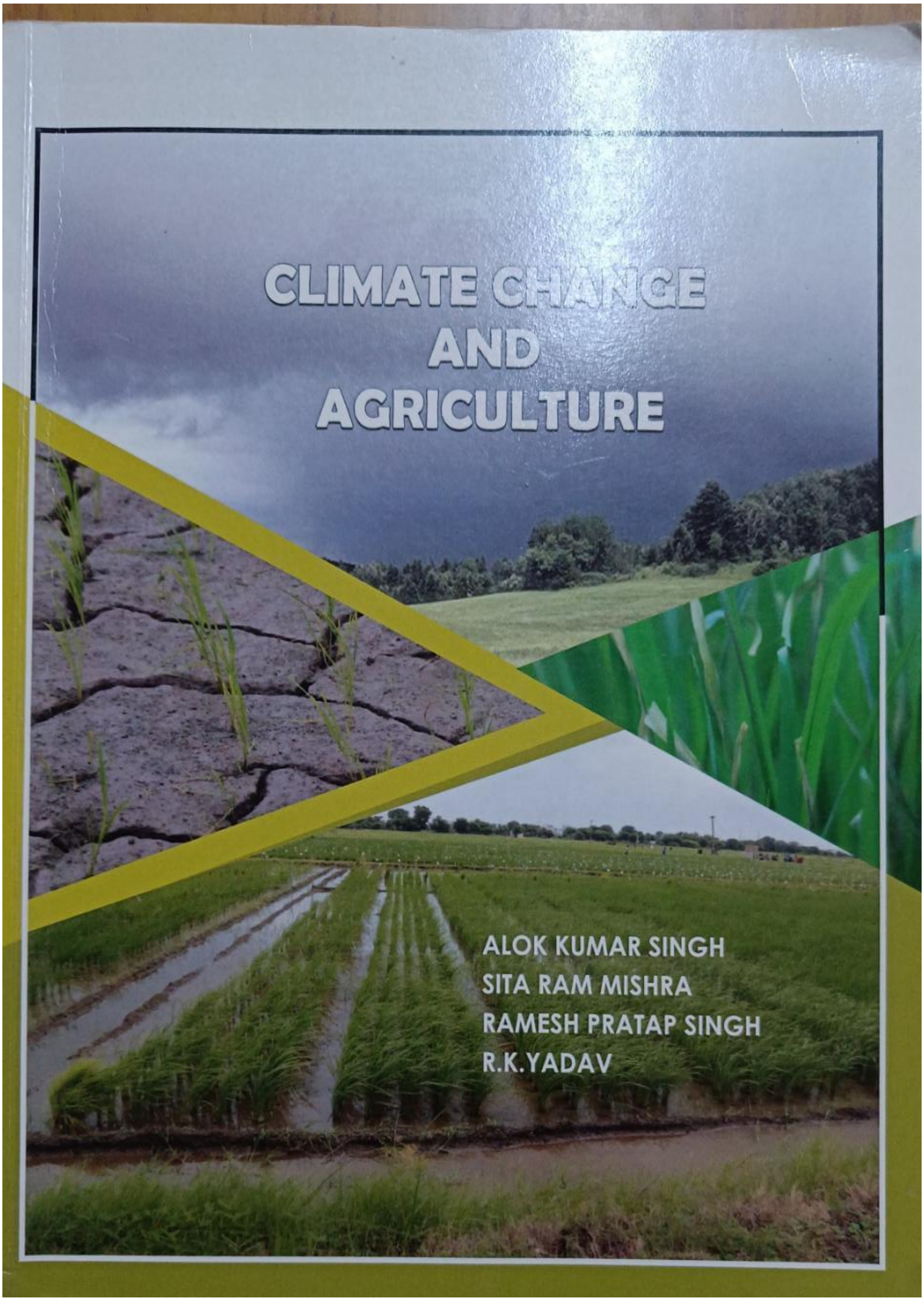

**Authors**

**Shraddha Singh**
Department of Crop Physiology, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Sumant Pratap Singh**
Department of Plant Molecular Biology and Genetic Engineering, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Saurabh Singh**
Department of Crop Physiology, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

**Alok Kumar Singh**
Department of Crop Physiology, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India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# LABORATORY PROTOCOL FOR LIFE SCIENCES

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Varsha Rani

# PLANT PHYSIOLOGY AT A GLANCE


VARSHA RANI
VD LOHOT
R.K YADAV
RAJ BAHADUR
PRASHANSHA SINGH
ALOK KUMAR SINGH
RAJEEV KUMAR
DOLLY PROMILA BARA

# Chapter 9

# Phyllochron: Acclimatize to low temperature in cereals

Preeti Singh[1,2], Varsha Singh[3], Vijai P.[2*], A.K. Singh[1], Alok Kumar Singh[1] and A. Hemantaranjan[2]

[1]Department of Crop Physiology, College of Agriculture, ANDUA&T, Kumarganj, Ayodhya (U.P.)- 224 229

[2]Department of Plant Physiology, Institute of Agricultural Sciences

[3]Department of Genetic and Plant Breeding, Institute of Agricultural Sciences Banaras Hindu University, Varanasi-221005

*Corresponding author's E-mail: pvijaivenkat@gmail.com

## Introduction

### Phyllochron

Phyllochron is an intervening period between the sequential emergences of leaves on the main culm of a plant and referred as leaf appearance. The term, phyllochron was first described in 1966 (Bunting *et al.*, 1965). The interval between leaf appearances can be recorded in both standard measurements of time as well as thermal time e.g., growing degree units (Wilhelm *et al.*, 1995). Study of phyllochron is a suitable method to understand the plant vegetative growth in better way and helps simulation of plant growth. Also, it is a basal parameter in predicting plant total leaf number and date of flowering. Many cereal crops are cold sensitive species having a capacity for acclimation to low temperature. The phyllochron is shorter in temperate environment than in a tropical and sub-tropical environment among the cereal crops. Typically, a maize phyllochron is 30% greater in tropical than in temperate areas (Kiniry and Bonhomme, 1991). Thermal interval for leaf tip appearance is overly critical for predicting the duration of vegetative growth development.

Low temperature is one of the most important limiting factors in the productivity of crops which frequently causes injuries to all crop seeds

A Comprehensive Note on

# Soil Science

(Volume-I)


* Anil Kumar Singh
* Kripal Singh * Chitranjan Kumar * Alok Kumar Singh * Dinesh Kr. Singh


SOIL : SOUL OF INFINITE LIFE

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VINEET KUMAR
RAJESH KUMAR SINGH
SHIVANGI NEGI

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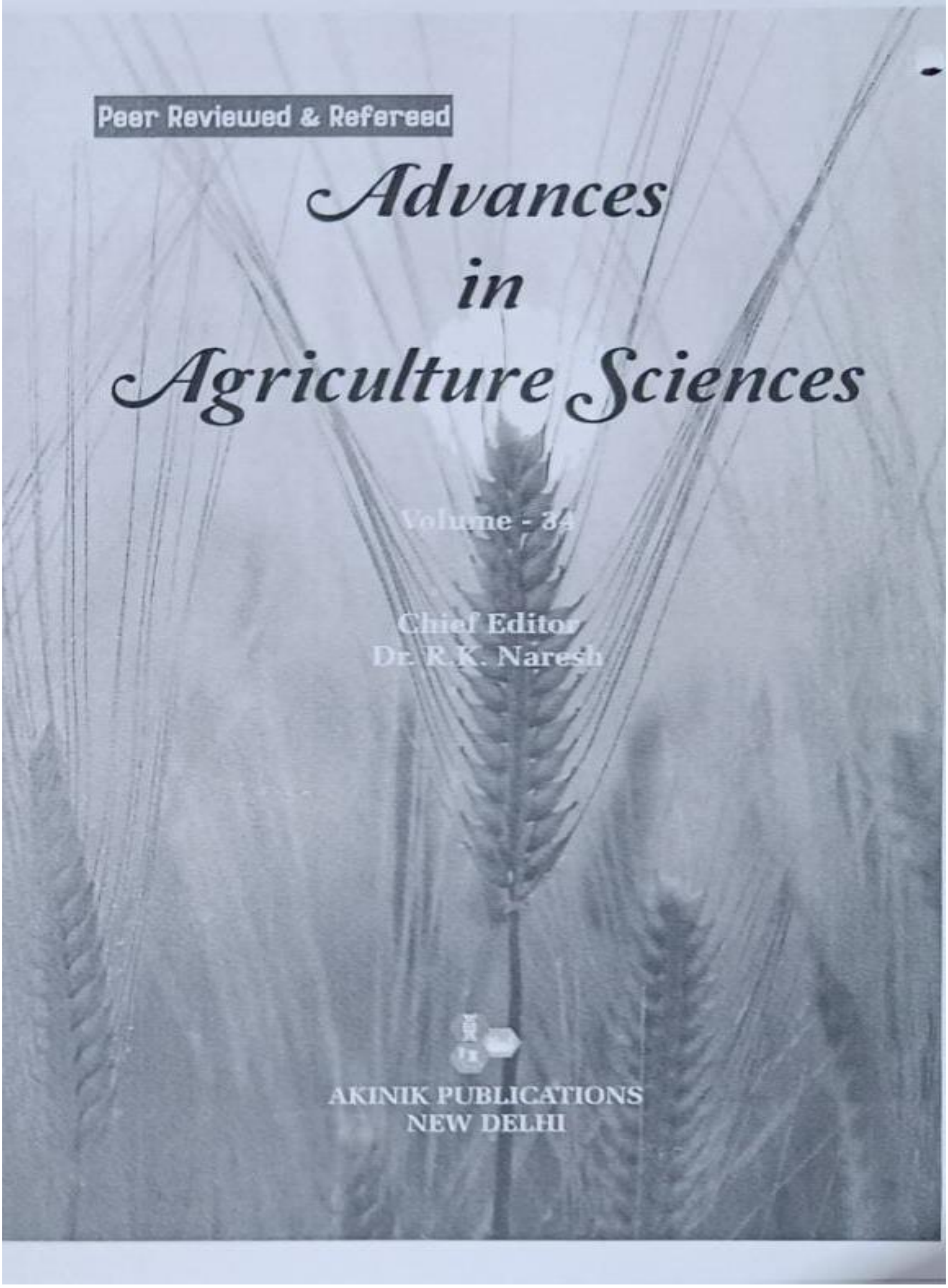
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# Chapter - 1

## Necessary Nutrients of Plant: Nutrient Functions and Deficiency Symptoms

Pradip Kumar Saini, Dr. R.K. Yadav, Anupam Singh, Dr. Alok Kumar Singh and Dr. R.N. Kewat

**Abstract**

In this chapter, a brief overview of the plant mineral nutrition is provided. The term "Necessary Nutrients of Plant: Nutrient Functions and Deficiency Symptoms" has been defined, and these elements are grouped according to their biochemical behaviour and physiological functions. Essential nutrient elements with their available forms and relative concentrations in higher plants. These necessary nutrients associate with the plants, the nitrogen cycle, phosphorus cycle, potassium cycle process complete in plants.

**Keyword:** plants mineral nutrition, macro and micro elements, essential mineral element etc.

### Introduction

Plants, like all other living things, need food for their growth and development. Plants require 16 essential elements. Carbon, hydrogen, and oxygen are derived from the atmosphere and soil water. The remaining 13 essential elements (nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, zinc, manganese, copper, boron, molybdenum, and chlorine) are supplied either from soil minerals and soil organic matter or by organic or inorganic fertilizers. For plants to utilize these nutrients efficiently, light, heat, and water must be adequately supplied. Cultural practices and control of diseases and insects also play important roles in crop production. Each type of plant is unique and has an optimum nutrient range as well as a minimum requirement level. Below this minimum level, plants start to show nutrient deficiency symptoms. Excessive nutrient uptake can also cause poor growth because of toxicity. Therefore, the proper amount of application and the placement of nutrients is important. Soil and plant tissue tests have been developed to assess the nutrient content of both the soil and plants. By

## Chapter 7

# MODULATION OF WATER STRESS BY PACLOBUTRAZOL

**Preeti Singh[1,3], Varsha Singh[2], Vijai P.[3], A.K. Singh[1] and Alok Kumar Singh[1*]**

[1]Department of Crop Physiology, ANDUA&T, Kumarganj, Ayodhya (U.P.) - 224 229

[2]Department of Genetics and Plant Breeding, Institute of Agricultural Sciences

[3]Department of Plant Physiology, Institute of Agricultural Sciences

Banaras Hindu University, Varanasi-221005

*Corresponding author's email: aloksingh.agri@gmail.com

**Paclobutrazol:**

Triazoles are the largest and most important group of systemic compounds, developed in 1960s for the control of fungal diseases in plants and animals. Commercial triazole derivatives (such as paclobutrazol [(2RS, 3RS)-1-(4-chlorophenyl)-4,4- dimethyl-2-(1,2,4-triazolyl)-pentan-3-ol]) have been recommended for use as either fungicides or plant growth regulators (Fletcher *et al.*, 1986). Characteristic of morphological and anatomical effects of the triazole include reduced shoot elongation and trichome length, increased epicuticular wax, larger chloroplasts and increased root growth (Fletcher and Hofstra, 1988; Gao *et al.*, 1988; Grossmann, 1990). Biochemical effects of the triazole include detoxification of active oxygen (Upadhyaya *et al.*, 1989; Kraus and Fletcher, 1994), increased levels of proline (Mackay *et al.*, 1990), antioxidants (Senaratna *et al.*, 1988) and chlorophyll content (Fletcher and Hofstra, 1988). More recently, it was found that triazole compounds are able to protect plants from the environmental stress conditions, e.g. drought, extreme temperature, gaseous sulphur dioxide and fungal infections (Wang, 1985; Fletcher and Hofstra, 1988; Davis and Curry, 1991; Pinhero and Fletcher, 1994). The triazole mediated stress protection is often explained in terms of hormonal changes such as an increase in cytokinins, a transient rise in ABA and a decrease in ethylene (Asare-Boamah and Fletcher, 1986; Fletcher and Hofstra, 1988; Mackay *et al.*, 1990).

# Research Trends in Agriculture Sciences

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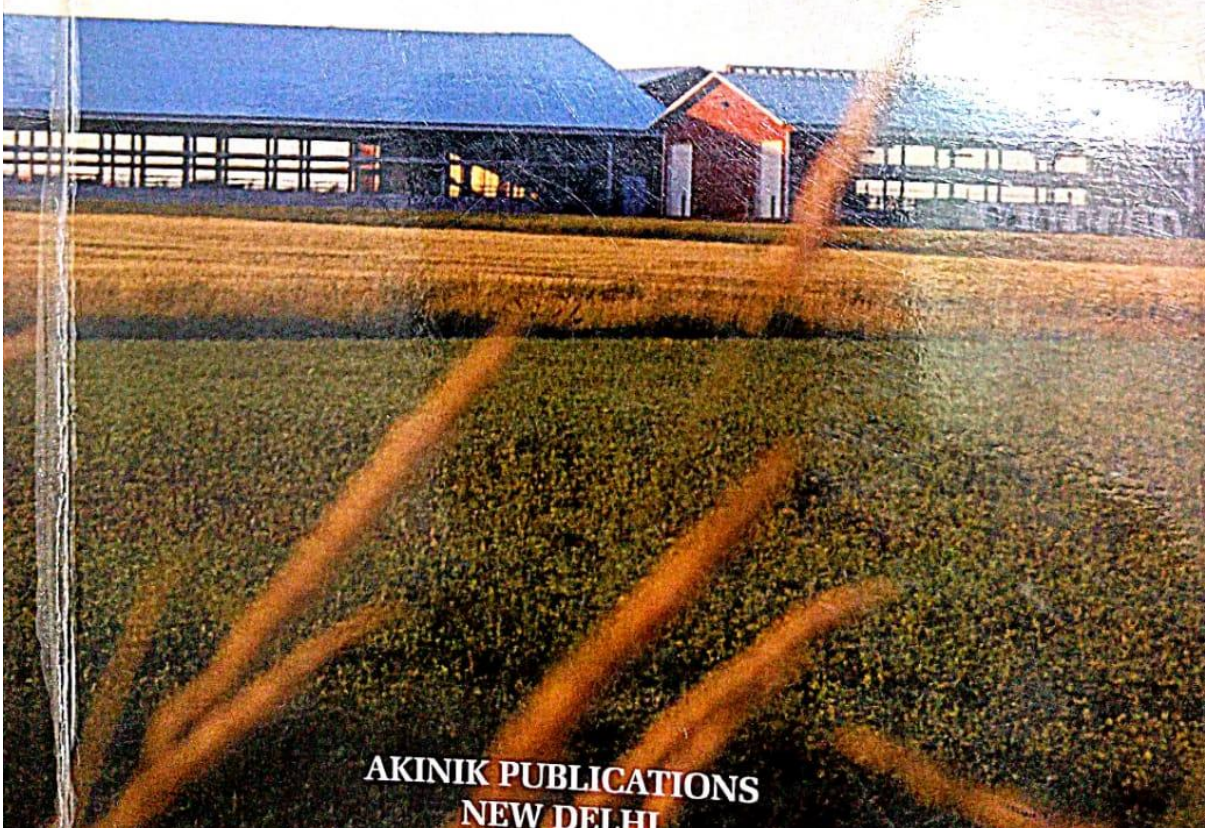
Chief Editor
Dr. R. K. Naresh



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Emerging Trends in Agricultural, Environmental and Rural Developmental Challenges and Solution : An Overview
Editors : Hemlata Pant, Kamlesh Singh, Manoj Kumar Singh and Devendra Swaroop

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# VERMICOMPOSTING: A POTENTIAL TECHNOLOGY FOR COST EFFECTIVE WASTE MANAGEMENT AND NUTRIENT RECYCLING IN AGRO-ECOSYSTEM

**Anil Kumar Singh[1], Alok Kumar Singh[2], Ashish Kumar Srivastava[3], and Viveka Nand Singh[4]**

[1]Tocklai Tea Research Institute, Tea Research Association, Jorhat- 785008, Assam, India

[2]Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad-224 229 (U.P.), India

[3]Hindustan Insecticides Limited, Muzaffarpur, Bihar, India (A Govt. of India Enterprise)

[4]KVK, ICAR-Indian Institute of Sugarcane Research, Rae Barely Road, Lucknow-226 002 (U.P.), India

## Introduction:

The indiscriminate use of fossil fuel based synthetic fertilizers to replenishment of the nutrients has created various environmental complications and declined the soil health, shattered micro-organism and friendly insects (Napolean et al., 2012, Lee and Pankhurst, 1992 and Singh et al., 2011) and making the crop more susceptible towards abiotic and biotic stresses. Furthermore unrestricted cultivation of soil, removal of crop residue and disproportional uses of agrochemicals reduced sustainability of agriculture that lead to land degradation (Dalal et al., 1995). On the other hand use of vermicompost, fine stable granular organic matter assist in the aeration, absorb water, prevent water logging and improve water holding capacity (Ansari and Jaikishun, 2010). Soils enriched with vermicompost provide additional beneficial substances that are absent in chemicals fertilizers (Ansari and Ismail, 2001 and Kale, 1998). Countries like India where lots of solid organic waste is available in different sectors with no dearth of manpower; the environmentally acceptable vermicomposting technology can very well be adopted for converting waste into wealth (Sharma et al., 2005). Among different composting procedure, vermicomposting has been observed to be an advantageous treatment system for different wastes (Logsdon, 1994 and Ndegwa et al., 2001).

## Vermicomposting:

Vermicomposting is a natural process which offers rapid recycling of various bio-wastes including crop residue, weed biomass and animal dung etc. into a nutrient rich eco-friendly nontoxic quality organic product vermicompost with the use of earthworms (Singh et al., 2016).Vermiculture (derived from the Latin word *vermis* meaning worm) is the mass production of earthworms for composting and the place used for culturing earthworm is called 'wormiri'. Although vermiculture is an old age practice however, in recent past, earthworms have been identified as one of the primary tools to process the biodegradable organic wastes (Greig Smith et al., 1992 and Ansari and Jaikishun, 2010).Earthwormsconsume organic biomass and excrete it in digested form called worm casts. Earthworms cast are popularly known as 'Black gold'. Vermicompost on application enriches soil quality by improving its physico-chemical and biological properties.



E-mail: aloksingh.agri@gmail.com

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**A COMPREHENSIVE NOTE ON SOIL SCIENCE**

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(Volume-I)


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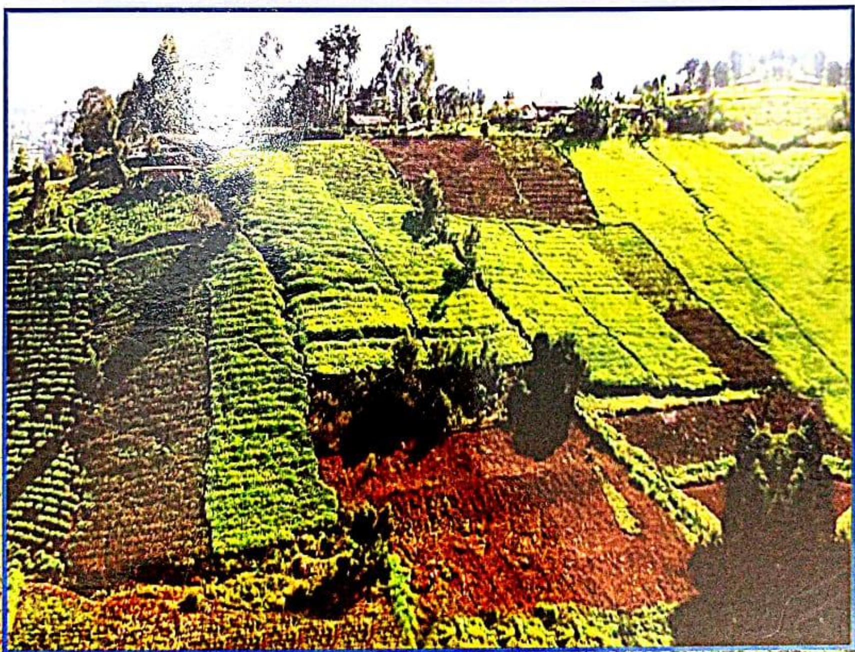

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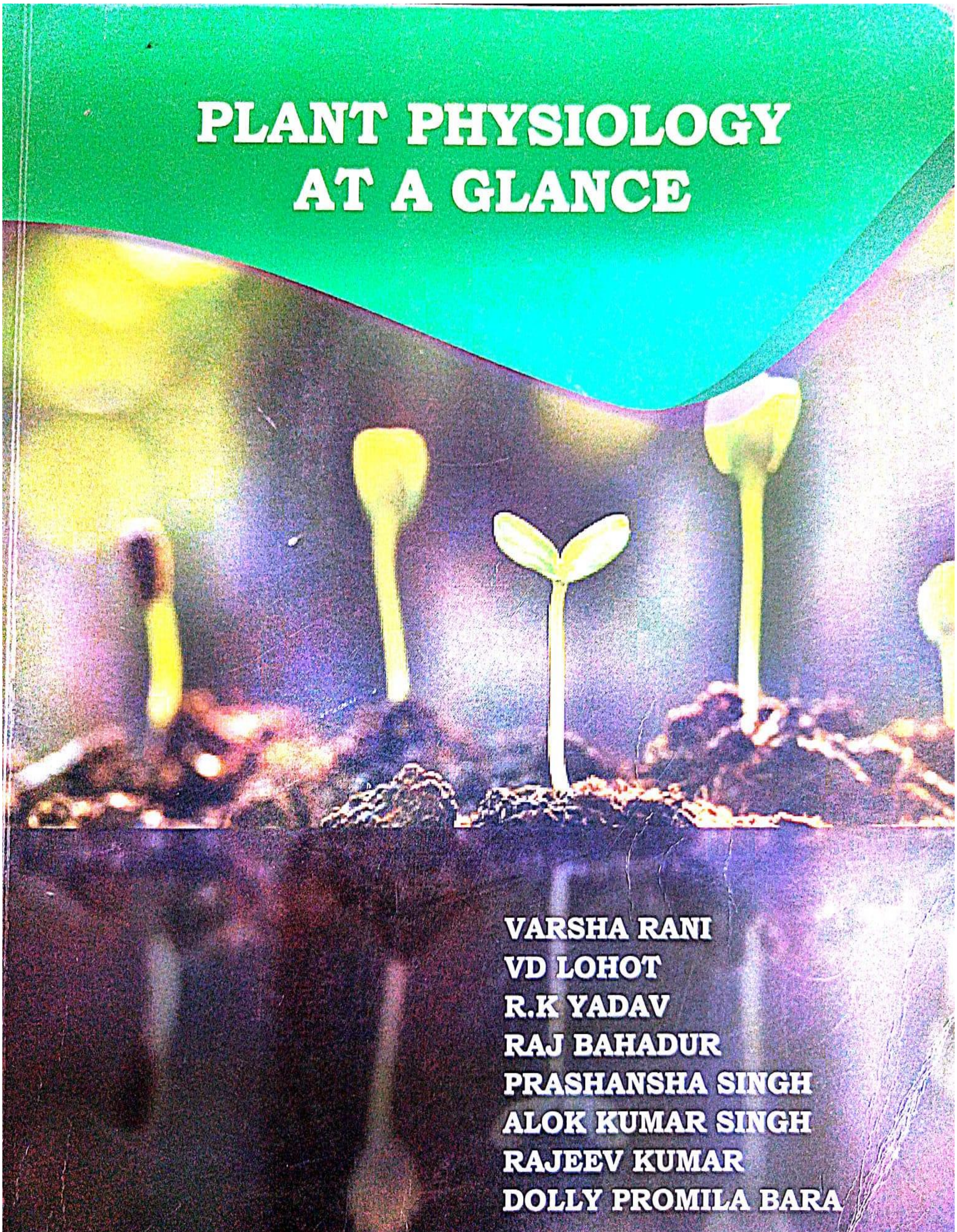
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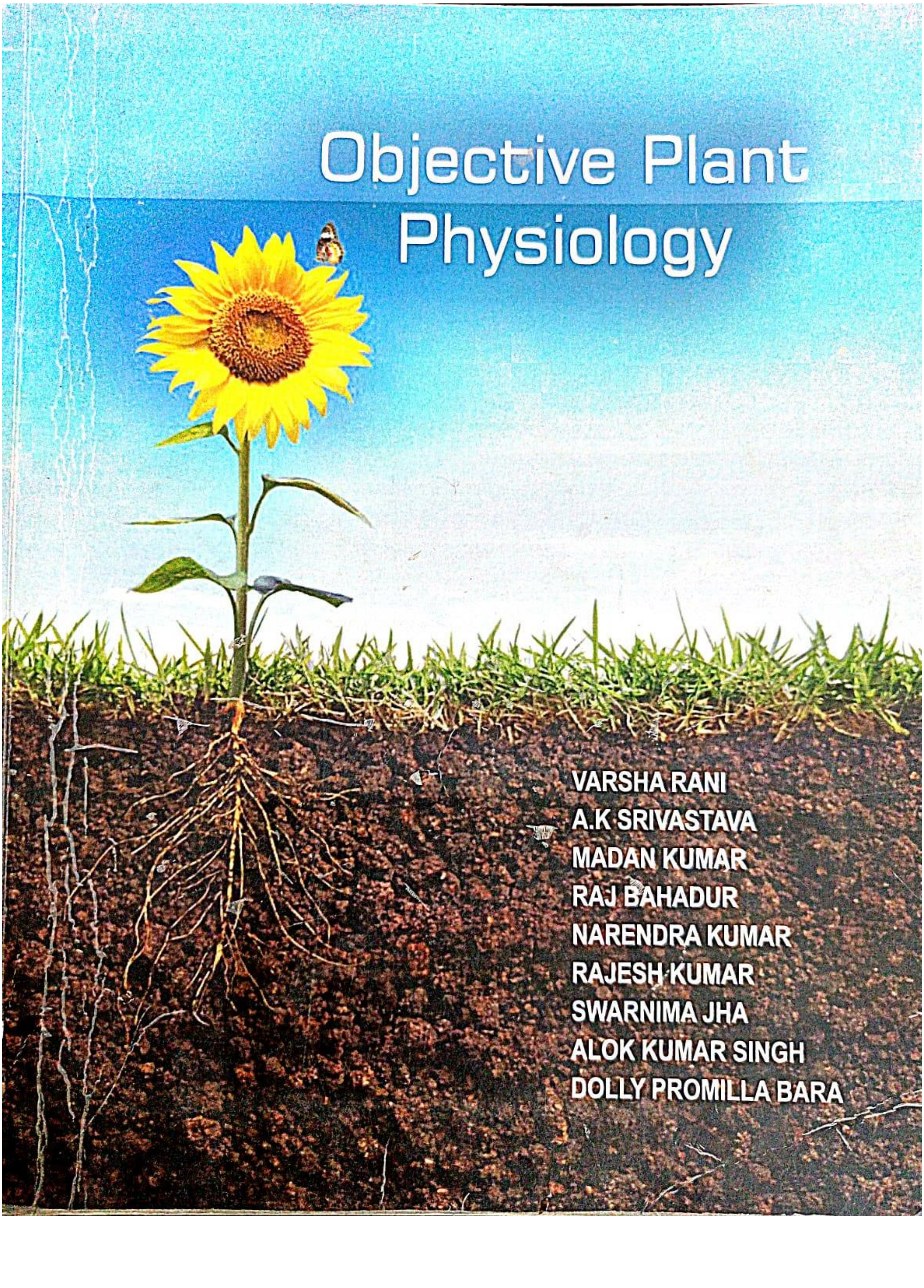
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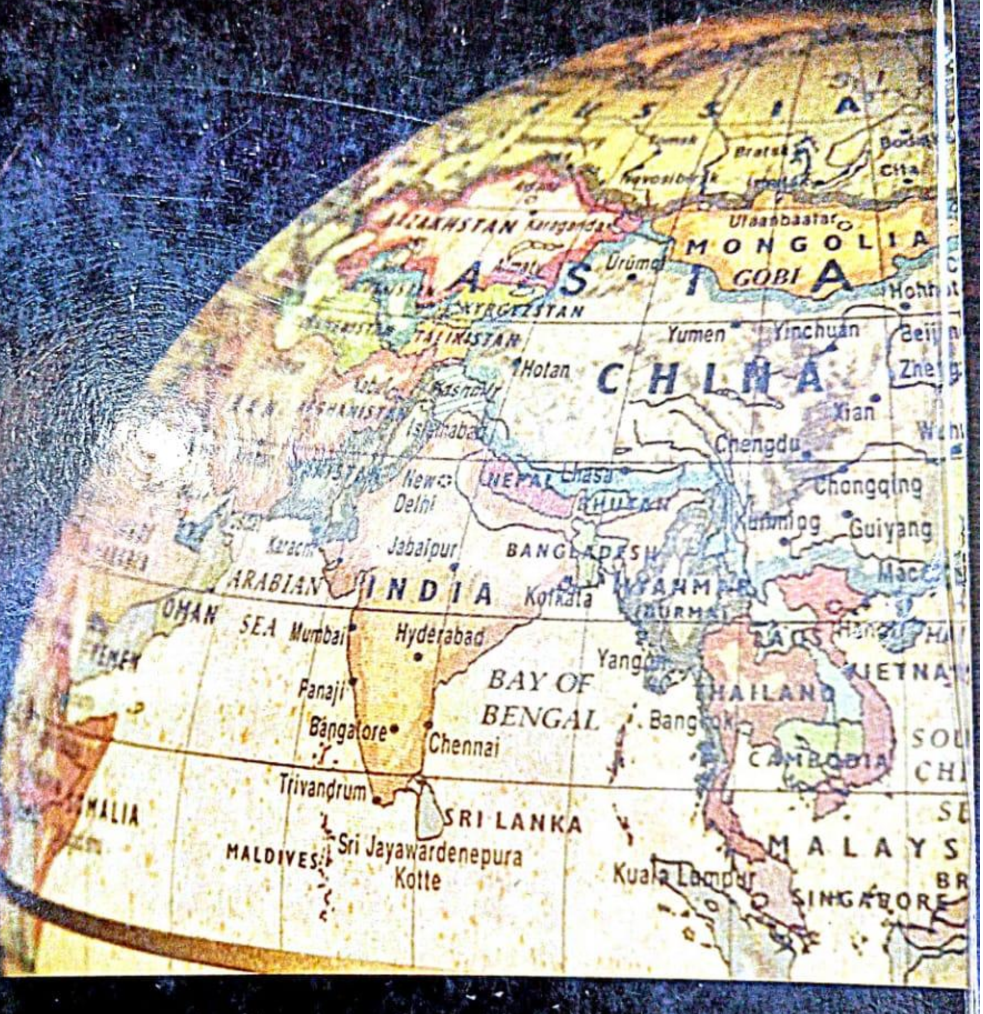


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# 18

# PREVENTION OF BOVINE MASTITIS: AN UPDATE

S.V. Singh, J.P. Singh, Ramakant, N K Singh
S. K. Maurya, D. Niyogi and K.P. Singh*
*College of Veterinary Science and Animal Husbandry, A.N. Deva University of Agriculture and Technology Kumarganj-224229, Faizabad U.P.*
**Veterinary Officer, Government Veterinary hospital, Deoranian, Bareilly*

**Abstract**

Mastitis is globally considered the most expensive disease of dairy animals caused by plethora of organisms. Though it is difficult, rather impossible, to eradicate the disease, but the development can be checked by adopting certain prevention techniques like dry cow therapy, phyto therapy, teat sealants, teat dips, cytokines, antioxidant therapy etc. The clinically affected animals should be provided prompt treatment and should be milked at last, with proper disposal of milk. This chapter describes the techniques that can be adopted to decrease the incidence of mastitis as well to prevent the development of new cases of mastitis.

**Key Words:** Mastits, Prevention, Bovines

Mastitis is an inflammation of mammary gland parenchyma, which is caused by bacteria and its toxins, characterized by physical, chemical and bacteriological changes in the milk and pathological changes in the glandular tissue of the udder. It is the most expensive disease of dairy cattle resulting

# VETERINARY ORTHOPEDICS AND LAMENESS

Anil Kumar Gangwar
Khangembam Sangeeta Devi    Ajit Kumar Singh
Naveen Kumar

KALYANI

## *About the Book*

The book covers most of the topics with updated information on veterinary orthopedics and lameness in a very concise form. The book is divided in to four parts namely orthopedics, equine lameness, canine lameness and bovine lameness. The main objective of the book is to provide the latest information to meet the requirements of not only undergraduate and postgraduate students but also to the teachers, veterinary surgeons and field veterinarians. The book contains more than 180 diagrams and good quality photographs. The book has been framed mainly as per syllabus approved by Veterinary Council of India.

## *About the Authors*

**Dr. A.K. Gangwar** graduated from the College of Veterinary Science and Animal Husbandry, Mathura and completed M.V.Sc. and Ph.D. in Veterinary Surgery and Radiology from Indian Veterinary Research Institute, Izatnagar. Dr. Gangwar joined College of Veterinary Science and Animal Husbandry, Kumarganj, Faizabad (UP) in the year 2002 and presently working as Associate Professor and Head, Department of Veterinary Surgery and Radiology of the same college. He published three text books, a book chapter and more than 52 research articles in different peer reviewed international and national journals. He is the recipient of many prestigious awards like appreciation award, young scientist award, and distinguished scientist award from reputed societies for his outstanding performance in the field of veterinary science.

**Dr. Khangembam Sangeeta Devi**, a graduate from the College of Veterinary Science and Animal Husbandry Mathura and completed M.V.Sc. in Veterinary Surgery and Radiology from Ranchi Veterinary College. Presently she is working as Assistant Professor in the Department of Veterinary Surgery and Radiology in the College of Veterinary Science and Animal Husbandry, Kumarganj, Faizabad (UP). Dr. Sangeeta published a textbook, more than 46 research/clinical articles in different peer reviewed international and national journals. She is the recipient of many prestigious awards like young scientist award, distinguished scientist award from reputed societies.

**Dr. Ajit Kumar Singh** graduated from College of Veterinary Science, Hyderabad and got ICAR-National Talent scholarship. Dr. Singh completed M.V.Sc. from College of Veterinary Science and Animal Husbandry, Faizabad (UP) with Gold Medal and Ph.D. in Veterinary Surgery and Radiology from ICAR-Indian Veterinary Research Institute, Izatnagar with DST-INSPIRE Fellowship. He is the recipient of many prestigious awards from reputed societies. Presently, Dr. Singh is working as guest Faculty at Department of Veterinary Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Kumarganj, Faizabad (UP).

**Dr. Naveen Kumar** joined Indian Veterinary Research Institute as a Scientist in the year 1989 and from 2006 onwards he holds the position of Principal Scientist. Dr. Kumar is a Fellow of National Academy of Veterinary Science. He guided more than 16 students (Master and doctorate level). Dr. Kumar has been an expert committee member, in the national task force of Bioengineering as well as Veterinary and Fisheries Sciences, Department of Biotechnology, Government of India. Dr. Naveen Kumar published two textbooks and has written more than 20 chapters for different textbooks. Dr. Kumar has more than 150 articles published in different peer reviewed international and national journals.

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# RECENT DEVELOPMENTS IN THE FIELD OF CARBON FIBERS

Edited by **Rita Khanna** and **Romina Cayumil**

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## Contents

Chapter 6

# Carbon Fibers in Biomedical Applications

Naveen Kumar, Anil Kumar Gangwar and
Khangembam Sangeeta Devi

Additional information is available at the end of the chapter

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**Abstract**

Three-dimensional growth of fibroblasts on carbon fibre mesh and assessment of biocompatibilty by *in vitro* and *in vivo* examination was done. Suitable size carbon fiber mesh after sterilization, placed in six well cell culture plate. The mesh was co-cultured with p-MEF cells. At different time intervals the viability and proliferation of the p-MEF cells was evaluated. The primary objective of this study was biological evaluation of carbon fibre mesh which can be used for creation of three-dimensional scaffolds for tissue engineering. Among the possible forms of implants, fibrous matrices are highly promising for the tissue regeneration by acting as a cell-supporting scaffold. Results of in vitro observations of the morphology p-MEF cells seeded on the surface of carbon fibre mesh shows adhesions and attachment of fibroblasts cells to carbon fibres on day 3 post seeding. They attached firmly and were uniformly spread along the fibres on day 5 postseeding and mostly spindle-shaped and cover almost all their surface on day 7 postseeding and such a spreading of cells indicates good adhesions and biocompatibility of carbon fibres. In vivo examination of retrieved sample on day 30 post implantation shows that carbon fibre mesh was covered by dense thick fibrous connective tissue.

**Keywords:** carbon fibers, carbon fiber mesh, primary mouse embryo fibroblasts (p-MEF), in vitro examination, in vivo examination

## 1. Introduction

Carbon fiber (CF) consists of a multitude of unique physical, chemical and biological characteristics that can be utilized and exploited for a number of diverse applications. Being light weight, high strength, and chemically stable, so they are applied in various fields including aeronautical

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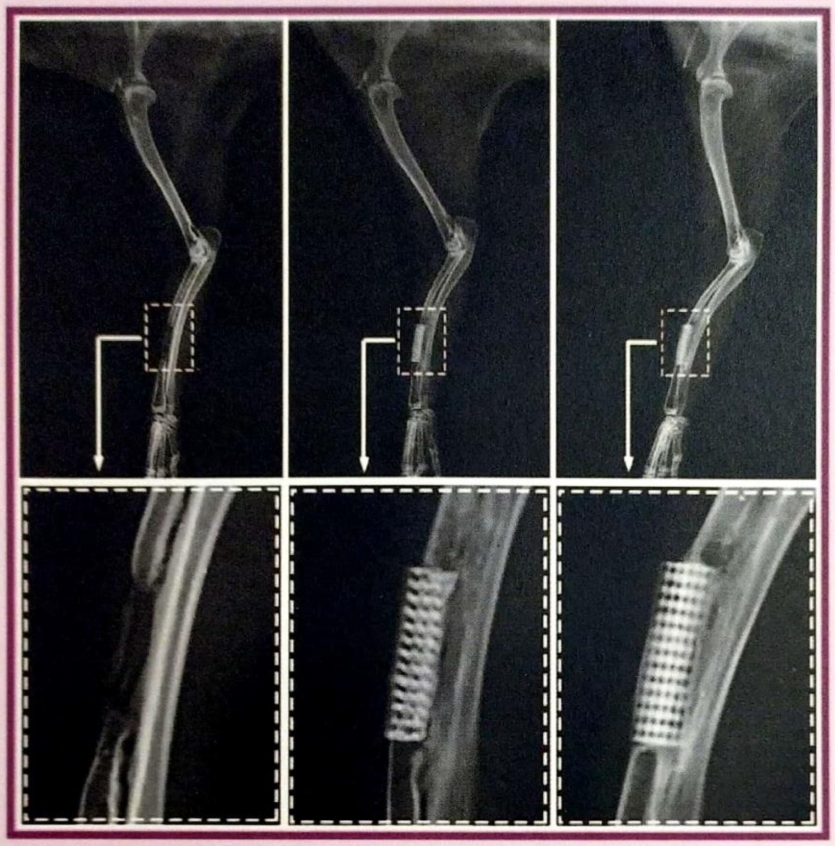

# HANDBOOK OF TISSUE ENGINEERING SCAFFOLDS

VOLUME TWO

Edited by
MASOUD MOZAFARI
FARSHID SEFAT
ANTHONY ATALA

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# Scaffolds for abdominal wall reconstruction

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*Naveen Kumar[1], Vineet Kumar[2], Anil Kumar Gangwar[3], Sameer Shrivastava[1,4], Swapan Kumar Maiti[1], Khangembam Sangeeta Devi[3], Sonal Saxena[4], P.D.S. Raghuvanshi[5], Naresh Kumar Singh[6], Ajit Kumar Singh[7], Karam Pal Singh[1]*

[1]Division of Surgery, ICAR-Indian Veterinary Research Institute, Bareilly, India; [2]Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India; [3]Department of Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, India; [4]Division of Veterinary Biotechnology, ICAR-Indian Veterinary Research Institute, Izatnagar, India; [5]Department of Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Anjora, Durg, India; [6]Department of Veterinary Surgery and Radiology, Faculty of Veterinary and Animal Sciences, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India; [7]Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India

## 43.1 Introduction

The abdominal wall is a layer of skeletal muscles, which protects the vital organs and provides mechanical support to the viscera. Any defect in the abdominal wall, in the form of tear or rupture occurred either due to trauma or congenital defect, may lead to the development of a hernia. A hernia represents protrusion of an organ or tissue through an acquired or natural opening in the abdominal wall like inguinal canal. Revolutionary advances have been developed in the past 20 years with respect to abdominal wall reconstruction (AWR). Innovative surgical approaches and contemporary synthetic and biological prosthetics have been an integral part of the surgical arsenal. Patients with complex abdominal wall defects must be evaluated on a case-by-case basis; interventions can vary from simple coverage and contouring to reconstruction of a dynamic functional abdominal wall. Ventral hernias may develop following otherwise successful abdominal surgeries, with an estimated incidence of 11% following laparotomy [1]. Incisional hernias encompass a breadth of clinical entities ranging from small, clean fascial separations to complete loss of the abdominal domain. Incisional hernia is a postoperative complication of abdominal surgery. Two chief predisposing factors of the incisional hernia are infection and mechanical

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# Scaffolds for bladder tissue engineering

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*Naveen Kumar[1], Sonal Saxena[2], Vineet Kumar[3], Sameer Shrivastava[1,2], Anil Kumar Gangwar[4], Swapan Kumar Maiti[1], Rukmani Dewangan[1], Sangeeta Devi Khangembam[1], P.D.S. Raghuvanshi[6], Naresh Kumar Singh[5], Ajit Kumar Singh[3], Karam Pal Singh[1]*

[1]Division of Surgery, ICAR-Indian Veterinary Research Institute, Bareilly, India; [2]Division of Veterinary Biotechnology, ICAR-Indian Veterinary Research Institute, Izatnagar, India; [3]Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India; [4]Department of Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, India; [5]Department of Veterinary Surgery and Radiology, Faculty of Veterinary and Animal Sciences, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India; [6]Department of Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Anjora, Durg, India

## 54.1 Introduction

Bladder dysfunction induced by disease or surgical intervention can result in chronic urinary incontinence and increased upper urinary tract pressure leading to irreversible kidney damage. Currently, the treatment of choice in these patients is enterocystoplasty with the aim to increase bladder capacity and lower the storage pressure However, it fails to restore the emptying function and is associated with complications such as increased mucus production, metabolic disturbances, urolithiasis, infections, and even malignancy [1–3]. To prevent these, various materials have been tried for reconstruction with only limited success so far.

Some disorders of the urinary tract can become severe enough to eventually require reconstruction. These include congenital disorders such as myelomeningocele or bladder exstrophy, bladder cancer, trauma and chronic inflammation resulting from interstitial cystitis, or other conditions. Apart from structural damage, injuries to the nerves that innervate the bladder can also lead to bladder dysfunction that is severe enough to warrant surgical intervention and eventual reconstruction of the lower urinary tract. The term "neurogenic bladder" is used to describe these alterations in bladder function that are provoked by neurologic dysfunction that results from disease or injury, and this condition often significantly increases the morbidity of the underlying condition [4]. In addition, pathologies involving the spinal cord (e.g., sacral agenesis, tethered spinal cord, traumatic cord injuries, multiple sclerosis, and transverse myelitis) may also lead to neurogenic bladder dysfunction [1,5]. The most common cause of the neurogenic bladder in children is spina bifida, which affects 1 in 1000 newborns [6]. Bladder dysfunction



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# Chapter 30

# Surgical Care of Perinate with Malformations

*Khangembam Sangeeta Devi, Anil Kumar Gangwar, Naveen Kumar, Vineet Kumar and Ajit Kumar Singh*

Abnormalities of structure and function, which are present at birth, are obviously congenital deformities. Occasionally calves are born with certain congenital anomalies like atresia ani/atresia ani et recti/atresia ani et recti et coli, atresia ani with rectovaginal fistula, cheiloschisis, arthrogryposis, contracted tendon, eventration of intestine, meningocele, unilateral and bilateral lateral patellar luxation, ocular dermoid and umbilical hernia, polythelia, hypospadias and cryptorchidism or some other abnormality that need serious care and attention. Congenital malformations can result from defective genetics or environmental factors or a combination of both. Pedigree analysis and breeding trials revealed that these anomalies are autosomal recessive diseases (Bryan et al. 1993). The environmental factors included consumption of toxic plants by the dam and maternal-foetal viral infections during early gestation (Bandemkiran et al. 2009). Bovine viral diarrhoea-mucosal disease virus can induce congenital anomalies in the bovine foetus. This virus is capable of crossing both the placental and foetal blood brain barrier. Maternal manganese deficiency is also responsible for these conditions.

Developmental anomalies sometimes lead to perinatal mortality or compatible with life causing aesthetic defects or having no effect on the animal and reduce the value of the defective neonates. Susceptibility to agents that affect development varies with foetal stages, but in general decreases with gestational age. Before Day 14 of gestation (period of pre-attachment), the zygote or embryo is resistant to teratogens that can cause congenital anomalies but is susceptible to genetic mutations. During Days 14 and 42, the embryo is extremely susceptible to teratogens, but this decreases with embryonic age, as the critical periods for the formation of various organs are passed. From Day 42, the foetus becomes resistant to teratogenic agents with increasing age, except for the late differentiating structures, e.g. cerebellum, palate, and urogenital system. The animals with congenital abnormalities require the utmost care. This chapter includes the various congenital abnormalities, their clinical signs and management in ruminants.

## Congenital anomalies of gastrointestinal tract (GIT)

Atresia ani/atresia ani et recti/ atresia ani et recti et coli are the main congenital anomalies of GIT, characterized by absence of anal opening since birth.

## Atresia ani or imperforate anus

It is a congenital abnormality characterized by persistence of the anal membrane covering the normal anal canal or is the failure of the anal membrane to break down. The rectum is intact and attached to the membrane. Atresia ani has been reported to be a heritable condition in calves and develops when a dorsal part of the cloacal plate fails to form. Affected calves initially will stand and suckle normally after birth but due to the absence of anal opening non–passage of faeces since birth will occur. Slightly distended abdomen and perineum have a scar indicative of the anal orifice. There is slight bulge of the subcutaneous tissues, and becomes more pronounced on increased intra-abdominal pressure, applied by pushing on the flanks or by

Chapter

# Fourier Transform Infrared Spectroscopy of the Animal Tissues

*Vineet Kumar, Shruti D. Vora, Foram A. Asodiya, Naveen Kumar and Anil K. Gangwar*

**Abstract**

Animal tissues are extensively used as scaffolds for tissue engineering and regenerative therapies. They are typically subjected to decellularization process to obtain a cell-free extracellular matrix (ECM) scaffolds. It is important to identify chemical structure of the ECM scaffolds and Fourier transform infrared (FTIR) appears to be a technique of choice. In this chapter, FTIR spectra of native and decellularized buffalo aortae, buffalo diaphragms, goat skin, and native bovine cortical bone are presented. The transmittance peaks are that of organic collagen amide A, amide B, amide I, amide II and amide III chemical functional groups in both native and decellularized aortae, diaphragms and skin. In bone, the transmittance peaks are that of inorganic $\nu_1$, $\nu_3$ $PO_4^{3-}$, $OH^-$ in addition to organic collagen amide A, amide B, amide I, amide II and amide III chemical functional groups. These important transmittance peaks of the tissue samples will help researchers in defining the chemical structure of these animal tissues.

**Keywords:** buffalo aorta, buffalo diaphragm, bovine bone, goat skin, Fourier transform infrared spectroscopy

## 1. Introduction

The extracellular matrix (ECM) scaffolds primarily composed of structural collagen protein are widely used in tissue engineering and regenerative medicine [1–15]. These are usually prepared from animal tissues by decellularization process. Decellularization is the process of removal of native cells from animal tissue, leaving behind a three-dimensional network of ECM proteins while preserving the bioactivity and mechanics of the tissue. In the decellularization process, animal tissues are subjected to physical, enzymatic and chemical treatments. Physical methods of decellularization include freezing, direct pressure, sonication, and agitation [16]. Enzymatic techniques of decellularization include the use of protease (trypsin) [1–5, 8, 10, 12–15], endonucleases and exonucleases. Chemical methods of decellularization include the use of acids and alkalis (acetic acid, peracetic acid, hydrochloric acid, sulfuric acid, ammonium hydroxide), nonionic detergents (Triton X-100), ionic detergents (sodium dodecyl sulfate, sodium deoxycholate, Triton X-200) [1–15], zwitterionic detergents (3-[(3-cholamidopropyl)dimethylammonio]-1-propanesulfonate, sulfobetaine-10, sulfobetaine-16), organic solvent (Tri(n-butyl)phosphate) [3, 10], hypertonic and

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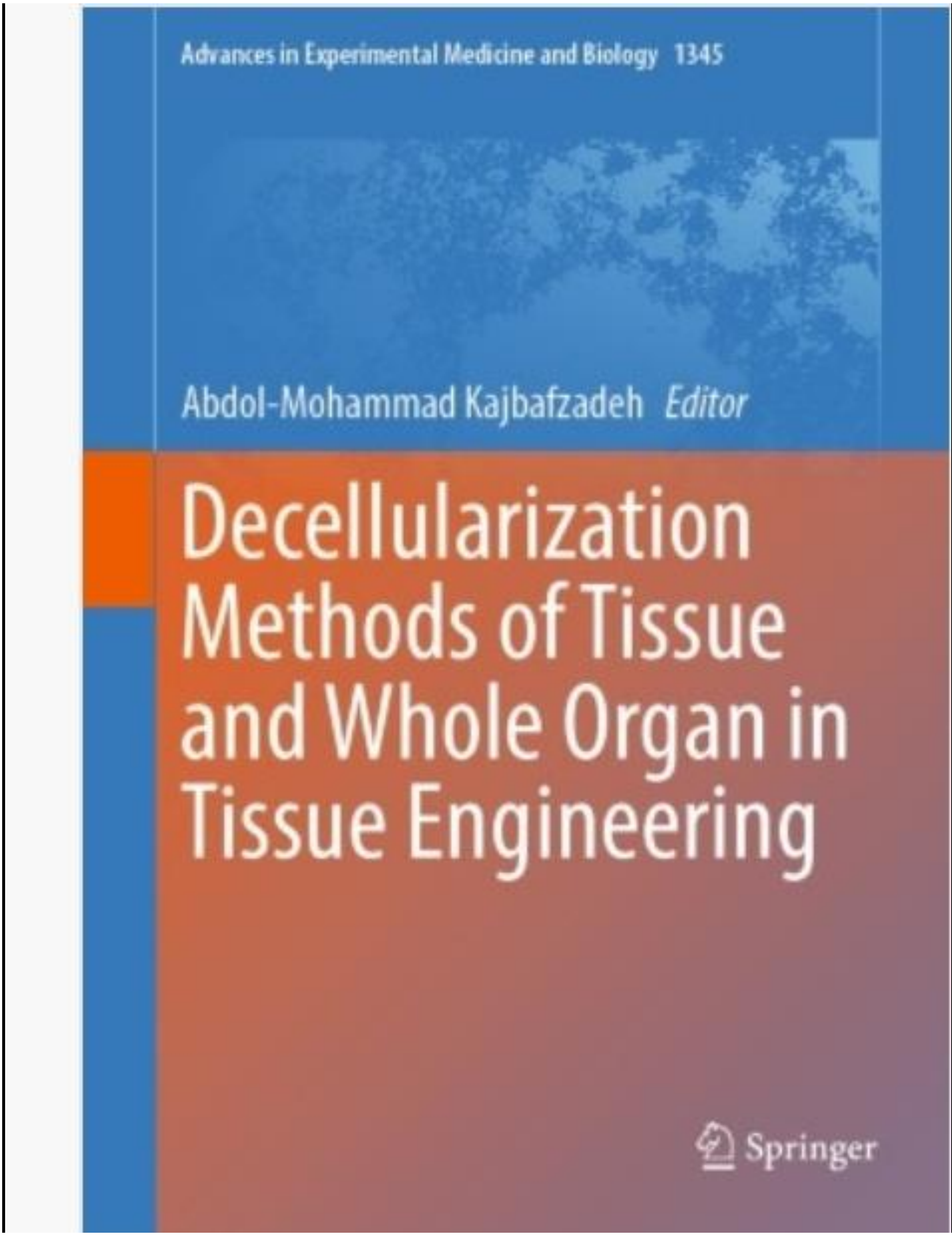
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Decellularization Methods of Tissue and Whole Organ in Tissue Engineering
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# Decellularization of Skin Tissue

# 15

Naveen Kumar, Vineet Kumar, Sanjay Purohit, Anil Kumar Gangwar, Sameer Shrivastava, Swapan Kumar Maiti, Sonal Saxena, Dayamon David Mathews, Pawan Diwan Singh Raghuvanshi, Ajit Kumar Singh, and Karam Pal Singh

**Abstract**

Biomaterials science encompasses elements of medicine, biology, chemistry, materials, and tissue engineering. They are engineered to interact with biological systems to treat, augment, repair, or replace lost tissue function. The choice of biomaterial depends on the procedure being performed, the severity of the patient's condition, and the surgeon's preference. Prostheses made from natural-derived biomaterials are often derived from decellularized extracellular matrix (ECM) of animal (xenograft) or human (allograft) origin. Advantages of using ECM include their resemblance in morphology and three-dimensional structures with that of tissue to be replaced. Due to this, scientists all over are now focusing on naturally derived biomaterials which have been shown to possess several advantages compared to synthetic ones, owing to their biocompatibility, biodegradability, and remodeling properties. Advantages of a naturally derived biomaterial enhance their application for replacement or restoration of damaged organs/tissues. They adequately support cell adhesion, migration, proliferation, and differentiation. Naturally derived biomaterials can induce extracellular matrix formation and tissue repair when implanted into a defect by enhancing attachment and migration of cells from surrounding environment. In the current chapter, we will focus on the natural and synthetic dermal matrix development and all of the progress in this field.

**Keywords**

Skin · Decellularization · Tissue engineering · Dermal Matrix

## 15.1 History

Biomaterials are those materials that are used in medical devices or in contact with biological systems (Ratner 2006). A biocompatible or suitable biomaterial for one application may not be biocompatible in another (Ratner 2006). An ideal implant should effectively repair the defect without eliciting an adverse host response while maintaining mechanical, as well as, biological integrity for a desired time ranging from a few weeks to even several years' durations. Further, they must be easily manufactured not only on macroscopic but also at the cellular level. However, on the odd occasion, these materials can cause immunological reactions in the host (Ratner et al. 1996).

N. Kumar (✉) · V. Kumar · S. Purohit · A. K. Gangwar · S. Shrivastava · S. K. Maiti · S. Saxena · D. D. Mathews · P. D. S. Raghuvanshi · A. K. Singh · K. P. Singh
Division of Surgery, ICAR-Indian Veterinary Research Institute, Izatnagar 243122, India


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# Enhancing Animal Health and Increase Productivity to Reduce Poverty

**Pramod Kumar, P.K.Maurya, P.K.Chaudhary and S.K.Maurya**
Department of Veterinary Physiology & Biochemisry
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## INTRODUCTION

A large part of the Indian population lives in rural areas where animals are indispensable for their livelihood and access to food. Many farmers in these areas depend on animals as the main source of income. For many households, animals are also the best means to preserve the necessary resources to cope with agricultural crises, to reduce poverty, or to help to keep the soil fertile and provide traction for ploughing and transport.

A comparison of livestock performance trends with the evolution of rural poverty in India indicates that growth in livestock production alone is not enough to reduce rural poverty. To help reduce poverty, sustainable production should be based on productivity gains. Prerequisites for enhancing productivity include better public and government policies, enhanced research and the reduction of animal disease risk.

Based on data from scientific publications, statistics and field observations, the study shows the importance of livestock in the economy and in the risk management strategies implemented by poor farmer. It compares the capacity of intensive growth and extensive growth in livestock production to reduce poverty, as well as the experiences of countries that have achieved differing results in fighting poverty. It concludes by examining the conditions needed for enhancing livestock productivity and the barriers that animal diseases pose to this improvement.

## THE EVOLUTION OF POVERTY IN INDIA

Poverty is a significant issue in India, despite having one of the fastest-growing economies in the world, clocked at a growth rate of 7.6% in 2015, and a sizable consumer economy. The World Bank and United Nations define poverty as a multidimensional phenomenon leading to 'pronounced deprivation of well-being. While the monetary dimension is the most important one, poverty is usually associated with undernourishment, severely curtailed access to housing, education and health care, and discrimination, affecting either individuals or groups. Extreme poverty is considered to stem mainly from public policy shortcomings and to be exacerbated by a host of factors, including: climate-related crises, conflict, ill-defined or unfair land ownership in the case of rural poverty, and lack of education. Most social groups living in extreme poverty are at a severe economic disadvantage from the outset and are caught in a vicious circle where the causes of poverty are hard to distinguish from its effects. Most poor people lived in rural areas. In addition, progress has been uneven across regions.

The World Bank reviewed and proposed revisions in May 2014, to its poverty calculation methodology and purchasing power parity basis for measuring poverty worldwide, including India. According to this revised methodology, the world had 872.3 million people below the new poverty line, of which 179.6 million people lived in India. In other words, India with 17.5% of total world's population had 20.6% share of world's poorest in 2011. As of 2014, 58% of the total population were living on less than $3.10 per day. According to the *Modified Mixed Reference Period (MMRP)* concept proposed by World Bank in 2015, India's poverty rate for period 2011-12 stood at 12.4% of the total population, or about 172 million people; taking the revised poverty line as$1.90.

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# Meeting the Challenges of Health and Welfare of Livestock and Food Security: Where Does a Veterinarian Stand?

**Shiv Kumar Yadav, Alok Kumar Yadav[1], Anand Kumar[2], S. K. Maurya[3] and Shailendra Kumar Verma[3]**
Department of Veterinary Biochemistry, Ranchi Veterinary College, Ranchi, Jharkhand
[1]Veterinary Officer, Central Cattle Breeding Farm, Andeshnagar, Lakhimpur-Kheri (U.P.)
[2]Department of Veterinary Gynaecology & Obstetrics, Ranchi Veterinary College, Ranchi, Jharkhand
[3]College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, (UP) India.

## INTRODUCTION

"Being admitted to the profession of veterinary science, I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health and welfare, the prevention and relief of animal suffering, the conservation of animal resources, the promotion of public health, and the advancement of medical knowledge". Every graduate entering into veterinary profession swears an oath not only to protect animal health but also welfare, to not only relieves animal suffering but to prevent it, this is what defines the goals, responsibilities of a veterinarian. Will Rogers once said, "The best doctor in the world is a veterinarian. He can't ask his patients what is the matter– he's got to just know." Veterinarians rely on their training to ascertain ailments and diseases. The ability to identify ailments in a variety of species demands intensive multi-disciplinary training, including anatomy, physiology, microbiology, parasitology, pathology, biochemistry, diagnostic imaging, medicine and surgery. In most circumstances, this training enables veterinarians to see cases through from start to finish, which is often not the case for human health professionals. Even their work environment is too vast, ranging from long hours spent in research labs and pet clinics, on farms and in the wild dealing with often confused and scared animals. Veterinarian and animal health In animal clinics, veterinarians work with companion, farm and exotic animals to diagnose and treat acute and chronic diseases, provide targeted vaccines, treat parasitic infection and infestation and perform minor surgeries like dressing wounds, mending broken bones, performing dental work to major ones like caesarean sections and also humanely euthanize whenever necessary. Veterinarians are also key contributors to ethical review processes in Vetero-legal cases, speaking with authority and pragmatism as the animals' advocate. That is what these animals deserve, not only the five freedoms- freedom from hunger, freedom from discomfort i.e. having shelter, freedom from pain and suffering from disease, freedom to express its normal behaviour, freedom from fear and distress; but proper internationally achievable and respected standards for their whole life.

## VETERINARIAN AND PUBLIC HEALTH

More than half of all human diseases are animal originated, caused by multi-host pathogens. Effective prevention and control of infectious diseases at the animal-human-ecosystems interface is the key to prevent the spread of diseases in animals and humans, enhancing food security and fostering poverty reduction. Increased transparency in the animal health situation contributes to better public health. All activities of animal science affect human health either directly through biomedical research and public health or indirectly by addressing domestic animal, wildlife, or environmental health. The Veterinary research transcends species boundaries and includes the study of spontaneously occurring and experimentally induced models of both human and animal disease and research at human-animal interfaces, such as food safety, wildlife and ecosystem health, zoonotic diseases and public policy. By its nature, veterinary science is comparative and gives rise to the basic science disciplines of comparative anatomy, comparative physiology, comparative pathology, and so forth; but its ability to reach its peak potential relies on adequate infrastructural, financial, and human resources. These veterinarians partner

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# Effect of Melatonin on Reproduction and Infertility Treatment

**Pankaj Kumar Choudhary, Pankaj Kumar Maurya, Pramod Kumar and S. K. Maurya**
Department of Veterinary Physiology and Biochemistry
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## INTRODUCTION

In the past few decades, a lot of studies regarding the biochemistry and physiology of hormone called melatonin ( N-acetyl-5-methoxytryptamine) have taken place. This hormone is secreted during the dark hours at night by the pineal gland and is responsible for the regulation of variety of important central and peripheral actions related to circadian rhythms and reproduction (Tamura *et al.*,2012). Although melatonin is primarily synthesized and secreted by the pineal gland, it is has been reported that it is also formed in the tiny amounts by other organs such as the retina, harderian gland, gastrointestinal tract, lymphocytes and the skin. The role of melatonin in other animal species is related to seasonal reproductive cycle.

Melatonin has also been reported to have free radical scavenging properties (Zang *et al.*, 1998) as well as stimulating several other antioxidant enzymes. Can melatonin supplementation during assisted reproductive technologies increase the success rate. Since the body is capable of producing melatonin does endogenous melatonin production or exogenous melatonin supplementation has any effect on the reproductive process of animals.

More recently, it has been discovered that an imbalance of reactive oxygen species or 'oxidative stress' can have a negative impact on the success of infertility treatment, and furthermore, investigators have begun addressing potential mechanisms of preventing these effects with the use of novel oxygen scavengers such as melatonin. It may be that these agents have a positive effect on pregnancy success rates following IVF treatment. We present a summary of the most recent work investigating melatonin and its effect on reproductive system and the treatment of infertility.

## EFFECT OF MELATONIN ON REPRODUCTIVE PROCESS

There is accumulation of evidence suggesting that the pattern of melatonin secretion, which is mediated by photoperiod, directly influences reproductive function. Much of the evidence has been generated from seasonally breeding mammals. Short-day breeder such as sheep, and white-tailed deer were shown to be sexually very active and capable during the shortest days of the year, when melatonin levels are highest in terms of their nocturnal duration (Chemineau *et al.*, 2008).

Investigation using long-day and short-day breeding animals have enormously contributed to the understanding of the mechanisms whereby day length and melatonin govern seasonal reproduction. These findings have led to the successful use of melatonin as a pharmacological agent to advance the breeding season of sheep and to induce estrous cycle and increase lambing during the interval when these animals would normally be experiencing seasonal anestrus (Abecia *et. al.*, 2005).

## EFFECT OF MELATONIN ON TESTICULAR FUNCTION

In animal studies, it has been shown that melatonin may modulate testicular function. In mice and rats it was reported that melatonin has an inhibitory effect on Leydig cells (Persengiev and Kehajova, 1991). There are contradictory reports concerning the effect of melatonin on spermatozoa function. It has been reported that long term administration of melatonin to healthy men is associated with decreased semen quality (Luboshitzky *et al.*, 2002). Sperm concentration, motility as well as testosterone levels were found to be significantly decreased in healthy men administered with melatonin. On the other hand, an *in vitro* study demonstrated that administration of melatonin to human spermatozoa improved progressive

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# Strategies and Challenges of Veterinary Profession to Improve Livelihood, Food Security And Safety

**Anand Kumar, Shiv Kumar Yadav[1], Alok Kumar Yadav[2], S. K. Maurya[3] and Shailendra Kumar Verma[3]**

Department of Veterinary Gynaecology & Obstetrics, Ranchi Veterinary College, Ranchi, Jharkhand

[1]Department of Veterinary Biochemistry, Ranchi Veterinary College, Ranchi, Jharkhand

[2]Veterinary Officer, Central Cattle Breeding Farm, Andeshnagar, Lakhimpur-Kheri (U.P.)

[3]College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, (UP) India

The classical view of a veterinarian as a person qualified to practice veterinary medicine has lead most people to think that their clinical practices are related to the prevention, cure or alleviation of pain and treatment of injuries in animals, especially domestic animals. Though these roles are very important, the contemporary roles undertaken by veterinarians go far beyond these more visible tasks, and this is the reason why there is a need for far greater awareness in the public eye. It must be recognized that as the world becomes intricately inter-connected and more complex, so are the various obligations and responsibilities that veterinary professionals must undertake.

Over the years veterinary professionals have played significant and contributory roles in animal and human health and welfare, biomedical research, food quality, food safety, food security, ecology, ethology, epidemiology, microbiology, parasitology, pathology, physiology, psychology, radiology, research and development of pharmaceuticals, remedies, vaccines, and toxicology; also as educators, trainers, and policymakers, and also interlinked with wildlife conservation efforts and the protection of the environment and biodiversity. As challenges have risen, veterinarians have found ways to adapt given that their knowledge and training makes them multifunctional professionals. This aids societies so that its animals stay healthy and productive. It is not surprising that becoming a veterinarian is a highly popular career choice.

Recognition that healthy and productive livestock make important contributions to food production, income generation, job creation, economic growth, and poverty alleviation is often overlooked or taken for granted. Yet, on average, livestock contribute some 40 percent of agricultural GDP.

As the world population grows and middleclass incomes rise, demand for livestock products increases—a consumption boom shaped by two decade of rapid economic growth and globalization. But there are certain high impact diseases that do not allow animal husbandry to flourish. Less dramatic diseases also impact the performance of farm animals, leading to lower production efficiencies and associated financial losses due to mortality and morbidity. Also, poor animal health in turn negatively influences animal welfare. In fact, studies have demonstrated that there is a direct correlation between the quality of livestock production and the provision of veterinary services. Given that food animals support the livelihoods and nourishment of almost a billion people, efforts should be directed at upholding food security.

In this regard, farm-oriented veterinary professionals should advise farmers and owners of livestock or managers of animal production systems on the most appropriate herd health management practices according to local and regional agro-ecological contexts. This extends beyond the treatment of animal illnesses or the implementation of preventive measures, such as strengthened biosecurity, programmed de-worming or vaccination, but also addresses housing, nutrition, cleaning, and environmental sanitation. The correct undertaking of latter practices will likely reduce the usage of veterinary medications and care, thereby reducing input and labor costs, which in turn positively influences farm productivity and profit margins.

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# Coping With Global Warming For Sustainable Livestock Production


**S. K. Maurya, P. K. Choudhary, P. K. Maurya and Pramod Kumar**

Department of Veterinary Physiology & Biochemistry

College of Veterinary Science & Animal Husbandry

Narendra Deva University of Agriculture & Technology, Kummarganj, Faizabad, UP


## INTRODUCTION

Livestock sector provides livelihoods to about 1.3 billion people and contributes about 40 percent to global agricultural output. In India, livestock are also a source of renewable energy for draft and an essential source of organic fertilizer for their crops. A population increase of 33%, is expected by 2050, but as the global standard of living increases, demand for agricultural products will increase by about 70% in the same period. Meanwhile, total global cultivated land area has not been changed, reflecting increased productivity and intensification efforts.

India has a fast growing livestock sector and is taking steps to achieve self sufficiency in production of animal products. India ranks first in the world in production of milk, seventh in production of egg and eighth in export of meat. There is a growing demand for livestock products, and worldwide milk production is expected to increase from 664 million tonnes (in 2006) to 1077 million tonnes (by 2050), and meat production will double from 258 to 455 million tonnes (Alexandratos and Bruinsma, 2012).

## CLIMATE CHANGE: EFFECT ON LIVESTOCK

Livestock sector is now using around 30 percent of the earth's entire land surface, mostly permanent pasture but also including 33 percent of the global arable land used for producing feed for livestock. As forests are cleared to create new pastures, it is a major driver of deforestation. At the same time herds cause wide-scale land degradation, with about 20 percent of pastures considered as degraded through overgrazing, compaction and erosion. At the same time, the livestock industry is also being affected due to change in climate and it can be summarized as—

- Quantity and quality of feed will be affected mainly due to an increase in atmospheric $CO_2$ levels and temperature (Chapman et al., 2012).
- The quality and quality of forage produced is being affected. An increase of 2°C will produce negative impacts on pasture and livestock production in arid and semiarid regions and positive impacts in humid temperate regions. The length of growing season is also an important factor for forage quality and quantity because it determines the duration and periods of available forage.
- Water availability issues will influence the livestock sector, which uses water for animal drinking, feed crops, and product processes. The livestock sector accounts for about 8% of global human water use and an increase in temperature may increase animal water consumption by a factor of two to three (Nardone et al., 2010).
- Water salination could affect animal metabolism, fertility, and digestion. Chemical contaminants and heavy metals could impair cardiovascular, excretory, skeletal, nervous and respiratory systems, and impair hygienic quality of production.
- Animal health can be affected directly or indirectly by climate change, especially rising temperatures. The direct effects are related to the increase of temperature, which increases the potential for morbidity and death. The indirect effects are related to the impacts of climate change on microbial communities (pathogens or parasites), spreading of vector-borne diseases, food-borne diseases, host resistance, and feed and water scarcity (Nardone et al., 2010). Temperature increases

# DIMENSIONS OF AGRICULTURAL SCIENCE

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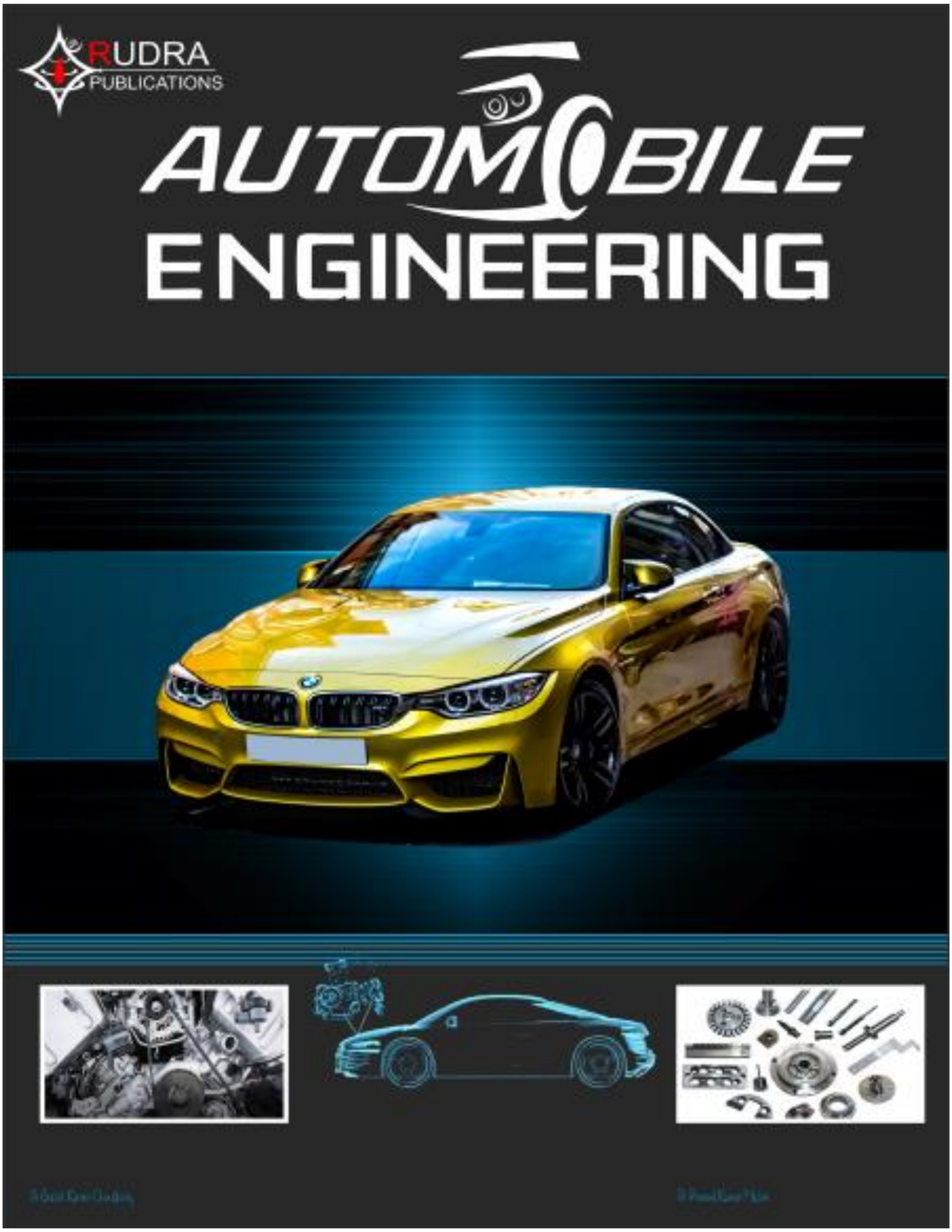
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# Automobile Engineering

(Automobile Engineering Lab Manual)

**Dr. Sushil Kumar Choudhary**

**&**

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Chapter 13

# IMPACT OF CLIMATE CHANGE ON INSECT PESTS

SAMEER KUMAR SINGH[1*], ALOK KUMAR PANDEY[2] UMESH CHANDRA[3] AND KANCHAN GANGARAM PADWAL[4]
[1&3] Department of Entomology,
[2]Agricultural Microbiology Section, Department of Soil Science & Agricultural Chemistry,
College of Agriculture, Acharya Narendra Deva University of Agriculture and Technology,
Kumarganj, Ayodhya–224229, (U.P.) India
[4]Faculty of Agriculture, Rajiv Gandhi South Campus, Banaras Hindu University,
Barkachha,Mirzapur–231001, (U.P.) India
*E-mail:– skbhu1991@gmail.com

The most general definition of climate change is a change in the statistical properties (principally its mean and spread)of meteorological variables when considered over long periods of time, regardless of cause(Mike, 2016).The term, "climatic change", was proposed by the World Meteorological Organization (WMO) in 1966 to encompass all forms of climatic variability on time-scales longer than 10 years, but regardless of cause. According to Intergovernmental Panel on Climate Change (IPCC), it is defined as "Change in the climate over time either due to natural variability or as a result of human activity".Climate Change can be illustrated as the phenomenon that includes change in environmental factors like temperature, humidity and precipitation over long period of time. Due to increased temperature, elevated $CO_2$ and other harmful gases, irregular rainfall, global food production is under the threat. Global temperature has been steadily rising since 1900 with an increase of about 1°C since then. A variety of numerical models representing the physical processes in the atmosphere, ocean, cryosphere and land surface simulate the response of the global climate systems to increasing greenhouse gas concentrations and forecast how the climate is expected to change until 2050 and 2070 (Shrestha, 2019).As described by IPCC, the most of global warming observed over last 50 years is attributed to the human activities.The rise in global climate temperature is the result of the enhanced greenhouse effect that is caused due to the increased levels of greenhouse gasses (GHG) like Carbon dioxide ($CO_2$), Chlorofluorocarbon (CFC), Methane ($CH_4$) and Nitrous oxide ($N_2O$) in the atmosphere. Over past hundred years, $CO_2$ concentration in the atmosphere has increased drastically from 280 ppm to 370 ppm and is likely to be doubled in 2100

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**Dr. Alok Kumar Singh**
Assistant Professor
Department of Crop Physiology,ANDUA&T, Kumarganj, Ayodhya, Uttar Pradesh

**Dr. S.R.Mishra**
Head
Department of Agricultural Meteorology,ANDUA&T, Kumarganj, Ayodhya, Uttar Pradesh

**Dr. Ramesh Pratap Singh**
Assistant Professor
Department of Agricultural Biochemistry,ANDUA&T, Kumarganj, Ayodhya, Uttar Pradesh

**Dr. R.K.Yadav**
Associate Professor
Department of Crop Physiology,ANDUA&T, Kumarganj, Ayodhya, Uttar Pradesh

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# Chapter 24

# Trends in Biopesticides Formulations for Crop Protection

**Vijay Laxmi Rai[1], Sameer Kumar Singh[1] and Rudra Pratap Singh[2]**

[1]College of Agriculture, Campus Azamgarh, Uttar Pradesh
[3]Krishi Vigyan Kendra, Kotwa, Azamgarh – 276001,
ANDUA&T, Ayodhya, Uttar Pradesh

*Bio-pesticides are typically inherently less harmful than traditional pesticides. They often have an effect on solely the target pest and closely connected organisms, in distinction to broad spectrum, conventional pesticides that will affect organisms as completely different as birds, insects, and mammals. They often are effective in tiny quantities and infrequently decompose quickly. Once used as a part of Integrated Pest Management (IPM) programs, bio-pesticides will greatly decrease the use of conventional pesticides, whereas crop yields stay high. To use bio-pesticides effectively, however, users have to be compelled to grasp a good deal regarding managing pests. Choice of the suitable formulations which will improve product stability and viability may solve the issue of inconsistency of field performance of the many potential biological management agents. The fascinating feature of bio-pesticides is environment friendly and simple biodegradability. In terms of production and development also, bio-pesticides have a position over chemical pesticides as a result of they involve low analysis expenditure and have quicker rates of product development. Though there are about one hundred forty bio-pesticide production units existing within the country as on today, but they are not able to meet the demand of more than 1 per cent of cropped area. There exists a large gap, which might only be bridged by putting in place of additional and more units for production of bio-pesticides.*

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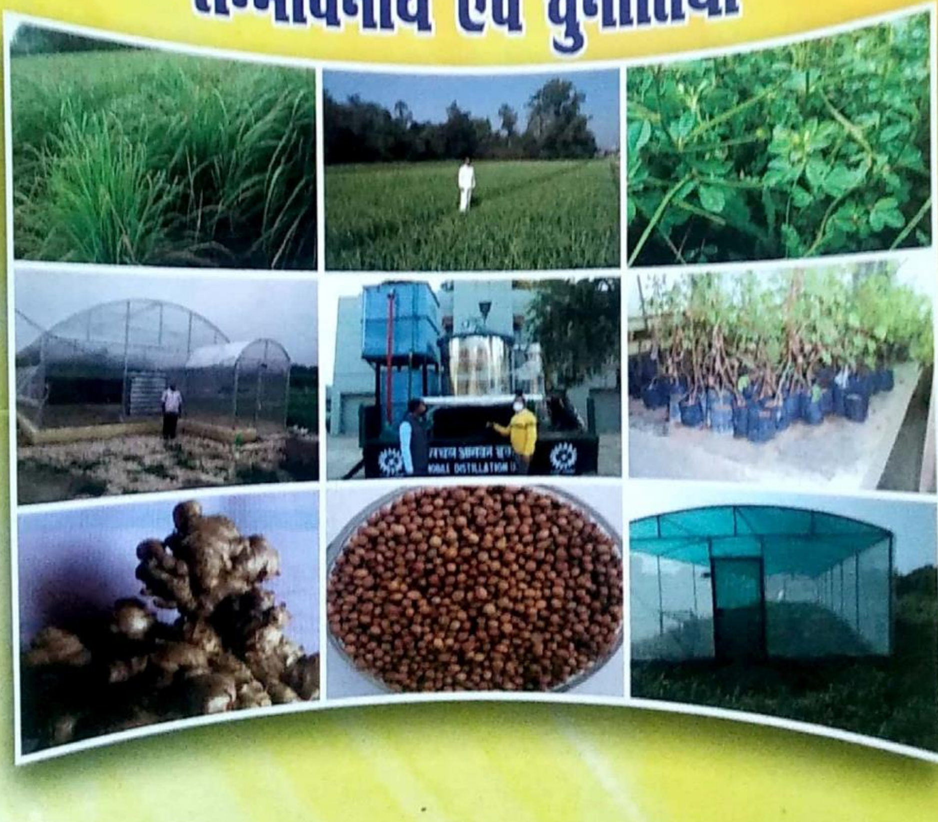

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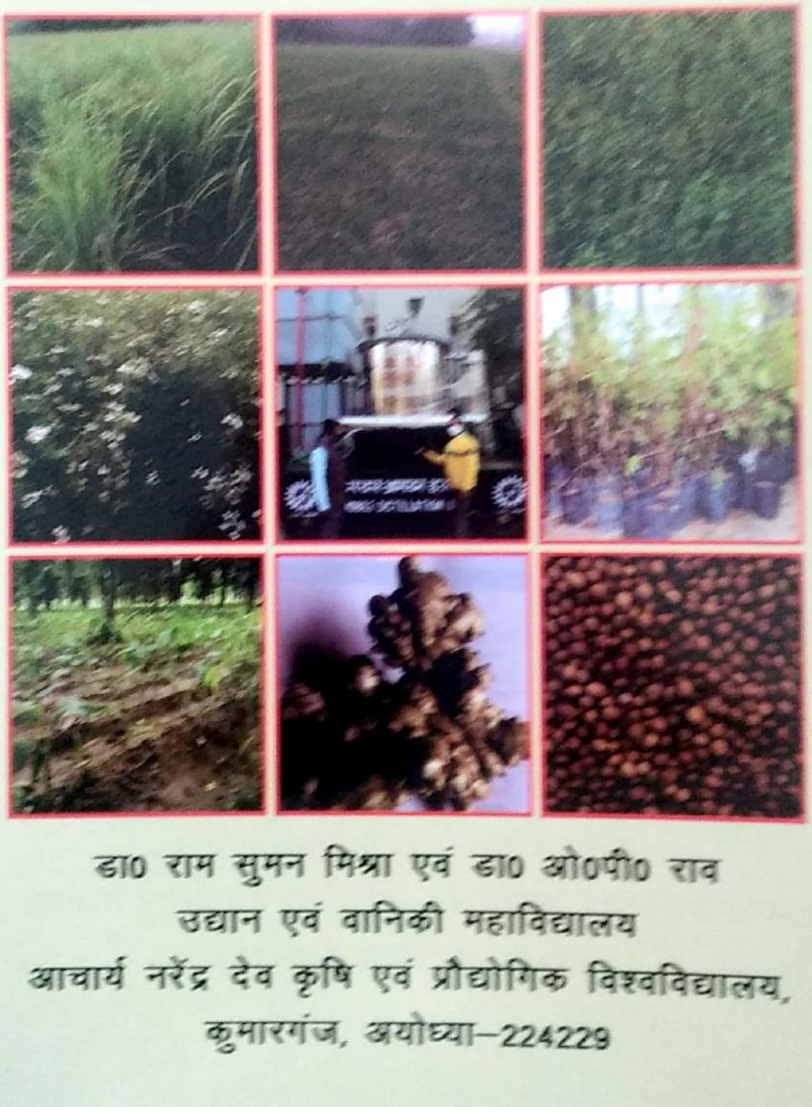

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Disease. (6) Autism Spectrum
tients suffering from Chronic
al Disease (ESRD). The ionic
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18). Effect of Foliar Application of
al Composition of Wheat Grains.

AM. (2016). Nano Chitosan-NPK
of Wheat Plants Grown in Sandy
-9.

i TM. (2004). Recent Advances on
ug Delivery. *Journal of Controlled*

y Pros and Cons to Agriculture:
*ogy and Applied Sciences*, 3, 43-55.

im MM, and Qureshi MI. (2018).
es to Aluminum Stress in Brassica
*technology*, 59(5), 615-627.

Studies in Vaucheria longicaulis
Effects on the F-actin Array.

ed M, and Ahmad P. (2019). The
ticle Foliar Spray Improved the
ulation in Rice (Oryza sativa L.)
1-12.

Dysfunction and the Production
*siology*, 128, 63-72.

dhan A, Roy A, and Panda SK.
ance to Aluminum Toxicity in
6357.

*ier*.

wth Responses, Root Exudates,
ns of Aluminium Toxicity and
*Botany*, 48, 75-92.

res Sanavi SAM, Sorooshzadeh
noparticles Effects on Yield and
r Late Season Drought Stress.
22-39.

Glycine Betaine Accumulation
y in Rice. Proceedings of the
*ical Sciences*, 1-11.



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# 10

# *Cercospora* Leaf Spot and its Impact on Biochemical Changes of Fenugreek


**R.S. Mishra**


Plants suffer from disease whose causes are similar to those affecting animals and humans (Agrios, 1998). Although we have no evidence that plants feel pain or discomfort. The development of disease in plants also fallows the same steps and is usually as complex as it is in animals. The mechanisms of plants which have produced disease vary with the causal agents. The reaction of a chemical nature is invisible, that soon becomes more widespread and starts histological changes which constitute the symptoms of the disease. The diseased cells and tissues do not preformed their normal physiological functions, as results of this plants growth is reduced and occurred considerable loss of yield. In India hardly any effort has been made to study the *Cercospora* leaf spot and its impact on biochemical changes of fenugreek. Hence, in this study, it has been reviewed under following sub headlines.

*(i)* Fenugreek and its importance.
*(ii)* Identification and characterization of *Cercospora* leaf spot of fenugreek.
*(iii)* Effect of *Cercospora* leaf spot disease on quality of fenugreek.
*(iv)* Management of *Cercospora* leaf spot of fenugreek with organic treatments.
*(v)* Effect of *Cercospora* leaf spot on growth and yield of fenugreek.


Department of Medicinal Plants, N.D. University of Agriculture and Technology, Kumarganj, Ayodhya - 224 229 (UP), (India)

The Author

Dr R S Mishra, Associate Professor (Senior Scale), Plant Pathology at N.D. University of Agriculture and Technology, Kumarganj, Faizabad, U.P. He has more than 17 years experience in teaching and research. He obtained M.Sc. (Ag.) degree from Allahabad Agricultural Institute Allahabad and Ph.D. degree from Jamia Hamdard University Delhi. Dr Mishra had worked on Interactive effect of elevated $CO_2$ and moisture stress on crop plants at IARI, New Delhi. He has been involved in research on Agro-meteorology and Agro Advisory Services. He obtained training from CRIDA, Hyderabad, IITM, Pune and IARI, New Delhi on the different aspect of Agro meteorology and plant disease management. Dr. Mishra developed protocol for Mushroom cultivation and management practices of *Coprinus* spp. in paddy straw mushroom. Presently, Dr. Mishra is actively engaged in teaching and research of Vegetable and Spices Diseases. Dr. Mishra has invited membership of New York Academy of Sciences. He has to his credit more than 80 publications including research papers, books, book chapter, manuals and popular articles. Dr. Mishra has developed four varieties of Haldi. He is the recipient of several Awards of professional Scientific Societies.

# Diseases of Vegetable, Spices and Plantation Crops

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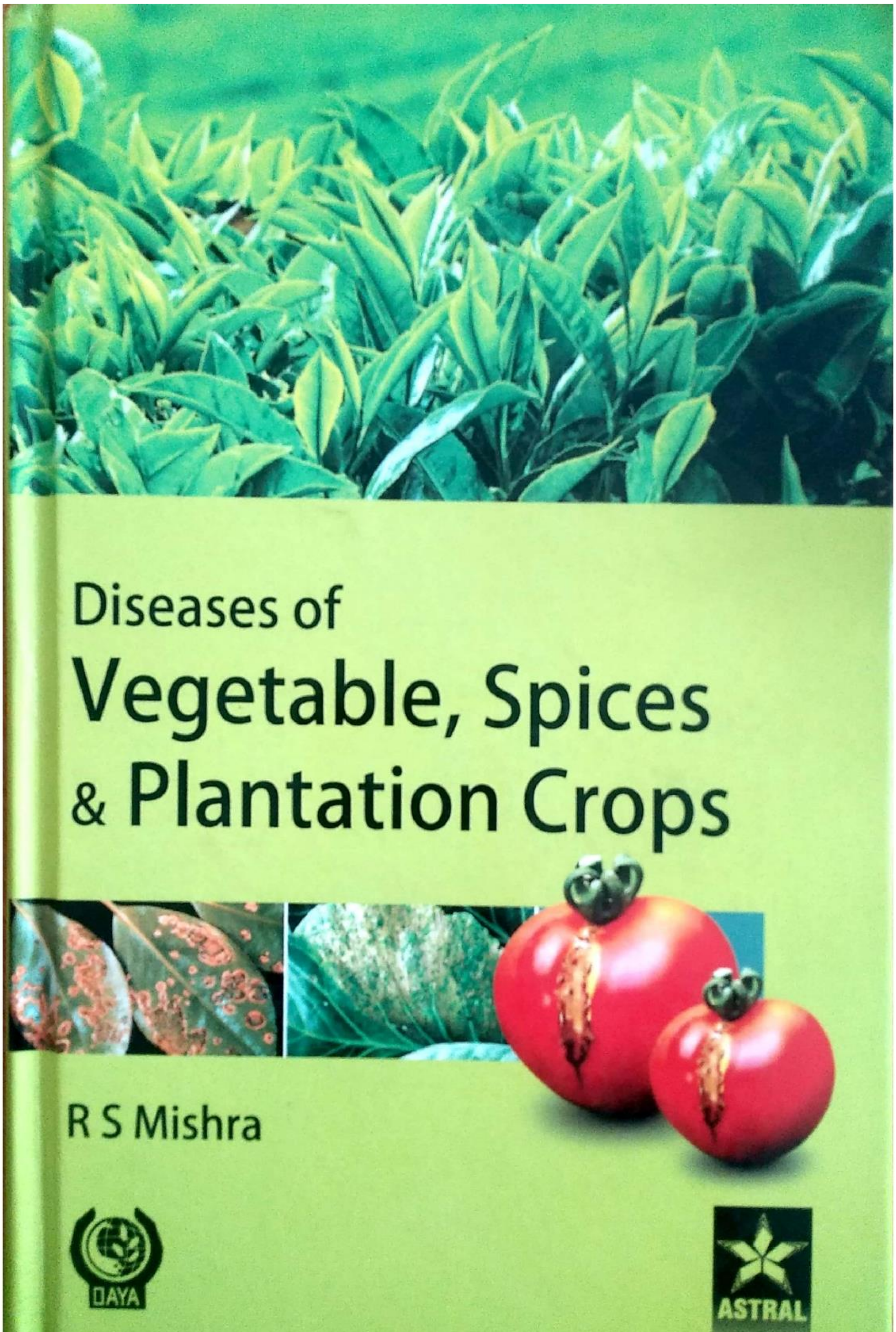
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# Agro-Meteorological Observatory

**S.R. Mishra1, Sidhant Gupta2, R.K. Aryan3 and A.K. Singh4**

**1. Associate Professor, Deptt. of Agro. Metrology, ANDUAT, Ayodhya, U.P.**

**2. M.Sc. Research Scholar, Deptt. Of Agro. Metrology, ANDUAT, Ayodhya, U.P.**

**3. Ph. D. Research Scholar, Deptt. of Agril. Metrology, ANDUAT, Ayodhya, U.P.**

**4. Associate Prof. Deptt. of Agronomy, A.N.D.UAT, Ayodhya, U.P.**

## Agro-Meteorological Observatory:

Agro-meteorological observatory is a place where all the necessary instruments are installed to observe and record different weather elements or parameters at stipulated interval of time. When the observations are recorded for a sufficiently long period of time and analyzed statistically, reliable crop-weather relations can be retrieved.

**or**

Agro meteorological observatories are those stations at which physical elements of climate and agriculture and allied sectors are observed to explore crop-weather relationships.

# ORGANIC FARMING IN INDIA

**Dr. Ankita Rao1, Deo Kumar2, Vikas Singh Sengar3and A.K. Singh4**

**1. Ph. D. Research Scholar, Deptt. of Agronomy, ANDUAT, Kumarganj, Ayodhya, U.P.**

**2. Assistant professor, Deptt. of Soil Science & Agricultural Chemistry,BUAT, Banda, U.P.**

**3. Ph. D. Research Scholar, Agril. Economics, ANDUAT, Kumarganj, Ayodhya, U.P.**

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**Dr. A. P. Rao** is Director Extension, A.N.D. University of Agriculture and Technology, Ayodhya (U.P.). He has served the University in various capacities- Dean, Student Welfare, Dean College of Fisheries, Professor and Head, Department of Fishery Biology and Resource Management and Chief of Protocol. He holds more than 34 years of experience in teaching, research and extension. Dr. Rao has published over 100 research papers in journals of National and International repute, several books and manuals. He has participated in various National and International conferences. Dr. Rao has several awards and honours to his credit- Best Teacher Award by PFGI, Mumbai (2011) and TANUVAS, Tamilnadu (2011), Scientist of the Year by The Academy of Environmental Biology (2013), Best Performance Award of the University by ANDUA&T, Ayodhya (2013). He has also been honoured with fellowships- Fellow International Society for Environmental Protection (FISEP) and Fellow Living World Society (FLWS), India.

**Dr. Vinod Singh** is presently working as Associate Professor in the Department of Genetics and Plant Breeding, College of Agriculture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (UP). Dr. Singh has more than 35 years of experience in teaching, research and extension. He has published various research papers in journals of repute. He has written more than 13 books and successfully guided several M.Sc. and Ph.D. students. Dr. Singh has been honored with Fellowship *viz.* Fellow International Society for Environmental Protection (FISEP) and Fellow Living World Society (FLWS) and he has delivered several talks on Radio and Doordarshan on different aspects of Agriculture.

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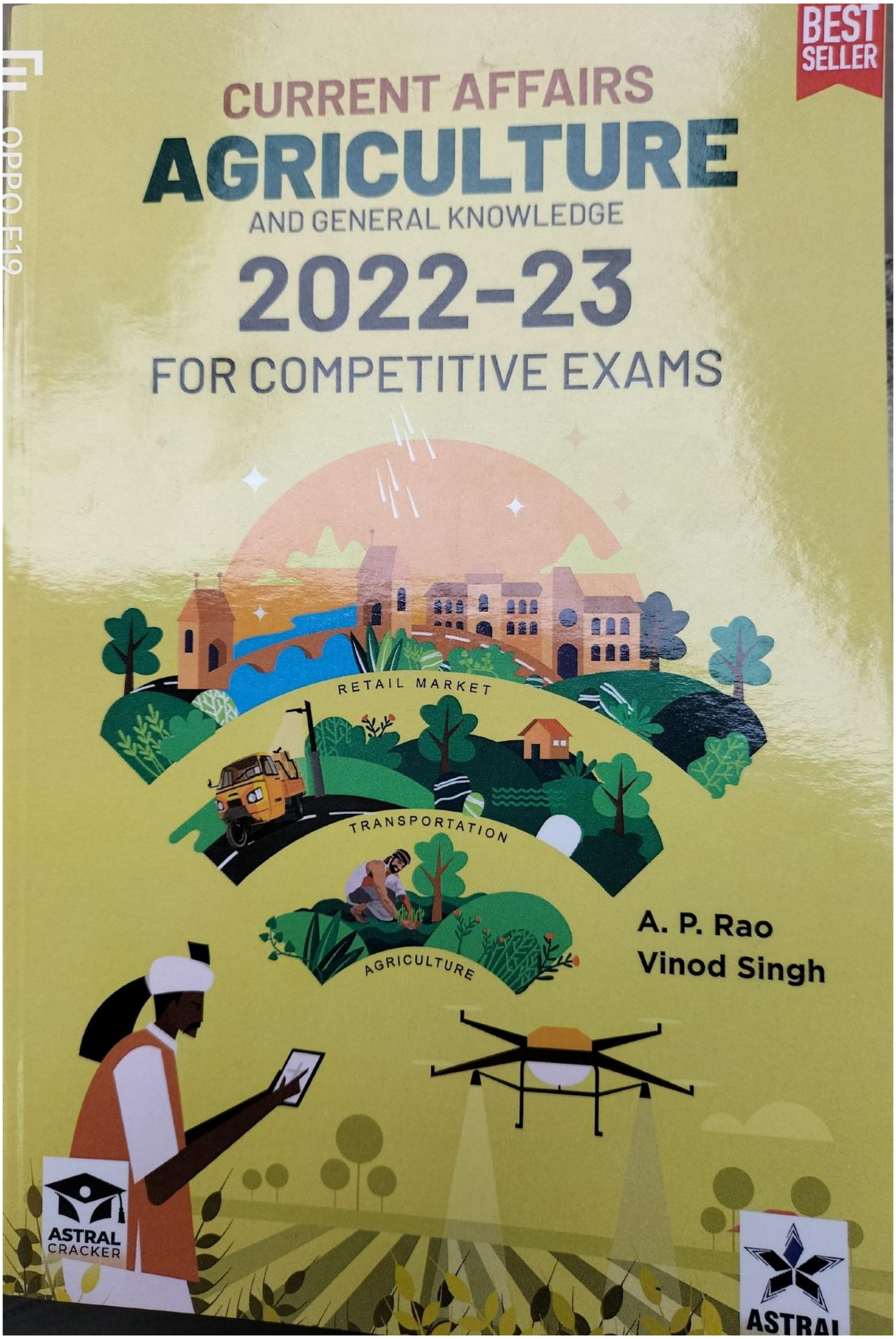
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**Amit Kumar Singh** obtained his M.Sc. (Ag) Agronomy from Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). He has qualified ARS (ICAR-NET) conducted by Agricultural Scientists Recruitment Board, New Delhi. Currently working as Block Technical Manager (BTM), ATMA, Paliganj, Patna. He worked as Senior Research Fellow (SRF) at ICAR-Research Complex for Eastern Region, Patna in research project sanctioned by Bill Gates Foundation, United States. He has vast experience in popularization of Agricultural farming techniques in the farmer field. He has published two books and number of research papers in national and international journals of repute and also organized/ participated various training programmes, seminars, symposia and workshops.

**Dr. Vinod Singh** is presently working as Associate Professor in the Department of Genetics and Plant Breeding, College of Agriculture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (UP). Dr. Singh has more than 32 years of experience in teaching, research and extension. He has published various research papers in journals of repute. He has written more than 13 books and successfully guided several M.Sc. and Ph.D. students. Dr. Singh has been honored with Fellowship viz. Fellow International Society for Environmental Protection (FISEP) and Fellow Living World Society (FLWS) and he has delivered several talks on Radio and Doordarshan on different aspects of Agriculture.

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# Chapter 1
# An Improved Estimation of Parameter of Morgenstern-Type Bivariate Exponential Distribution Using Ranked Set Sampling

**Vishal Mehta**
*Department of Agricultural Statistics, College of Agriculture, Acharya Narendra Deva University of Agriculture and Technology, Azamgarh, India*

## ABSTRACT

*In this chapter, the authors suggest some improved versions of estimators of Morgenstern type bivariate exponential distribution (MTBED) based on the observations made on the units of ranked set sampling (RSS) regarding the study variable Y, which is correlated with the auxiliary variable X, where (X,Y) follows a MTBED. In this chapter, they firstly suggested minimum mean squared error estimator for estimation of $\theta 2$ based on censored ranked set sample and their special case; further, they have suggested minimum mean squared error estimator for best linear unbiased estimator of $\theta 2$ based on censored ranked set sample and their special cases; they also suggested minimum mean squared error estimator for estimation of $\theta 2$ based on unbalanced multistage ranked set sampling and their special cases. Efficiency comparisons are also made in this work.*

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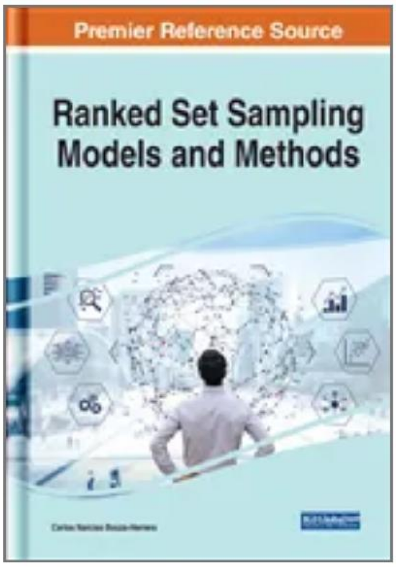


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administrative and research experience. His areas of interest are Databases, Data Science, Big Data Analytics, Distributed and Parallel Computing, Grid Computing, Cloud Computing, and Machine Learning. He has many awards, honors, and recognitions to his credit. He delivered several invited/expert talks on recent research topics at renowned institutes and universities. He has published several research papers in SCI/Scopus, peer-reviewed International Journals and book chapters. He has also presented and published many research papers in National/International Conferences. Dr Singh has also worked as an editor of proceedings of various International/National Conferences. He has attended/participated in several workshops at reputed Institutes/Universities/Organizations. He has organized several Conference/Seminar/Workshops. He has supervised Post Graduate Thesis/Dissertations and handled an AICTE sponsored research project under the RPS scheme and one consultancy project. He has been a member of professional societies, such as CSI, ISTE, IEEE, and has been a member/reviewer of several Scopus-Indexed journals.

**Dr Ravindara Bhatt** is an Associate Professor in the Department of Computer Science and Engineering and Information Technology at Jaypee University of Information Technology, Waknaghat, India. Ravindara joined the Department of Computer Science and Engineering and Information Technology, Jaypee University of Information Technology, in 2006. Ravindara earned his PhD degree from Indian Institute of Technology, Kharagpur. Dr Ravindara has over 20 years of extensive experience in Academics and Industry. His areas of interest are Data Science, Big Data, Machine Learning, and Wireless Sensor Networks. He has published several research papers in SCI/Scopus, peer-reviewed International Journals. He has also presented and published many research papers in National/International Conferences and is a reviewer for various renowned international journals.

**Mr Prateek Thakral** is currently an Assistant Professor in the Department of Computer Science and Engineering, Jaypee University of Information Technology, Waknaghat Solan. He has earned a B.Tech in Information Technology and an M.Tech in Computer Engineering from Kurukshetra University, Kurukshetra in 2010 and 2013, respectively. Before joining JUIT, he was an Assistant Professor (on contract) at the National Institute of Technology Kurukshetra for four years. He has 8 years of teaching experience in total. He has published about 10 research papers as various reputed book chapters, journals and international conferences. He is currently serving as a member of the Computer Society of India (CSI).

**Dr Dinesh Chander Verma** holds a PhD(CSE), MTech(IT), MCA and MPhilin in Computer Science. He has more than 17 years of teaching experience that includes significant administrative, research, and industrial exposure. He has delivered many expert talks, chaired sessions, and reviewed a good number of research articles. His areas of interest include Machine Learning, MANET, IoT, and Data Science. He is a Life Member of the Indian Society for Information Theory and Applications (ISITA). He has published several research articles, book chapters in Scopus/UGC Care/ESCI indexed journals. He has authored two books for UG courses and published one patent too. He has conducted several conferences/ seminars/ FDPs on recent emerging technologies and has mentored many industrial live projects on emerging technologies.

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# Chapter - 6

## Expectation and Generating Functions

**Vishal Mehta, Ajay Kumar Gautam, Ashish Tiwari and Gokul Kirshnan K.B.**

**Abstract**

In this chapter we are going to discuss about random variable, expectation and different generating functions. In mathematics and statistics several experiments were conducted in order to understand the concept more precisely. The chapter focuses to give clear cut idea about the various topics mentioned earlier so that the readers can understand the concept logically and its practical application can be understand through the various example given throughout the chapter in different topics.

**Keywords:** distribution function, moments, PDF, PMF and random variable

**Introduction**

In this chapter we are going to discuss about random variable, expectation and different generating functions. In mathematics and statistics several experiments were conducted in order to understand the concept more precisely. The chapter focuses to give clear cut idea about the various topics mentioned earlier so that the readers can understand the concept logically and its practical application can be understand through the various example given throughout the chapter in different topics. We know that during our day today life we are doing different activities which can be considered as a random experiment. The sample space can be obtained for these different activities. For example if we cooking as an random experiment, we can consider the ingredients as the random variables such as the different weights we are taking for preparing the meal for a month can be considered as the number of possible values. Similarly the other experiments like tossing a coin or dice also give us sample space with different outcomes. Most of the concept in this chapter has been explained by taking example of tossing of unbiased fair coin.

The contents and concept explained in this chapter are the basics of statistics so a reader can get sufficient knowledge in statistics by reading and solving the problems mentioned under topics. Random variable can be

# Chapter - 6
# Expectation and Generating Functions


**Authors**

**Vishal Mehta**
Department of Agricultural Statistics, ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh, India

**Ajay Kumar Gautam**
Department of Agricultural Statistics, ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh, India

**Ashish Tiwari**
Department of Agricultural Statistics, ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh, India

**Gokul Kirshnan K.B.**
Department of Agricultural Statistics, ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh, India

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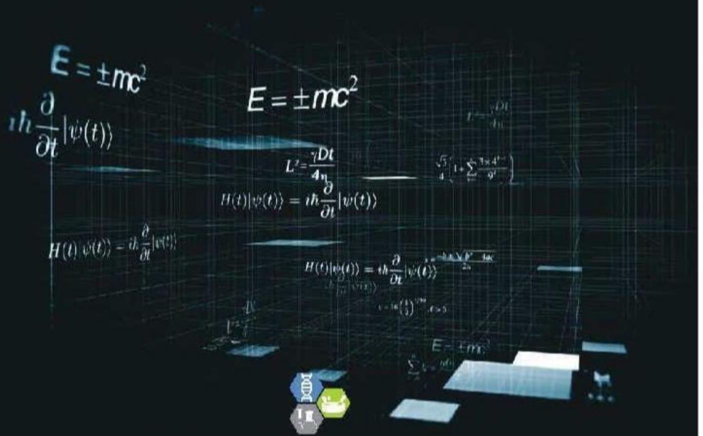

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## About the Author

Dr. Adesh Kumar received his education from Chandra Shekhar Azad University of Agriculture and Technology Kanpur (B.Sc. Ag. & AH) and Indian Agricultural Research Institute (M.Sc. & Ph. D Microbiology). He joined Narendra Deva University of Agriculture and Technology Kumarganj Faizabad in 2008 as Assistant Professor Microbiology and has been involved in teaching and research actively. He is dealing with research projects financed by UPCAR and CSTUP. He has written two books, many book chapters and published more than 30 research papers in journals of repute. He is also member of many scientific societies and conferred many awards to him.

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# MODEL SHORT AND ESSAY TYPE QUESTIONS & ANSWERS IN BIOTECHNOLOGY

SUJATHA, T.P
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## About the Authors

**Km. Komal** born on 2nd April 1996 and received her education from D.A.V. College, Muzaffarnagar affiliated to Chaudhary Charan Singh University, Meerut (B.Sc. and M.Sc. Biotechnology) & pursuing Ph.D Ag. Biotechnology from ANDUAT, Kumarganj, Ayodhya. She has published many research papers in National and International Journals of repute. She has written many book chapters. He has awarded by different societies.

**Phool Singh Hindoriya** was born at Shivpur District of Madhya Pradesh. He has completed his graduation from Banaras Hindu University, Varanasi, U.P. and post-graduation in agronomy from ICAR-NDRI, Karnal, Haryana.

**Dheer Pratap Singh** was born on 23th October 1994 and he received his education from Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (B.Sc. Agriculture) and from Monad University, Hapur (M.Sc. Ag. Agronomy) and Pursuing Ph.D. from Integral University, Lucknow.

**Abhinav Singh** is Research Scholar in Department of Agricultural Extension Education at Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.), India. He did his B.Sc. (Agriculture) from National P.G. College, Gorakhpur (U.P.), affiliated to Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur (U.P.) in 2017.

**Dr. Adesh Kumar** born in 1977 and received his education from CSUAT, Kanpur (B.Sc. Ag. & AH) and IARI, New Delhi (M.Sc. & Ph. D Microbiology). He joined ANDUAT, Kumarganj, Ayodhya as Assistant Professor Microbiology, he has written 8 books, many book chapters and published more than 50 research papers in journals of repute. He is also member of many scientific societies and conferred many awards to him.

**Niyaj Ahamad** born on 15th Feb. 1997 and received his education from Integral University, Lucknow (B.Sc. Honos. Ag.) & ANDUAT, Kumarganj, Ayodhya (M.Sc. Ag. Biotechnology). He has published many research papers in National and International Journals of repute. He has written two books and several book chapters. He has awarded by different societies.

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# 13

# Role of Ribosome-Inactivating Proteins and Antifungal Proteins in Food Crops

*Divya Srivastava*, Adesh Kumar and Shambhoo Prasad*

## INTRODUCTION

There are some proteins have been investigated for selective toxicity[1] and were espionage agents to transgenic plant protection by biologists[2] "silver bullet" therapies by cancer researchers[3], and biological weaponry by military groups. One class of such proteins, ribosome-inactivating proteins (RIPs), are found in genera throughout the plant kingdom as well as in certain fungi and bacteria. These proteins act as *N*-glycosidases to modify large rRNAs and render them incapable of sustaining further translation. The Kcat for nonplant ribosomes is greater than $10^3$ $min^{-1}$ for the RIPs abrin (from *Abrusprecatorius*) and ricin (from *Ricinus communis*)[4]. Thus, a single molecule has the potential to kill a cell.

Because of their selective toxicity, RIPs have been primary candidates for the toxic moiety of immunotherapeutics. As a result, much of the RIP literature reflects attempts to isolate and characterize RIPs from new plant sources and to exploit these RIPs as anticancer agents[5]. Numerous other studies have focused on enzymology, uptake of lectin-associated RIPs into target cells, and subsequent transport to ribosomal targets in the cytosol. These investigations have provided a broad knowledge base for understanding biochemical and medicinal properties of RIPs. This chapter summarizes work related to RIP activities and considers unresolved issues in how these activities may affect plant metabolism and protection.

Department of Plant Molecular Biology and Genetic Engineering, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, U.P. *Corresponding author

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rapidly across Europe. BiologicalInvasions, 13, 2981–2995. doi:10.1007/s10530-011-9983-0

Saroj Shrestha.(2019).Effects of Climate Change in Agricultural Insect Pest. *Acta Scientific Agriculture* 3.12: 74-80.

Siegenthaler U, Stocker TF, Monnin E, Luthi D, Schwander J, Stauffer B, Raynaud D, Barnola JM, Fischer H, Masson Delmotte V, Jouzel J (2005). Stable carbon cycle-climate relationship during the late pleistocene. Science, 310: 1313-1317.

Spahni R, Chappellaz J, Stocker TJ, Loulergue L, Hausammann G, Kawamura K, Fluckiger J, Schwander J, Raynaud D, Masson Delmotte V, Jouzel J (2005). Atmospheric methane and nitrous oxide of the late pleistocene from Antarctic ice cores. Science, 310: 1317-1321.

Tewksbury J. J., Huey R. B., Deutsch C. A. (2008). Putting the heat on tropical animals. Science 320:1296–7.

Thomas, T. (1989). Sugar beet in the greenhouse - a global warning. *Brown Sugar*, 59: 24-26.

Vaclav Kudela (2009).Potential Impact of Climate Change on GeographicDistribution of Plant Pathogenic Bacteria in Central Europe. Plant Protect. Sci. Vol. 45, 2009, Special Issue: 27–32.

War, A.R., Taggar, G.K., War, M.Y. and Hussain, B. (2016). Impact of climate change on insect pests, plant chemical ecology, tritrophic interactions and food production. *InternationalJournal of Clinical and Biological Sciences* 1:16–29.

Williams J. W. and Jackson S. T. (2007). Novel climates, no-analogCommunities, and ecological surprises. *Frontier of Ecological Environment*.5:475–85.

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CHAPTER 10

# RNAi TECHNOLOGY - A BIOTECHNOLOGICAL TOOL TO MITIGATE THE IMPACT OF CLIMATE CHANGE ON THE CROPS

Arun Kumar[1], Adesh Kumar[2*], Shambhoo Prasad[2], Ved Prakash[3], Jaipal[4], and Sushil Kumar Singh[5]

[1]PBR Agriculture college, Gausganj, Hardoi

[2]Department of Plant molecular Biology and Genetic Engineering, ANDUAT Kumarganj, Ayodhya -224229

[3]Department of Soil Science, ANDUAT Kumarganj, Ayodhya -224229

[4]UPCAR, Lucknow, [5]Department of Plant Pathology, ANDUAT Kumarganj, Ayodhya -224229

*Corresponding author- adeshkumar1977@gmail.com

## Abstract

RNA interference (RNAi) is a means of reducing or switching-off the expression of individual genes, often described as 'gene silencing'. RNAi is a natural process with important defense and regulatory functions in animals, plants and fungi. The efficacy of RNAi varies among different insect orders and also depends upon various factors, including the target gene selection, method of dsRNAs delivery, and expression of dsRNAs and presence of off-target effects. RNAi-mediated silencing of different insect genes involved in various physiological processes was found to be detrimental to insect's growth, development and survival. The silencing of a gene is a consequence of degradation of RNA into short RNAs that activate ribo-nucleases to target homologous mRNA. RNAi has also been exploited in plants for resistance against pathogens, insect/pest, nematodes, and virus that cause significant economic losses. Keeping beside the significance in the genome integrity maintenance as well as growth and development, RNAi induced gene syntheses are vital in plant stress management. Modifying the genes by the interference of small RNAs is one of the ways through which plants react to the environmental stresses. Hence, investigating the role of small RNAs in regulating gene expression assists the researchers to explore the potentiality of small RNAs in abiotic and biotic stress management. This novel approach opens new avenues for crop improvement by developing disease resistant, abiotic or biotic stress tolerant, and high yielding elite varieties.

# 12

# Biotechnology as the Tool to Develop Insect Resistant Transgenic *Bt* Crops

*Divya Srivastava*, Adesh Kumar and Shambhoo Prasad*

## INTRODUCTION

Agriculture is the backbone of Indian economy which has gone through immense changes in the second half of the twentieth century. Adoption of technologies, high yielding varieties, and agrochemicals between 1960 to 2000 lead to 'The Green Revolution' increasing the crop yield per hectare. Use of chemical pesticides has played a positive role in increasing agricultural productivity and in making India self-sufficient in food grain production.

Today the pests have become a major concern for the farmers across the world. Throughout the world, food plants are damaged by more than 10,000 species of insects. Sometimes the yield loss by insects reaches as high as 60-70%. Dhaliwal et al. (2010) reported that the Indian agriculture is currently suffering an annual loss of about Rs. 8, 63, 884 million due to insect pests. This is due to misuse and overuse of insecticides which cause resistance and increase the survival rate of the insect pests. So, to solve this problem *Bacillus thuringiensis* got introduced as an ecofriendly insecticidal source[1].

*Bacillus thuringiensis (Bt)* is a natural soil bacterium. *Bt.* is known as one of the best modern agricultural defenses against plant-eating insects and this can be applied to the surface of plants to provide temporary protection as well as it can be genetically engineered into the plant to protect against insects throughout the lifespan of the plant[2]. The bacterial fermentation technology was led to optimization of better formulations and cheaper *Bt* products hence it played a

Narendra Deva University of Agriculture and Technology, Faizabad, U.P.

*Corresponding author.

sense and antisense RNA. Proc Nat Acad Sci USA. 95:13959–13964

Watson JM, Fusaro AF, Wang M, Waterhouse PM., 2005. RNA silencing platforms in plants. FEBS Lett. 579:5982–5987.

Worrall, E. A., Bravo-Cazar, A., Nilon, A. T., Fletcher, S. J., Robinson, K. E., Carr, J. P., et al. (2019). Exogenous Application of RNAi-Inducing Double-Stranded RNA Inhibits Aphid-Mediated Transmission of a Plant Virus. *Front. Plant Sci.* 10, 265.

Zandalinas, S.I., Mittler, R., Balfago´n, D., Arbona, V., Go´mez-Cadenas, A., 2017. Plant adaptations to the combination of drought and high temperatures. Physiol. Plant 162, 2–12.

Zeng, Q.-Y., Yang, C.-Y., Ma, Q.-B., Li, X.-P., Dong, W.-W., Nian, H., 2012. Identification of wild soybean miRNAs and their target genes responsive to aluminum stress. BMC Plant Biol. 12, 182.

Zhou, Z.S., Zeng, H.Q., Liu, Z.P., Yang, Z.M., 2012. Genome-wide identification of Medicago truncatula microRNAs and their targets reveals their differential regulation by heavy metal. Plant Cell Environ. 35, 86 –99





CHAPTER 11

# PLANT BIOTECHNOLOGICAL APPROACHES FOR IMPROVING AGRICULTURAL YIELD AND FOOD SECURITY IN CHANGING CLIMATE

Adesh Kumar[1*], Minakshi[1], Shambhoo Prasad[1], Arun Kumar[2], Alok Pandey[3], Ved Prakash[3], Jaipal[4], Sushil Kumar Singh[5] and Raj Bahadur[6]

[1]Department of Plant molecular Biology and Genetic Engineering, ANDUAT Kumarganj, Ayodhya -224229
[2]PBR Agriculture college Gausganj, Hardoi
[3]Department of Soil Science, ANDUAT, Kumarganj, Ayodhya -224229
[4]UPCAR, Lucknow, [5]Department of Plant Pathology, ANDUAT Kumarganj, Ayodhya -224229
[6]Department of Crop Physiology, ANDUAT Kumarganj, Ayodhya -224229

*Corresponding author- adeshkumar1977@gmail.com

**Abstract:**
Climate change effects particularly in region suffer persistent soil and water resource scarcity significantly increases production risk. The effects of climate change on agriculture may depend not only on changing climate condition but also on the ability to adapt through changes in technology and demand for food. The negative effects of climate change on agricultural productivity and food security as a result of extreme temperature, drought, salinity and infectious disease vectors include low yield, hunger and malnutrition. Conventional agricultural biotechnology methods such as energy-efficient farming, use of bio-fertilizers, tissue culture and breeding for adaptive varieties are among feasible options that could positively address the potential negative effects of climate change and thereby contributing to carbon sequestration initiatives. On the other hand, the adoption of modern biotechnology through the use of genetically modified stress tolerant and high yielding transgenic crops also stand to significantly counteract the negative effects of climate change. Safe application of biotechnology will greatly complement other on-going measures being taken to improve agricultural productivity and food security. Both conventional and modern agricultural biotechnologies will significantly contribute to the current and future worldwide climate change adaptation and mitigation efforts.

**Key words:** Biotechnology, mitigation Adaptation, carbon sequestration, climate change, biotic stress, abiotic stress

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# MITIGATION OF ABIOTIC STRESSES IN AGRICULTURAL CROPS BY RHIZOBACTERIA

**Adesh Kumar**

[1]Department of Plant molecular Biology and Genetic Engineering, College of Agriculture, A.N.D.U.A.&T. Kumarganj, Ayodhya -224229

Email: gcy1972@gmail.com

**Abstract**

Extreme events like prolonged droughts, intense rains and flooding, heat waves and frost damages are likely to further increase in future due to climate change. A wide range of adaptations and mitigation strategies are required to cope with such impacts. Efficient resource management and crop improvement for evolving better varieties can help to overcome abiotic stresses to some extent. However, such strategies being long drawn and cost intensive, there is a need to develop simple and low-cost biological methods for the management of abiotic stress, which can be used on short term basis. Microorganisms could play an important role in adaptation strategies and increase of tolerance to abiotic stresses in agricultural crops. Plant-growth promoting rhizobacteria (PGPR) mitigate most effectively the impact of abiotic stresses such as drought, low temperature, and salinity and high temperatures on crops through the production of exopolysaccharates and bio-film formation. PGPR mitigate the impact of drought on crops through a process so called induced systemic tolerance which includes bacterial production of cytokinins, production of antioxidants and degradation of the ethylene precursor ACC by bacterial ACC deaminase. These microbes also provide excellent models for understanding the stress tolerance, adaptation and response mechanisms that can be subsequently engineered into crops to mitigate the abiotic stress induced by climate change.

**Keywords** – Rhizobacteria, Abiotic stress, tolerance, Crops, Climate change

## 1. Introduction

Abiotic stresses affect the productivity of agricultural crops as well as the microbial activity in soil. Extreme conditions such as prolonged drought, intense rains flooding, high temperatures, frost and low temperatures, which are expected to intensify in the future due to climate changes, will significantly affect plants and soil microorganisms. Crop production in tropical regions is facing increasing stresses caused due to natural and anthropogenic factors. Increased incidence of abiotic and

### 1.6 Cross-Slope Farming

Cross-Slope Farming is the practice of conducting field operations perpendicular to the field slope. This includes: Tillage and seeding; Planting strips of different crops ; Diversion terraces Cross slope farming is the most effective method to control large volumes of runoff that flow over a long field. Other soil conservation practices can be effectively integrated with cross slope farming. Farming across the slope requires fields to be wide enough to efficiently farm and may require equipment modification to avoid side hill slippage on steep slopes.

### 1.7 Diversion terraces

Diversion terraces are shallow grassed ditches, with a berm on the downhill side, which are constructed across the slope to intercept surface runoff water moving down the field. The terraces decrease the slope length and remove large flows of water safely from the field with the help of grassed or rocked waterways. Terrace construction information: Terraces may remove up to 5% of land from production. Terraces should be designed to have a grade along the length that is less than 2%. The position of a terrace in a field depends on field slope, soil type and other soil conservation practices used.

### References


- Bai, Z., Caspari, T., Gonzalez, M.R., Batjes, N.H., Mäder, P., Bünemann, E.K., de Goede, R., Brussaard, L., Xu, M., Ferreira, C.S.S. and Reintam, E. (2018). Effects of agricultural management practices on soil quality: A review of long-term experiments for Europe and China. Agriculture, ecosystems & environment, 265, 1-7.
- Baumhardt, R.L. and Blanco-Canqui, H. (2014). Soil: Conservation Practices. 10.1016/B978-0-444-52512-3.00091-7.
- Bhattacharyya, R., Ghosh, B.N., Dogra, P., Mishra, P.K., Santra, P., Kumar, S., Fullen, M.A., Mandal, U.K., Anil, K.S., Lalitha, M. and Sarkar, D (2016). Soil conservation issues in India. Sustainability, 8(6), 565.
- De Graaff, J. (1996). The price of soil erosion: An economic evaluation of soil conservation and watershed development.
- Dumanski, J., & Peiretti, R. (2013). Modern concepts of soil conservation. International soil and water conservation research, 1(1), 19-23.
- Gupta, R.P.; Kumar, S.; Singh, T. Soil Management to Increase Crop Production;


# Isolation and Characterisation of Plant growth promoting RHIZOBACTERIA (PGPR) of pulse crop


**Niyaj Ahamad[1], Adesh Kumar[1], Shalini Srivastava[1], Km. Komal[1], Meenakshi[1], Siddhant Gupta[2]**

[1]Department of Plant Molecular Biology & Genetic Engineering,
Department of Agricultural Meteorology
[2]ANDUAT, Kumarganj, Ayodhya (U.P.) 224229, India.
Corresponding Author: niyajahmad740@gmail.com


## Introduction

Plant growth promoting rhizobacteria (PGPR) are groups of beneficial bacteri that promote plant growth and biocontrol by variety of mechaninsms. In the context c increasing global concern for food quality and environmental issues, the utilization c PGPR for minimizing chemical inputs in agriculture practices is a potentially importan issue.

PGPR could be defined as beneficial bacterial strains that colonize the roots o plant for plant growth stimulation and biocontrol potential. They can affect plant growt by promoting plant-microb symbiosis, competition for colonization space and nutrients and decreasing the activities of plant pathogenic microbes. PGPR stimulates plan growth and biocontrol by variety of direct and indirect mechanisms. Direct mechanism of PGPR includes facilitating availability of resources i.e. solubilisation of phosphate, nitrogen fixation, iron acquisition by siderophore and modulating proper level of plant hormones like auxins, cytokinins and gibberellins and lowering the level of ethylene by production of ACC deaminase enzyme. Indirect mechanisms of PGPR include suppression of fungal, bacterial and likewise chitinase, protease, cellulose, antibiotics, HCN, ammonia and volatile organic compound etc. Several other mechanism of indirect growth promotion by PGPR include antagonistic activities, signal interference, quorum sensing, inhibition of biofilm formation, systemic acquired resistance and induced systemic resistance, inhibition of biofilm formation, increasing mineral nutrient solubilisation. PGPR isolates have been isolated and screened from rhizospheric soil of diverse pulse and other crops to enhance growth, seed emergence, crop yield and production. PGPR have been commercially used as microbial bioinoculants of biofertilizers to enhance crop production. PGPR offers and attractive strategy for replacement and reduction of high amount of chemical pesticides and fertilizers (Tiwari et. al., 2016).

### Mechanisms of PGPR

Formation of PGPR colonies roots of plant and exert beneficial effects on plant

Iqbal Ahmad · Shamim Ahmad
Kendra P. Rumbaugh *Editors*

# Antibacterial Drug Discovery to Combat MDR

## Natural Compounds, Nanotechnology and Novel Synthetic Sources

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## Content

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# ROLE OF BENEFICIAL RHIZOSPHERIC BACTERIA IN PLANT GROWTH

**Adesh Kumar**

[1]Department of Plant molecular Biology and Genetic Engineering, College of Agriculture, A.N.D.U.A.& T., Kumarganj, Ayodhya -224229

*Corresponding author- adeshkumar1977@gmail.com

**Abstract:**

Climate change and the highly growing world population becomes a huge challenge to feed the whole population. To overcome this challenge and increase the crop yield, a large number of fertilizers are applied but these have many side effects. Instead of these, scientists have discovered beneficial rhizobacteria, which are environmentally friendly and may increase crop yield and plant growth. The microbial population of the rhizosphere shows a pivotal role in plant development by inducing its physiology. Plant depends upon the valuable interactions among the roots and microbes for the growth, nutrients availability, growth promotion, disease suppression and other important roles for plants. Recently numerous secrets of microbes in the rhizosphere have been revealed due to huge development in molecular and microscopic technologies. The current knowledge on the development, maintenance, interactions of Rhizobacterial populations and various proposed mechanisms normally used by PGPR in the rhizosphere that encouraging the plant growth and alleviating the stress conditions in plants.

## Introduction

Rhizosphere is an area around the plant roots and surrounding soil. Microbial population present in this region is comparatively diverse from that of its bulk soil because of root exudates which function as a source of nourishment for microbes (Burdman *et al.*, 2000) Research has shown that several plants associated microbes can have concentrating effects on plant growth, nutrients, seed germination and disease management (Gevers *et al.*, 2012). In plant-microbe association, plants could be regarded as a super organism that relies on microbes for their particular functions as well as traits. In response, plants deposited their photosynthetic carbon in their surroundings rhizosphere (Berendsen *et al.*, 2012) Thus, the plant-microbe association is beneficial in nourishing the microbial population and prompting its composition and activities. So far, the interactions among the plants and microbes have been studied

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*Editors:*

**TUHINA VERMA**

*Professor*

Department of Microbiology,

Dr. Ram Mannohar Lohia Avadh University, Ayodhya (UP)

**SHAMBHOO PRASAD**

*Associate Professor*

Department of Plant Molecular Biology and Genetic Engineering,

Narendra Dev University of Agriculture and Technology,

Kumarganj, Ayodhya (UP)



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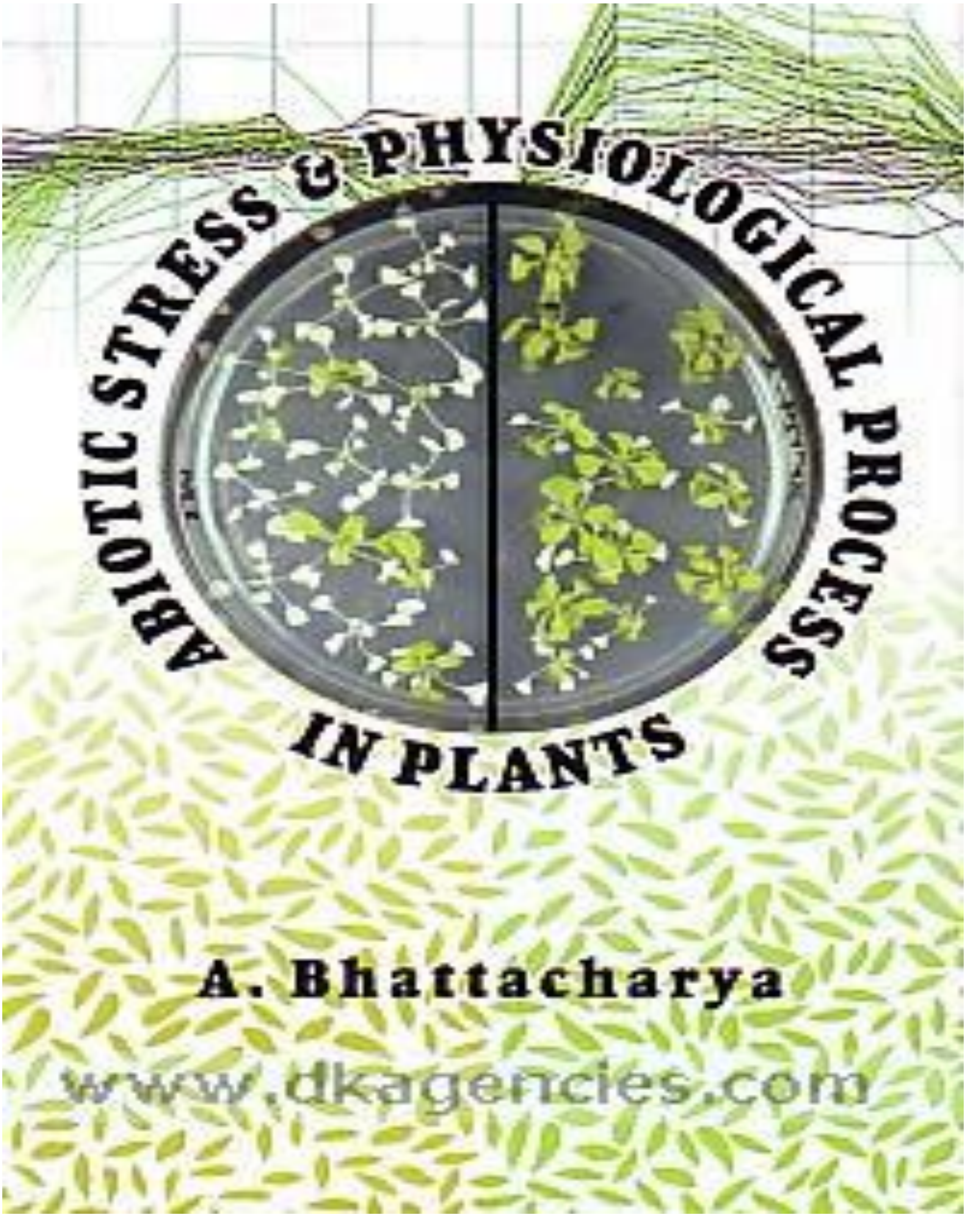
ABIOTIC STRESS & PHYSIOLOGICAL PROCESS
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A. Bhattacharya
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# Abiotic Stress and Physiological Process in Plants

**A. Bhattacharya**

Former Principal Scientist (Plant Physiology)
Indian Institute of Pulses Research
Kanpur, India

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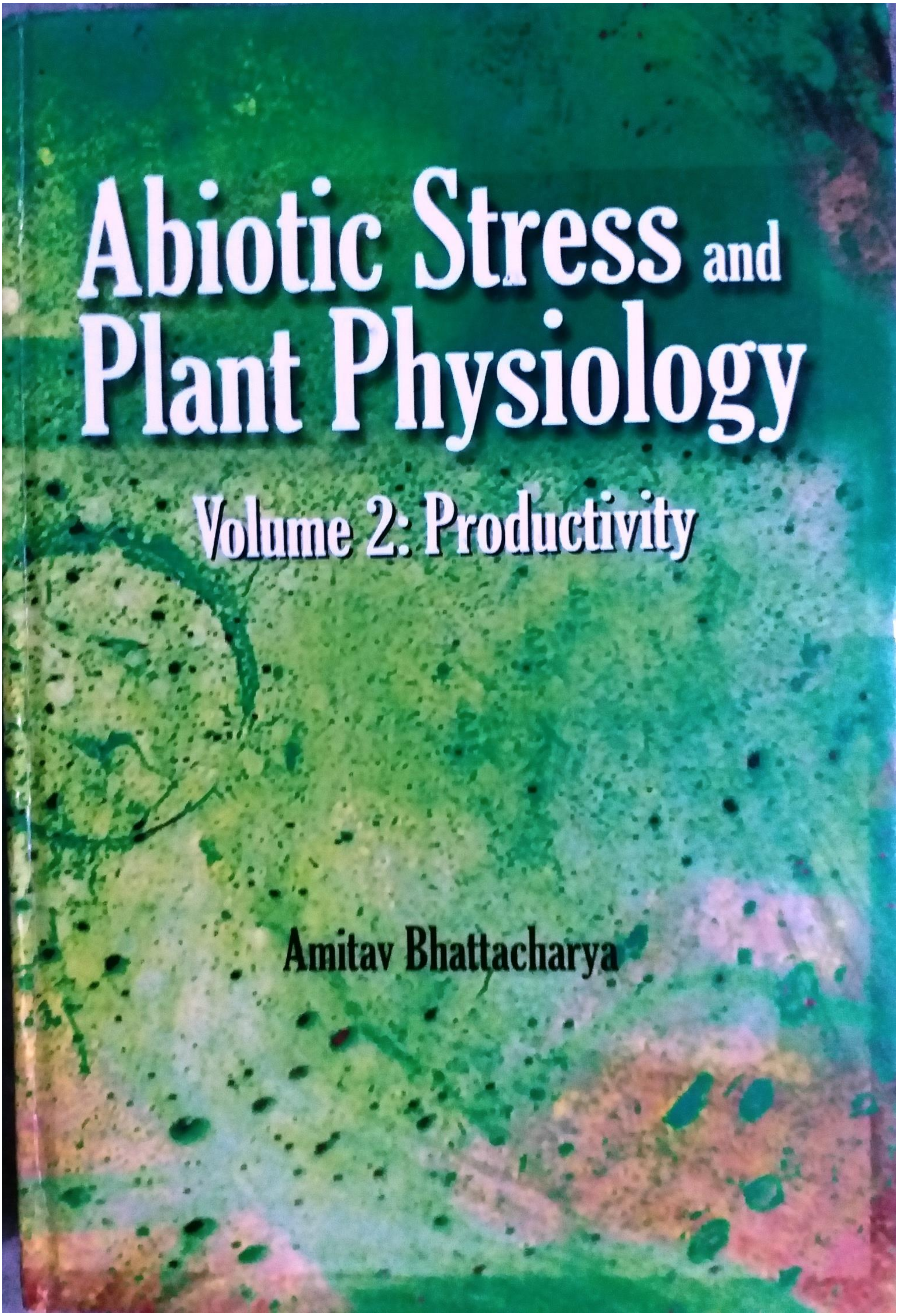
# 3

# Nitrogen Fixation Under Salinity, Low and High Temperature and Moisture

***Raj Bahadur****

*Even though our atmosphere consists of nearly 80% of $N_2$, it is the limiting element in most ecosystems. Bio-available nitrogen can enter an ecosystem via atmospheric nitrogen deposition, mostly in the form of ammonium and nitrogen oxides. The source of this nitrogen is mostly anthropogenic for these compounds, but nitrogen oxides are also formed by lightning (about 10% of nitrogen deposition on the land). However, the largest input of nitrogen comes from nitrogen fixed by micro-organisms; called diazotrophs.These can be either free living or associated to plants from, mainly, the family of the Fabaceae. Nitrogen input from legumes can be a sustainable source of nitrogen in agricultural systems. The symbiotic micro-organisms in the root nodules, the rhizobia, can take up gaseous di-nitrogen from the air and 'fix' the nitrogen into molecules that can be assimilated by the plant. In return, the plant provides the rhizobia with a carbon source in the form of di-carboxylic acids. The enzyme responsible for the nitrogen fixation, nitrogenase, is irreversibly damaged when exposed to oxygen. The plant produces leg hemoglobin, a protein related to human hemoglobin to provide the rhizobia in the nodules with oxygen, often giving functional nodules a pink color. The symbiosis first appeared around 58 million years ago when the Papilionoideae (a subfamily of the Fabaceae) underwent genome duplication. Interestingly, the genes involved in the signaling seem to be originally involved in the symbiotic relationship with mycorrhiza. Thus, it seems that only through this whole genome duplication, genes became available that were free to fulfill this new function in the communication with rhizobia, thereby enabling the legumes to start this almost unique symbiotic relationship.*

**Scientist (Plant Physiology) Narendra Dev University of Agriculture & Technology, Kumarganj Faizabad-224229 (U.P.) India*


Abiotic Stress and
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Volume 2: Productivity
Amitav Bhattacharya

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Former Principal Scientist (Plant Physiology)
Indian Institute of Pulses Research
Kanpur, India

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# 4

# Role of Growth Regulators Under Abiotic Stress

*Raj Bahadur*

*Marginal land areas will need to be used to meet the increasing requirement of future generations, especially in developing countries. These marginal areas commonly impose abiotic stresses on crops due to factors such as salinity, drought, flooding, low nutrients and aluminium or heavy metal toxicity. As a consequence, the growth and yield of crops from such areas is typically low and their quality in also poor. Endogenous plant growth regulators play an important role in regulating plant responses to abiotic stress by sensitizing growth and developmental processes. While the physiological and molecular mechanisms linked to the role of ABA and cytokinins in stress tolerance are well explained, there is growing interest to elucidate the associations of auxins, ethylene, gibberellins, brassinosteroids, and polyamines in stress tolerance mechanism and also on possible cross talk mechanism among different growth regulators during stress tolerance acquisition. Identification and characterization of the gene regulating synthesis of different endogenous growth regulators and recent progresses on hormonal signaling, mutant research, and physiological actions have provided scope for manipulating their biosynthetic pathways for developing transgenic crop plants with enhanced abiotic stress tolerance. Researches have also provided some leads in exploiting the potential of growth regulators in enhancing the resistance to abiotic stresses of crops. Plant growth-regulators (PGRs), are biochemical and chemical compounds stimulates plant growth and productivity when applied, even in small quantities at appropriate plant growth stages. These are being extensively used in agriculture to enhance the productivity in agricultural crops. Their central role in plant growth and development is through nutrient allocation and source-sink transitions while most of the plant bioregulators (PBRs) stimulate redox signaling under abiotic stress conditions.*

Department of Crop Physiology, Narendra Deva University of Agriculture & Technology Kumarganj, Faizabad- 224229

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Dr. S P Giri
Dr Gulzar Singh Sanghera
Dr. Nitendra Prakash
Yachna Shree
Dr Ekhlaque Ahmad
Dr. Ajay Tiwari
Dr. Chandra Pati Singh
Dr. Brajendra

**Dr. S P Giri**
(Rice Breeder, Crop Research Station, Masodha, NDUAT, Faizabad)

**Dr Gulzar Singh Sanghera**
(Principal Scientist (PBG) Sugarcane,PAU, Regional Research Station, Post Box 34
Kapurthala, 144601, Punjab, India)

**Dr. Nitendra Prakash**
(Rice Breeder, Crop Research Station, Ghaghraghat, NDUAT)

**Yachna Shree**
(Department of Genetics and Plant Breeding, Birsa Agricultural University Ranchi Jharkhand)

**Dr Ekhlaque Ahmad**
(Junior Scientist cum Assistant Professor
Zonal Research Station, Birsa Agricultural University, Chianki, Palamau)

**Dr. Ajay Tiwari**
(Department of Genetics and Plant Breeding, Indira Gandhi Krishi Agriculture University, Raipur-492012 (CG)- India)

**Dr. Chandra Pati Singh**
(Asstt. Rice Breeder/ Asstt. Prof.ZARS, Baribag, Ghazipur,(N.D. University of Agriculture & Technology, Kumarganj, Faizabad).

**Dr. Brajendra**
(Principal Scientist, ICAR-IIRR,Hyderabad)

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# BREEDING FOR BIOTIC STRESS

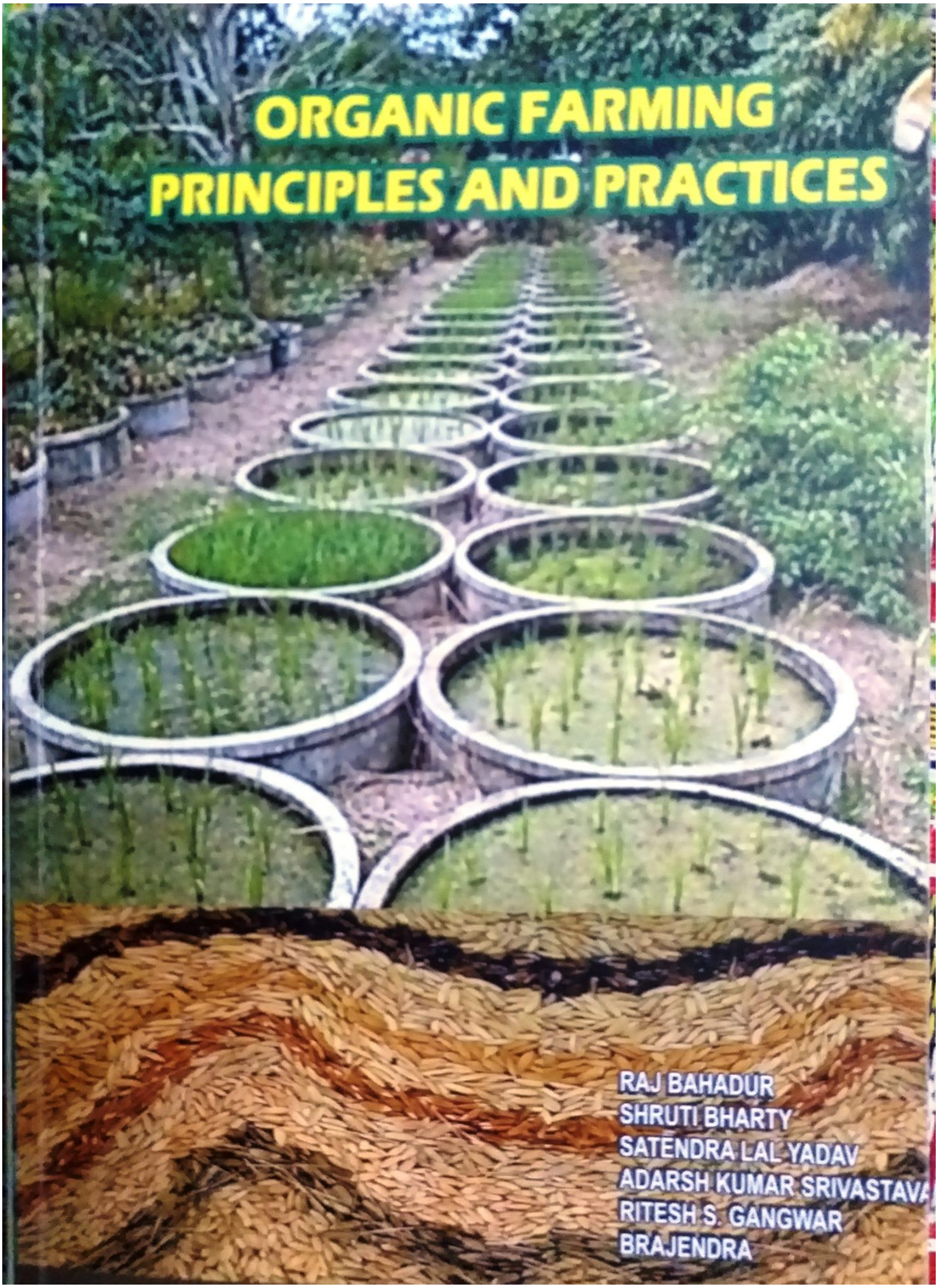
**Priyanka Rajpoot, O.P. Verma, Raj Bhadur and P.K. Singh**

Department of Genetics and Plant Breeding, N.D. University of Agriculture and Technology, Kumarganj, Faizabad 224 229, Uttar Pradesh, India

## Introduction

The long-term target of improving crops resistance and tolerance to biotic stresses is a familiar goal for breeders. Disease is an abnormal condition in the plant produced by an organism of an environmental factor. More specially, disease may be defined as' the series of invisible and visible responses of plant cell and tissues to a pathogenic microorganism of an environmental fector that result in adverse changes in form, function or integrity of plants and may lead to partial impairment or death of the plant or its parts. Several biotic and abiotic stress challenge crop productivity.

There are numerous successful examples wherein the conventional breeding approaches have done wonders some of these include the resistant varieties against the rusts and smuts in wheat,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***Authors***

**DR RAJ BAHADUR**
Associate Professor, Department of Crop Physiology
NDUAT Kumarganj, Ayodhya)

**SHRUTI BHARTY**
Central Integrated Pest Management Centre
Ranchi, Jharkhand

**DR SATENDRA LAL YADAV**
Scientist Agronomy, KVK Hazaribag

**DR. ADARSH KUMAR SRIVASTAVA**
(Scientist Agricultural Extension. Krishi Vigyan Kendra. Dhanbad)

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(SMS Agronomy,Krishi Vigyan Kendra Barabanki, NDUAT Kumarganj, Ayodhya)

**DR. BRAJENDRA**
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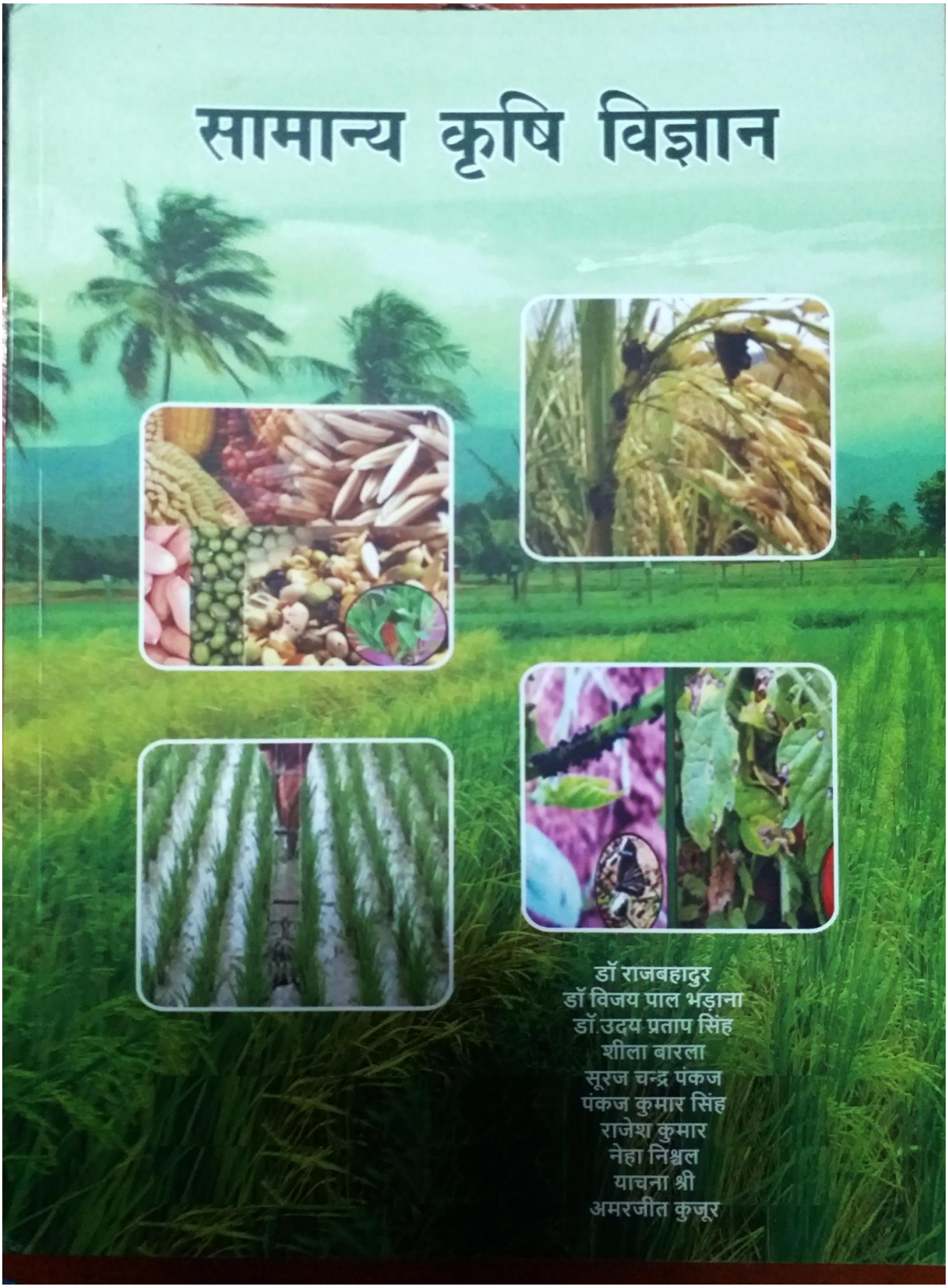
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**डॉ विजय पाल भड़ाना**
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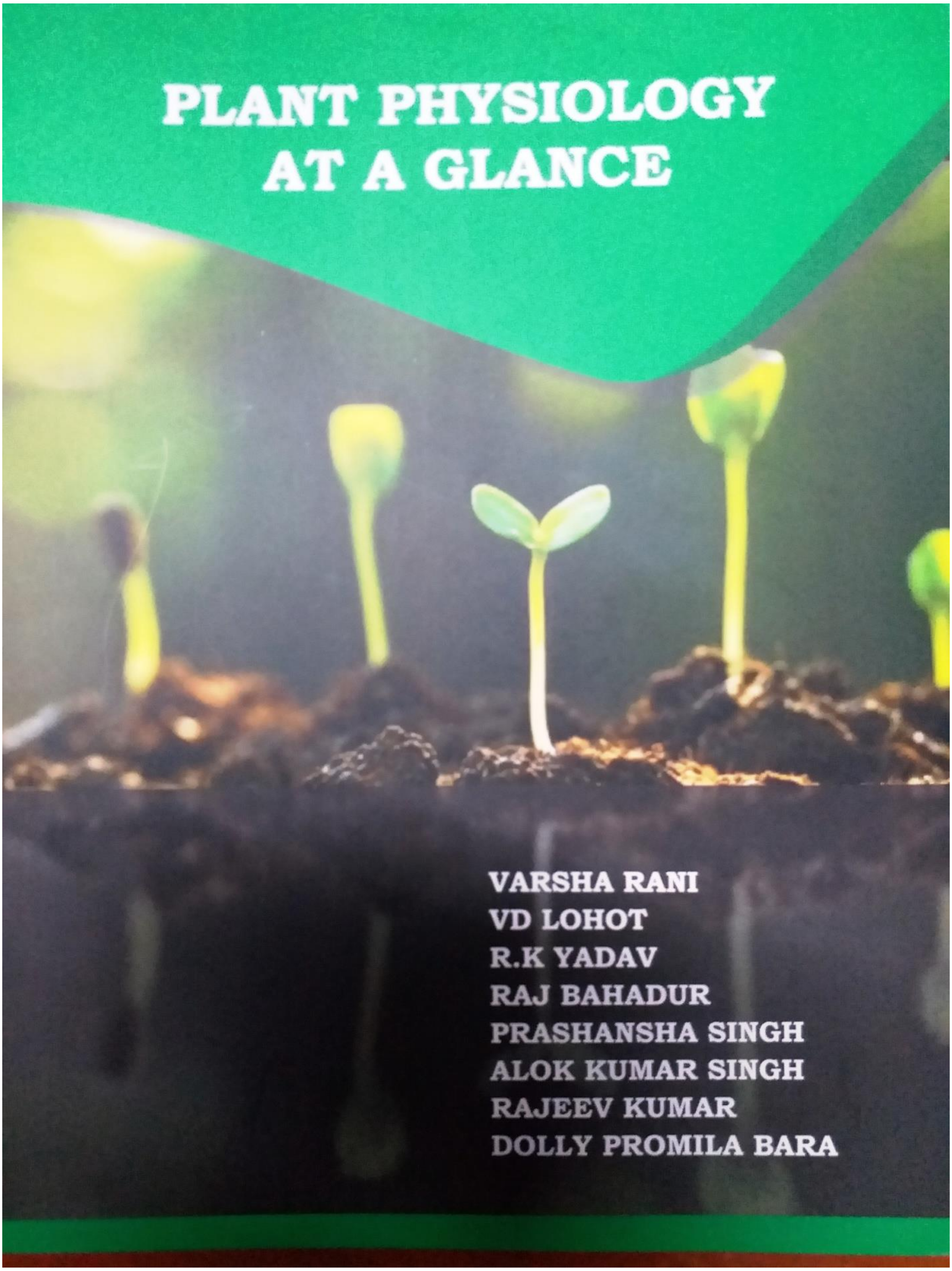
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VD LOHOT
R.K YADAV
RAJ BAHADUR
PRASHANSHA SINGH
ALOK KUMAR SINGH
RAJEEV KUMAR
DOLLY PROMILA BARA

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**Authors**

**Dr. Varsha Rani**

(Department Of Crop Physiology, Birsa Agricultural University, Ranchi)

**Dr. VD LOHOT**

(Scientist, Plant Physiology, ICAR-IINRG, Namkum, Ranchi)

**Dr R.K Yadav**

(Associate professor,Department of Crop Physiology, NDUAT faizabad)

**Dr Raj Bahadur**

(Associate Professor, Department of Crop Physiology, NDUAT Kumarganj, Ayodhya)

**Dr Prashansha Singh**

(Deptt of crop physiology,BFIT. Dehradun)

**Dr Alok Kumar Singh**

(Department of Crop Physiology, NDUAT Faizabad)

**Dr. Rajeev Kumar**

(Department of Botany, Magadh University, Bodh Gaya, Bihar)

**Dolly Promila Bara**

(St Xavier's college Ranchi,Jharkhand)

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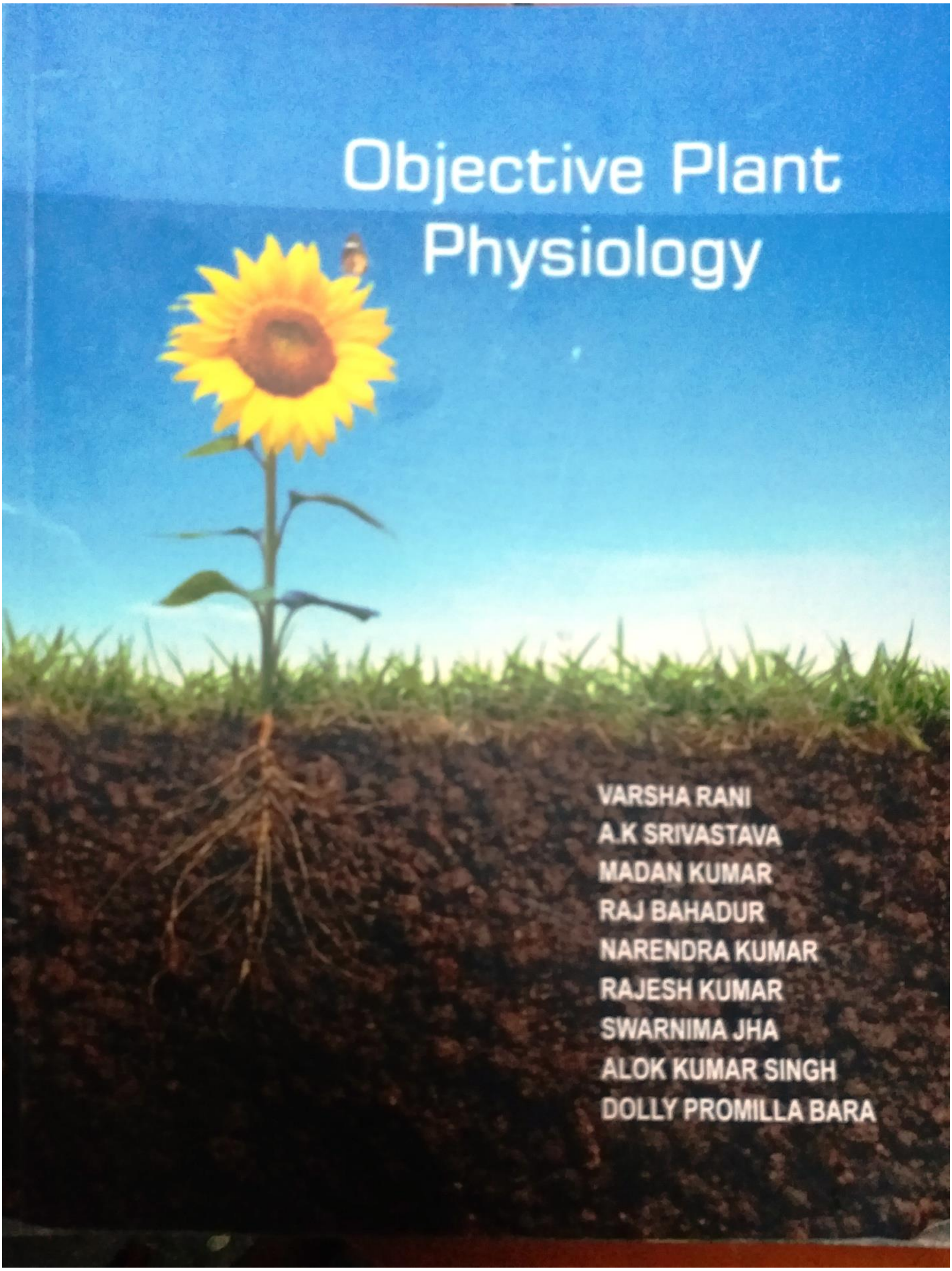
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**Authors**

**Dr. Varsha Rani**
(Assistant Professor, Department of Crop Physiology, Birsa Agricultural University, Ranchi)

**Dr. A.K Srivastava**
(Head of the Department, Department of Botany, St. Xavier's College, Ranchi)

**Dr. Madan Kumar**
(Scientist, Department of Crop Physiology, ICAR-Indian Institute of Agricultural Biotechnology, Namkum, Ranchi, India)

**Dr Raj Bahadur**
(Associate Professor, Department of Crop Physiology, NDUAT Kumarganj, Ayodhya)

**Dr. Narendra Kumar**
(Guest Assistant Professor, Department of Botany, M.B Govt P.G College, Kumaun University, Nainital, Uttarakhand)

**Rajesh Kumar**
(Department of Genetics and Plant Breeding, BAU, Ranchi)

**Swarnima Jha**
(Department of Botany, St. Xavier's College, Ranchi)

**Dr. Alok Kumar Singh**
(Department Of Crop Physiology **NDUAT Faizabad)**

**Dolly Promilla Bara**
(Department of Botany, St. Xavier's College, Ranchi)

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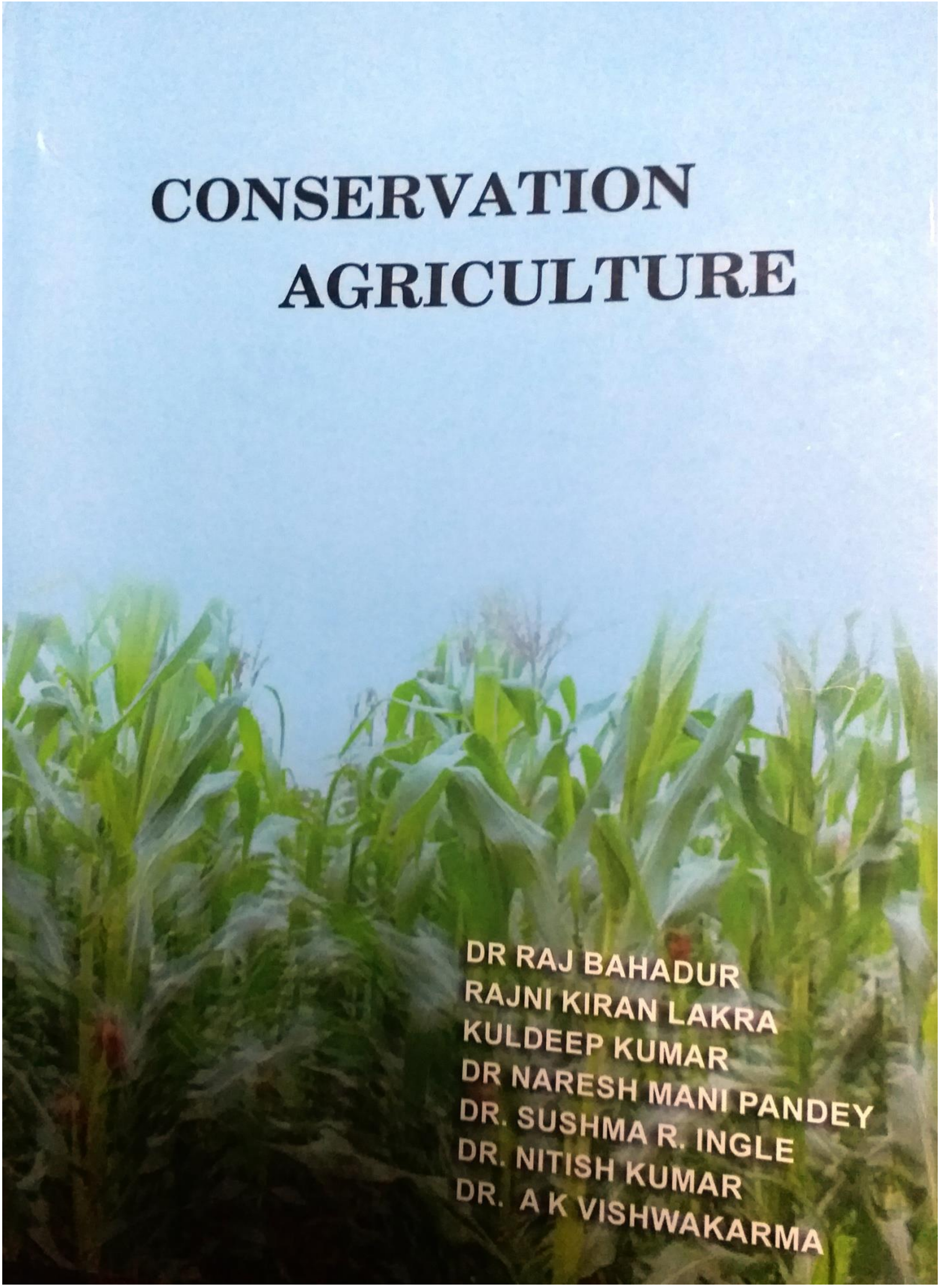
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**Dr Raj Bahadur**
Associate Professor, Department of Crop Physiology
N.D. University of Agriculture and Technology,
Kumarganj, Faizabad 224 229, Uttar Pradesh, India

**Rajni Kiran Lakra**
(Department of Agronomy, Birsa Agricultural University, Ranchi)

**Kuldeep kumar**
(Department of Agronomy, Birsa Agricultural University, Ranchi)

**Dr Naresh Mani Pandey**
Technical Assistant, Department of Agriculture,
Government of Uttar Pradesh.

**Dr. Sushma R. Ingle**
Assistant Field Officer Soil & Land Use Survey of India Ahmedabad-380007 Gujarat

**Dr. Nitish kumar**
Krishi vigyan Kendra, Aurangabad, Bihar Agricultural university, Sabour

**Dr. A K Vishwakarma**
(Principal Scientist, ICAR-IIRR, Hyderabad)

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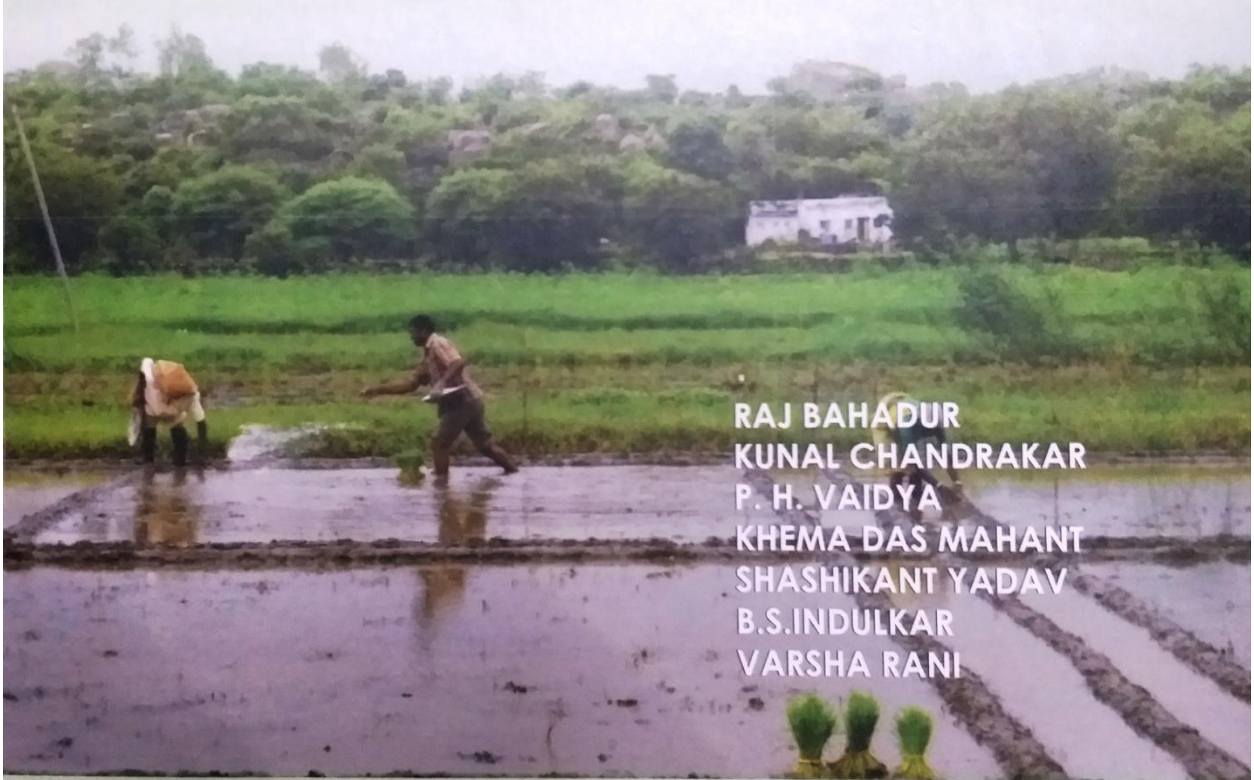

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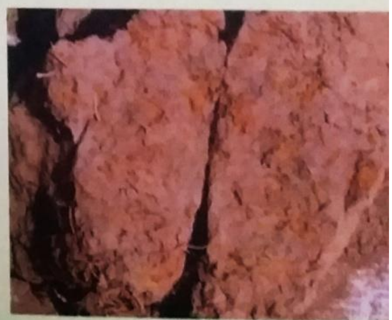

# NUTRIENT DEFICIENCIES AND THEIR MANAGEMENT

**Dr Raj Bahadur**
Associate Professor, Department of Crop Physiology
NDUAT Kumarganj, Ayodhya)

**Kunal Chandrakar**
(Subject matter Specialist, KVK,Mahasamund CG)

**Dr. P. H. Vaidya**
Associate Professor,Department of Soil Science & Agricultural Chemistry,VNMKV,Parbhani

**Khema Das Mahant**
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**Shashikant Yadav**
Senior Scientist and Head, KVK, Masodha, Ayodhya, UP)

**Dr. B.S.Indulkar**
Professor, Department of Soil Science & Agricultural Chemistry,VNMKV,Parbhani

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# THE FERTILIZER (CONTROL) ORDER 1985

Divya Singh[1], Atish Yadav[2] & Dr. Anil Kumar singh[3]

1&2 M.Sc Ag.(Agronomy) , Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Ayodhya, U.P.
3Associate Professor Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Ayodhya, U.P.

Email: atish9241yadav@gmail.com

**Abstract**

A fertilizer is a chemical product either mined or manufactured material containing one or more essential plant nutrients that are immediately or potentially available in sufficiently good amounts. Fertilizer (Control) Order, 1985 which is administered by Department of Agriculture Cooperation, Govt. of India has been issued under the Essential Commodities Act, 1955. The FCO lays, down as to what substances qualify for use as fertilizers in the soil, product-wise specifications, methods for sampling and analysis of fertilizers, procedure for obtaining license/registration as manufacture/dealer in fertilizers and conditions to be fulfilled for trading thereof, etc.

The FCO has laid down fertilizer-wise detailed specifications and no fertilizer, not meeting the said specification, can be sold in the country for agricultural purposes. It also lays down detailed procedure for sampling and analysis of each fertilizer. The Central Fertilizer Quality Control & Training Institute CFQC&TI), Faridabad and its four Regional Fertilizer Control Laboratories (RFCL) under the Department of Agriculture & Co-operation (DAC) take samples of imported fertilizers at the discharge port for analysis thereof. The States also have their own State notified quality control laboratories that analyses samples taken from field (warehouses/dealers/retailers) as well as from the manufacturing plants. Based on the analysis, the labs declare samples as standard or non-standard in terms of specifications laid down in the FCO. The sub-standard quantities are arrived at as per procedure laid down in the FCO and the copies of analysis report are sent to DAC, DOF, the concerned manufacturer/importer etc. No subsidy is payable on quantities declared as sub-standard.

**Keywords**: FCO, CFQC&TI

## Introduction:

"Fertilizer" means any substance used or intended to be used as a fertilizer of the soil and/or crop and specified in Part A of Schedule I and includes a mixture of fertilizer and special mixture of fertilisers provisional fertilizer, customized fertilizer, Bio-fertilizers specified in Schedule III and Organic fertilizers specified in Schedule IV and non-edible deoiled cake fertilizers specified in Schedule V.

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herbicide resistance will surely be developed if it is continuously used in the same area for long period. No case of herbicide resistance was reported from any of the centres of AICRP-Weed Control like UAS, Bangalore; Visva-Bharati, Sriniktan; GBPAU &T, Pantnagar and 19 other centres where the same herbicide has been used during last 10-12 years in long term permanent trial. This confirms that herbicide *per se* does not cause any mutation. Rather resistant gene is present in any of the single individual naturally in a large population over a large area. As evident from the definition of resistance, it is not due to the mutation caused by the herbicide as chemical, rather resistance appears from the selection of natural mutation that exists as a small fraction of population of resistant plants. Herbicide-resistant plant biotypes are believed to be emerging from only one or a few plants that are already present in a population. It may be a single plant in a population of several million.

Although they look morphologically identical, minor invisible genetic differences do exist among them that confer inherent resistance against herbicides. Such a minute number of resistant plants continue to grow and expand by generation over time and seasons. When we apply a herbicide continuously for consecutive seasons, the susceptible plants of a weed decrease drastically and those resistant biotypes increase gradually to the extent that we find that the herbicide appears to be ineffective at one point. At this stage, we say that the weed has developed resistance against a herbicide or in other words called selection pressure of herbicides reached to maximum (Duke *et al.* 1991).

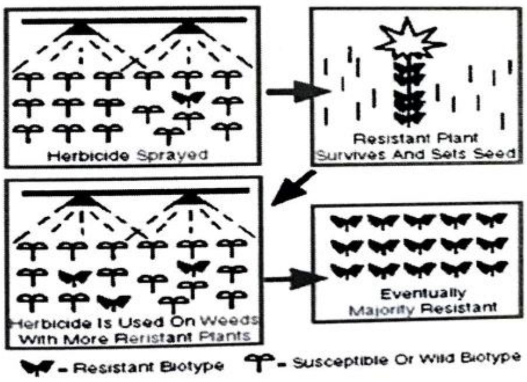


**Fig. 1 Choice for herbicide resistance occurs** (Gunsolus JL. 2008)

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Title of the Book
Agriculture and Forestry: Current Trends, Perspectives, Issues - IV

**Keywords:** Biotype, herbicide, mutation, resistance, weeds

**Contact Author**
**T. Pandiaraj**
College of Agriculture (Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya), Kotwa, Azamgarh, Uttar Pradesh

## Introduction

Like any other pests, weeds also have witnessed resistance development against herbicide whe weeds exposed to the same herbicide over many years. As illustrated in Fig. 1, while simil herbicide group or herbicide chemical is used frequent times in agricultural land, susceptib weeds are destroyed, leaving resistant weeds to mature and lead the population.

**Herbicide tolerance:** It is the ability of a species to survive and reproduce after herbici treatment. It is the ability to compensate for the damaging effect of herbicides with physiological mechanisms involved (Menalled and Dyer 2006).

**Herbicide resistance:** Refers to the inherited ability of a weed or crop biotype to survive herbicide application to which the original population was susceptible. Thus, herbicide resistan is simply an altered response to a herbicide by a species which was earlier susceptible and it is t naturally occurring, irreversible and inheritable ability of some weed biotypes within a populati (Duary and Yaduraju 1999).

## Development of resistance

Frequent use of the same group of herbicide and/ or herbicides having similar action mode i modern agriculture involving mono-cropping system and zero tillage could be the main grounds the event of herbicide resistance. It is apparent from the meaning of herbicide that if som herbicides do not show a lethal effect on a weed species, it should not wrap that resistance h developed. There are several factors governing the efficacy of chemicals in herbicide. The reaso for poor herbicide efficacy should be honestly assessed prior to concluding herbicide resistance Often, use of the term herbicide resistance is a misconception. It does not always mean th

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# Herbicide Resistance in Weeds and Its Efficient Management

**T. Pandiaraj, Prakash Yadav, D.K. Singh**
College of Agriculture (Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya), Kotwa, Azamgarh, Uttar Pradesh

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**Abstract:**

As a management of weed is a vital constituent of agronomic methods of crop cultivation, chemical method of weed (herbicide) control is used greatly to harvest maximum yield. This herbicide has transformed the management of weed in global agriculture. However, there are some demerits like herbicide resistance, weed shift flora and environmental pollution. Of which, herbicide resistance is a major concern in the world agriculture. In the last three decades, many dozens of herbicide resistant weeds were reported from all over the world. Most of them are resistance to triazine group of herbicides. Herbicide resistance is considered global phenomenon and number of resistant weeds biotypes is rising at an alarming rate. It is necessary to accurately realize the herbicide resistance, its evolution as well as mode and mechanism of resistance to deal the problem. The use of herbicides having different sites of action and herbicide rotation in weed management programme may prevent or delay the development of herbicide resistance in weed. The most successful long-term planning for management of weed resistance is the adoption of Integrated Weed Management (IWM) with different suitable methods in a combined manner and also provides positive beneficial towards the ecological standpoint. Given the challenges in management of herbicide-resistant weeds, IWM will possibly play a significant role in enhancing future food security for an increasing world population. However, fundamental research and facilities are essential for healthy perceptive of herbicide resistance and its management.

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# Chapter 16

# Role of Weather and Climatic Data for Agricultural Crop Production and Protection

**Jitendra Singh[1], Susmita Das[1], D.K. Das[2] and T. Pandiaraj[3]**
[1]Central Tasar Research and Training Institute, Central Silk Board, Ranchi
[2]Division of Agricultural Physics, IARI, New Delhi
[3]College of Agriculture Campus (ANDUAT., Kumarganj, Ayodhya), Azamgarh, U.P.
***Corresponding author:** jitendrasingh.iari@gmail.com

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**Abstract**

Weather and climate play an important role for selection of all the farm operations from sowing to harvesting in agriculture. The characterization of the climatic parameters of any location would reveal the selection of proper technologies to exploits the favorable agro-climatic condition and climatic requirements for optimal growth, development and yield of crops, incidence, multiplication and spread of pests and diseases and susceptibility to weather-induced stresses and affliction by pests and diseases vary amongst crops, with the same crop with the varieties and with the same crop variety with its growth stages. Decision on land use and management, selecting plants, and crop management practices such as irrigation, pest and disease control and crop-weather relationships should not be made without knowing climate conditions. Increased temperature causes migration of insect species towards higher latitudes, while in the tropics higher temperatures might adversely affect specific pest species. The impacts of climate change can be positive, negative or neutral, since these changes can decrease, increase or have no impact on insect pests and diseases, depending on specific location of each region or period. web enabled weather-based decision support system is an important component of Integrated pest management which not only enhances the production of agricultural crop but also reduces the pesticides application for management of pest.

**Keywords**: Climate Change, Crop Pests, Decision Support System, Forewarning.

## Introduction

Climate is defined as the prevalent pattern of weather observed over a prolonged period of time. Climate variables (e.g., temperature, precipitation, wind speed) can be time-averaged on a daily, monthly, yearly or decade basis. Agricultural crop production is influenced by weather and climatic events. The benefits of understanding these events help in the establishment of techniques. The effect of climatic parameters on agricultural production are given below.

### 1. Temperature

Temperature is an important weather parameter because the information generated from it can help planning of agricultural activities such as date of sowing, flowering, physical maturity and harvesting

# Chapter 12

# Precision Nitrogen Management in Rice Crop through Chlorophyll Meter (SPAD) in Rice-Wheat Cropping System under Resource Conserving Technology

**T. Pandiaraj* and D. K. Singh**
College of Agriculture Campus (ANDUAT, Kumarganj, Ayodhya), Kotwa, Azamgarh, U.P.
***Corresponding author:** pandianeagro@gmail.com

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**Abstract**

The human population continues to grow steadily with the shrinking resources being used for agricultural production situates great challenge against Indian agricultural system to attain food and environmental security. The rice-wheat cropping system (RWCS) is a major production system in the Indo-Gangetic Plains of India covering nearly 10.5 million hectares. In India, more than 90% area of the RW area is irrigated and is facing yield stagnation, soil degradation, declining ground water table and air pollution. Conventional agricultural practices that rely heavily on blanket fertilizer recommendation, eventually leading to deteriorated partial factor productivity and N use efficiency. We investigated the effect of SPAD-based N-management on productivity and N use efficiency of rice under resource conservation technology practices. The treatments consisted of two tillage (direct seeded rice and transplanted rice) and two levels of mulching (no mulch and paddy straw mulch) in main plots and two levels of fertility (100% RDF and 75% RDF) in sub-plot. The experiment was laid out in factorial-split plot design, replicated thrice with a single plot size of 21.6 m$^2$. The results revealed that SPAD value an index for leaf chlorophyll content was observed higher in TPR compared to DSR. Similarly, both mulch and 100% RDF application recorded superior for leaf chlorophyll content of rice. Hence, the N is substantially required to DSR method of establishment over TPR.

**Keywords**: Direct Seeded, Resource Conservation Technology, Rice, SPAD, Transplanted Rice.

## Introduction

The main staple food crops which have been cultivated and consumed worldwide in different countries are the rice (*Oryza sativa* L.) and wheat (*Triticum aestivum* L.). Together, the two crops contribute 80% of the total cereal production in the south Asian countries (Timsina & Connor, 2001). The rice-wheat cropping system is the most widely adopted production system in Asian countries and worldwide. Rice (*Oryza Sativa* L.) and wheat (*Triticum aestivum* L.) are grown in sequence over 26 m ha of South and East Asia to meet the food demands of rapidly expanding human population and brings together conflicting and complementary practices (Timsina and Connor, 2001). This system covers about 12 m ha in India (Tripathi *et al.*, 2011) and is the backbone of country's food

# Chapter 11

# Tasar Sericulture: Impact of INM on Nutritional Status of Leaf

**Soma Karmakar[1]*, A.K. Srivastava[1] and T. Pandiaraj[2]**
[1]University Department of Botany, Ranchi University, Ranchi, India
[2]College of Agriculture, Azamgarh (ANDUA&T., Kumarganj, Ayodhya), U.P. India
***Corresponding author:** smarten436@gmail.com

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**Abstract**

*Terminalia tomentosa* is a primary food plant of *Antheraea mylitta* Drury, a polyphagous insect of Saturniidae family which is exploited commercially for the production of silk. Good quality of silk production depends on the nutrient of leaf. So, to optimize the growth and nutrient of leaf, Integrated Nutrient Management Practices (INM) has been used to increase soil fertility and to supply plant nutrient at an optimum. In order to evaluate the effect of INM practices on the different leaf parameters of *Terminalia tomentosa* food plant of *Antheraea mylitta* Drury, an experiment in Randomized Complete Block Design consisting of 20 treatments with three replication was conducted at Central Tasar Research & Training Institute, Nagri, Ranchi. Results revealed that the application of INM treatments are significant on various leaf parameters. Highest single leaf length and breadth mean was observed in $T_{19}$ (23.29cm; 11.96cm, respectively) which was applied with 75% RDF through fertilizer+25% through vermicompost+ *Azotobacter*+PSB. Weight of single leaf was found to be highest in $T_{13}$ (5.19g). The number of leaves was recorded highest in $T_{19}$ (1892). The fresh leaf yield ranged from 1617.32 - 5208.22g with a mean of 4085.72g. The treatment $T_{19}$ (5032.1g) recorded the highest fresh leaf yield. Highest total N was recorded as 1.65% in $T_9$ which was applied with 50% RDF+ Phosphorus Solubilizing Bacteria followed by $T_{19}$ (1.63%). Highest total P was observed in $T_4$ (0.97%) over the control and total K was recorded highest in $T_7$ (1.8%) followed by $T_8$ (1.74%). The crude protein was recorded highest in $T_9$ (10.3324%) followed by $T_{19}$ (10.157%) and total carbohydrate recorded highest in $T_4$ (222.5 mg/g) followed by $T_{20}$ (182.9mg/g). The study indicates that INM practices significantly influenced the different parameters.

**Keywords:** *Azotobacter*, *Antheraea mylitta*, Crude protein, Moisture, Vermicompost.

## Introduction

Tussar silk in sanskrit is known as "Kosa Silk" (Nakpathom *et al.*, 2009; Pilanee Vaithanomsat *et al.*,2008) and is valued for its rich texture and natural deep gold colour (Vigneswaran *et al.*, 2015). Aboriginals residing in the central India plateau mainly in the states of Jharkhand, Bihar, Chhattisgarh, Madhya Pradesh, Orissa and West Bengal extending Uttar Pradesh, Andhra Pradesh and Maharashtra practices this old age tradition of Tasar culture (Sinha, 2003) i.e., rearing of Tasar silkworm and other activities of silk production. Tropical Tasar is produced by the larvae of yellow orange moth known as *Antheraea mylitta* Drury (Roychoudhury, 2006). *Antheraea mylitta* the wild

# Chapter 3

# The Need of Precision Agriculture for Indian Scenario

**S. Sathya[1*] and T. Pandiaraj[2]**
[1]Adhi Parasakthi Agricultural College (Affiliated to Tamil Nadu Agricultural University, Coimbatore), Kalavai, Vellore District, Tamil Nadu
[2]College of Agriculture (ANDUAT, Kumarganj, Ayodhya), Kotwa, Azamgarh, Uttar Pradesh.
***Corresponding Author E-mail:** sathiyatryguy@gmail.com

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**Abstract**

While agriculture in India has achieved grain self-sufficiency but the production is, resource intensive, cereal centric and regionally biased. The resource intensive ways of Indian agriculture have raised serious sustainability issues too. Precision farming has a most prominent technology to improve the food grain production in terms of quantity and quality. Precision farming or precision agriculture is about doing the right thing, in the right place, in the right way, at the right time. Managing crop production inputs such as water, seed, fertilizer etc., to increase yield, quality, profit, reduce waste and becomes eco-friendly. This has wide implications for economic development, urbanization and energy-use for such nations. Transplantation of High-tech PA technologies developed from advanced countries to the developing countries posed a real dilemma for scientists for making them compatible to the needs of developing countries. Application of balanced soft and hard PA technologies based on the need of specific domestic conditions of a country is expected to eventually prove suitable for developing countries also. Therefore, the objective of this paper is to find out feasibility and scope for adoption of PA in India.

**Keywords:** Monitoring, Remote Sensing, Scouting, Sensor, VRT.

## Indian Agriculture: A Scenario

With a population of 1.27 billion, India is the world's second most populous country. It is the seventh largest country in the world with an area of 3.288 million sq kms. With the highest mountain range in the world, the Himalayas to its North, the Thar Desert to its West, the Gangetic delta to its East and the Deccan Plateau in the South, the country is home to vast agro-ecological diversity. India is the world's largest producer of milk, pulses and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, livestock and plantation crops.

India's climate varies from humid and dry tropical in the south to temperate alpine in the northern reaches and has a great diversity of ecosystems. Four out of the 34 global biodiversity hotspots and 15 WWF global 200 eco-regions fall fully or partly within India. Having only 2.4

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# *Chapter 25*

# Physiological Disorder/Nutrient Deficiency in Fruit Crops

***H.K. Singh*[1], *Abhishek Singh*[2] *and Rahul Singh Raghuvanshi*[2]**

***[1]Department of Fruit Science, College of Horticulture and Forestry,***
***[2]Department of Plant Pathology, College of Agriculture,***
***Narendra Deva University of Agriculture and Technology,***
***Kumarganj, Ayodhya – 224 229, U.P.***

## Introduction

A shortage of plant nutrients or the presence of nutrients at dangerous amounts to the plant causes physiological disease/nutrient deficit. They interfere with the plant's ability to operate. Because the plant displays disease-like symptoms while suffering from nutritional or physiological abnormalities, nutrient disorders are frequently misdiagnosed as diseases. A decline in yield may be caused by nutrient deficiencies. When a balanced and appropriate supply of nutrients is absent, fruit crops perform poorly. It's critical that plants have access to all of the key nutrients they require. Until the nutrient is fully delivered, a low supply of just one of them will inhibit growth. Physiological and nutritional issues have a higher impact on the yield as well as the quality of fruit crops. Crop diseases are caused by disturbances in plant metabolic activity caused by an excess or lack of environmental variables such as temperature, light, aeration, and nutritional imbalances. Micronutrient deficit creates far more problems in fruit crops than macronutrient deficiency. With the reduced

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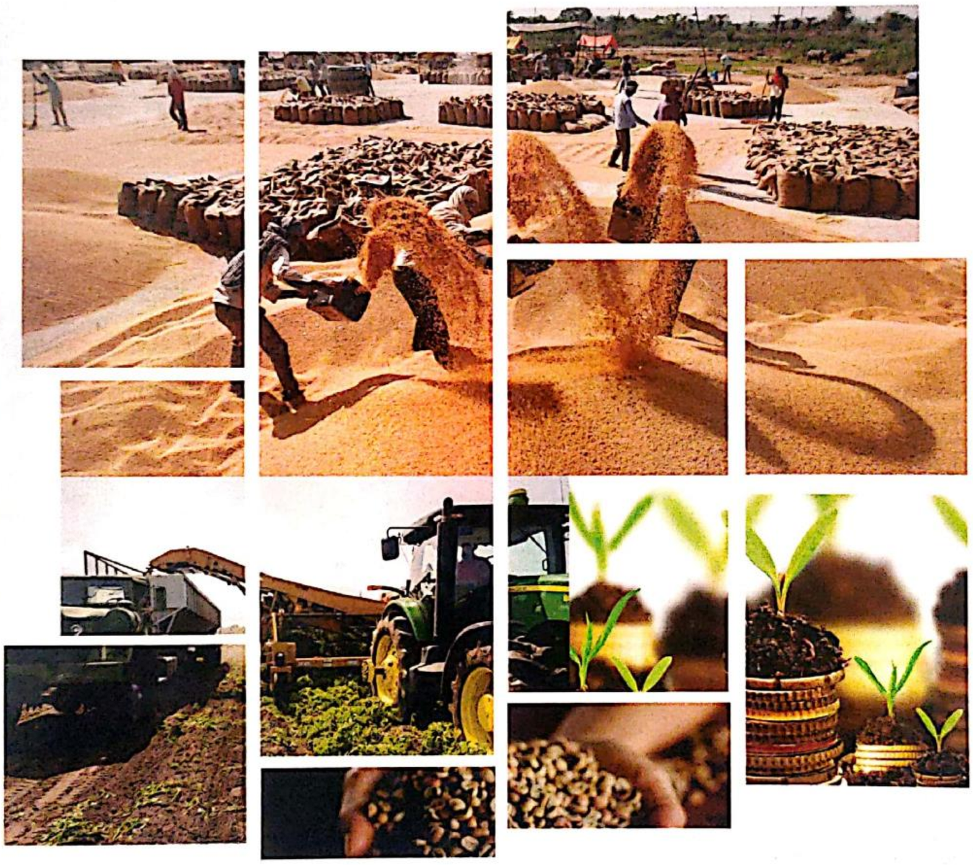

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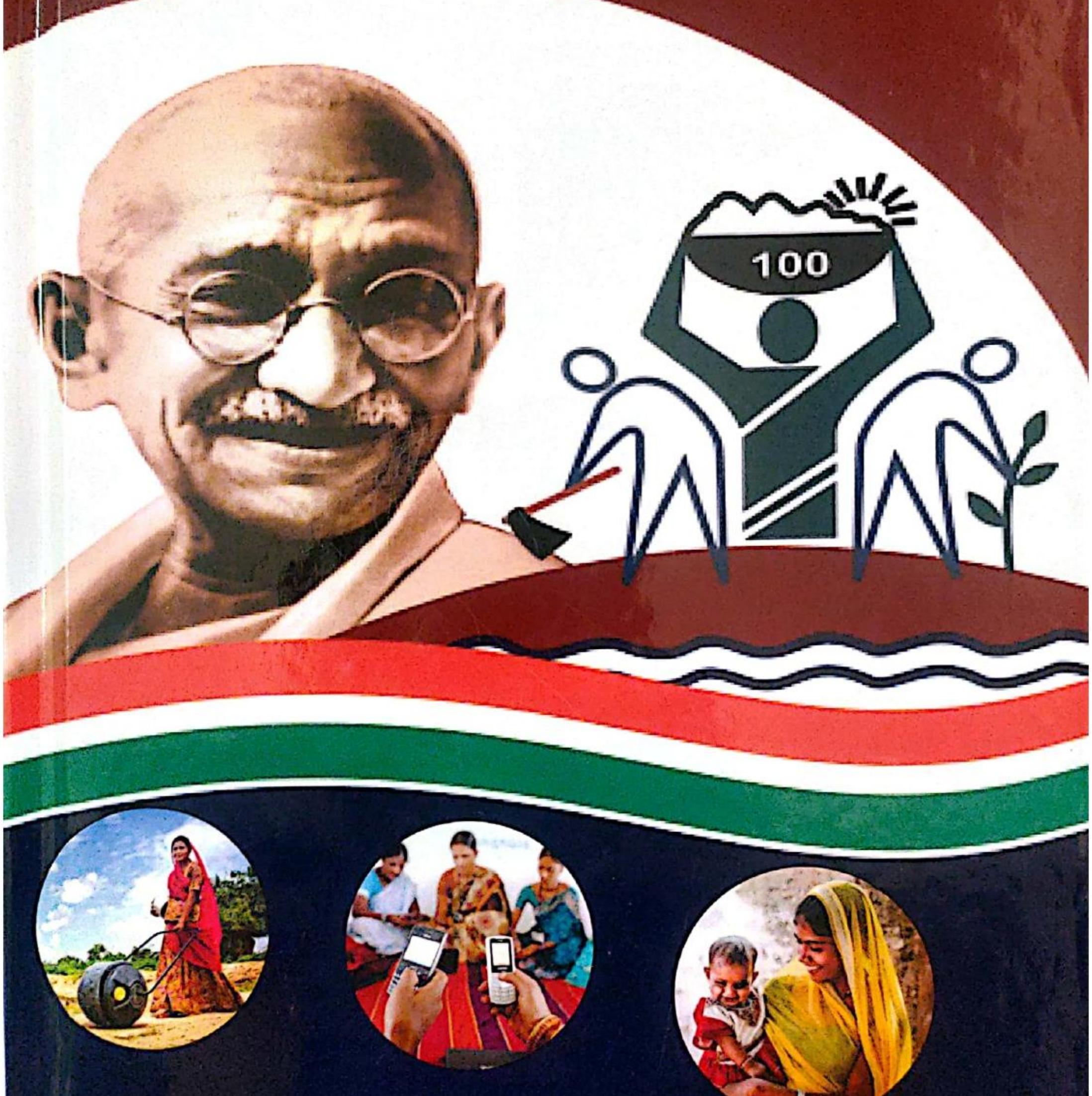



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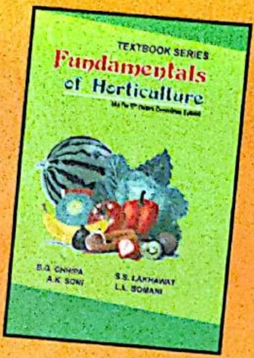

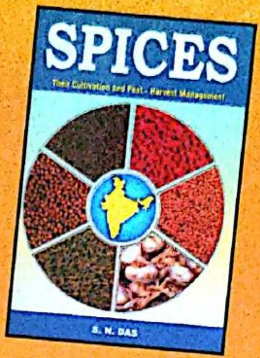

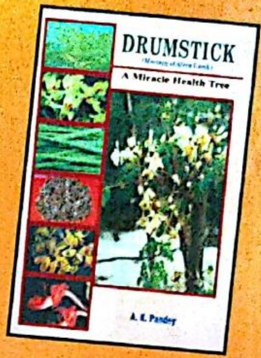

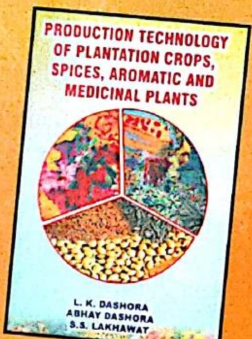

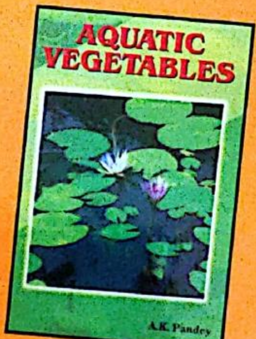

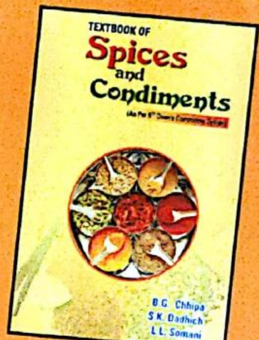

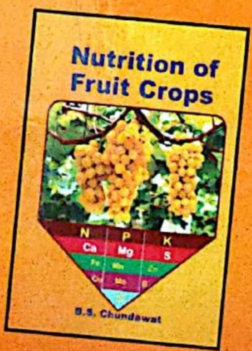

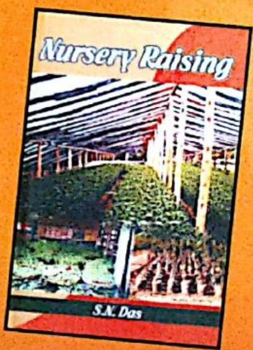

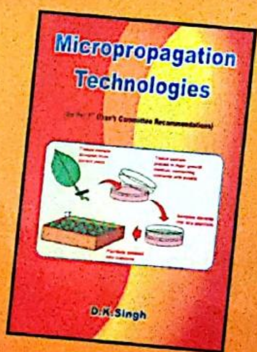


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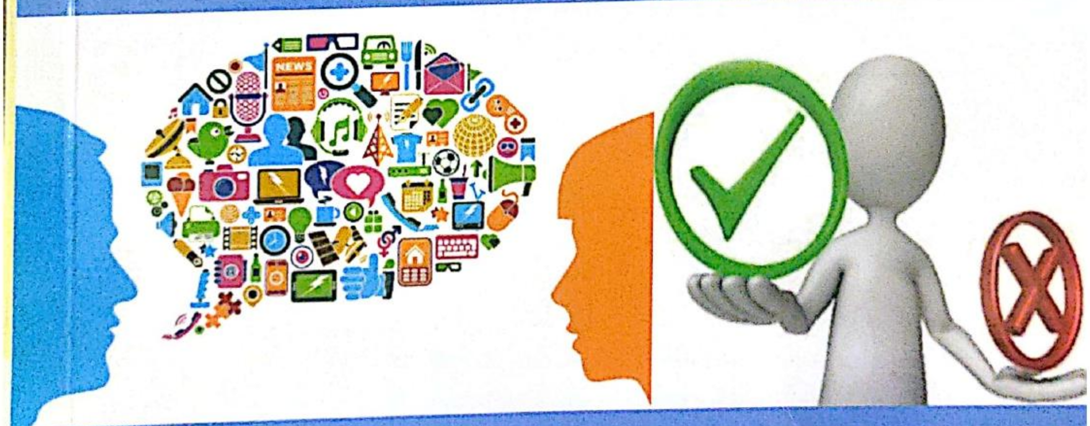

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# Text Book
# on
# Fundamentals of Extension Education

• F. L. Sharma • N. R. Meena • J. S. Manhas

Text Book on Fundamentals of Extension Education
• Sharma • Manhas
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## About the Author

**Dr. F. L. Sharma** is presently working as Professor (Extension Education) in the Faculty of Agriculture, Bhupal Nobels' University, Udaipur (Rajasthan). Dr. Sharma served at Rajasthan College of Agriculture, MPUAT, Udaipur more than 30 years in various capacities namely Assistant professor, Associate professor, Professor, Head of Department, Chief Warden, Incharge of Central Library, Incharge of RAWE and Entrepreneurship development cell of the college. Dr. Sharma was bestowed with Gold Medal and University Best Teacher Award. He has guided 19 Ph.D. and 20 M.Sc. students in the field of Extension Education. Dr. Sharma served as Chairman and members of several committees constituted at college as well as University level.

Dr. Sharma authored six books and published more than 170 research papers besides a number of farm publications in the journals and magazines of repute. He is the life member of six professional societies of Extension Education and also worked as Co-PI in NAIP Research Project funded by ICAR. He was the member of Board of studies for Faculty of Agriculture, MPUAT, Udaipur from 2000 to 2012.

He has attended several seminars, conferences, workshops, trainings, webinars organized at National and International Level. He has also received best oral and poster presentation awards in National and International Seminars and conferences organized by various organizations.

**Dr. N. R. Meena** is an Assistant Professor, Department of Extension Education, College of Agriculture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh. Dr. Meena has 5 years experience in teaching, Research and Extension at the University level. He authored one book and published more than 20 research papers in the National & International Journals.

He has awarded two Young Scientists awards from Indian Society of Extension Education, ICAR, New Delhi and one Excellence Teaching award from Astha Foundation, Meerut, UP. He also received best Ph.D. thesis award.

**Dr. J. S. Manhas** is working as Assistant Professor (Extension Education) in the Division of Agricultural Extension Education, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu (SKUAST-J), Chatha, UT of Jammu &Kashmir. He did his M.Sc. and Ph.D. in Extension Education at MPUAT, Udaipur, Rajasthan and was awarded University Gold Medal in M.Sc. (Agriculture) Extension Education. He has thirteen years experience in teaching and research and published 50 research papers. He has guided two M.Sc. (Agri.) students. He has also contributed three book chapters in different books. He is a member of eight professional societies. Dr. J.S. Manhas is a recipient of ISEE Fellow Award and Young Scientist Award of Indian Society of Extension Education (ISEE), IARI, New Delhi for his significant literary contribution. Besides, he has three best paper presentation awards to his credit. He has qualified NET of ICAR, New Delhi.

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# Chapter - 2

## Selection of Most Promising Genotypes of Indian Mustard (*Brassica juncea* L. Czern & Coss.) for Best Seed Quality Parameters

S.C. Vimal, J.K. Maurya, Satish Kumar Chakravarti and V.B. Singh

**Abstract**

Oilseed crops have been the backbone of agricultural economy of India from time immemorial. The important oilseed crops grown in the country in order of importance are Groundnut, Rapeseed-Mustard, Sesame, Linseed, Safflower, Castor, Sunflower and Niger. India is one of the leading oilseeds producing country in the world and it is a rich center of diversity for rapeseed-mustard. India ranks first in the world in area and production for groundnut, castor, sesame and niger while second in safflower and third in rapeseed-mustard and linseed in spite of large possibilities for cultivation, vast area and agro-climatic conditions, we import >40% of annual edible oils and having low productivity as compared to world average. The genotypes mentioned serve as promising parents/donors for seed vigour index and others characters for which they showed high performance. Similarly, some other genotypes indicating very high mean performance for other attributes can be used as donors for improving these seed quality parameters in a component breeding approach even if they have medium or low vigour index.

**Keywords:** Indian mustard, genotypes, seed vigour, seed quality parameters

**Introduction**

Botanically, the genus *Brassica* has six species (*B. nigra, B. oleracea B. campestris, B. carinata, B. juncea and B. napus)* among them first three species are elementary and diploid with 2n=16, 18 and 20 and other three species are tetraploid having 2n=34, 36 and 38. All these crops are grown under wide range of agro-climatic conditions. Indian mustard or brown mustard (rai) was originally introduced from China into north- eastern India, from where it had spread to Afghanistan via Punjab, eastern Afghanistan, together with adjoining north- western India. It is predominantly cultivated

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# Chapter - 3

## Secondary Metabolites in Plants: A Defensive System

S.K. Vishwakarma, R.N. Kewat, R.K. Yadav, S.C. Vimal and S.K. Chakravarti

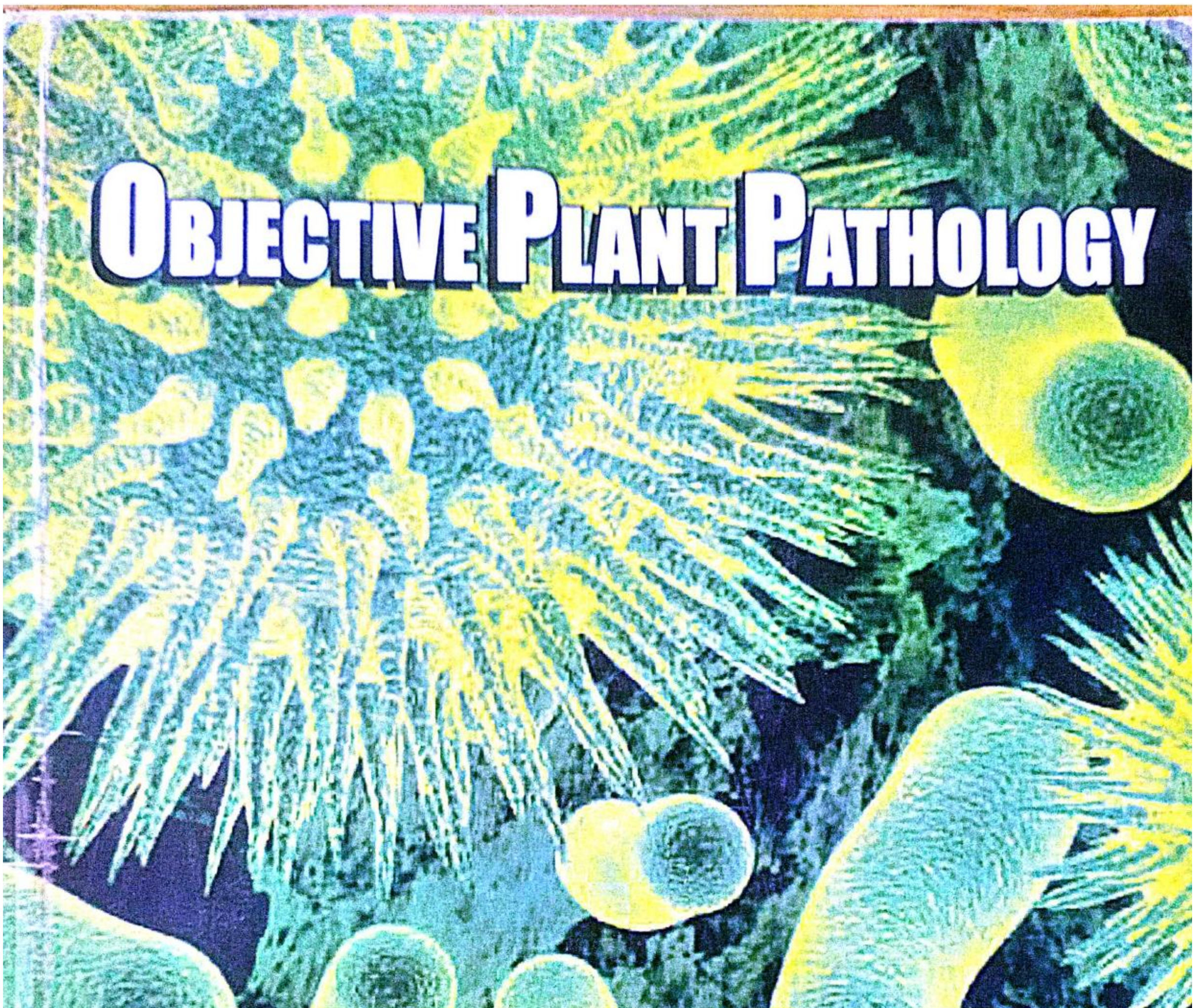
**Abstract**

In all natural habitats, plants are surrounded by an enormous number of potential enemies (biotic) and various kinds of abiotic environmental stress. Nearly all ecosystems contain a wide variety of bacteria, viruses, fungi, nematodes, mites, insects, mammals and other herbivorous animals, greatly responsible for heavy reduction in crop productivity. By their nature, plants protect themselves by producing some compounds called as secondary metabolites. Secondary metabolites, including terpenes, phenolics, nitrogen (N) and sulphur (S) containing compounds, defend plants against a variety of herbivores and pathogenic microorganisms as well as various kinds of abiotic stresses. This represents an overview about some of the mechanisms by which plants protect themselves against herbivory, pathogenic microbes and various abiotic stresses as well as specific plant responses to pathogen attack, the genetic control of host-pathogen interactions. Therefore, additional research in area of natural pesticides development is needed in current scenario. In the long term, it will probably be possible to generate gene cassettes for complete pathways, which could then be used for production of valuable defensive secondary metabolites in bioreactors or for metabolic engineering of crop plants. This will improve their resistance against herbivores and microbial pathogens as well as various environmental stresses.

**Keywords:** Plants, metabolites, defensive system, biotic stress, abiotic stress

**Introduction**

In natural systems, plants face a plethora of antagonists and thus posses a myriad of defense and have evolved multiple defense mechanisms by which they are able to cope with various kinds of biotic and abiotic stress. Generally, it is difficult to assign a change in the physiology of metabolism of the crop to a specific stress factor as normally a complex variety of various stress factors affects the plant simultaneously. However, there are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**V.Laxman**
(SRF , Soil science, ICAR-IIRR, Hyderabad)

**Dr. Subhash Chandra**
(Plant Pathologist. Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya (UP)

**Miss Diksha Vishwakarma**
(Teaching Associate, Deptt. Soil Science & Agricultural Chemistry,RAK College of Agriculture Sehore- 466001 (M.P.)

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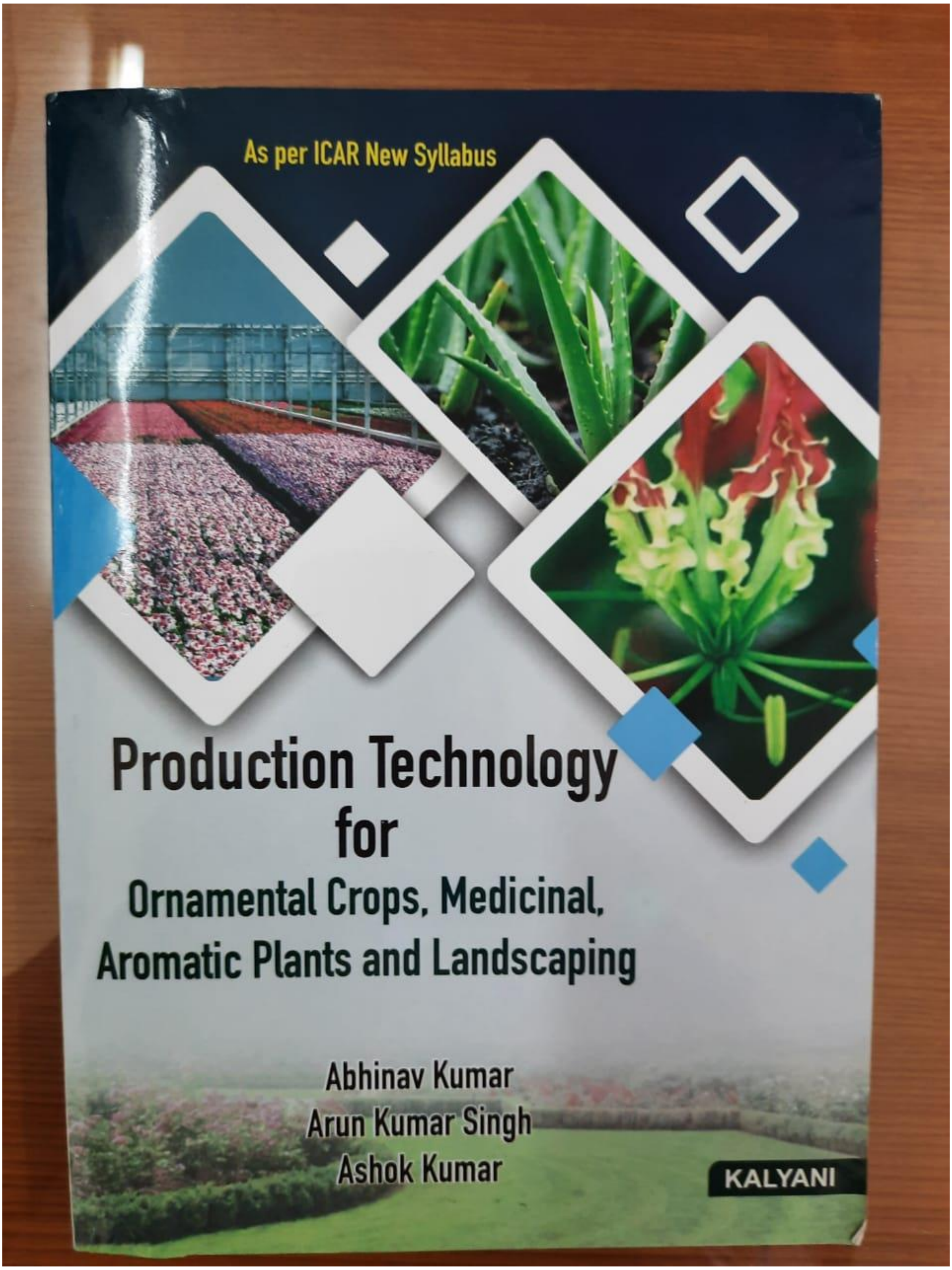
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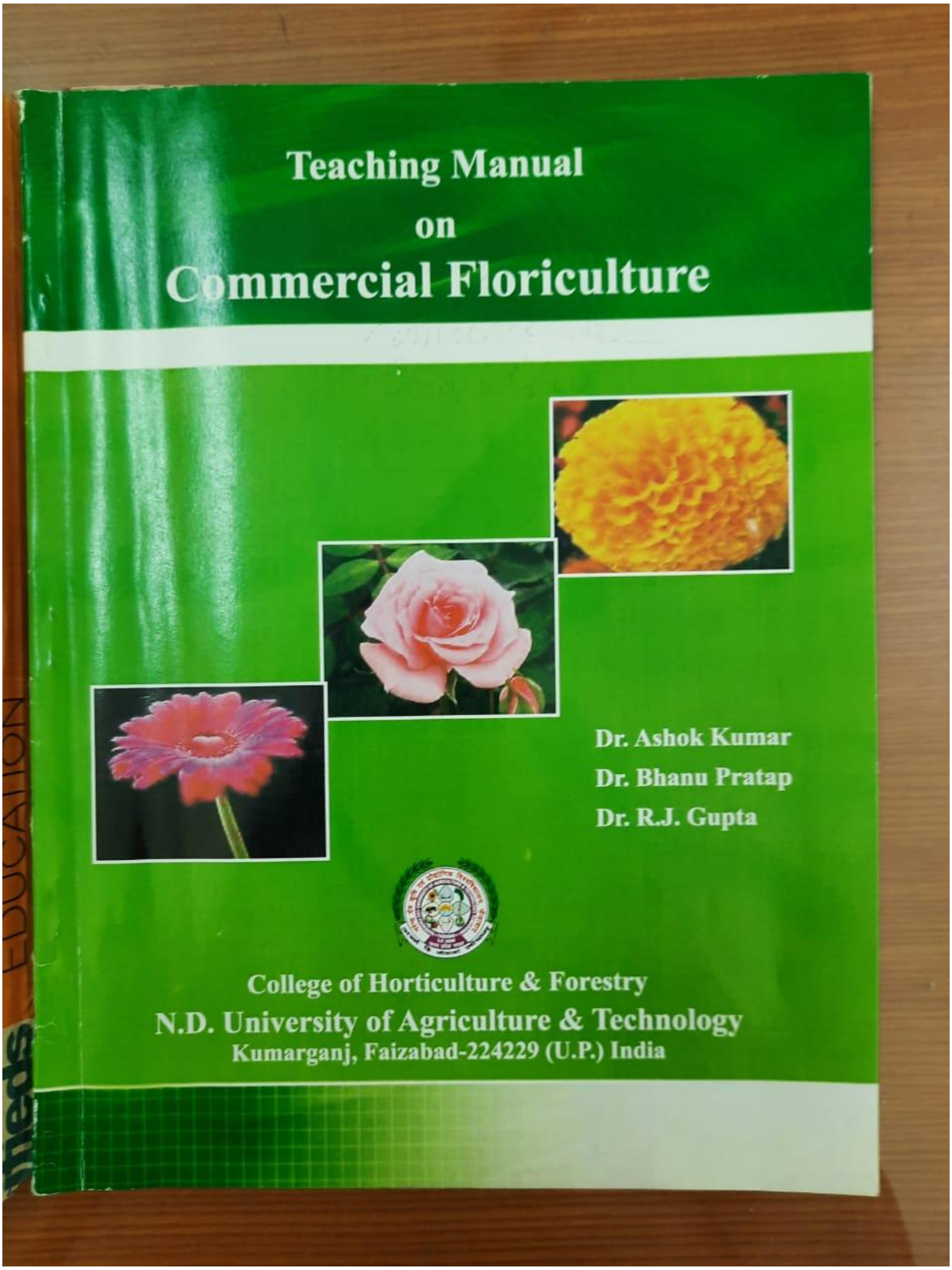
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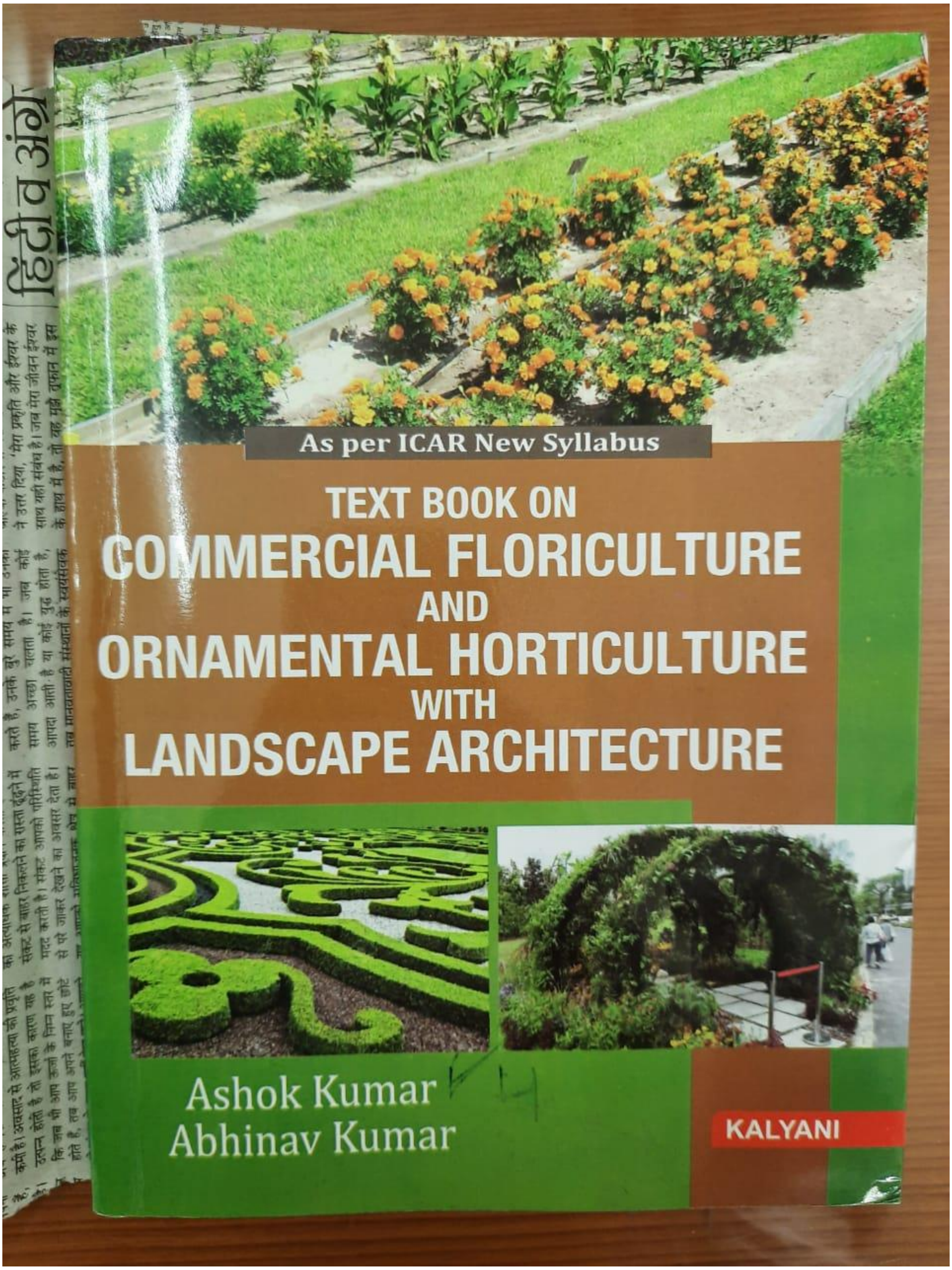

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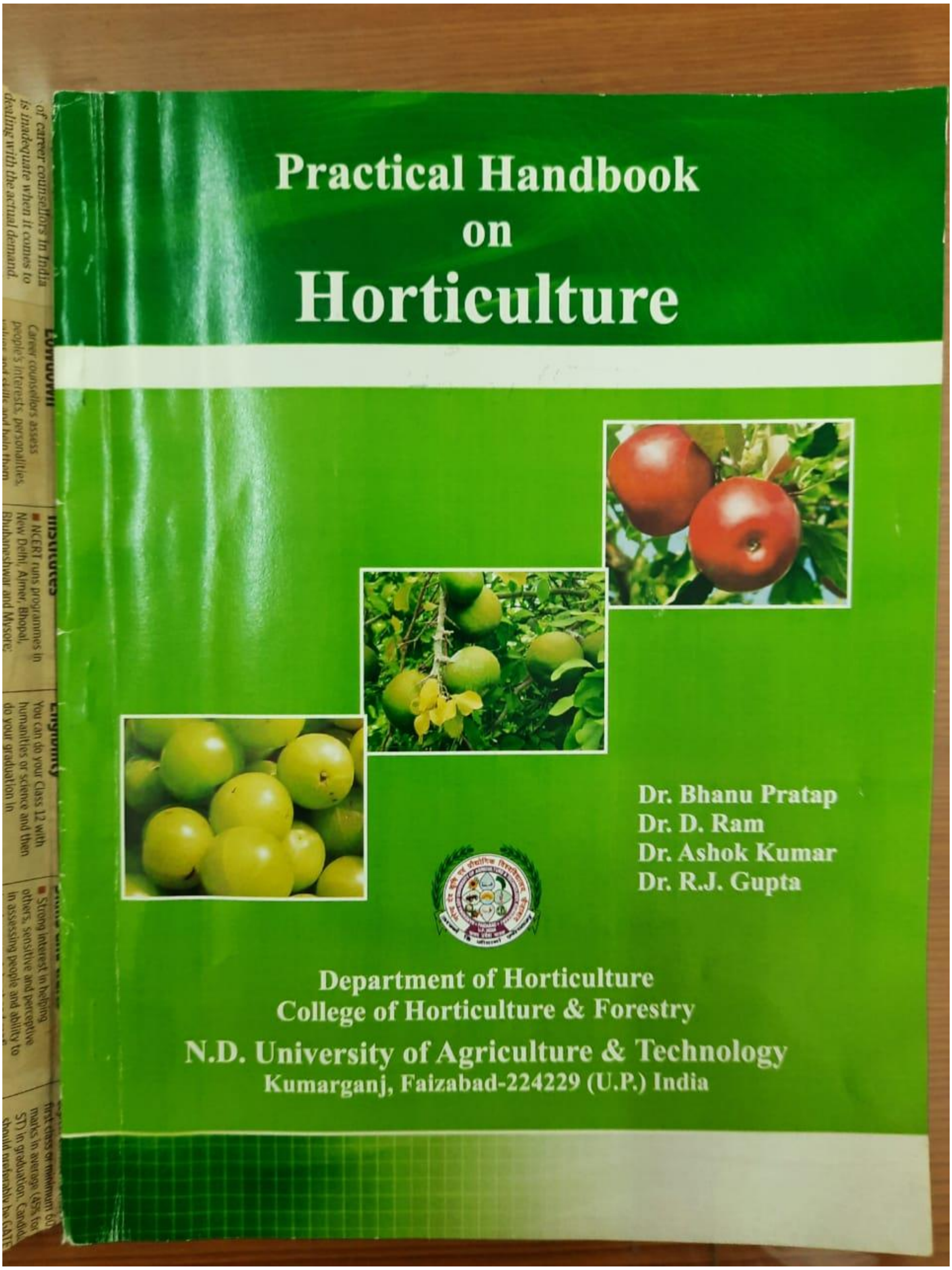
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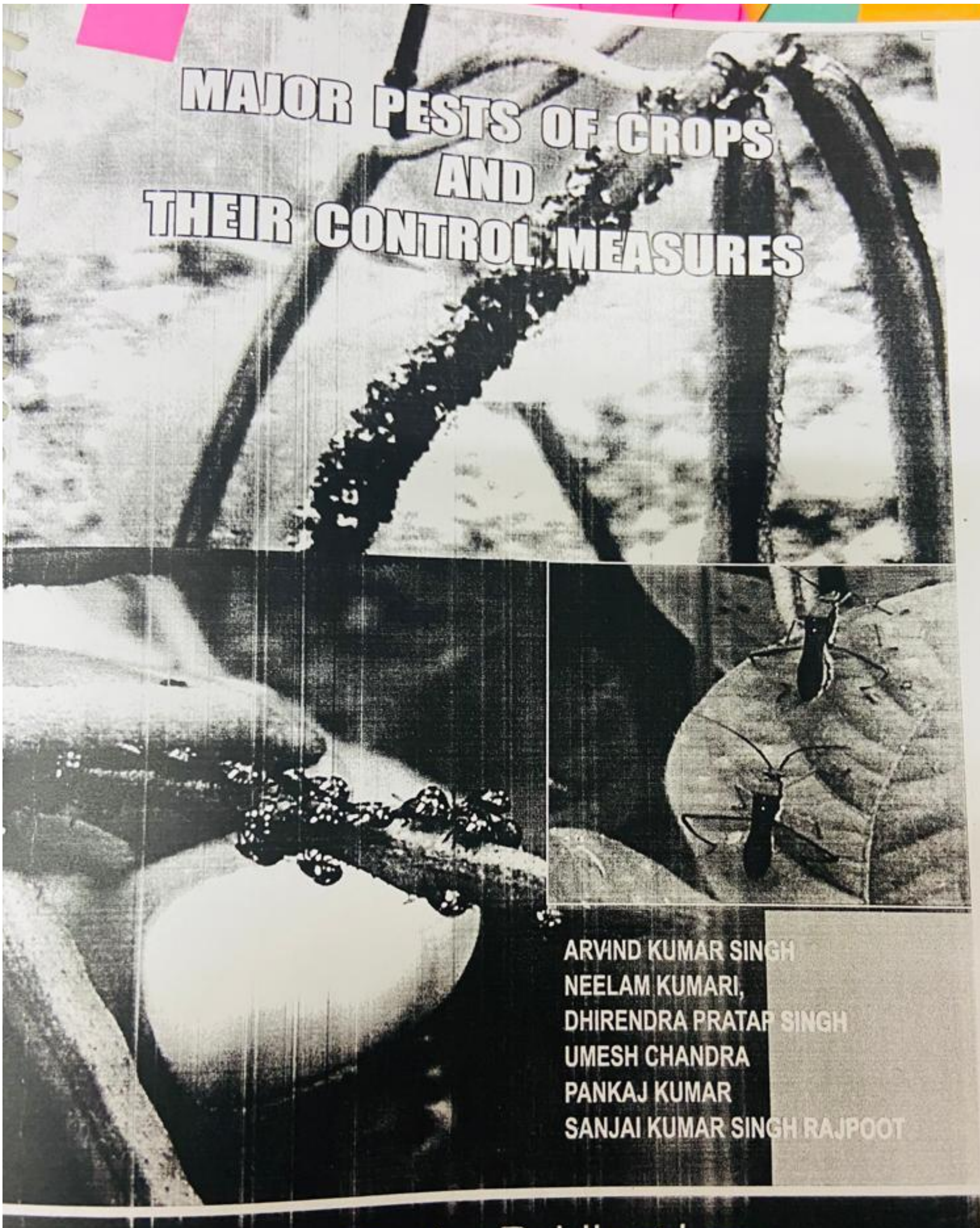

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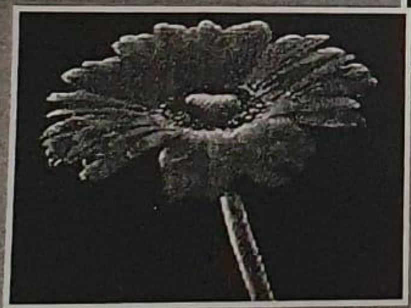

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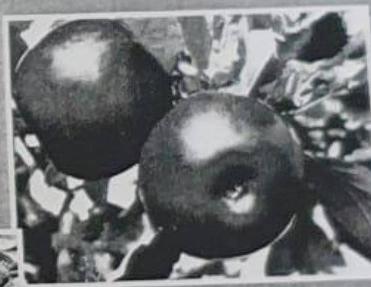

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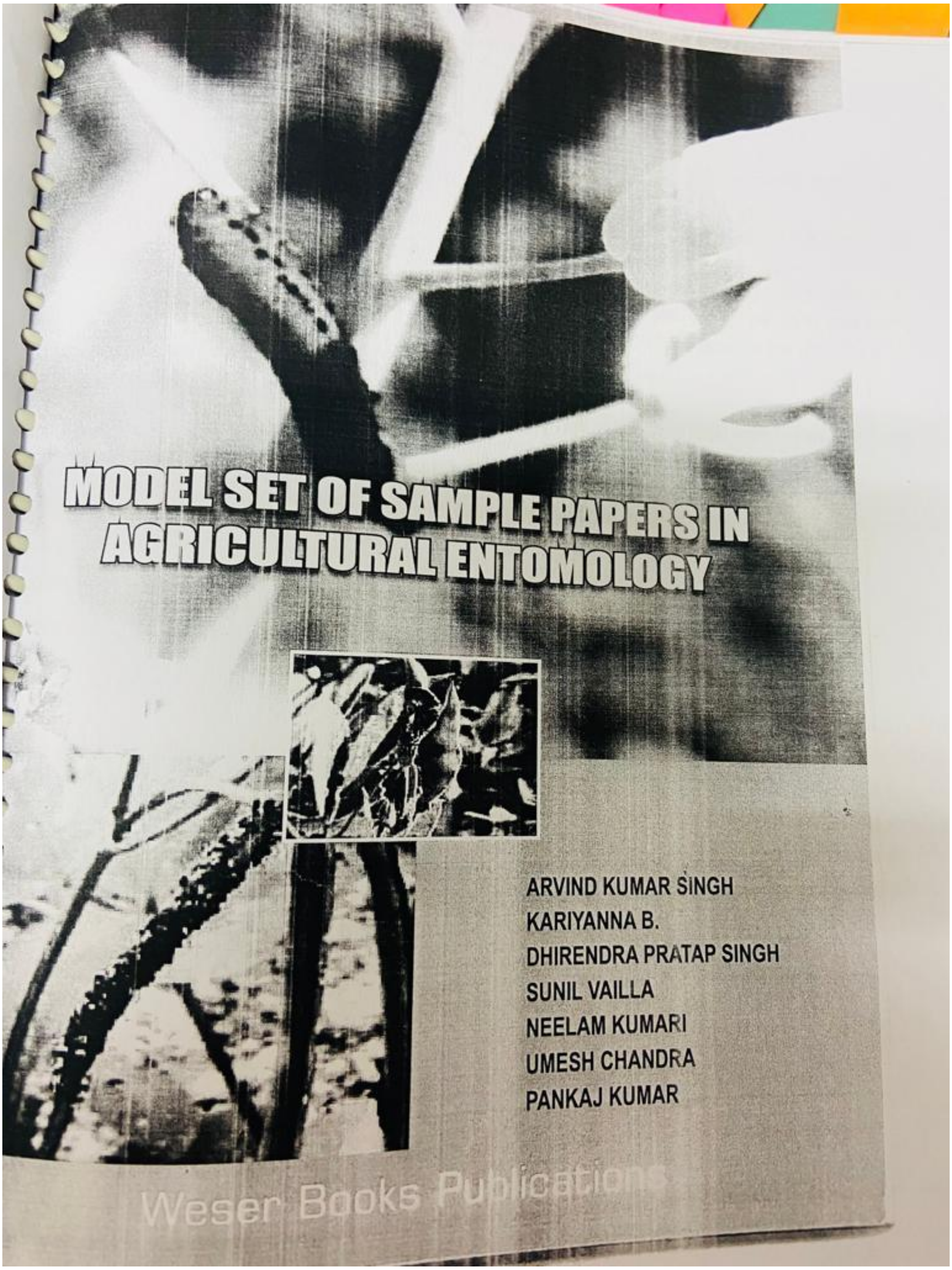
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**Dr. Anuu**

He has completed his degree of M.Sc. (Ag) and Ph.D. (Ag) Agricultural Statistics from department Agricultural Statistics of Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya in 2008 and 2013 respectively. He worked as SRF in project entitled NAIP-Project-"Strengthening Statistical Computing for NARS" from Division of Livestock Economics Statistics and Information Technology, Indian Veterinary Research Institute, Izatnagar (U.P.) and more than 3 years experience as a guest Faculty in the department Agricultural Statistics of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya. He has written more than 16 research paper published in reputed NAAS rated National and International journals. He has successfully completed 3 and 7 day International Level Online FDP. He has achievement as he has received various awards in the area of teaching and research.

Dr R K Doharey is Professor of Extension Education, Department of Extension Education, College of Agriculture (Main Campus) and Former Associate Dean, College of Agriculture Campus, Kotwa, Azamgarh under Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (UP), India. He passed B.Sc. Ag., from Kanpur University, Kanpur in 1995, received M.Sc. Ag. (Extension Education) degree in 1997 from Institute of Agricultural Sciences, B.H.U., Varanasi (UP) and acquired Ph.D. degree in (Agricultural Extension) from Chhatrapati Shahuji Maharaj University, Kanpur (UP) in 2004. Qualified National Eligibility Test (NET) from ICAR in 1997, 1999 and 2001. His had wide International Experience like visited 18 countries United State of Emirates UAE (Dubai, Sharjah, Abu Dhabi), Doha (Qatar), United Kingdom(UK), Holland, Poland, Germany, Switzerland, Italy, France, Netherlands, Rome, Russia, Singapore, Malaysia, Thailand, Nepal etc. He has Published 93 Research Papers in national and international journals, 144 research abstracts, 31 awards received from national and international societies and departments, 50 TV talk, 29 Radio talk, 61 seminars/symposia attained, 15 Life members of the Societies, 23 universities paper setter, 04 Books published, 10 Book Chapters, 35 Popular Article, 06-Folders, 20 Kisan Mela organized, 09 Report Compiled etc.

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He has completed his degree of B.Sc. Ag (Hons.), C S Azad University of Agriculture and Technology Kanpur 2015 and M.Sc. (Ag) and Ph.D. (Ag) Agricultural Economics from department Agricultural Economics of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya in 2017 and 2020 respectively. He has written more research paper published in reputed NAAS rated National and International journals. He has achievement as he has received various awards.

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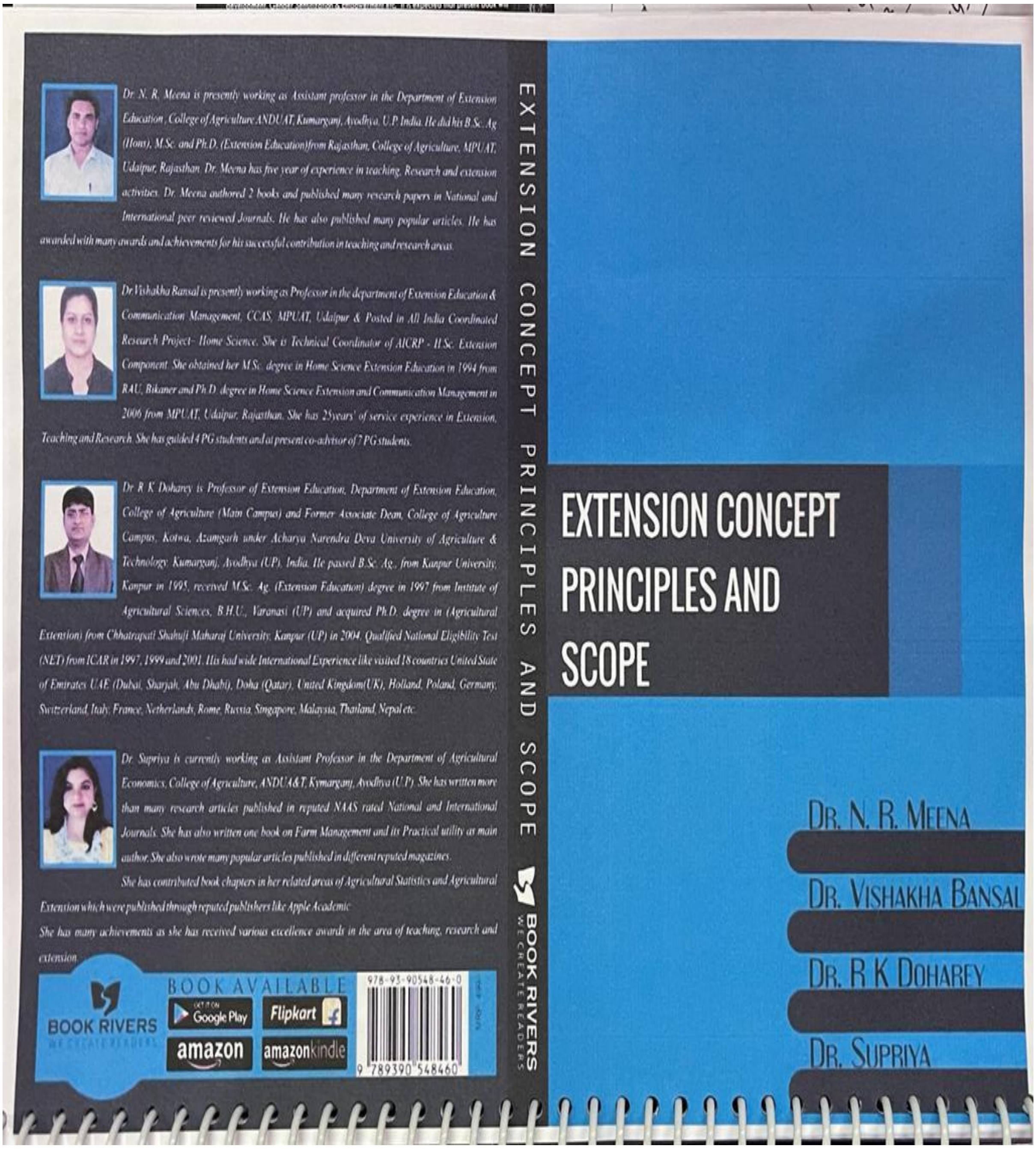

Dr. N. R. Meena is presently working as Assistant professor in the Department of Extension Education , College of Agriculture ANDUAT, Kumarganj, Ayodhya. U.P. India. He did his B.Sc. Ag (Hons), M.Sc. and Ph.D. (Extension Education)from Rajasthan, College of Agriculture, MPUAT, Udaipur, Rajasthan. Dr. Meena has five year of experience in teaching, Research and extension activities. Dr. Meena authored 2 books and published many research papers in National and International peer reviewed Journals. He has also published many popular articles. He has awarded with many awards and achievements for his successful contribution in teaching and research areas.
Dr Vishakha Bansal is presently working as Professor in the department of Extension Education & Communication Management, CCAS, MPUAT, Udaipur & Posted in All India Coordinated Research Project- Home Science. She is Technical Coordinator of AICRP - H.Sc. Extension Component. She obtained her M.Sc. degree in Home Science Extension Education in 1994 from RAU, Bikaner and Ph.D. degree in Home Science Extension and Communication Management in 2006 from MPUAT, Udaipur, Rajasthan. She has 25years' of service experience in Extension, Teaching and Research. She has guided 4 PG students and at present co-advisor of 7 PG students.
Dr R K Doharey is Professor of Extension Education, Department of Extension Education, College of Agriculture (Main Campus) and Former Associate Dean, College of Agriculture Campus, Kotwa, Azamgarh under Acharya Narendra Deva University of Agriculture & Technology Kumarganj, Ayodhya (UP), India. He passed B.Sc. Ag., from Kanpur University, Kanpur in 1995, received M.Sc. Ag. (Extension Education) degree in 1997 from Institute of Agricultural Sciences, B.H.U., Varanasi (UP) and acquired Ph.D. degree in (Agricultural Extension) from Chhatrapati Shahuji Maharaj University, Kanpur (UP) in 2004. Qualified National Eligibility Test (NET) from ICAR in 1997, 1999 and 2001. His had wide International Experience like visited 18 countries United State of Emirates UAE (Dubai, Sharjah, Abu Dhabi), Doha (Qatar), United Kingdom(UK), Holland, Poland, Germany, Switzerland, Italy, France, Netherlands, Rome, Russia, Singapore, Malaysia, Thailand, Nepal etc.
Dr Supriya is currently working as Assistant Professor in the Department of Agricultural Economics, College of Agriculture, ANDUA&T, Kymarganj, Ayodhya (U.P). She has written more than many research articles published in reputed NAAS rated National and International Journals. She has also written one book on Farm Management and its Practical utility as main author. She also wrote many popular articles published in different reputed magazines.
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*Mr. Pradip Kumar Saini*, is a M.Sc. (Ag.) student in the Department of Crop Physiology Agriculture College, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.), my thesis work complete under the supervision of Dr. R. K. Yadav. He has completed training programmes of 1 to 3 months during that were funded by MSME-DI, (ESDP ON FOOD PROCESSING) Kanpur and Agriculture & Mushroom Training DHFP, Basti. He has published number of research papers/Book chapter, Review Paper, English popular articles, Abstracts, National & International seminar or conference participate.

*Dr. R. K. Yadav*, received his B. Sc (Ag) & A.H., he obtained his M.Sc. (Ag) Crop Physiology & Ph.D. Crop Physiology, FROM C.S. Azad University of Agriculture & Technology, Kanpur U.P. Dr. R.K. Yadav was promoted to Associate Professor, Department of Crop Physiology in the year 2004 N. D. University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) I have got the award in young scientist award, outstanding achievement award, distinguished scientist award, young professional award and excellence in teaching award. Dr. R. K. Yadav has guided 20 post graduate students for the award of their degree. He has published 50 research paper in National/International Journal, 14 Popular Article, 60 Abstract, Training and Participated in National/International seminar, symposia & conference.

*Dr. Girish Goyal*, District Etawah (UP), Received his B. Sc (Agriculture) Degree from Bundelkhand University, Jhansi. He obtained his M.Sc. (Ag) Agronomy and Ph. D. (Scholar), Department of Agronomy from C.S. Azad University of Agriculture & Technology, Kanpur. He has completed training programmers were funded by "SPECIALISED TRAINING PROGRAMME ON FOOD PROCESSING" MSME - Development Institute, Kanpur. Now I would like to share my research experience. He has published research papers, popular articles, abstract, National/International seminar, conference. I have got the award in best Agriculture Research Work, Best M. Sc Thesis Award et Best Young



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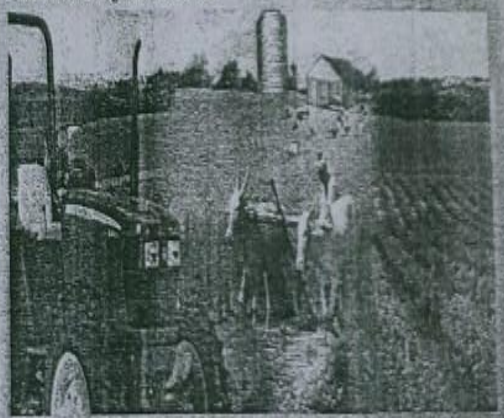

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## About the Authors

**Km. Komal** born on 2nd April 1996 and received her education from D.A.V. College, Muzaffarnagar affiliated to Chaudhary Charan Singh University, Meerut (B.Sc. and M.Sc. Biotechnology) & pursuing Ph.D Ag. Biotechnology from ANDUAT, Kumarganj, Ayodhya. She has published many research papers in National and International Journals of repute. She has written many book chapters. He has awarded by different societies.

**Phool Singh Hindoriya** was born at Shivpur District of Madhya Pradesh. He has completed his graduation from Banaras Hindu University, Varanasi, U.P. and post-graduation in agronomy from ICAR-NDRI, Karnal, Haryana.

**Dheer Pratap Singh** was born on 23th October 1994 and he received his education from Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (B.Sc. Agriculture) and from Monad University, Hapur (M.Sc. Ag. Agronomy) and Pursuing Ph.D. from Integral University, Lucknow.

**Abhinav Singh** is Research Scholar in Department of Agricultural Extension Education at Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.), India. He did his B.Sc. (Agriculture) from National P.G. College, Gorakhpur (U.P.), affiliated to Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur (U.P.) in 2017.

**Dr. Adesh Kumar** born in 1977 and received his education from CSUAT, Kanpur (B.Sc. Ag. & AH) and IARI, New Delhi (M.Sc. & Ph.D Microbiology). He joined ANDUAT, Kumarganj, Ayodhya as Assistant Professor Microbiology. he has written 8 books, many book chapters and published more than 50 research papers in journals of repute. He is also member of many scientific societies and conferred many awards to him.

**Niyaj Ahamad** born on 15th Feb. 1997 and received his education from Integral University, Lucknow (B.Sc. Honos. Ag.) & ANDUAT, Kumarganj, Ayodhya (M.Sc. Ag. Biotechnology). He has published many research papers in National and International Journals of repute. He has written two books and several book chapters. He has awarded by different societies.

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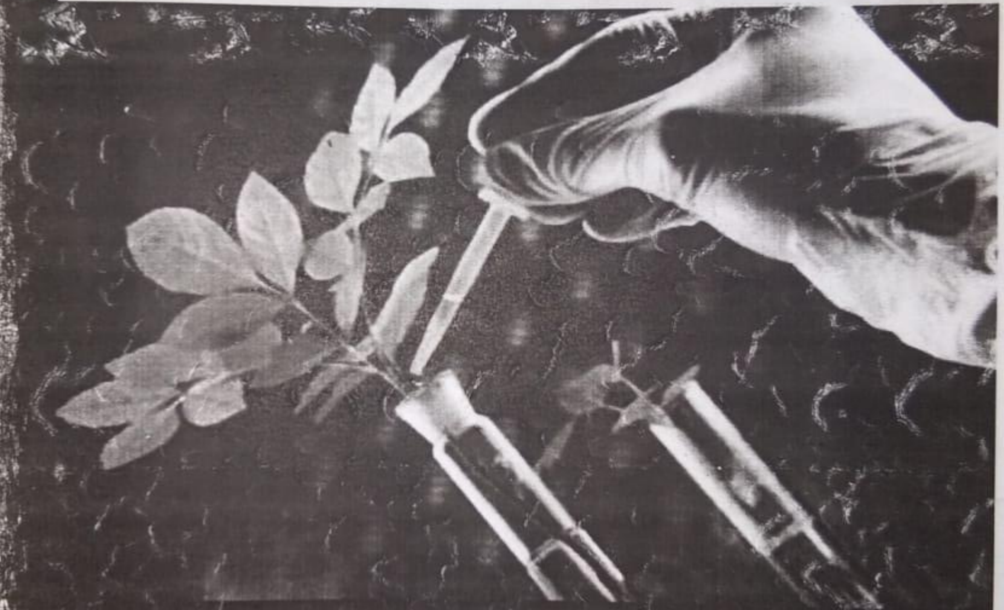

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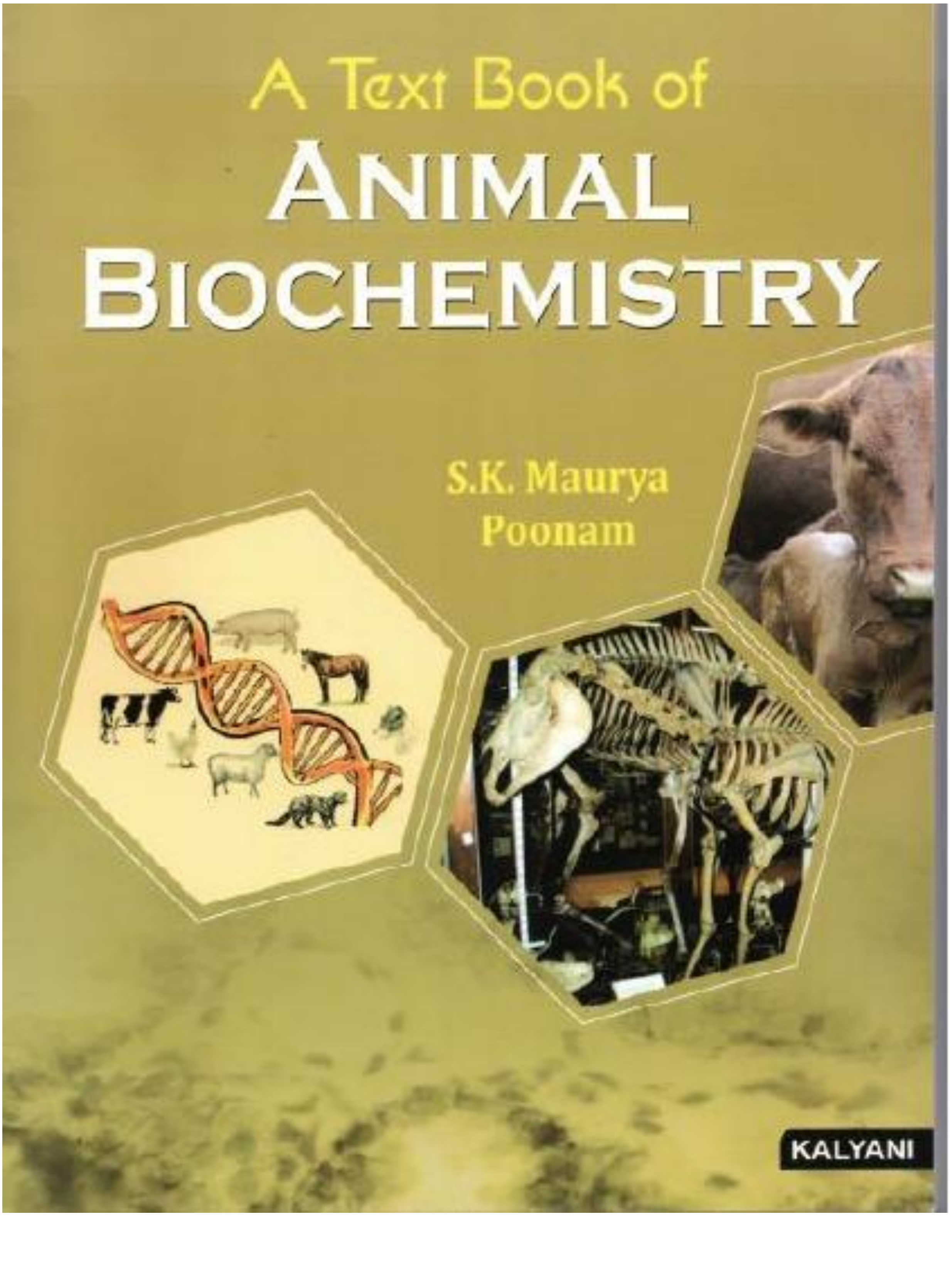
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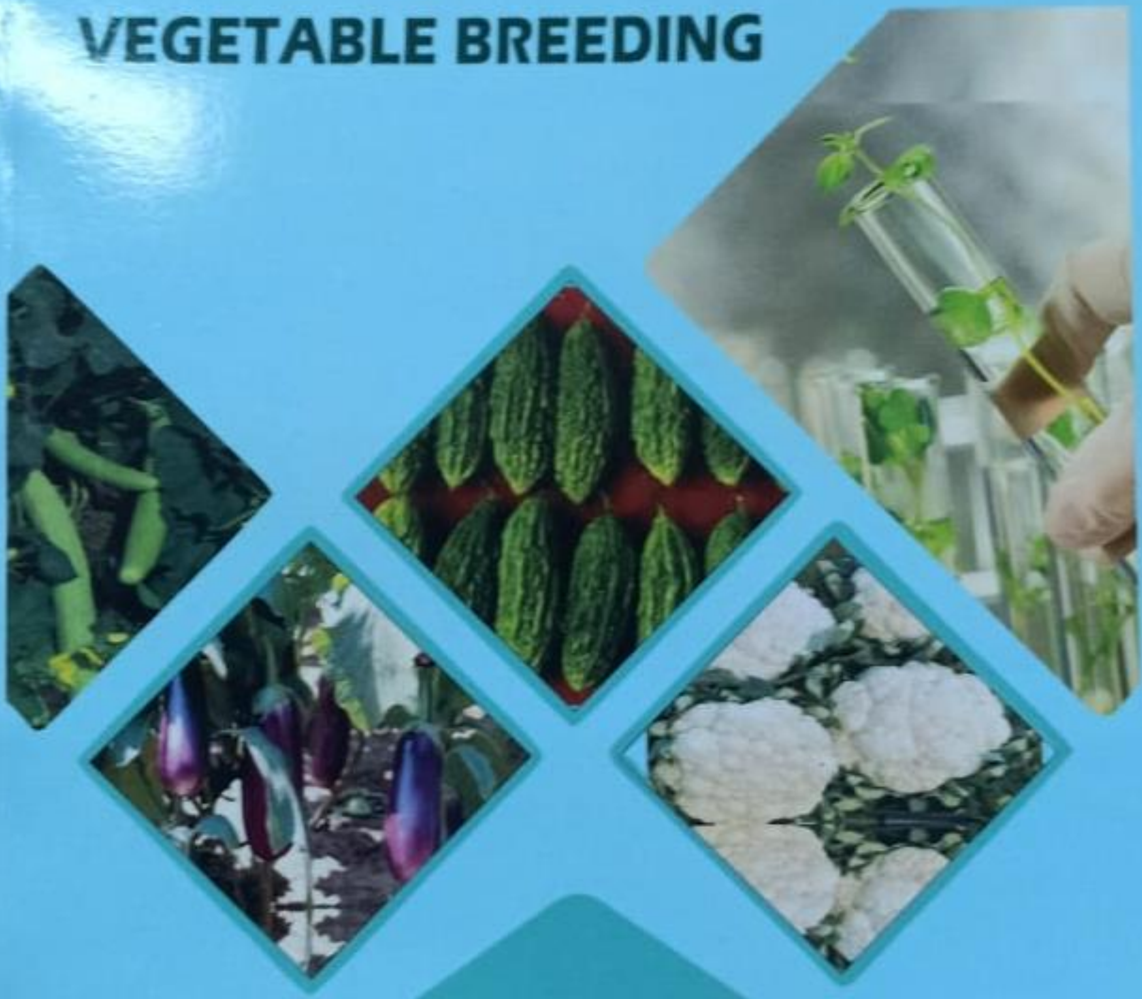

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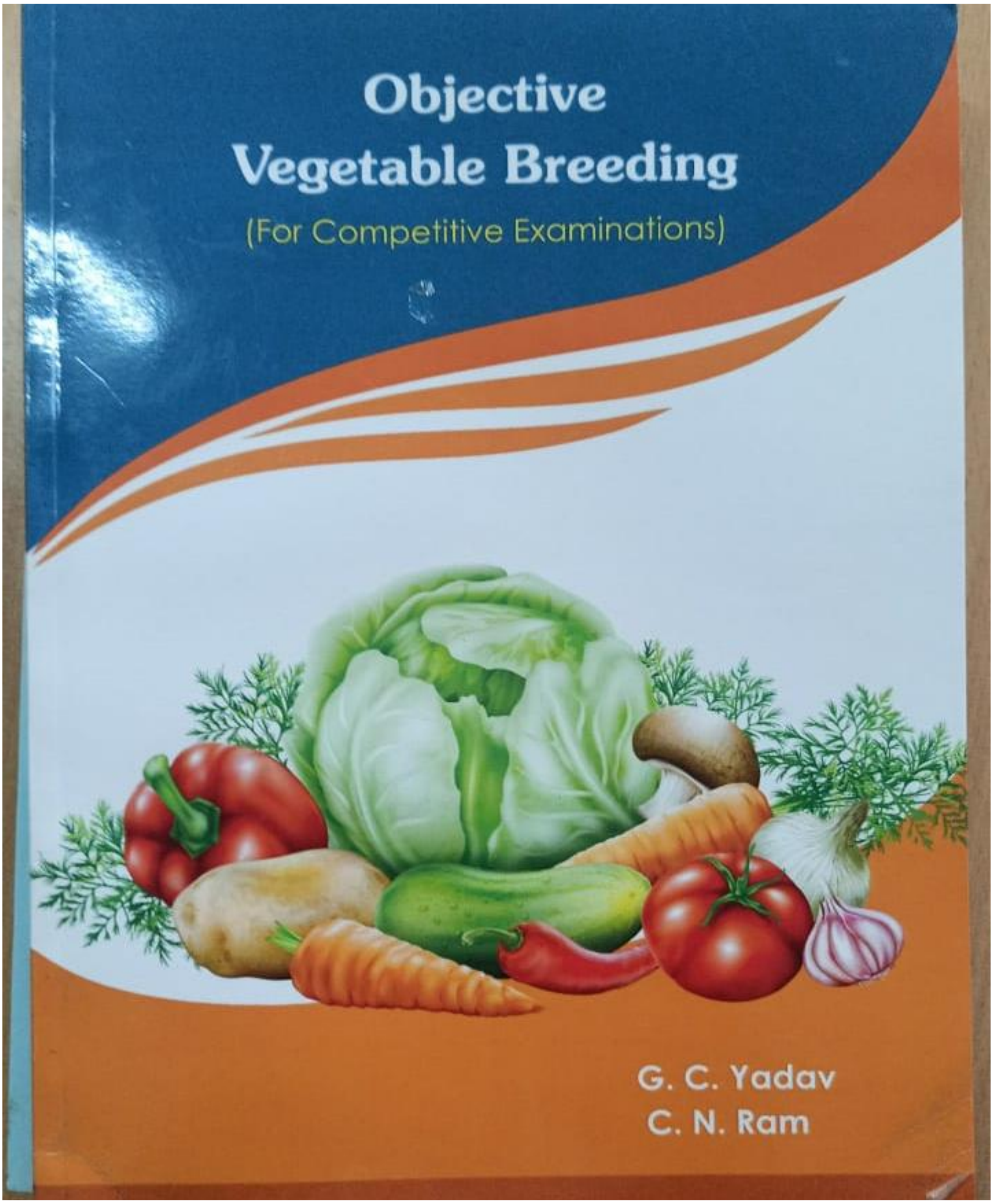
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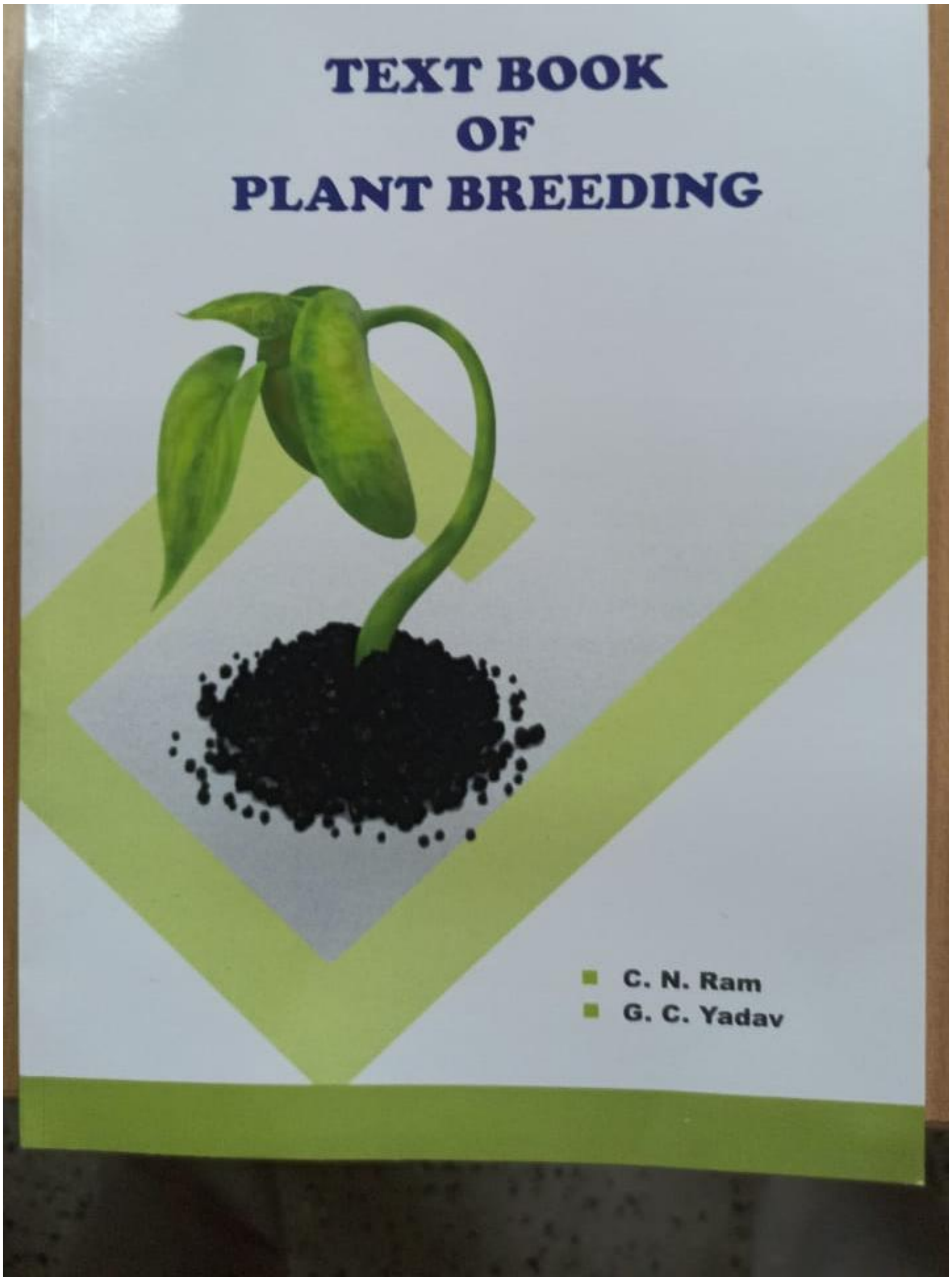
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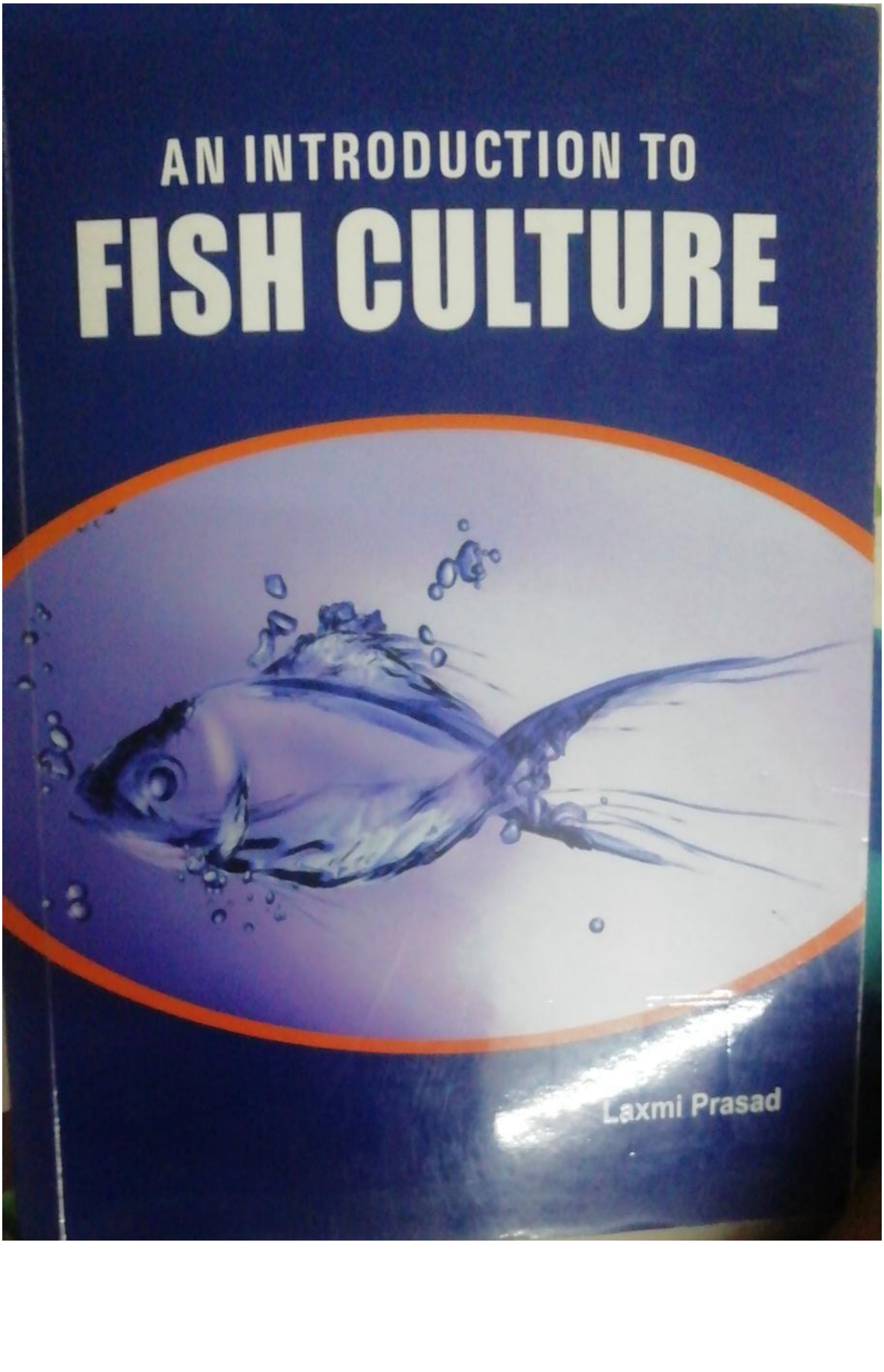
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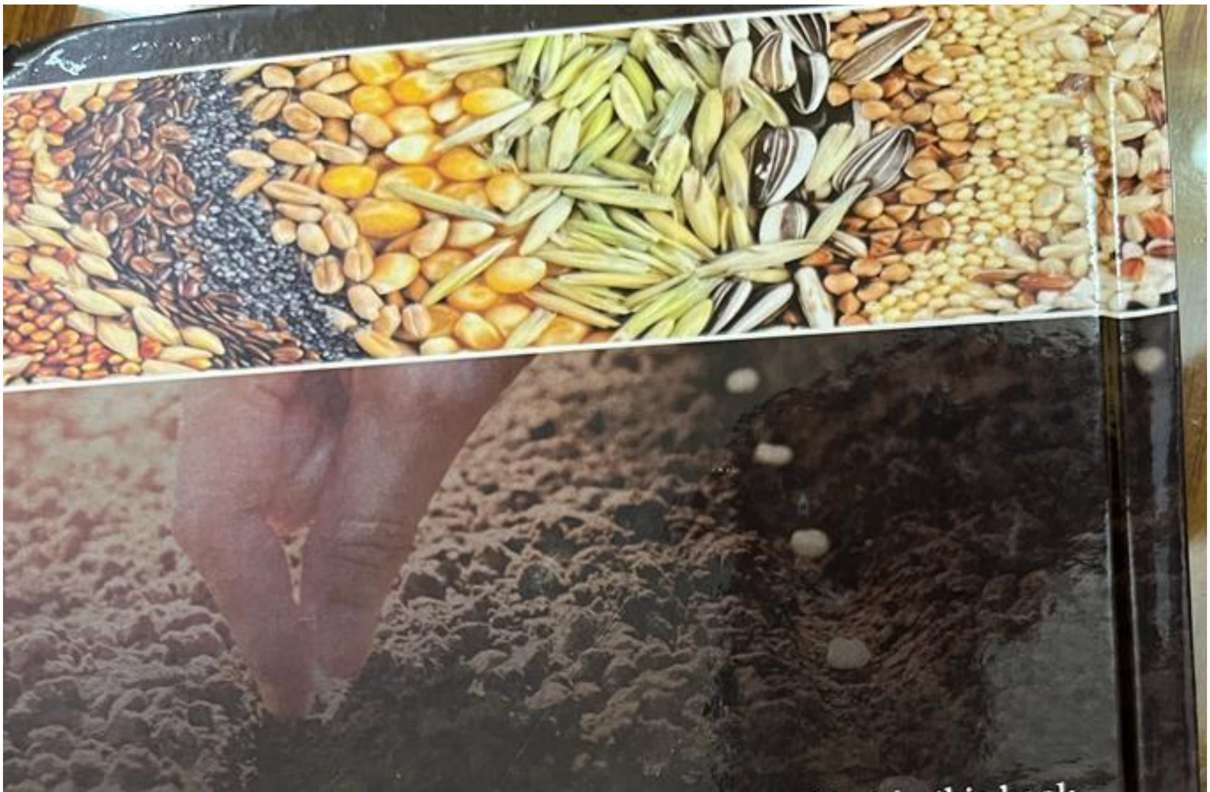

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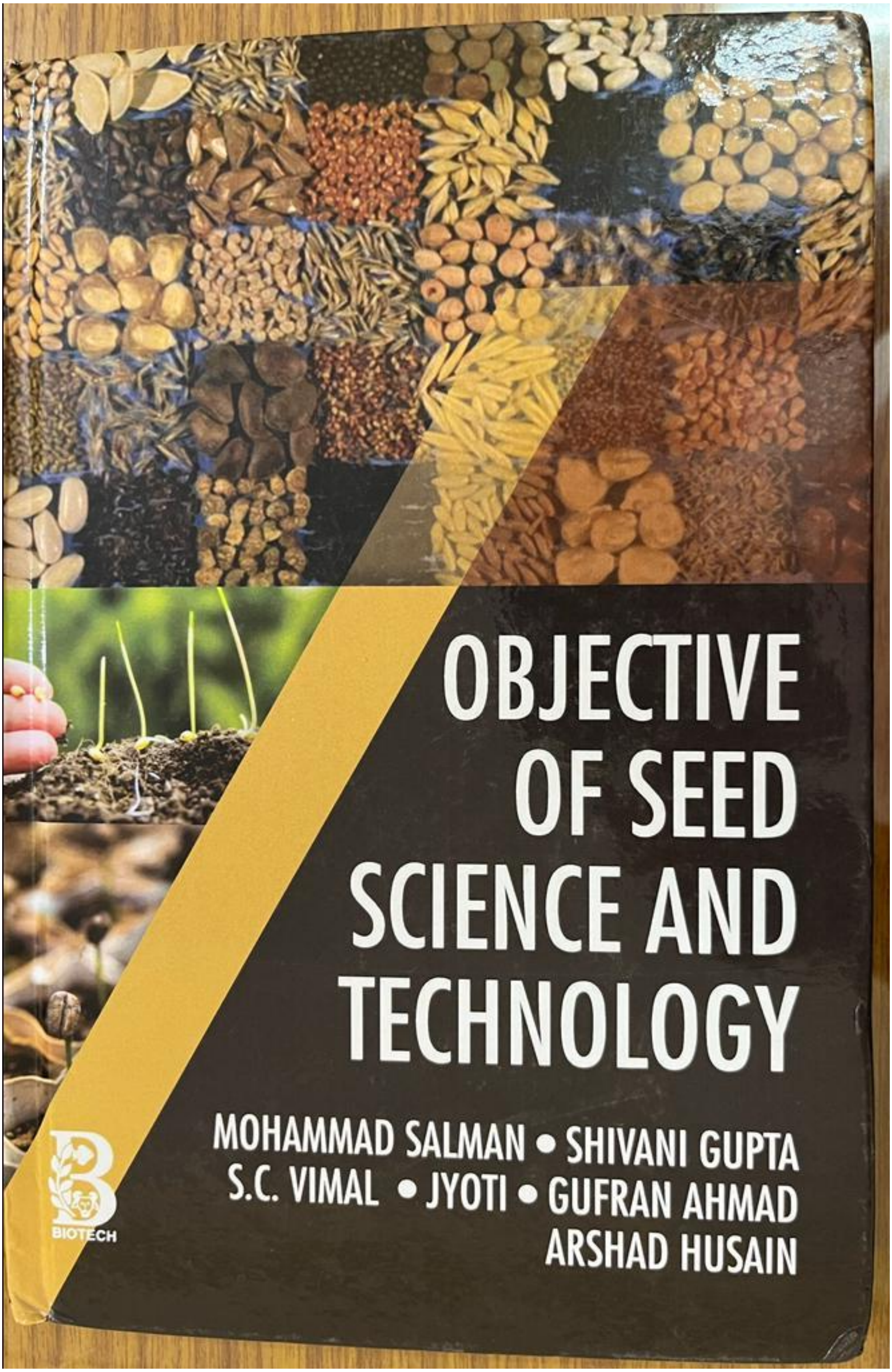
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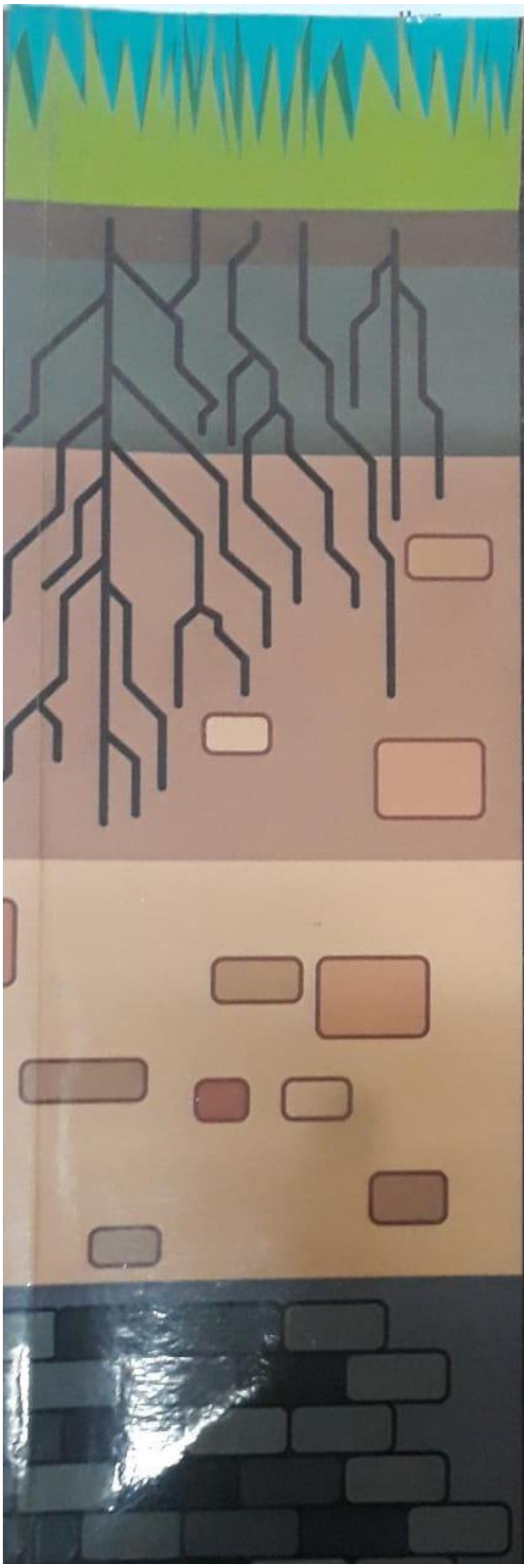

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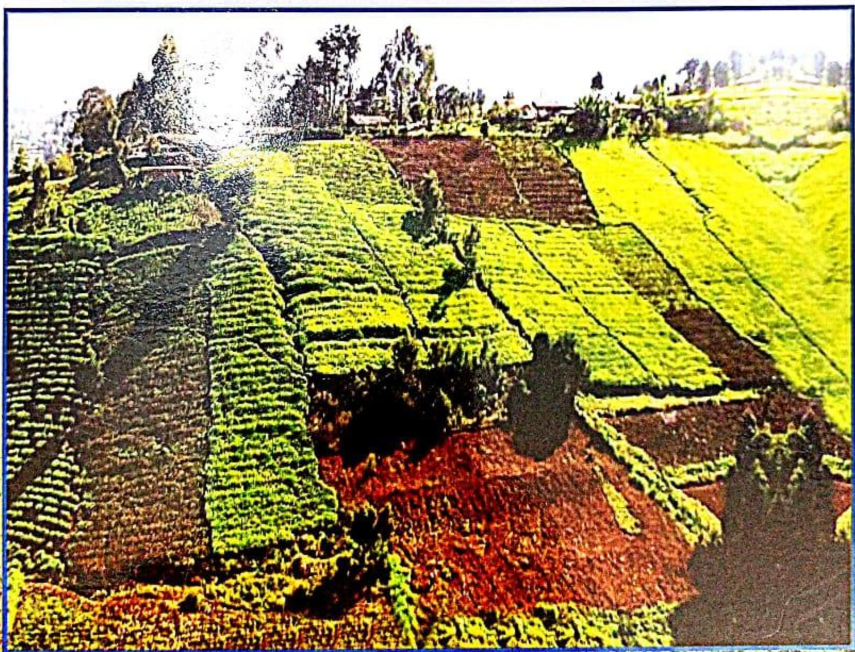

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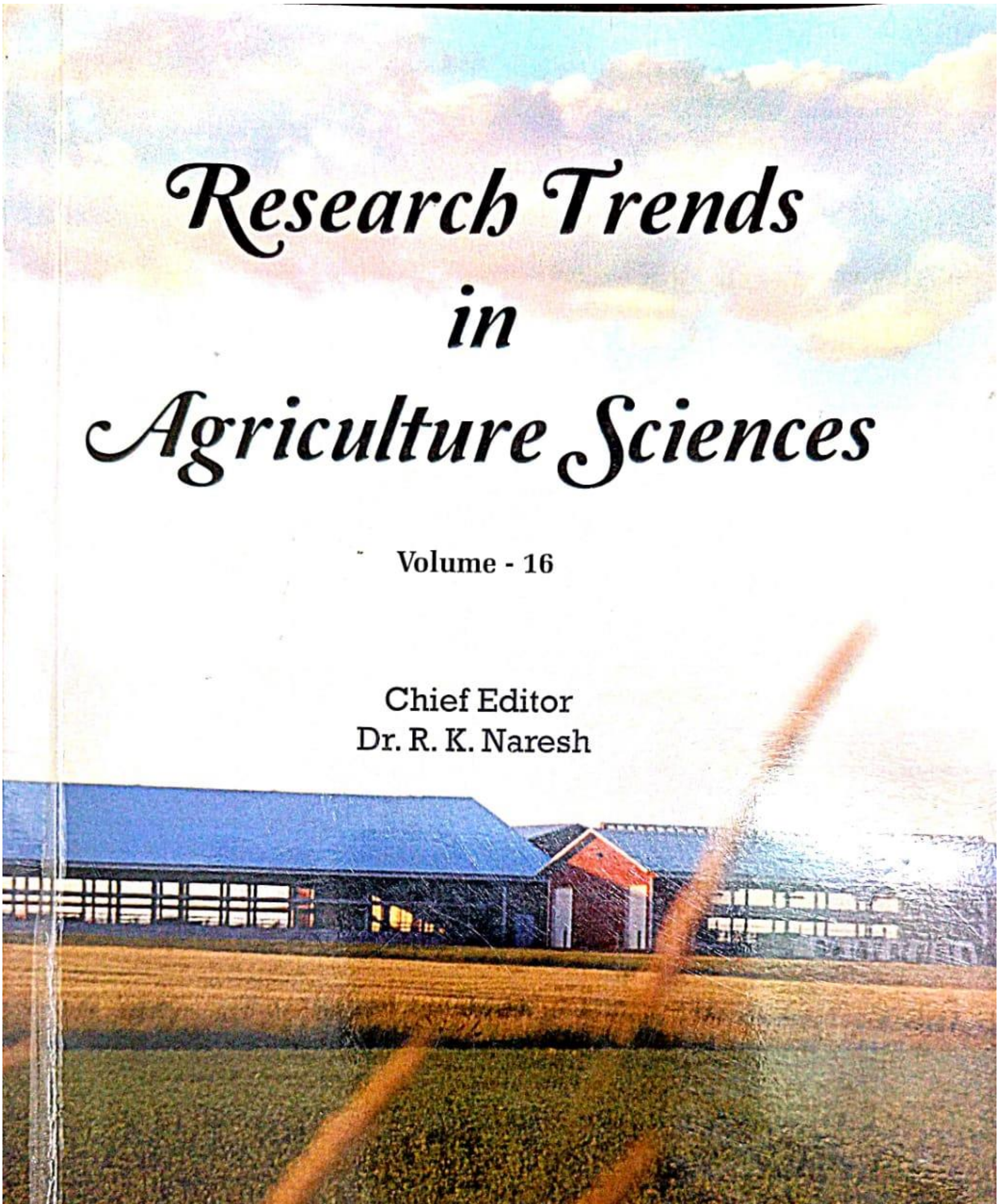
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# 4

# Role of Growth Regulators Under Abiotic Stress

***Raj Bahadur***

*Marginal land areas will need to be used to meet the increasing requirement of future generations, especially in developing countries. These marginal areas commonly impose abiotic stresses on crops due to factors such as salinity, drought, flooding, low nutrients and aluminium or heavy metal toxicity. As a consequence, the growth and yield of crops from such areas is typically low and their quality in also poor. Endogenous plant growth regulators play an important role in regulating plant responses to abiotic stress by sensitizing growth and developmental processes. While the physiological and molecular mechanisms linked to the role of ABA and cytokinins in stress tolerance are well explained, there is growing interest to elucidate the associations of auxins, ethylene, gibberellins, brassinosteroids, and polyamines in stress tolerance mechanism and also on possible cross talk mechanism among different growth regulators during stress tolerance acquisition. Identification and characterization of the gene regulating synthesis of different endogenous growth regulators and recent progresses on hormonal signaling, mutant research, and physiological actions have provided scope for manipulating their biosynthetic pathways for developing transgenic crop plants with enhanced abiotic stress tolerance. Researches have also provided some leads in exploiting the potential of growth regulators in enhancing the resistance to abiotic stresses of crops. Plant growth-regulators (PGRs), are biochemical and chemical compounds stimulates plant growth and productivity when applied, even in small quantities at appropriate plant growth stages. These are being extensively used in agriculture to enhance the productivity in agricultural crops. Their central role in plant growth and development is through nutrient allocation and source-sink transitions while most of the plant bioregulators (PBRs) stimulate redox signaling under abiotic stress conditions.*

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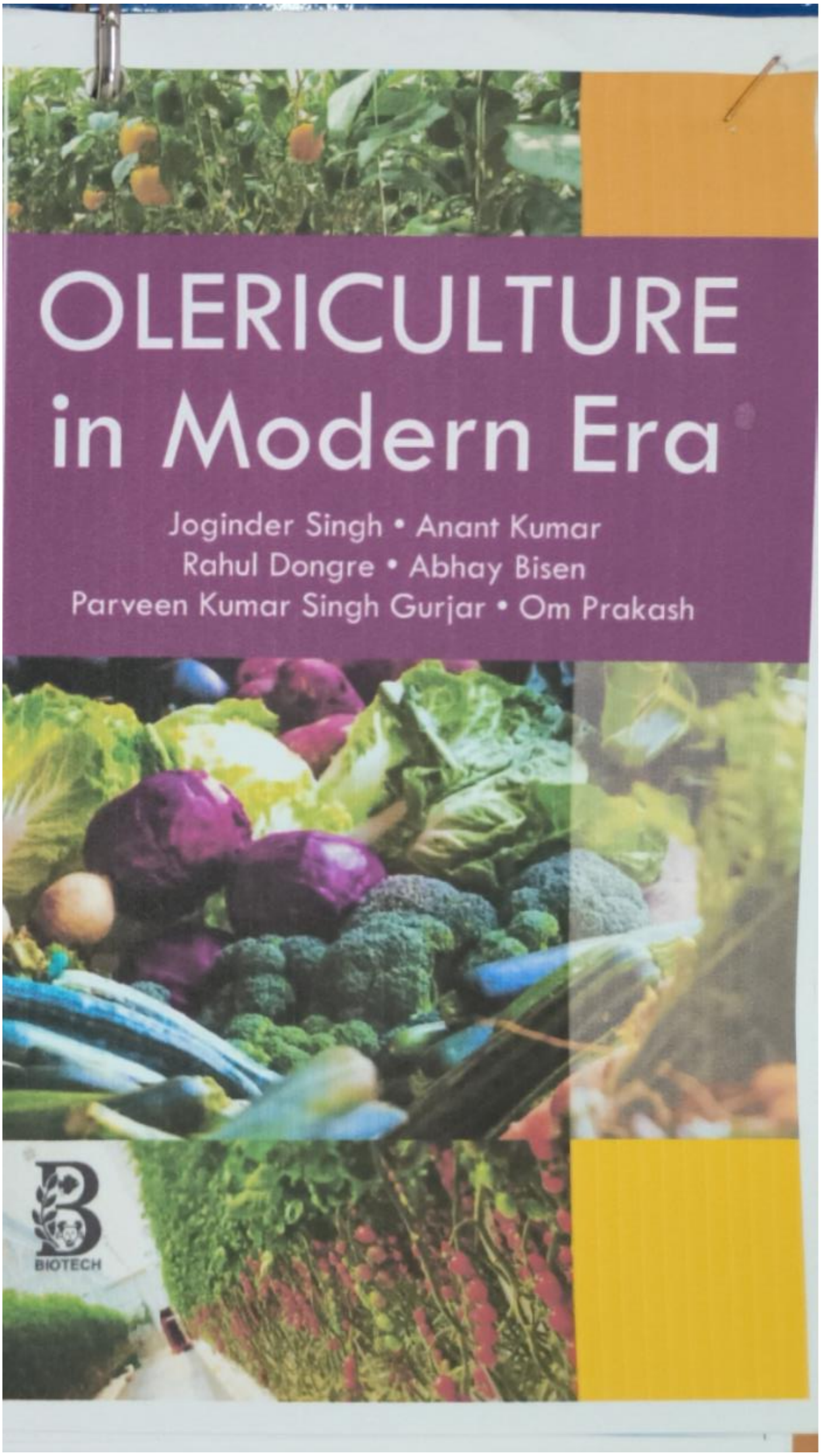
OLERICULTURE
in Modern Era
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The present book contains thirty one chapters focusing on the Role of Biofertilizers in Organic Vegetable Production, Cultivation of Sprouting Broccoli, Protection of Plant Varieties and Farmers' Right Act and its Importance in Horticulture, Site Specific Nutrient Management for Increasing Fertilizer Use Efficiency, Integrated Pest Management: A Holistic Approach towards Sustainable Agriculture, Approaches for Biofortification in Vegetable Crops, Role of Vegetables as Nutraceuticals, In vitro Approaches for Vegetable Crops Improvement, Biochemical Basis of Stress Resistance in Vegetable Crops, Hybrid Seed Production Techniques in Vegetable Crops, Vegetable Grafting: For Combating Stresses and to Increase Productivity, Potential of Wild Species for Genetic Enhancement in Pigeonpea, Underexploited and Underutilized Vegetable Crops of North-Eastern Region of India, Unutilized Vegetables Grown in Jammu, Lycopene: An Important Antioxidant for Human Health, Air Pollution and its Impact on Vegetable Crops, Breeding for Pest Resistance in Vegetable Crops: A Review, Vegetable Production under Protected Conditions, Nursery Management in Vegetables, Hydroponics: An Advanced Technique for Sustainable Green Fodder Production, Cultivation of Mushroom, Prospective of e-Commerce in Agriculture, Prevalence of Anemia in Under 1-5 Year Children: A Medical Institution-Based Study, Programme Planning, Importances and their Objectives, Microarray Technology in Genomics, Information and Communication Technology in Agriculture, Cyber Extension: An Initiative for Research, Extension and Communication, Oil and Gas Companies, Women Empowerment Schemes, Advance Training Technology and Basics of Learning and Teaching.

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# OLERICULTURE in Modern Era

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# CHAPTER 9

## DISEASES OF PIGEONPEA(*Cajanus cajan* L. Millsp.)

**Dr. Subhash Chandra, *Dr. R.D.S. Yadav, *Dr. S.P. Giriand Dr. S. K. S. Rajput****

Dept. of Plant Pathology, *Dept. of Genetics and Plant Breeding and **Dept. of Entomology

Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya-224229 (U. P.)

*Email – chandrasubhash75@yahoo.in*

**Abstract:**

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is one of the most important grain legume components of subsistence farming systems in the semi-arid tropics. Many fungi, viruses, nematodes, bacteria, and mycoplasma-like organisms attack pigeonpea, but only a few of these are important constraints to pigeonpea production. This chapter provides information on the distribution, economic importance, symptoms, causal agents,disease cycle and management of major diseases of pigeonpea. The text is supplemented with disease symptoms and a diagnostic key is included to facilitate identification. Information provided on control measures includes the use of resistant varieties, cultural practices and chemicals. Supporting literature on the major diseases are as follow.

### FUSARIUM WILT

The wilt of pigeonpea is common throughout India, being very destructive in part of Maharastra, Madhya Pradesh, Uttar Pradesh and Bihar. The wilt is also found in many other countries

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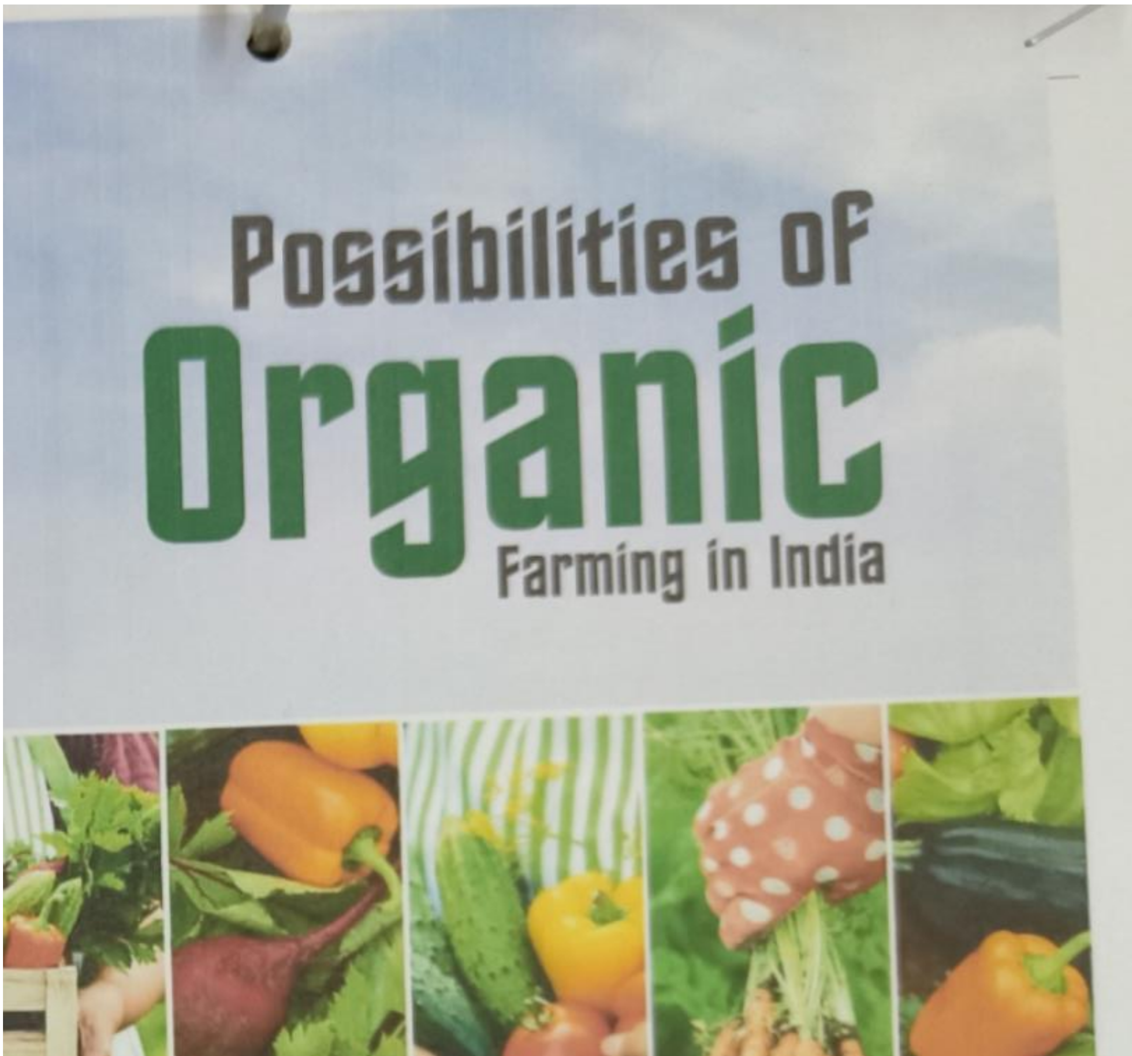
Possibilities of
Organic
Farming in India
R. Chandra
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# Possibilities of Organic Farming in India

Book is to provide an overview of the potential role and challenges of organic farming in this global perspective, as seen from different perspectives such as sustainability, food security and fair trade. Initially, the book provides an overall status of global trends in agriculture followed by discussions of possibilities sustainability, globalization and the relative new concepts of 'ecological justice'.

**Dr. R. Chandra**, Associate Professor, Department of Horticulture, A. S. College, Lakhaoti Bulandshahr (CCS University, Meerut, Uttar Pradesh). He did B. Sc. in Agriculture from R. B. S. College, Bitchpuri, Agra in 1999 and M. Sc. and Ph. D. in Horticulture with specialization in Floriculture and Landscaping in the year of 2002 and 2005 from GBPUA&T., Pantnagar. He has published 23 research papers, 25 popular articles, 01 book and 02 book chapters. He received the Excellence Teaching Award in 2020 from ATDS, Ghaziabad.

**Dr. Sachin Kumar Jain** did his B.Sc. (Ag) from R.K. (PG) College, Shamli in 2011 and awarded with Vice Chancellor Gold Medal. He did his M.Sc.(Ag.) in Plant Pathology (2013) and Ph. D. Plant Pathology (2016) from SVPUA&T., Meerut (U.P.). He joined in Department of Plant Pathology of Amar Singh (PG) College, Lakhaoti as an Assistant Professor in 2017. Dr. Jain has published more than 22 research papers, 15 abstracts and 20 popular articles. He is a life member of National Science Congress and Indian Phytopathological Society.

**Dr. Raj Pal Singh** obtained his B.Sc.(Ag) Degree from NDUA&T., Faizabad, M.Sc (Ag) in Agronomy from BHU, Varanasi, Ph.D in Agronomy from C.C.S.University , Meerut. He had professional experience in CAPART as Young Professional (2005-2006), as SMS Agronomy in GVT-KVK, Godda, Jharkhand. He appointed in 2017 as Assistant Professor in A.S. college, Lakhaoti, Bulandshahr. He had Total 13 research papers, 25 popular articles, 03 Training manuals, 02 books. He got ICAR award and Vice chancellor award.

**Dr. Ajay Kumar** is Assistant Professor in the Department of Plant Pathology, Amar Singh (P.G.) College, Lakhaoti, Bulandshahr, UP. He did his B.Sc. (Ag) in 2009 from UP Autonomous College, Varanasi, U.P.; M.Sc. (Plant Pathology) and Ph.D. (Plant Pathology) from NDUA&T, Ayodhya, U.P. He has published 30 research papers, 1 review paper, 9 book chapters, 5 books, 2 newsletters and 15 popular articles. He supervised 1 student of M.Sc. Plant Biotechnology. Dr. Kumar has joined the life membership of 3 societies and received 4 awards by different societies.

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# Chapter - 7

## Diseases of Lentil (*Lens culinaris* Medik.)

**Dr. Subhash Chandra, Rahul Singh Raghuvanshi, Dr. Ramesh Chand and Shyam Babu Gautam**

**Abstract**

Pluses constitute an important part of human food. Pulses are valued for their high protein content and protein quality and thus, supplement the cereal based diets. The area under lentil in India is around 1.55 m. ha with a production of 1.61 m. tones and productivity 1039 Kg/ha (Anonymous, 2018). Lentil seed has a relatively higher protein, carbohydrates and calories compared to other legumes and its high average protein content and fast cooking characteristics make this crop as the most desired in many lentil producing regions (Muehlbauer *et al.*, 1985). Lentil suffers from a number of diseases which are caused by fungi, bacteria, viruses, nematodes and plant parasites (Khare et al., 1979). Fungal diseases of lentils are the most important biological constraint to productivity. *Ascochyta lentis* (ascochyta blight) and *Fusarium oxysporum* f. sp. *lentis* (fusarium wilt) are the major fungal pathogens that can cause severe losses in most lentil growing regions of the world. Fungal diseases such as botrytis grey mould (*Botrytis fabae* and *B. cinerea*), rust (*Uromyces viciae-fabae*), stemphylium blight (*Stemphylium botryosum*), and anthracnose (*Colletotrichum truncatum*) are also important in some growing seasons in particular countries when environmental conditions are conducive for infection. Lentil plants can also be infected by a range of viruses but generally the affect on yield is not as great as that caused by fungal pathogens. Lentil yellows disease caused by bean leaf roll virus (BLRV), beet western yellows virus (BWYV), or subterranean clover red leaf virus (SCRLV) is widespread throughout the world. Other important virus diseases of lentil include bean yellow mosaic (BYMV), pea seed borne mosaic (PSbMV), cucumber mosaic (CMV), alfalfa mosaic (AMV) and broad bean stain (BBSV). Integrated disease management practices including use of resistant cultivars, modified cultural practices and use of fungicides or insecticides can reduce the impact of these diseases on lentil production.

# Chapter - 5

## Virus Transmission by Vegetative Reproduction, Plant Virus Serology and Other Methods, Viruses are Transmitted to Plants

Rahul Singh Raghuvanshi, Subhash Chandra, Vishwa Vijay Raghuvanshi, Prabha Siddharth and Prajanya Dubey

**Abstract**

Transmission of plant viruses occurs both vertically and horizontally. Seed transmission is a significant factor in vertical transmission, which is the transfer of a virus from a parent plant or insect vector to its offspring. In horizontal transmission, the virus travels mechanically, by touch, or through both from one plant to another. In natural settings, viruses are carried by a variety of vectors, including nematodes, fungus, and insects. Horizontal transmission can also happen through several artificial vegetative reproduction techniques, which are frequently used by farmers and horticulturists.

**Keywords:** Transmission of viruses, serology of plant viruses, vegetative transmitted

### Introduction

Any viruses present in the mother plant from which these organs are removed will almost always be passed on to the offspring whenever plants are reproduced vegetatively by budding or grafting, cuttings or the use of tubers, corms, bulbs, or rhizomes. Given that the majority of florist's crops, nearly all fruit, many decorative trees and shrubs, many field crops, including potatoes, are reproduced vegetatively, this method of viral transmission is crucial for all of these different types of agricultural plants. When propagating through budding, a virus in the bud or the rootstock may significantly reduce the number of successful bud unions with the rootstock and, as a result, produce weaker stands. The natural root grafts between nearby plants, especially trees, can potentially spread viruses. Natural root grafts are the sole known method of tree-to-tree transmission of the virus in established orchards for a number of tree viruses.

# Chapter - 8

## Diseases of Pigeonpea (*Cajanus cajan* L. Mill sp.)

**Dr. Ramesh Chand, Rahul Singh Raghuvanshi, Dr. Subhash Chandra and Shyam Babu Gautam**

**Abstract**

Pigeonpea (*Cajanus cajan* (L.) Mill sp.) is one of the most important grain legume components of subsistence farming systems in the semi-arid tropics. Many fungi, viruses, nematodes, bacteria, and mycoplasma-like organisms attack pigeonpea, but only a few of these are important constraints to pigeonpea production. This chapter provides information on the distribution, economic importance, symptoms, causal agents, disease cycle and management of major diseases of pigeonpea. The text is supplemented with disease symptoms and a diagnostic key is included to facilitate identification. Information provided on control measures includes the use of resistant varieties, cultural practices and chemicals. Supporting literature on the major diseases is as follow.

**Keywords:** Pigeonpea, major diseases, symptoms

### Introduction

Pigeonpea (*Cajanus cajan* (L.) Millspaugh) is an important grain legume of the Indian subcontinent, Southeast Asia and East Africa. More than 85% of the world pigeonpea is produced and consumed in India, where it is a key crop for food and nutritional security of the people. The centre of origin is the eastern part of peninsular India, including the state of Orissa, where the closest wild relatives occur. Though pigeonpea has a narrow genetic base, vast genetic resources are available for its genetic improvement.

### Fusarium wilt

The wilt of pigeonpea is common throughout India, being very destructive in part of Maharashtra, Madhya Pradesh, Uttar Pradesh and Bihar. The wilt is also found in many other countries like Kenya, Malawi and Tanzania Bangladesh, Germany, Ghana, Indonesia, Italy, Kenya, Myanmar, Nepal, Thailand, Vietnam, Venezuela but it is more important

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# CHAPTER 14

# DISEASES OF CHICKPEA(*Cicer arietinum*L.) and THEIR MANAGEMENT

**Dr. Subhash Chandra, Dr. Shiva Nath*and Dr. Ajay Kumar**
Dept. of Plant Pathology and *Dept. of Genetics and Plant Breeding Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya-224229 (U. P.)
Email – chandrasubhash75@yahoo.in

Chickpea (*Cicer arietinum* L.) is one of the world's most important cool season food crops mostly grown in dry lands. The production of chickpea in India 7.33 million tones (2018). The crop suffers from serious diseases that affect it in all growth stages. The pathogens that affect chickpea include fungi, bacteria, viruses, nematodes and mycoplasma, which results in severe economic losses globally. Among these, fungi are the largest and perhaps pods of chickpea. The handbook is designed to assist agricultural research and extension workers who may have had less formal training in plant pathology to diagnose chickpea diseases. The bulletin provides information on economic importance, distribution, chickpea diseases, and will be useful to farmers, extension workers, disease is also provided.

## WILT

Fusarium wilt is a soil borne seed bore disease of chickpea (*Cicer arietinum* L.) in India, Iran, Pakistan, Nepal, Spain and Tunisia. The disease is being a major constraint in chickpea production in California and Mediterranean region.In India first reported by Butler in 1918 from Bihar. It causes 20-100 per cent losses in crop yield depending upon stage of infection and severity of pathogen. In severe condition losses may upto 60-70 per cent. Seed harvested from wilted plants are lighter, rough and dull than those from healthy plants.

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**WESER BOOKS**

Chapter 20

# DISEASES OF URDBEAN AND MUNGBEAN

**Dr. Subhash Chandra, Dr. Shiv Pratap Singh, Dr. M. P. Chauhan* and Umesh Chandra****

Dept. of Plant Pathology, *Dept. of Genetics and Plant Breeding and **Dept. of Entomology

Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya-224229 (U. P.)

*Email – chandrasubhash75@yahoo.in*

**Abstract:**

Mungbean [Vigna radiate (L.) Wilczek] and Urdbean [V. mungo (L.) Hepper] are the important pulse crops in India after chickpea and pigeonpea. These are also widely cultivated throughout Southern Asia like Pakistan, Sri Lanka, Bangladesh, Thailand, Laos, Vietnam, Indonesia, China and Taiwan. In India these crops are cultivated in three different seasons, like., *kharif*, *rabi* and *Zaid*. The maximum area of its cultivation is under *kharif*, where intercropping with sorghum, pearl-millet, maize, cotton, castor, pigeonpea, etc., are popular. These crops are grown principally for its high protein seeds that are used as human food, that can be prepared by cooking, fermenting, milling or sprouting, they are utilized in making curries, boiled dahl, sprouts, bean cake etc. The protein is comparatively rich in lysine, an amino acid that is deficient in cereal grains. They complement each other and hence enhance the food quality. Besides being a rich source of protein, these are also important for sustainable agriculture and enriching soil organic matter through biological nitrogen fixation. India is the largest producer of mungbean and account 54% of the world production and covers 65% of the world acreage. Mungbean is grown on about 3.30 million hectares with annual production of 1.84 million tons. Similarly, Urdbean is grown on about 3.92 million hectares with annual production of 2.67 million tons (AICRP, 2018-2019). The yield losses (5-100%) reported due to various biotic stresses, which is responsible for the fluctuation in the average yield. The biotic stresses like diseases incited by fungi, bacteria, viruses, and nematodes are major limiting factors for high yield. Therefore, there is a need to correct identification, diagnosis and adaptation of suitable management strategies against different diseases of these crops. Since mungbean and urdbean are infested by similar bacterial, fungal pathogens and viruses. A brief account of the

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# MAJOR DISEASES OF WHEAT AND THEIR MANAGEMENT

**Rahul Singh Raghuvanshi*[1], Subhash Chandra[1], Abhishek Singh[2] and Vivek Singh[2]**

[1]Department of Plant Pathology, College of Agriculture, Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya – 224 229, U.P.

[2]Department of Plant Pathology, College of Agriculture, Chandra Sekhar Azad University of Agriculture and Technology Kanpur U.P.

*Corresponding author E-mail: raghuvanshir22@gmail.com

**Abstract:**

Wheat is the staple crop throughout the world and a great source of nutrition. Sometimes the wheat plant gets attacked by pathogens like fungi, bacteria and virus. Some of the common disease their symptoms and management are studied. The complexity of the interaction between a pathogen and its host, influenced by biotic and abiotic factors of the environment, make the control of these disease. Fungi is the most common causative agent in case of wheat. Some of the common disease caused by fungi are leaf rust, stem rest, stripe rust, loose smut, tan spot, powdery mildew, ergot and common bunt. Virus and bacteria also cause diseases in wheat. Wheat strike mosaic virus one of the diseases is bacterial blight of leaf. These diseases can be controlled by using disease resistant varieties. Due to the infection of these diseases there can be loss of 40-50% but sometimes it may be more. These diseases can be controlled by using some control measures. There are several chemical and herbal methods are used for the control of these diseases.

**Keywords:** Wheat, disease, management, control, symptoms, pathogen.

**Introduction:**

Wheat is on the top rank in the world among the cereals both on the basis of area and production that's why it is also known as "king of cereals". Wheat is a staple crop in the world. It is the second largest consumable cereal crop throughout the world after the rice. In India wheat is a Rabi crop. It is preferably grown in tropical areas of the world. Wheat is an annual grass cultivated mostly in all moderately dry temperature climates. It needs comparatively cool, moist, spring having 10-degree Celsius temperature at the time of sowing, warm, and bright days at the time of sprouting and dry harvest periods. Wheat is grown best in areas having 35cm to 60cm annual rainfall. The best soils for wheat are clay and loams. The best fertilizer is barnyard manure. For proper cultivation of wheat, the fields are cleared and then ploughed 4-5 times before sowing. Healthy and ripe seeds are sown in slightly moist soil. Sowing generally starts in October and continuous upto middle of November fertilizer is added for obtaining better yield.

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# Chapter 21

## Cultivation of Mushroom

***Rahul Singh Raghuvanshi*, Subhash Chandra, Abhishek Singh, Sakshi Pandey, Vivek Singh and S.P. Singh***

***Department of Plant Pathology, College of Agriculture, Acharya Narendra Dev University of Agriculture and Technology, Ayodhaya, Uttar Pradesh***

### Introduction

Mushroom is a saprophytic fungus that grows on dead and decaying organic matter. Due to the absence of chlorophyll, it is unable to synthesize its own food and hence is dependent upon the organic matter/substrate for food. In India, commercial cultivation of mushrooms had been with the joint effort of scientists and farmers. Mushroom husbandary is now one of the major sources of income for farmers of many states like Haryana, Uttar Pradesh, Punjab, Uttarakhand and Himanchal Pradesh. The major producers of mushrooms are Punjab, Tamil Nadu and Andhra Pradesh. Button mushroom (*Agaricus bisporus*) constitutes about 90 per cent of total production in India.

### History

The consumption of mushroom by man probably predates recorded history, and the historical record is an indeed ancient one. It is estimated that the first mushroom was cultivated around 600 A.D. This was *Auricularia auricula*. Later, around 800-900A.D. *Flammulina velutipes* was also cultivated in China. *Lentinula edodes* is estimated by us to have been cultivated for the first time between 1000-1100A.D. Of the leading mushrooms of today that were cultivated before 1900,

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Zonal Research Station, Darisai, East Singhbhum, (BAU Ranchi), Jharkhand

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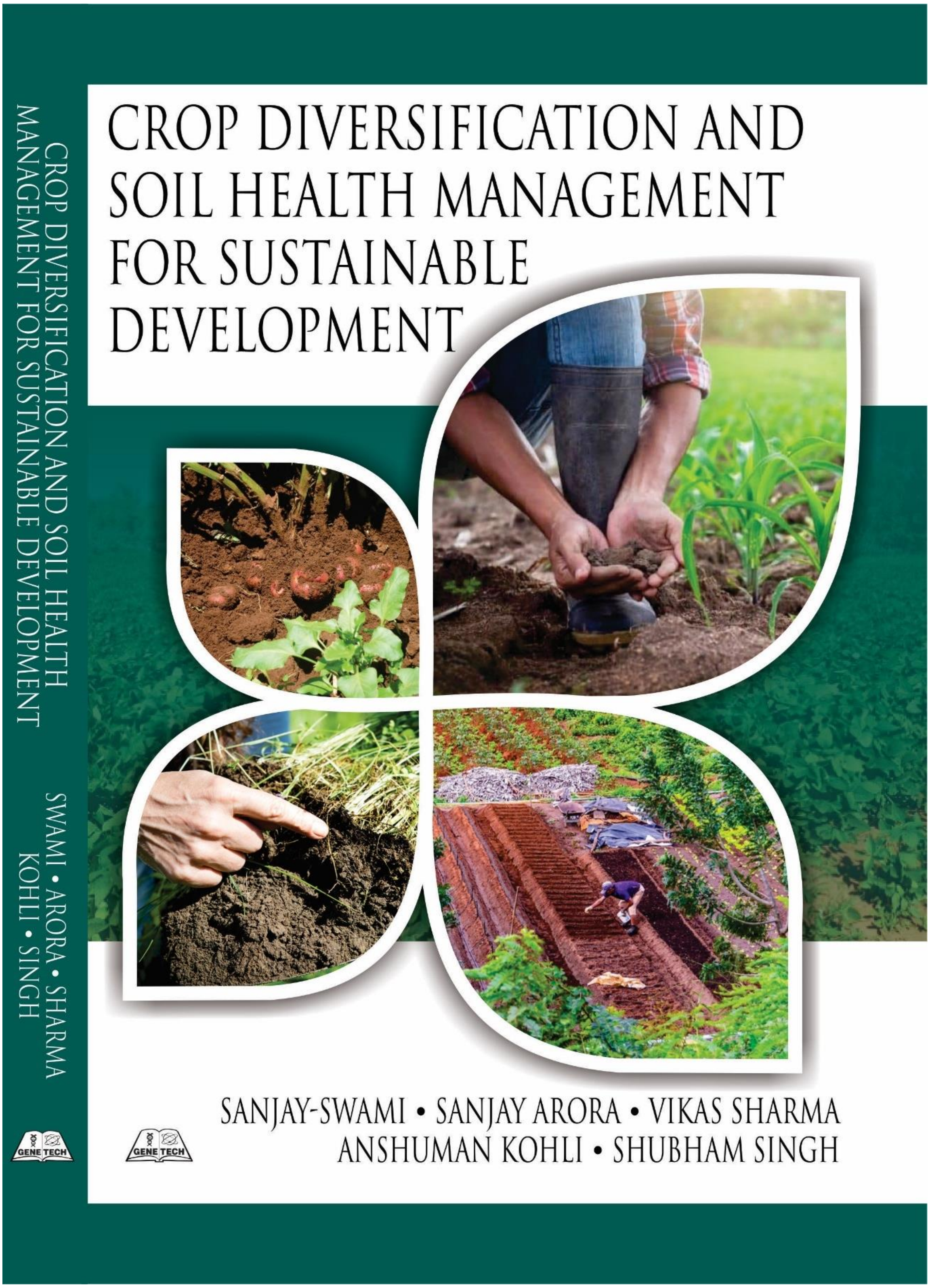
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The book entitled Crop Diversification and Soil Health Management for Sustainable Development is the outcome of the technical papers presented during the International Web Conference on Resource Management and Biodiversity Conservation to Achieve Sustainable Development Goals under the patronage of the Academy of Natural Resource Conservation and Management (ANRCM), Lucknow (UP), India during 11th to 12th September, 2020. The compilation of the papers includes various issues of global concern as well as different regions of the country.

The publication would surely serve as a valuable source book for the researchers, scientists, teachers, academicians, policy planners and students who want to be fully acquainted with the recent developments in crop diversification and soil health management for sustainable development.

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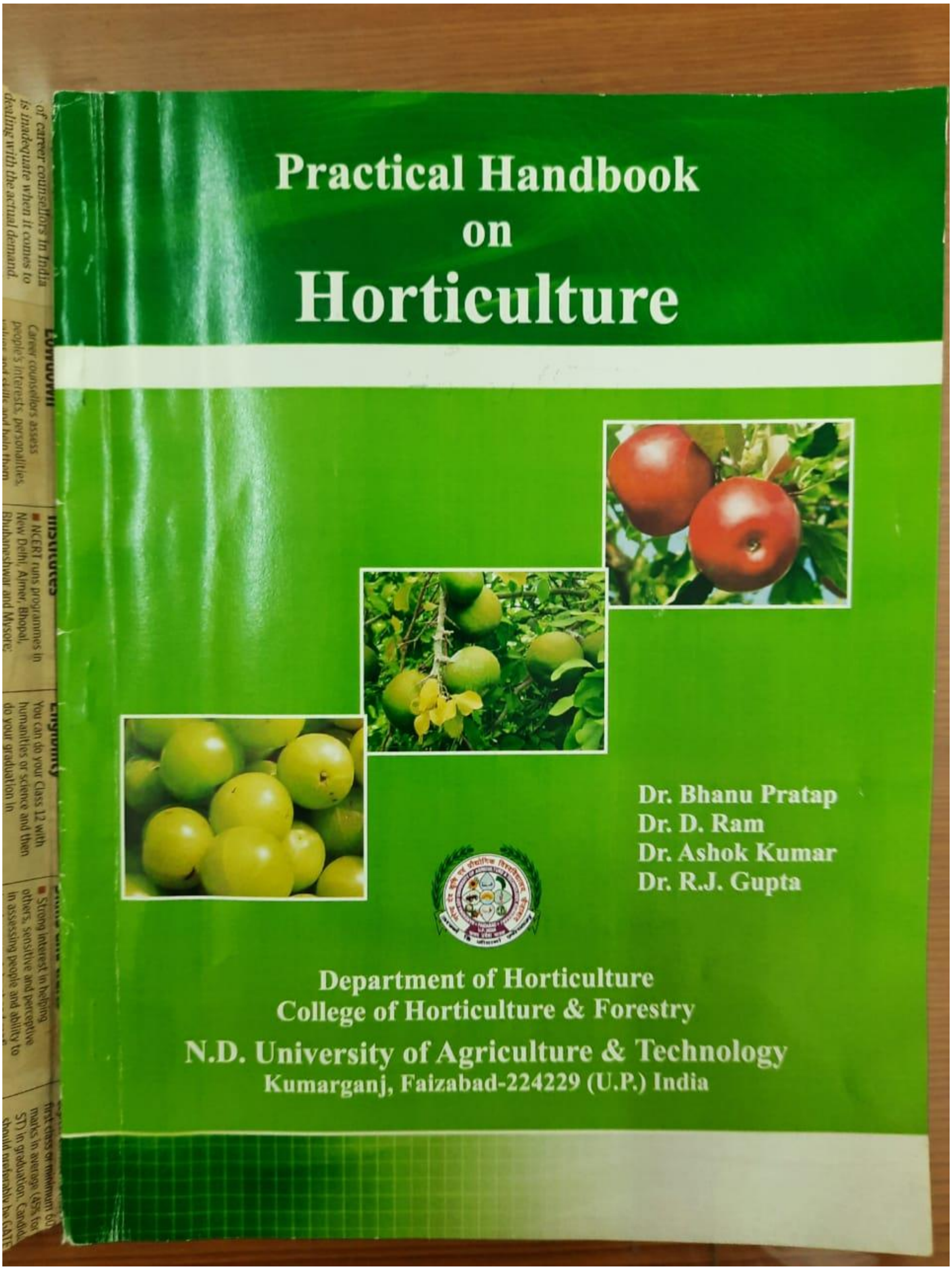
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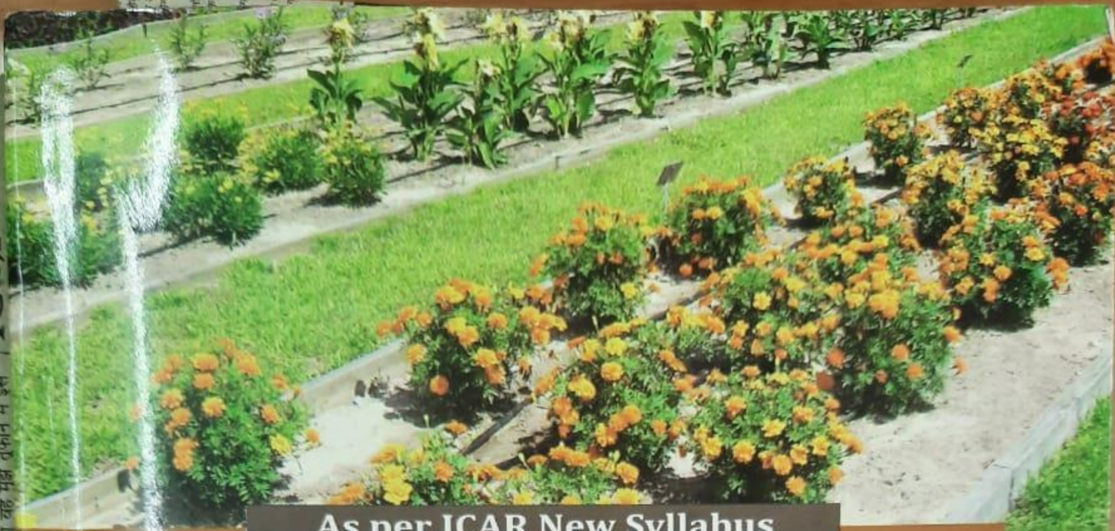

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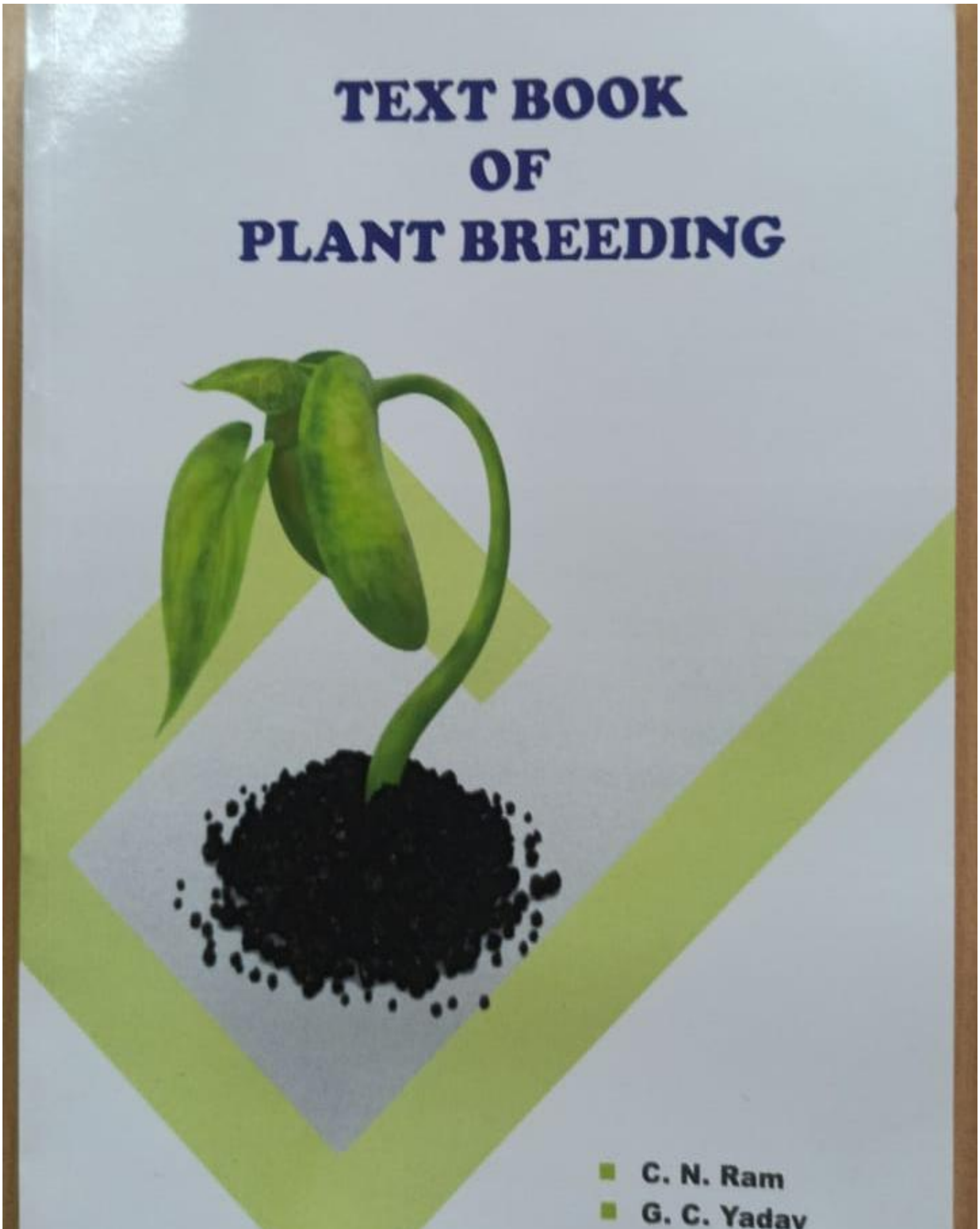
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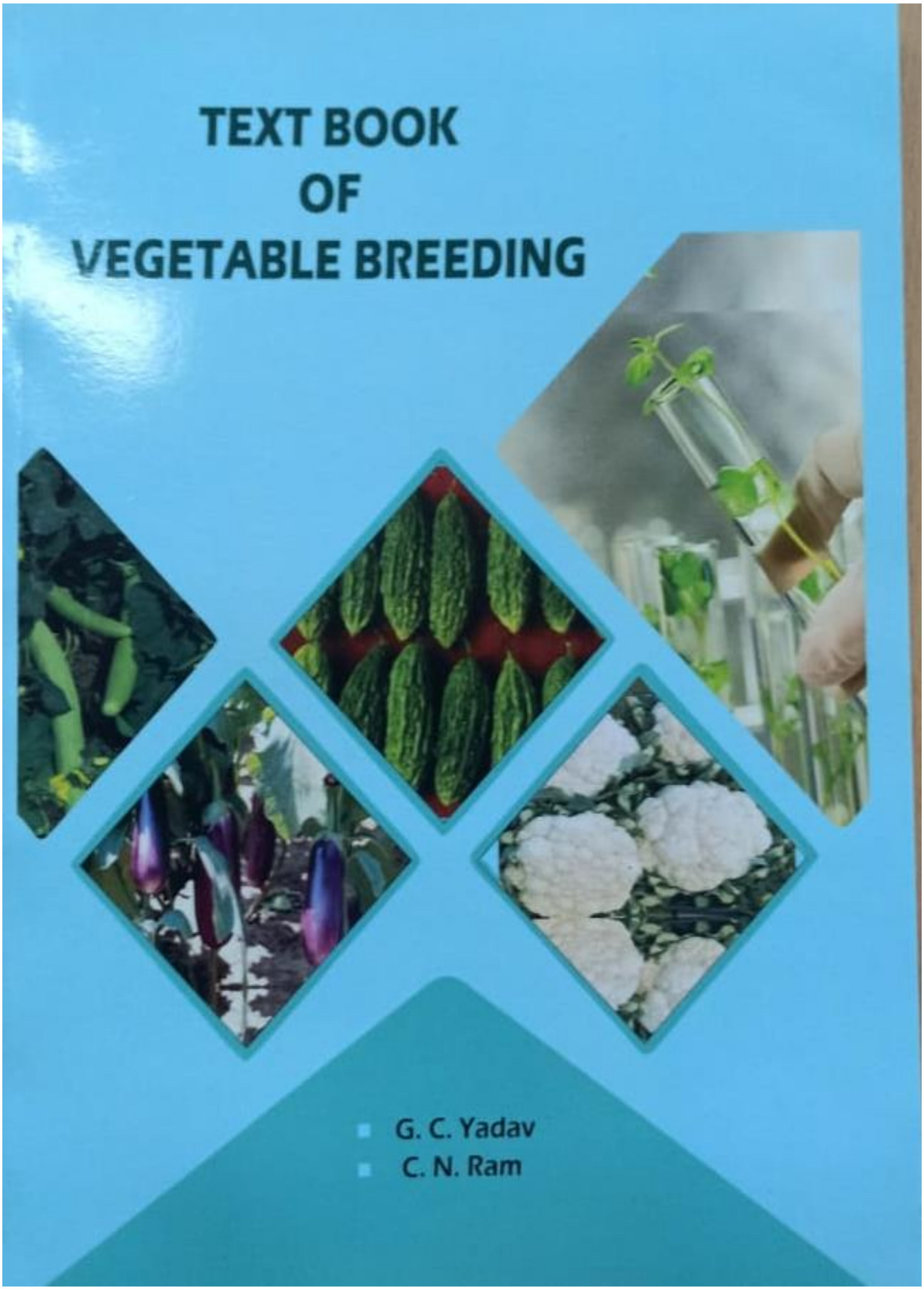
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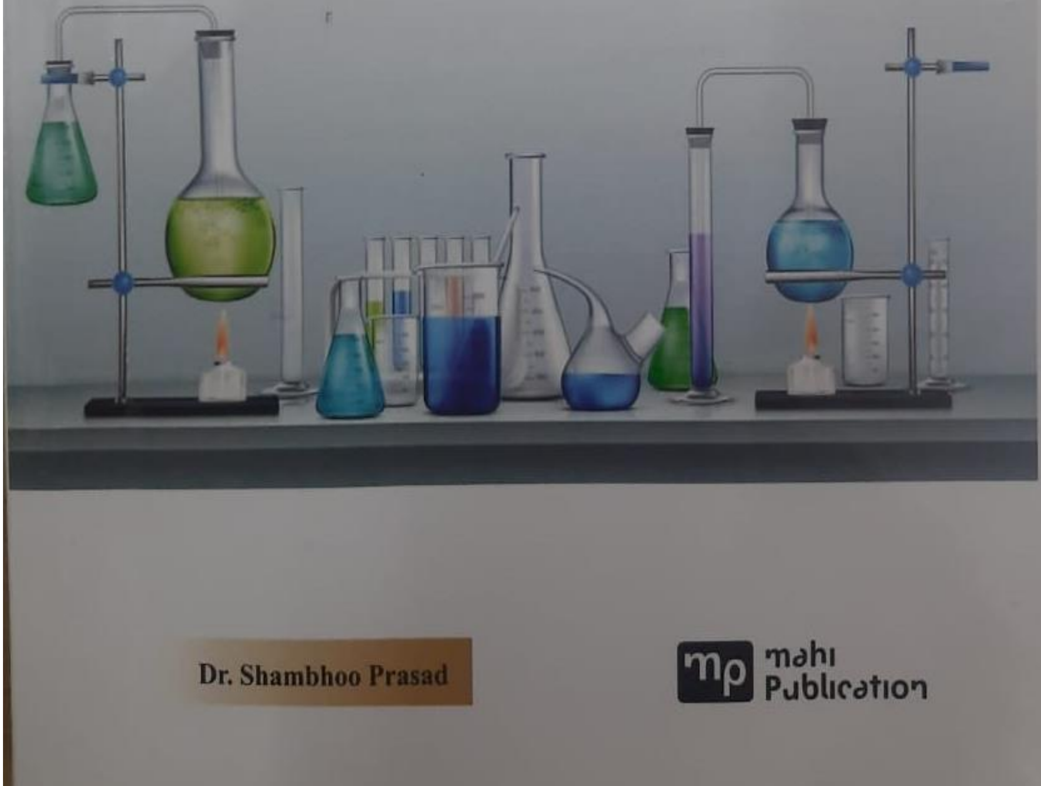

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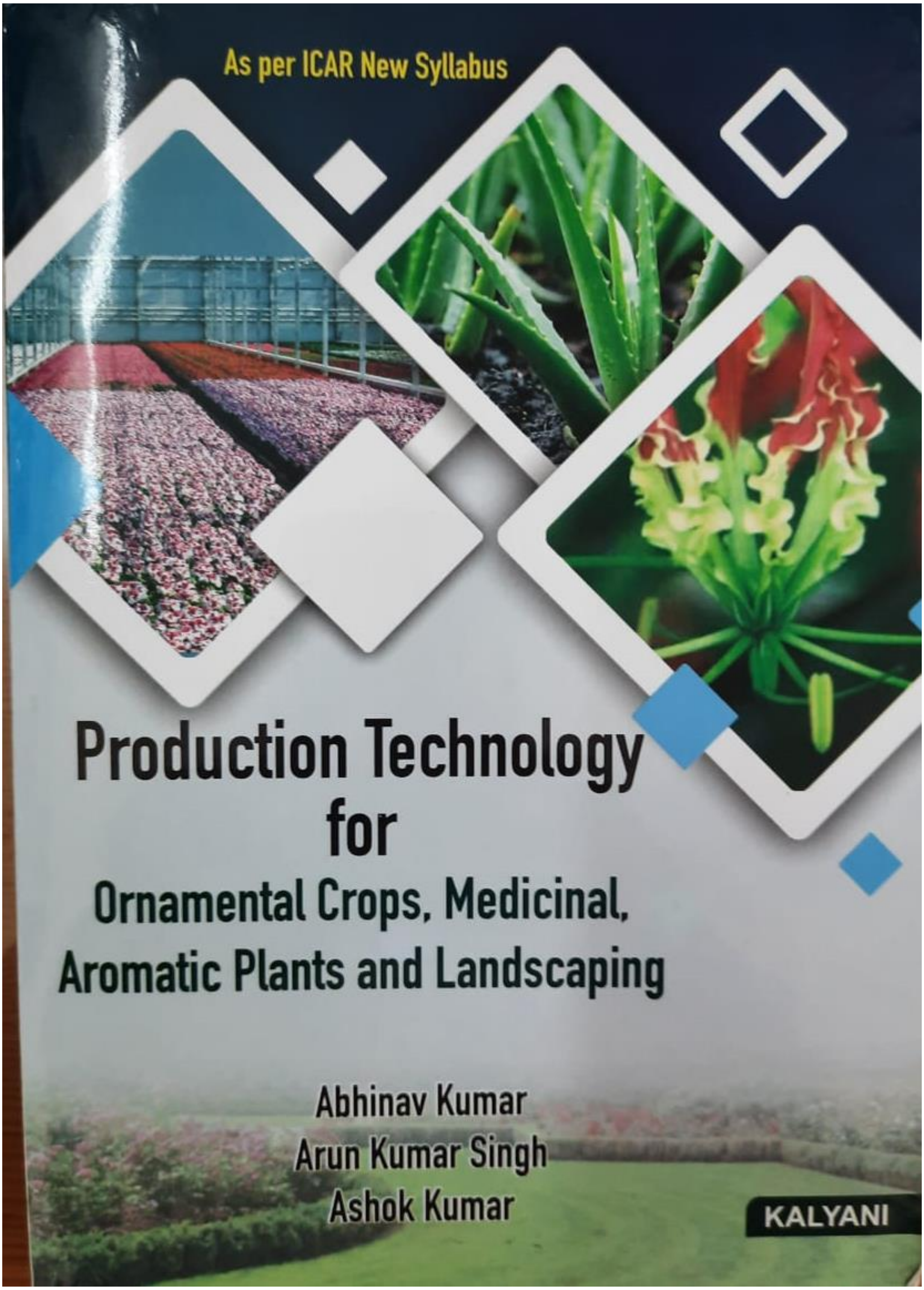
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# 35

# Surgeon's Role in Animal Welfare with Special Reference to Bovine Acute Abdomen

**A.K. Gangwar, Khangembam Sangeeta Devi and Ashish Kumar Srivastava**
College of Veterinary Science & Animal Husbandry
Narendra Dev University of Agriculture & Technology, Kumarganj, Faizabad (UP)-224 229

All surgeons who work with farm animals play a crucial role in protecting animal health. Poor health of the animal contributes to poor welfare. The surgeon's role is related to the prevention, cure or alleviation of pain and treatment of injuries in animals. Apart from this, veterinary surgeons have played significant and contributory roles in animal health and welfare and biomedical research. Livestock contributes about 40 percent of agricultural GDP. Healthy and productive livestock make important contributions to food production, income generation, job creation, economic growth, and poverty alleviation is often overlooked or taken for granted. The main source of income of the farmer is agriculture and livestock. If the animal is diseased, definitely the farmer will suffer from the economic loss. There are so many surgical conditions in the cattle which causes great loss to the livestock producers and dairy farmers.

Certainly amongst the most challenging situations in bovine medicine, the acute abdomen can become a nightmare and result in difficult situations with client, especially in valuable animals. The acute abdomen represents both a diagnostic and therapeutic challenge. In the bovine, the cost and risk of a standing laparotomy is such that in many situations, it almost appears more economical to quickly move toward a surgical approach since both diagnostic and therapeutic purposes can be achieved simultaneously.

Acute abdomen includes the gastrointestinal diseases ( esophageal obstruction, ruminal tympany, abomasal displacement, caecal dilation, gastric ulcers, intestinal obstruction, intestinal/mesenteric volvulus, gastroenteritis, hemorrhagic gastroenteritis etc), reproductive tract disorders ( pyometra, uterine torsion and dystocia), urinary tract affections (obstructive urolithiasis, nephritis, cystitis, urinary bladder stones), peritoneal affections (peritonitis, non traumatic hemoabdomen), abdominal tumors (tumors leading to obstruction and hemoabdomen), splenic torsion, biliary obstruction and pancreatitis/pancreatic abscess.

The clinical signs of acute abdominal disorders vary greatly. Typically, the veterinarian is presented with a cow that has become ill suddenly and has stopped eating and defaecating. The abdomen may be dilated on the left side, right side or both sides, and the entire side of the abdomen or only the dorsal aspect may be affected. The dilated abdomen may be "papple", barrel or pear-shaped. Occasionally, affected cows have colic symptoms, which are usually mild and include restlessness, shifting of weight from one hind foot to the other, spastic flexion of a hind limb, lowering of the back and tail swishing. Rarely, colic symptoms are severe in which case kicking at the abdomen, kicking out with a hind limb, lying down and standing up and sweating are seen. The back may be arched or sunken, and the abdominal wall may be relaxed or tense. An arched back indicates parietal pain and a sunken back corresponds with visceral pain. Sometimes, urination is abnormal.

In cattle with acute abdominal disease and severe symptoms, a rapid diagnosis is paramount to avoid irreparable organ damage. In the past, an exploratory laparotomy was often quickly resorted to as a diagnostic aid in acute abdomen in cattle with no clear diagnosis. Today, many farmers will consent to exploratory laparotomy only when the prognosis is good and the procedure has a reaso-nable chance of being curative. If the prognosis is poor, an exploratory laparotomy should be avoided; it causes

# Strategies and Challenges of Veterinary Profession to Improve Livelihood, Food Security and Safety

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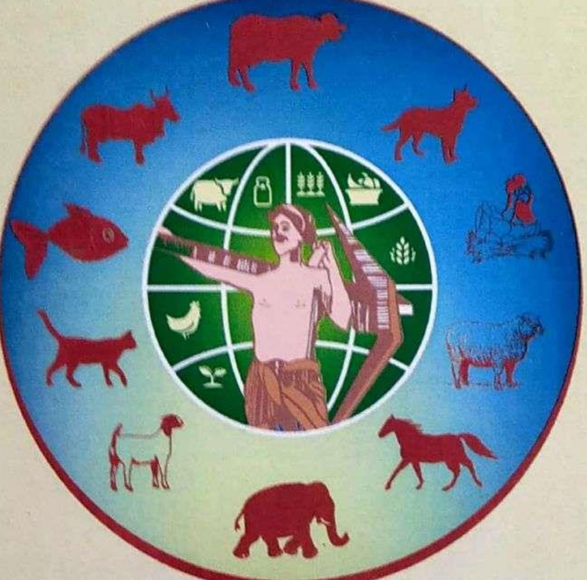

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- Vijay Singh

College of Veterinary Science & Animal Husbandry
Narendra Deva University of Agriculture & Technology,
Kumarganj Faizabad- 224 229

Chapter 6

# Carbon Fibers in Biomedical Applications

Naveen Kumar, Anil Kumar Gangwar and
Khangembam Sangeeta Devi

Additional information is available at the end of the chapter

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**Abstract**

Three-dimensional growth of fibroblasts on carbon fibre mesh and assessment of biocompatibilty by *in vitro* and *in vivo* examination was done. Suitable size carbon fiber mesh after sterilization, placed in six well cell culture plate. The mesh was co-cultured with p-MEF cells. At different time intervals the viability and proliferation of the p-MEF cells was evaluated. The primary objective of this study was biological evaluation of carbon fibre mesh which can be used for creation of three-dimensional scaffolds for tissue engineering. Among the possible forms of implants, fibrous matrices are highly promising for the tissue regeneration by acting as a cell-supporting scaffold. Results of in vitro observations of the morphology p-MEF cells seeded on the surface of carbon fibre mesh shows adhesions and attachment of fibroblasts cells to carbon fibres on day 3 post seeding. They attached firmly and were uniformly spread along the fibres on day 5 postseeding and mostly spindle-shaped and cover almost all their surface on day 7 postseeding and such a spreading of cells indicates good adhesions and biocompatibility of carbon fibres. In vivo examination of retrieved sample on day 30 post implantation shows that carbon fibre mesh was covered by dense thick fibrous connective tissue.

**Keywords:** carbon fibers, carbon fiber mesh, primary mouse embryo fibroblasts (p-MEF), in vitro examination, in vivo examination

## 1. Introduction

Carbon fiber (CF) consists of a multitude of unique physical, chemical and biological characteristics that can be utilized and exploited for a number of diverse applications. Being light weight, high strength, and chemically stable, so they are applied in various fields including aeronautical

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Hassan El-Dessouky, Mohamed Nasr Saleh, Félix A. López, Carlos González, Cláudio S. Lopes, Andrea Fernández, Bo Jin, Aleksandr Evhenovych Kolosov, Elena Kolosova, Yang Liu, Chao Zhang, Xinyu Zhang, Naveen Kumar, Anil Kumar Gangwar, Sangeeta Devi Khangembam, Feng Xu, Xusheng Du, Helezi Zhou, Rita Khanna



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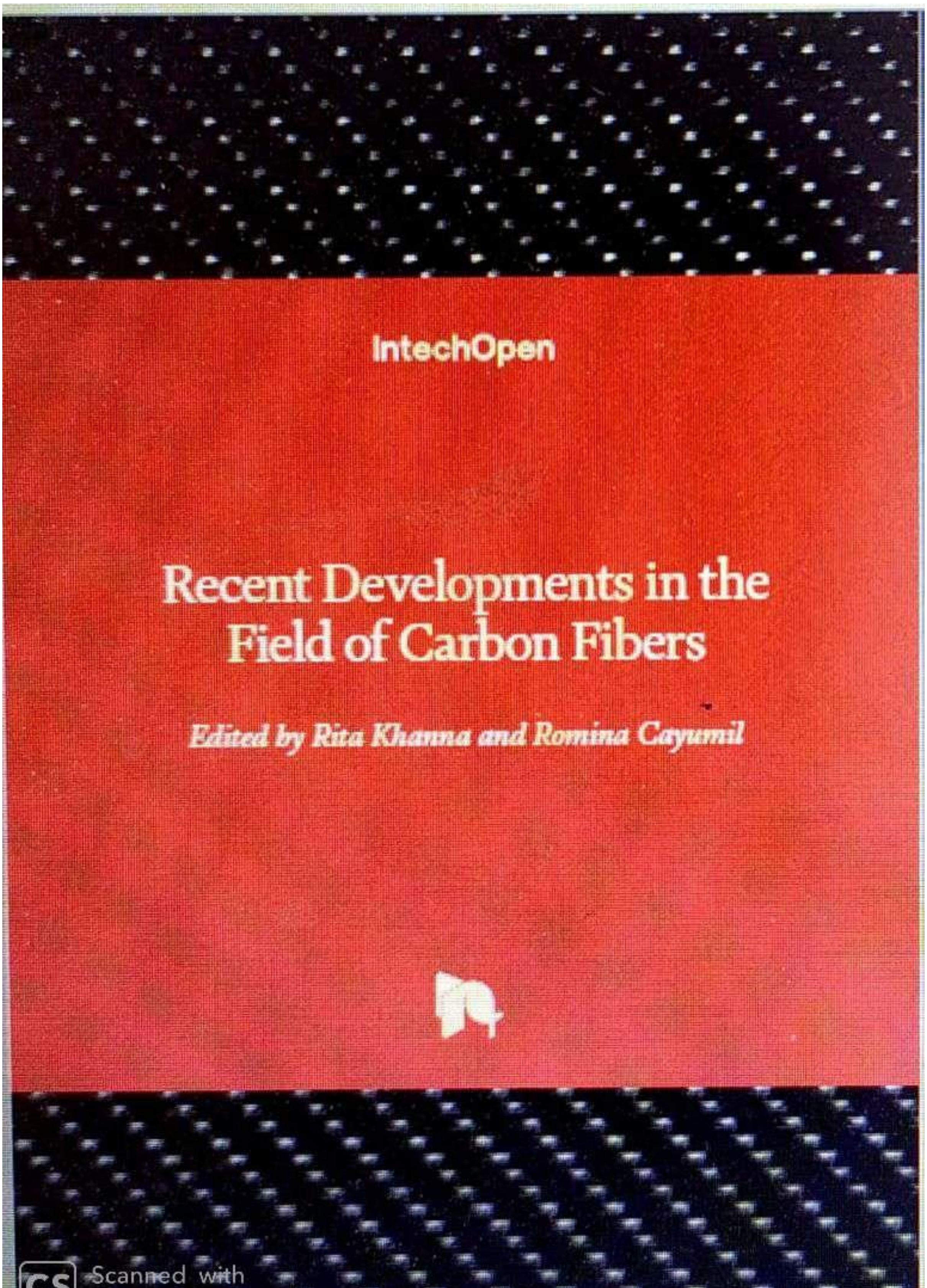
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# Tissue Scaffolds

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Chapter 24

# Tissue Scaffolds Derived from Buffalo and Goat Pericardium

**Ashok Kumar Sharma, Naveen Kumar, Honjon Perme, Rukmani Dewangan, Amit Kumar, Himani Singh, Swapan Kumar Maiti, Vineet Kumar, Jetty Devarathanam, Anil Kumar Gangwar, Sameer Shrivastava, and Sonal Saxena**

## Abstract

Acellular scaffold from buffalo pericardium was prepared by continuously stirring the tissues in 4% sodium deoxycholate for 2–4 h, followed by treatment with 2000 Kunitz units DNase–I suspended in 1 M sodium chloride solution for 2 h. The process was repeated twice. The acellular goat pericardium was prepared by continuously stirring the tissues in 4% sodium deoxycholate for 2–4 h. The prepared acellular biomaterials were stored in PBS solution containing 1% amikacin at 4 °C. They were evaluated based on gross observations, microscopic observations, collagenase enzyme degradation, free amino group content analysis, moisture content analysis, SDS-PAGE, and in vitro cell cytotoxicity determination.

**Key words** Buffalo pericardium, Goat pericardium, Decellularization, Sodium deoxycholate, Gross observations, Microscopic observations, Collagenase enzyme degradation, Free amino group contents, Moisture contents, SDS-PAGE, In vitro cell cytotoxicity

## 1 Introduction

The pericardium is the outermost covering of the heart. It is composed of an outer layer, the fibrous pericardium, and an inner layer, the serous pericardium. The serous pericardium consists of a parietal and visceral layer. The parietal layer is contiguous with the fibrous pericardium and is separated from the visceral layer, which covers the muscular wall of the heart, by the pericardial cavity. The material used to make the leaflets of pericardial heterografts consists of the fibrous pericardium and the parietal layer of the serous pericardium. In vivo, most of the functions of the pericardium are mechanical [1].

The primary constituent of the pericardium is collagen which is essentially a polymer of amino acids. The collagen molecule consists of three chains of polyamino acids or polypeptides arranged in a trihelical configurations ending in a non-helical carboxyl and amino

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Chapter 22

# Tissue Scaffolds Derived from Buffalo Diaphragm and Clinical Applications

**Vineet Kumar, Naveen Kumar, Ashok Kumar Sharma, D. T. Kaarthick, Anil Kumar Gangwar, Himani Singh, Shruti Vora, Foram A. Asodiya, Swapan Kumar Maiti, Dayamon David Mathew, Remya Vellachi, Harendra Singh Rathore, Aswathy Gopinathan, Kiranjeet Singh, and Pawan Diwan Singh Raghuvanshi**

## Abstract

Acellular scaffold from buffalo diaphragm was prepared by continuously stirring of tissues in 0.5, 1, 2, 3, and 4% sodium dodecyl sulfate (SDS) solution, respectively. The tissue was continuously agitated at a rate of 250 rpm for 12, 24, 48, and 72 h at room temperature. They were evaluated based on gross, histological, scanning electron microscopic observations, DNA content evaluation, Fourier transform infrared (FTIR) spectroscopy, 4′,6-diamino-2-phenylindole dihydrochloride (DAPI) staining, agarose gel electrophoresis, and in vitro study of matrix metalloproteinases. Treatment of the diaphragm with 2% sodium dodecyl sulfate solution for 4 h revealed orderly arranged collagen fibers. The prepared acellular matrix was extensively rinsed with sterile phosphate-buffered solution to remove the residual detergent and stored in phosphate-buffered solution containing 1% amikacin at 4 °C. The prepared matrices were tested in clinical cases of abdominal wall defects of different species of animals.

**Key words** Buffalo diaphragm, Decellularization, Sodium dodecyl sulfate, Gross, histological, scanning electron microscopic observations, DNA contents, Evaluation, Fourier transform infrared spectroscopy, 4′,6-Diamino-2-phenylindole dihydrochloride staining, Agarose gel electrophoresis, In vitro study of matrix metalloproteinases

## 1 Introduction

In the surgical repair of congenital abdominal wall defects, the easy availability of a nonimmunogenic and non-prosthetic biomaterial that could guide the regeneration of normal tissue is a fascinating possibility. Biomaterials are already in use, but an acellular matrix (ACM) can arouse exact regeneration of the mislaid tissue. Decellularized scaffolds can be prepared from animal tissues and represent a promising biomaterial for exploration in tissue regeneration

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# Chapter 21

# Tissue Scaffolds Derived from Goat Esophagus By Herbal Detergent

**Sangeeta Devi Khangembam, Anil Kumar Gangwar, Ravi Prakash Goyal, Vipin Kumar Yadav, Rabindra Kumar, Rajesh Kumar Verma, and Naveen Kumar**


## Abstract

The main focus of this study was to explore the decellularization property of soap nut pericarp extract (SPE) as a safe natural detergent for decellularized tubular esophageal scaffold as chemical detergents like sodium deoxycholate, sodium dodecyl sulfate, and Triton X-100 impair the collagenous and non-collagenous proteins, glycosaminoglycans, and growth factors. Further, certain chemicals and enzymes are responsible for residual cytotoxicity in the decellularized extracellular matrix. Different concentrations (2.5, 5.0, and 10%) of SPE were used for the decellularization of the goat esophagus. Histological analysis of hematoxylin and eosin- and Masson's trichrome-stained tissue samples confirmed decellularization with preservation of extracellular matrix microarchitecture. Scanning electron microscopic images of the luminal surface of decellularized esophageal matrix showed randomly oriented collagen fibers with large interconnected pores and cells were absent. However, the external surface was more textured with fibrous structures, and collagen fibers were well preserved. The DAPI-stained decellularized tissues revealed the complete removal of nuclear components, verified by DNA content measurement and SDS-PAGE. The FTIR spectra of decellularized goat esophagus show absorption peaks of amides A, B, I, II, and III. Elastic modulus of the decellularized goat esophagus scaffolds increased ($P > 0.05$) as compared to native tissues. Histological and scanning electron microscopic evaluation of in vitro seeded scaffolds showed attachment and growth of primary chicken embryo fibroblasts (P-CEFs) over and within the decellularized scaffolds. It was concluded that 5% SPE is ideal for the preparation of cytocompatible decellularized goat esophageal scaffold with well-preserved extracellular matrix architecture and may be used as an alternative to biological detergents and other chemicals.


**Key words** Goat esophagus, Decellularization, Soap nut pericarp extract, DAPI staining, FTIR

## 1 Introduction

Collagen is one of the best biomaterials because of its good biocompatibility, negligible immunogenicity, and biodegradability. It was opined that the immune response of collagen depends upon the source from which it is collected [1]. Most of the collagen scaffolds used in tissue engineering belong to porcine or bovine

Naveen Kumar et al. (eds.), *Tissue Scaffolds*, Springer Protocols Handbooks, https://doi.org/10.1007/978-1-0716-2425-8_21,

# Chapter 19

# Tissue Scaffolds Derived from Buffalo Aorta and Clinical Applications

**Jetty Devarathanam, Ashok Kumar Sharma, Naveen Kumar, Vineet Kumar, Shruti Vora, D. T. Kaarthick, Anil Kumar Gangwar, Rukmani Dewangan, Foram A. Asodiya, Himani Singh, Sameer Shrivastava, Sonal Saxena, and Swapan Kumar Maiti**

## Abstract

In this study, protocols were optimized for the preparation of acellular scaffold from buffalo aorta. The protocols comprise the use of 1% Triton X-100 and 1% sodium dodecyl sulfate detergents along with trypsin. The study revealed that the protocol in which the aorta was treated with 1% sodium dodecyl sulfate detergent for 24 h followed by treatment with 0.25% trypsin enzyme solution for 2 h and then again with same 1% sodium dodecyl sulfate for the next 24 h showed complete acellularity with normal thickness and arrangement of collagen fibers. The acellular matrices were evaluated based on histopathological observations; scanning electron microscopic observations; DNA extraction, quantification, and purity; and Fourier transform infrared (FTIR) spectroscopy. The developed acellular aortic matrices were tested for the repair of abdominal wall defects in guinea pigs; clinical cases of hernia in buffalo, cattle, buck, and calves; and repair of the trachea in cow.

**Key words** Buffalo, Aorta, Triton X-100, Sodium dodecyl sulfate, Trypsin, Clinical application

## 1 Introduction

Reconstructive surgery is an innovative field of science concerned with the utilization of various synthetic and biological materials as implants and prostheses. Abdominal wall reconstruction is one of the challenging tasks in reconstructive surgery due to the limitations of available mesh materials. Even though much research has been carried out in this field, to date there is no such material that can be used in abdominal wall reconstruction with promising success. The principal concept in the management of abdominal wall defects is "tension-free" closure. Previously several synthetic materials like polypropylene, polyknitted mesh were used to achieve this objective. However, due to their suboptimal performance in clinical

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# Chapter 18

# Tissue Scaffolds Derived from Goat Aorta by Herbal Detergent

Sangeeta Devi Khangembam, Anil Kumar Gangwar, Ravi Prakash Goyal, Naveen Kumar, Vineet Kumar, Mahesh Kumar Verma, Parvez Ahmed, and Vipin Kumar Yadav

## Abstract

A novel decellularization method using an aqueous extract of soap nut pericarp, an herbal detergent, is described. The presently available decellularization agent raises some concerns due to the presence of some residual cytotoxic agents in the extracellular matrix. We develop a protocol for decellularization of goat aorta using 5% soap nut pericarp. The aorta samples were processed in 5% soap nut pericarp and evaluated at 24, 48, 72, 96, and 120 h using hematoxylin-eosin staining, scanning electron microscopy, diamidino-2-phenylindole (DAPI) staining, mechanical testing, SDS-PAGE, and DNA quantification. Histological analysis shows complete decellularization with preservation of extracellular matrix microarchitecture at 120 h. Staining of tissue samples with DAPI demonstrates complete removal of DNA fragments. The Fourier transform infrared spectroscopy results of native and decellularized tissues revealed the presence of amide peaks of collagen. Tensile strength of the decellularized scaffolds decreased non-significantly ($P > 0.05$) when compared to native tissues. Cell viability and proliferation of primary chicken embryo fibroblasts (p-CEF) demonstrated that the decellularized aorta prepared using 5% SPE exhibits good cytocompatibility.

**Key words** Goat aorta, Decellularization, Soap nut pericarp extract, Fourier transform infrared spectroscopy, DAPI staining, Cytocompatibility

## 1 Introduction

Tissue decellularization is the process of removal of cellular components to produce an acellular extracellular matrix (ECM). Extraction of cellular material and debris from tissue may remove lipid membranes and membrane-associated antigens as well as soluble proteins as a means for reducing the antigenic response to xenograft materials. Decellularization processes likely cause alterations of the ECM structure and thus influence the mechanical properties. Decellularization techniques are classified by the chemicals used, such as acid or alkaline treatment, biological detergent treatment,

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# Chapter 11

# Tissue Scaffolds Derived from Buffalo Gallbladder

**Ashok Kumar Sharma, Naveen Kumar, Poonam Shakya, Anil Kumar Gangwar, Sangeeta Devi Khangembam, Sonal Saxena, Sameer Shrivastava, Kiranjeet Singh, Ajit Kumar Singh, Aswathy Gopinathan, Remya Vellachi, Dayamon David Mathew, Swapan Kumar Maiti, and Karam Pal Singh**

## Abstract

The gallbladder extracellular matrix (ECM) isolated from mammals have been found to have essential bio-components that support cell proliferation, migration, and differentiation. These matrices are naturally rich in collagen, elastin, glycosaminoglycans (GAGs), laminin, and fibronectin on which the cells can migrate, attach, and grow. In this chapter, we illustrate protocols for decellularization of the buffalo gallbladder with ionic biological detergent (0.5% and 1% sodium dodecyl sulfate) and nonionic biological detergent (0.5% and 1% Triton X-100) for different time intervals. The efficacy of decellularization method for the preservation of extracellular matrix scaffold structure and integrity was confirmed using histology, scanning electron microscopy, and DNA quantification. Treatment with 0.5% sodium dodecyl sulfate for 48 h resulted in decellularization of buffalo gallbladder.

**Key words** Buffalo gallbladder, Decellularization, Histology, DNA quantification, Scanning electron microscopy

## 1 Introduction

The ECM with adequate bioactive molecules, capable of supporting the growth of cells participating in regeneration, is an ideal graft suitable for wound healing application [1]. The ECM isolated from certain mammalian organs and tissues have been found to have these essential bio-components that support cell proliferation, migration, and differentiation [2]. These scaffolds are naturally rich in collagen, elastin, glycosaminoglycans (GAGs), laminin, and fibronectin on which the cells can migrate, attach, and grow. In addition, many of the bioactive degradation products released from graft at the site of grafting mimic growth factors required for healing [3]. The ECM is also known to aid angiogenesis by

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# Chapter 10

## Tissue Scaffolds Derived from Goat Gall Bladder by Herbal Detergent

Sangeeta Devi Khangembam, Anil Kumar Gangwar, Amit Kumar Sachan, Preeti Patel, Ravi Prakash Goyal, Naveen Kumar, Vineet Kumar, and Ajit Kumar Singh

**Abstract**

In the present study, goat gall bladder was delaminated by hypertonic saline and decellularized by 5% aqueous extract of soap nut pericarp with continuous agitation on a magnetic stirrer. Complete delamination was observed at 8 h intervals. The gall bladder scaffolds at 48 h were completely decellularized as verified by histology, DAPI staining, scanning electron microscopy, and estimation of DNA contents. Soap nut extract treated gall bladder scaffold was slightly soft in consistency. Histology revealed that the gall bladder scaffold was completely decellularized and collagen fibers were loosely arranged and thick. DAPI staining showed complete removal of nuclear components. Scanning electron microscopy of decellularized tissues showed randomly oriented fibrillar structures with large interconnected pores, and cells were absent. Soap nut pericarp extract is a viable option for decellularization of tissues without any toxicity in the host cells.

**Key words** Gall bladder, Decellularization, Soap nut pericarp

## 1 Introduction

The goat gall bladder is a simple muscular sac and does not have muscularis mucosae and submucosa. The muscularis externa (muscle layer) has bundles of smooth muscle cells, collagen, and elastin fibers. Various biological detergents like Triton X-100, Tween 20, sodium dodecyl sulfate, and sodium deoxycholate have been used for decellularization of the gall bladder with variable results and certain cell cytotoxicity. Kumar et al. [1] reported the biomaterial properties of cholecyst-derived scaffold recovered by a non-detergent/enzymatic method. So there is a need to find out plant origin detergents which have low cell toxicity and good biocompatibility. *Sapindus mukorossi*, a member of the family Sapindaceae, is commonly known by several names such as soap nut, soapberry, washnut, reetha, aritha, dodan, and doadni in India.

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Chapter 8

# Tissue Scaffolds Derived from Pig Gallbladder

**Ashok Kumar Sharma, Naveen Kumar, Poonam Shakya, Anil Kumar Gangwar, Sangeeta Devi Khangembam, Sonal Saxena, Sameer Shrivastava, Remya Vellachi, Dayamon David Mathew, Aswathy Gopinathan, Kiranjeet Singh, Swapan Kumar Maiti, and Karam Pal Singh**

## Abstract

In this chapter, we illustrate protocols for decellularization of the pig gallbladder with ionic biological detergent (0.5% and 1% sodium dodecyl sulfate) and nonionic biological detergent (0.5% and 1% Triton X-100) for different time intervals. The efficacy of the decellularization method for the preservation of the extracellular matrix scaffold structure and integrity was confirmed using histology, scanning electron microscopy, and DNA quantification. Treatment with 0.5% sodium dodecyl sulfate for 48 h resulted in complete decellularization of pig gallbladder.

**Key words** Pig gallbladder, Decellularization, Histology, DNA quantification, Scanning electron microscopy

## 1 Introduction

The decellularized tissues are expected to mimic closely the complex three-dimensional structure and mechanical properties of the native tissues from where it originates [1]. One of the major goals in using natural biodegradable materials is to induce the host, to replace the implanted construct with native tissue [2]. Cholecyst-derived extracellular matrix (CEM) prepared from ECM of pig gallbladder had variable application in the field of regenerative medicine [3]. This CEM found to be a novel acellular proteinaceous biodegradable biomaterial and may have potential applications as scaffolds in heart valve tissue engineering. This matrix is rich in collagen and contains several other macromolecules useful in tissue remodeling [4].

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Chapter 7

# Tissue Scaffolds Derived from Buffalo Skin and Clinical Applications

**Sanjay Purohit, Naveen Kumar, Anil Kumar Gangwar, Vineet Kumar, Sameer Shrivastava, Sonal Saxena, Swapan Kumar Maiti, and Karam Pal Singh**

## Abstract

We standardized the protocols for the development of an acellular dermal matrix from buffalo skin. Acellular dermal matrices composed of extracellular matrix (ECM) are typically derived by decellularization of native tissues. Sodium dodecyl sulfate, sodium deoxycholate, Triton X-100, and Tween 20 were used in combination with trypsin enzyme to lyse cells, followed by rinsing to remove cell remnants. Preservation of the three-dimensional ultrastructure of ECM is highly desirable, which requires proper decisions regarding the agents and techniques involved in the process. The percentage of biological detergent used and the time for making them acellular have been optimized. The decellularization was confirmed by histological examination at different time intervals and accordingly the protocols were optimized. Sodium dodecyl sulfate in combination with trypsin was found very effective for the removal of cellular contents from the buffalo skin. The decellularized matrix scaffold was successfully tested in four clinical cases of hernias in buffaloes.

**Key words** Buffalo skin, Acellular matrices, Ionic biological detergents, Nonionic biological detergents, Trypsin enzyme, Decellularization, Clinical application

## 1 Introduction

Decellularized scaffolds derived from various tissues have been widely studied for tissue engineering and regenerative medicine applications. In the past several decades, we have observed an increased interest in developing acellular skin-derived biological scaffolds composed of extracellular matrix (ECM). The method used for decellularization varies depending upon the tissues used [1]. Allogeneic acellular dermal matrices can be considered as a viable option for skin tissue replacement.

### 1.1 Buffalo Skin

The structure, distribution, and dimension of skin strata and sweat glands have been investigated in Egyptian buffaloes [2]. Samples

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Chapter 6

# Tissue Scaffolds Derived from Pig Skin

**Naveen Kumar, Sanjay Purohit, Ashok Kumar Sharma, Dayamon David Mathew, Anil Kumar Gangwar, Vineet Kumar, Sameer Shrivastava, Sonal Saxena, Remya Vellachi, Swapan Kumar Maiti, and Karam Pal Singh**

## Abstract

Sodium deoxycholate (SD), sodium dodecyl sulfate (SDS), Triton X-100, and Tween 20 detergents in combination with trypsin enzyme are used for the preparation of acellular dermal matrix from pig skin. The decellularization was confirmed by histological examination. The protocol using 2% SDS for 48 h was optimized which resulted in preservation of three-dimensional ultrastructure of ECM which is highly desirable.

**Key words** Pig skin, Acellular matrices, Ionic biological detergents, Nonionic biological detergents, Trypsin enzyme, Decellularization

## 1 Introduction

The pig is considered as an excellent animal model in many fields of biomedical research. Indeed, its anatomy, physiology, and immune system share numerous similarities with human. Pig skin is very similar to its human counterpart, as opposed to many "loose-skinned" animals such as mouse and rat. Table 1 shows the comparison between the skin of different species.

The skin of rodents differs significantly from humans as it is loosely connected to the subcutaneous connective tissue. In contrast, pig and human skin are tightly attached to it.

### 1.1 Pig Skin

Several studies assessed the pig skin using various approaches such as histology, confocal Raman microspectroscopy, and infrared spectroscopy. They showed that in pigs the stratum corneum (SC) thickness is 20–26 microns comparable to what is observed in humans. Complete epidermis varies from 30 to 140 microns in thickness in pigs compared to 50–120 microns in humans.

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# Chapter 5

# Tissue Scaffolds Derived from Sheep Skin

**Naveen Kumar, Sanjay Purohit, Vineet Kumar, Anil Kumar Gangwar, Sameer Shrivastava, Sonal Saxena, and Swapan Kumar Maiti**

## Abstract

We have standardized the protocols for the development of acellular dermal matrix from sheep skin. Acellular dermal matrices are composed of extracellular matrix (ECM) and are typically derived by decellularization of native tissues. Sodium deoxycholate (SD), sodium dodecyl sulfate (SDS), Triton X-100, and Tween 20 detergents in combination with trypsin enzyme are used to lyse the cells followed by rinsing to remove the cells. The decellularization was confirmed by histological examination. Treatment with 2% SD and 2% SDS for 24 h along with trypsin resulted in complete acellularity of the dermis. The results are more or less similar with these too detergents. We succeeded in preservation of three-dimensional ultrastructure of ECM which is highly desirable and requires proper decisions regarding the agents and techniques involved in the process.

**Key words** Sheep skin, Acellular matrices, Ionic biological detergents, Nonionic biological detergents, Trypsin enzyme, Decellularization

## 1 Introduction

The thickness of the skin is closely connected with many of characteristics of the organism, but above all it depends on the overall development of the animal, its productivity, and hence with breeding feature. It varies depending on the age and conditions of animals.

### 1.1 Sheep Skin

The epidermal layer of sheep consists of two layers: the superficial stratum and lower sprout. The surface layer is formed by a single row of flat, horizontally elongated cells with large round and oval nuclei. Cells of the surface layer are clearly expressed keratinization, as the push, approaching the surface, solidification occurs. Lower germ or Malpighian layer is the deepest layer of the epidermis, consisting of soft living cells of a cylindrical shape. These cells are adjacent to the fibrous layer of the dermis and are powered via the special conical elevation, called the dermal papilla. Presenting the

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# Chapter 4

# Tissue Scaffolds Derived from Goat Skin and Clinical Applications

**Vineet Kumar, Naveen Kumar, Foram A. Asodiya, Sanjay Purohit, Ashok Kumar Sharma, Dayamon David Mathew, Anil Kumar Gangwar, Sameer Shrivastava, Sonal Saxena, and Swapan Kumar Maiti**

## Abstract

Decellularization is the process of removing the cellular components from tissues. It is a promising technique for obtaining a highly preserved extracellular matrix scaffold for tissue engineering and regenerative therapies. In this chapter, protocol for decellularization of the goat skin using ionic biological detergent and proteolytic enzyme is presented. The efficacy of the decellularization method for preservation of extracellular matrix scaffold structure and integrity was confirmed using histology, DNA quantification, scanning electron microscopy, and Fourier transform infrared spectroscopy. Clinical application and outcome of the final decellularized goat dermal matrix scaffold into repair of hernia in buffaloes, a cat, and goats are also described.

**Key words** Goat skin, Decellularization, DNA quantification, FTIR spectroscopy, Scanning electron microscopy

## 1 Introduction

Animal tissues are extensively used as scaffolds for tissue engineering and regenerative therapies [1–14]. They are typically subjected to decellularization process to remove the cellular components and obtain highly preserved extracellular matrix (ECM) scaffold. These ECM scaffolds provide a native framework for cell adhesion at the site of tissue defect and allow local cells to migrate into the matrix and adhere before undergoing differentiation [15]. Tissue scaffolds are slowly degraded by cellular proteases at the implantation site and are replaced by new endogenous extracellular matrix proteins secreted by ingrowing fibroblasts. Further, the ECM scaffolds stimulate rapid neo-vascularization during tissue regeneration [16] and are relatively inert immunologically [17]. They are resistant to adhesions and encapsulation [18]. Infection rates of ECM

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# Chapter 3

# Tissue Scaffolds Derived from Rabbit Skin and Clinical Applications

**Naveen Kumar, Sanjay Purohit, Ashok Kumar Sharma, Dayamon David Mathew, Anil Kumar Gangwar, Vineet Kumar, Sameer Shrivastava, Sonal Saxena, Remya Vellachi, Swapan Kumar Maiti, and Karam Pal Singh**

## Abstract

We standardized the protocol for the development of acellular dermal matrix from rabbit skin. Acellular dermal matrices are composed of extracellular matrix (ECM) and are typically derived by decellularization of the native tissues. Physical, chemical, and enzymatic methods, biological detergents alone, or in combination are used to lyse cells, followed by rinsing to remove cell remnants. Preservation of three-dimensional ultrastructure of ECM is highly desirable, which requires proper decisions regarding the agents and techniques involved in the process. The percentage of biological detergent used, time for making them acellular, has been optimized. The decellularization was confirmed by histological examination, DNA content analysis, and SEM analysis. We successfully achieved in preservation of three-dimensional ultrastructure of ECM which is highly desirable and requires proper decisions regarding the agents and techniques involved in the process. Clinical application and outcome of the final decellularized rabbit dermal matrix scaffold in the repair of hernias in buffaloes, dogs, goats, and calves is also described.

**Key words** Rabbit skin, Acellular matrices, Ionic biological detergents, Nonionic biological detergents, Trypsin enzyme, Decellularization

## 1 Introduction

The skin is the largest organ of the mammalian body with an estimated total weight of 5 kg and a surface area of around 2 $m^2$ for adult humans. Being most exposed to the environment, it represents a major physical and immunological protection against injury and infection. Accordingly, similar to the mucosal immune system, a skin immune system (SIS) has been described representing a coordinated system in which epithelial cells, resident immune cells, and a local microenvironment including locally produced vitamins control immunity and tolerance to self and foreign

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# Chapter 2

# Tissue Scaffolds Derived from Rat Skin and Clinical Applications

**Anil Kumar Gangwar, Naveen Kumar, Vineet Kumar, Ashok Kumar Sharma, Dayamon David Mathew, Sangeeta Devi Khangembam, Sameer Shrivastava, Sanjay Purohit, Sonal Saxena, Remya Vellachi, Swapan Kumar Maiti, and Karam Pal Singh**

## Abstract

Protocol for the development of acellular dermal matrix from rat skin was optimized. The skin was de-epithelialized first by subjecting it to hypertonic solution treatment for different time intervals. Later, the de-epithelialized tissue samples were subjected to five different protocols, viz., hypertonic solution, Triton X-100, sodium dodecyl sulfate, and sodium deoxycholate (1% and 2% solution) for different time intervals for decellularizing the tissues. Tissue samples were collected at different time intervals for histological and scanning electron microscopic examinations. Treating the rat skin in hypertonic solution for 8 h resulted in complete de-epithelialization. At 48 h, all the samples treated with different protocols showed complete acellularity with removal of cellular debris. Clinical application and outcome of the final decellularized rat dermal matrix scaffold in the repair of hernias in dogs and horses is also described.

**Key words** Hypertonic solution, Triton X-100, Sodium dodecyl sulfate, Sodium deoxycholate, Rat skin, Acellular matrices, Decellularization

## 1 Introduction

The skin losses can occur due to acute trauma, resection of cutaneous malignancies, donor site harvesting, chronic wounds, or even surgical interventions. The full-thickness injuries are characterized by the complete destruction of epithelial regenerative tissues. Currently, autologous skin grafting is the treatment of choice for full-thickness skin injuries. In this process, donor site also heal with some scarring and may be very painful. The large wound that cannot be corrected by conventional surgical procedures requires substitute of missing tissue to keep the wound free of infection, to reduce pain, and to ensure early wound healing [1]. In the cases of

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# Chapter 1

## Naturally Derived Biomaterials: An Overview

**Naveen Kumar, Vineet Kumar, Sameer Shrivastava, Anil Kumar Gangwar, Aswathy Gopinathan, Swapan Kumar Maiti, Sonal Saxena, Sangeetha Palakkara, Raguvaran Raja, and Pawan Diwan Singh Raghuvanshi**

**Abstract**

The extracellular matrix (ECM) is a complex network with multiple functions during tissue regeneration. Precisely, the properties of ECM have been thoroughly used in tissue engineering and regenerative medicine research, aiming to restore the function of damaged or dysfunctional tissues. One of the most promising techniques for tissue and organ regeneration is decellularization, in which the ECM is isolated from its native tissues in order to produce a natural scaffold. The ECM ideally retains its inherent structural, biochemical, and biomechanical cues and can be decellularized to produce a functional tissue or organ. While decellularization can be accomplished using chemical and enzymatic, physical, or a combination of these methods, each strategy has its benefits and drawbacks. A biological scaffold from ECM can be produced by a variety of decellularization methods whose caveat consists in efficiently eliminating cells from the treated tissue. Preservation of the ECM matrix ultrastructure is highly desirable because of its unique architecture, contained growth factors, and decreased immunological response. All of these properties provide attachment sites and adequate environment for the cells colonizing this scaffold, reconstituting the decellularized organ. Tissue decellularization is gaining momentum as a technique to obtain potentially implantable decellularized extracellular matrix (dECM) with well-preserved key components. The chapter briefly describes different decellularization methods, evaluates these protocols, and compares the advantages and disadvantages of these methods in terms of their ability to retain desired ECM characteristics for particular tissues and organs.

**Key words** Extracellular matrix, Naturally derived biomaterials, Scaffolds, Chemical decellularization, Detergent, Cell lysis, Regenerative medicine

## 1 Introduction

Biomaterials science encompasses elements of medicine, biology, chemistry, materials, and tissue engineering. Biomaterials are those materials that are used in medical devices or in contact with biological systems [1]. They are engineered to interact with biological systems to treat, augment, and repair or replace lost tissue function. The choice of biomaterial depends on the

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*Editors*
Naveen Kumar
ICAR-Indian Veterinary Research Institute
Izatnagar, India

Sameer Shrivastava
ICAR-Indian Veterinary Research Institute
Izatnagar, India

Sonal Saxena
Indian Veterinary Research Institute
Izatnagar, India

Vineet Kumar
Sardar Vallabhbhai Patel University of Agriculture and Technology
Meerut, India

*Anil Kumar Gangwar*
Acharya Narendra Dev University of Agriculture and Technology
Ayodhya, India

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# 15 Decellularization of Skin Tissue

Naveen Kumar, Vineet Kumar, Sanjay Purohit, Anil Kumar Gangwar, Sameer Shrivastava, Swapan Kumar Maiti, Sonal Saxena, Dayamon David Mathews, Pawan Diwan Singh Raghuvanshi, Ajit Kumar Singh, and Karam Pal Singh

**Abstract**

Biomaterials science encompasses elements of medicine, biology, chemistry, materials, and tissue engineering. They are engineered to interact with biological systems to treat, augment, repair, or replace lost tissue function. The choice of biomaterial depends on the procedure being performed, the severity of the patient's condition, and the surgeon's preference. Prostheses made from natural-derived biomaterials are often derived from decellularized extracellular matrix (ECM) of animal (xenograft) or human (allograft) origin. Advantages of using ECM include their resemblance in morphology and three-dimensional structures with that of tissue to be replaced. Due to this, scientists all over are now focusing on naturally derived biomaterials which have been shown to possess several advantages compared to synthetic ones, owing to their biocompatibility, biodegradability, and remodeling properties. Advantages of a naturally derived biomaterial enhance their application for replacement or restoration of damaged organs/tissues. They adequately support cell adhesion, migration, proliferation, and differentiation. Naturally derived biomaterials can induce extracellular matrix formation and tissue repair when implanted into a defect by enhancing attachment and migration of cells from surrounding environment. In the current chapter, we will focus on the natural and synthetic dermal matrix development and all of the progress in this field.

**Keywords**

Skin · Decellularization · Tissue engineering · Dermal Matrix

## 15.1 History

Biomaterials are those materials that are used in medical devices or in contact with biological systems (Ratner 2006). A biocompatible or suitable biomaterial for one application may not be biocompatible in another (Ratner 2006). An ideal implant should effectively repair the defect without eliciting an adverse host response while maintaining mechanical, as well as, biological integrity for a desired time ranging from a few weeks to even several years' durations. Further, they must be easily manufactured not only on macroscopic but also at the cellular level. However, on the odd occasion, these materials can cause immunological reactions in the host (Ratner et al. 1996).

N. Kumar (✉) · V. Kumar · S. Purohit · A. K. Gangwar · S. Shrivastava · S. K. Maiti · S. Saxena · D. D. Mathews · P. D. S. Raghuvanshi · A. K. Singh · K. P. Singh
Division of Surgery, ICAR-Indian Veterinary Research Institute, Izatnagar 243122, India



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Chapter

# Fourier Transform Infrared Spectroscopy of the Animal Tissues

*Vineet Kumar, Shruti D. Vora, Foram A. Asodiya, Naveen Kumar and Anil K. Gangwar*

## Abstract

Animal tissues are extensively used as scaffolds for tissue engineering and regenerative therapies. They are typically subjected to decellularization process to obtain a cell-free extracellular matrix (ECM) scaffolds. It is important to identify chemical structure of the ECM scaffolds and Fourier transform infrared (FTIR) appears to be a technique of choice. In this chapter, FTIR spectra of native and decellularized buffalo aortae, buffalo diaphragms, goat skin, and native bovine cortical bone are presented. The transmittance peaks are that of organic collagen amide A, amide B, amide I, amide II and amide III chemical functional groups in both native and decellularized aortae, diaphragms and skin. In bone, the transmittance peaks are that of inorganic $\nu_1$, $\nu_3$ $PO_4^{3-}$, $OH^-$ in addition to organic collagen amide A, amide B, amide I, amide II and amide III chemical functional groups. These important transmittance peaks of the tissue samples will help researchers in defining the chemical structure of these animal tissues.

**Keywords:** buffalo aorta, buffalo diaphragm, bovine bone, goat skin, Fourier transform infrared spectroscopy

## 1. Introduction

The extracellular matrix (ECM) scaffolds primarily composed of structural collagen protein are widely used in tissue engineering and regenerative medicine [1–15]. These are usually prepared from animal tissues by decellularization process. Decellularization is the process of removal of native cells from animal tissue, leaving behind a three-dimensional network of ECM proteins while preserving the bioactivity and mechanics of the tissue. In the decellularization process, animal tissues are subjected to physical, enzymatic and chemical treatments. Physical methods of decellularization include freezing, direct pressure, sonication, and agitation [16]. Enzymatic techniques of decellularization include the use of protease (trypsin) [1–5, 8, 10, 12–15], endonucleases and exonucleases. Chemical methods of decellularization include the use of acids and alkalis (acetic acid, peracetic acid, hydrochloric acid, sulfuric acid, ammonium hydroxide), nonionic detergents (Triton X-100), ionic detergents (sodium dodecyl sulfate, sodium deoxycholate, Triton X-200) [1–15], zwitterionic detergents (3-[(3-cholamidopropyl)dimethylammonio]-1-propanesulfonate, sulfobetaine-10, sulfobetaine-16), organic solvent (Tri(n-butyl)phosphate) [3, 10], hypertonic and

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Chapter 30

# Surgical Care of Perinate with Malformations

*Khangembam Sangeeta Devi, Anil Kumar Gangwar, Naveen Kumar, Vineet Kumar and Ajit Kumar Singh*

Abnormalities of structure and function, which are present at birth, are obviously congenital deformities. Occasionally calves are born with certain congenital anomalies like atresia ani/atresia ani et recti/atresia ani et recti et coli, atresia ani with rectovaginal fistula, cheiloschisis, arthrogryposis, contracted tendon, eventration of intestine, meningocele, unilateral and bilateral lateral patellar luxation, ocular dermoid and umbilical hernia, polythelia, hypospadias and cryptorchidism or some other abnormality that need serious care and attention. Congenital malformations can result from defective genetics or environmental factors or a combination of both. Pedigree analysis and breeding trials revealed that these anomalies are autosomal recessive diseases (Bryan et al. 1993). The environmental factors included consumption of toxic plants by the dam and maternal-foetal viral infections during early gestation (Bandemkiran et al. 2009). Bovine viral diarrhoea-mucosal disease virus can induce congenital anomalies in the bovine foetus. This virus is capable of crossing both the placental and foetal blood brain barrier. Maternal manganese deficiency is also responsible for these conditions.

Developmental anomalies sometimes lead to perinatal mortality or compatible with life causing aesthetic defects or having no effect on the animal and reduce the value of the defective neonates. Susceptibility to agents that affect development varies with foetal stages, but in general decreases with gestational age. Before Day 14 of gestation (period of pre-attachment), the zygote or embryo is resistant to teratogens that can cause congenital anomalies but is susceptible to genetic mutations. During Days 14 and 42, the embryo is extremely susceptible to teratogens, but this decreases with embryonic age, as the critical periods for the formation of various organs are passed. From Day 42, the foetus becomes resistant to teratogenic agents with increasing age, except for the late differentiating structures, e.g. cerebellum, palate, and urogenital system. The animals with congenital abnormalities require the utmost care. This chapter includes the various congenital abnormalities, their clinical signs and management in ruminants.

## Congenital anomalies of gastrointestinal tract (GIT)

Atresia ani/atresia ani et recti/ atresia ani et recti et coli are the main congenital anomalies of GIT, characterized by absence of anal opening since birth.

## Atresia ani or imperforate anus

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For book details contact
szenci.otto@univet.hu

Ottó Szenci • John F. Mee • Ulrich Bleul • Marcel A. M. Taverne

# Bovine Prenatal, Perinatal and Neonatal Medicine

Hungarian Association for Buiatrics, Budapest

# Scaffolds for bladder tissue engineering

# 54

*Naveen Kumar[1], Sonal Saxena[2], Vineet Kumar[3], Sameer Shrivastava[1,2], Anil Kumar Gangwar[4], Swapan Kumar Maiti[1], Rukmani Dewangan[1], Sangeeta Devi Khangembam[1], P.D.S. Raghuvanshi[6], Naresh Kumar Singh[5], Ajit Kumar Singh[3], Karam Pal Singh[1]*

[1]Division of Surgery, ICAR-Indian Veterinary Research Institute, Bareilly, India; [2]Division of Veterinary Biotechnology, ICAR-Indian Veterinary Research Institute, Izatnagar, India; [3]Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India; [4]Department of Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, India; [5]Department of Veterinary Surgery and Radiology, Faculty of Veterinary and Animal Sciences, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India; [6]Department of Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Anjora, Durg, India

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Bladder dysfunction induced by disease or surgical intervention can result in chronic urinary incontinence and increased upper urinary tract pressure leading to irreversible kidney damage. Currently, the treatment of choice in these patients is enterocystoplasty with the aim to increase bladder capacity and lower the storage pressure However, it fails to restore the emptying function and is associated with complications such as increased mucus production, metabolic disturbances, urolithiasis, infections, and even malignancy [1–3]. To prevent these, various materials have been tried for reconstruction with only limited success so far.

Some disorders of the urinary tract can become severe enough to eventually require reconstruction. These include congenital disorders such as myelomeningocele or bladder exstrophy, bladder cancer, trauma and chronic inflammation resulting from interstitial cystitis, or other conditions. Apart from structural damage, injuries to the nerves that innervate the bladder can also lead to bladder dysfunction that is severe enough to warrant surgical intervention and eventual reconstruction of the lower urinary tract. The term "neurogenic bladder" is used to describe these alterations in bladder function that are provoked by neurologic dysfunction that results from disease or injury, and this condition often significantly increases the morbidity of the underlying condition [4]. In addition, pathologies involving the spinal cord (e.g., sacral agenesis, tethered spinal cord, traumatic cord injuries, multiple sclerosis, and transverse myelitis) may also lead to neurogenic bladder dysfunction [1,5]. The most common cause of the neurogenic bladder in children is spina bifida, which affects 1 in 1000 newborns [6]. Bladder dysfunction

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# Scaffolds for abdominal wall reconstruction

# 43

*Naveen Kumar[1], Vineet Kumar[2], Anil Kumar Gangwar[3], Sameer Shrivastava[1,4], Swapan Kumar Maiti[1], Khangembam Sangeeta Devi[3], Sonal Saxena[4], P.D.S. Raghuvanshi[5], Naresh Kumar Singh[6], Ajit Kumar Singh[7], Karam Pal Singh[1]*

[1]Division of Surgery, ICAR-Indian Veterinary Research Institute, Bareilly, India; [2]Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India; [3]Department of Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, India; [4]Division of Veterinary Biotechnology, ICAR-Indian Veterinary Research Institute, Izatnagar, India; [5]Department of Surgery and Radiology, College of Veterinary Science and Animal Husbandry, Anjora, Durg, India; [6]Department of Veterinary Surgery and Radiology, Faculty of Veterinary and Animal Sciences, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India; [7]Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India

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# HANDBOOK OF TISSUE ENGINEERING SCAFFOLDS

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Chapter 30

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Chapter 6

# Carbon Fibers in Biomedical Applications

Naveen Kumar, Anil Kumar Gangwar and
Khangembam Sangeeta Devi

Additional information is available at the end of the chapter

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**Abstract**

Three-dimensional growth of fibroblasts on carbon fibre mesh and assessment of biocompatibilty by *in vitro* and *in vivo* examination was done. Suitable size carbon fiber mesh after sterilization, placed in six well cell culture plate. The mesh was co-cultured with p-MEF cells. At different time intervals the viability and proliferation of the p-MEF cells was evaluated. The primary objective of this study was biological evaluation of carbon fibre mesh which can be used for creation of three-dimensional scaffolds for tissue engineering. Among the possible forms of implants, fibrous matrices are highly promising for the tissue regeneration by acting as a cell-supporting scaffold. Results of in vitro observations of the morphology p-MEF cells seeded on the surface of carbon fibre mesh shows adhesions and attachment of fibroblasts cells to carbon fibres on day 3 post seeding. They attached firmly and were uniformly spread along the fibres on day 5 postseeding and mostly spindle-shaped and cover almost all their surface on day 7 postseeding and such a spreading of cells indicates good adhesions and biocompatibility of carbon fibres. In vivo examination of retrieved sample on day 30 post implantation shows that carbon fibre mesh was covered by dense thick fibrous connective tissue.

**Keywords:** carbon fibers, carbon fiber mesh, primary mouse embryo fibroblasts (p-MEF), in vitro examination, in vivo examination

## 1. Introduction

Carbon fiber (CF) consists of a multitude of unique physical, chemical and biological characteristics that can be utilized and exploited for a number of diverse applications. Being light weight, high strength, and chemically stable, so they are applied in various fields including aeronautical

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**Contributors**

Hassan El-Dessouky, Mohamed Nasr Saleh, Félix A. López, Carlos González, Cláudio S. Lopes, Andrea Fernández, Bo Jin, Aleksandr Evhenovych Kolosov, Elena Kolosova, Yang Liu, Chao Zhang, Xinyu Zhang, Naveen Kumar, Anil Kumar Gangwar, Sangeeta Devi Khangembam, Feng Xu, Xusheng Du, Helezi Zhou, Rita Khanna



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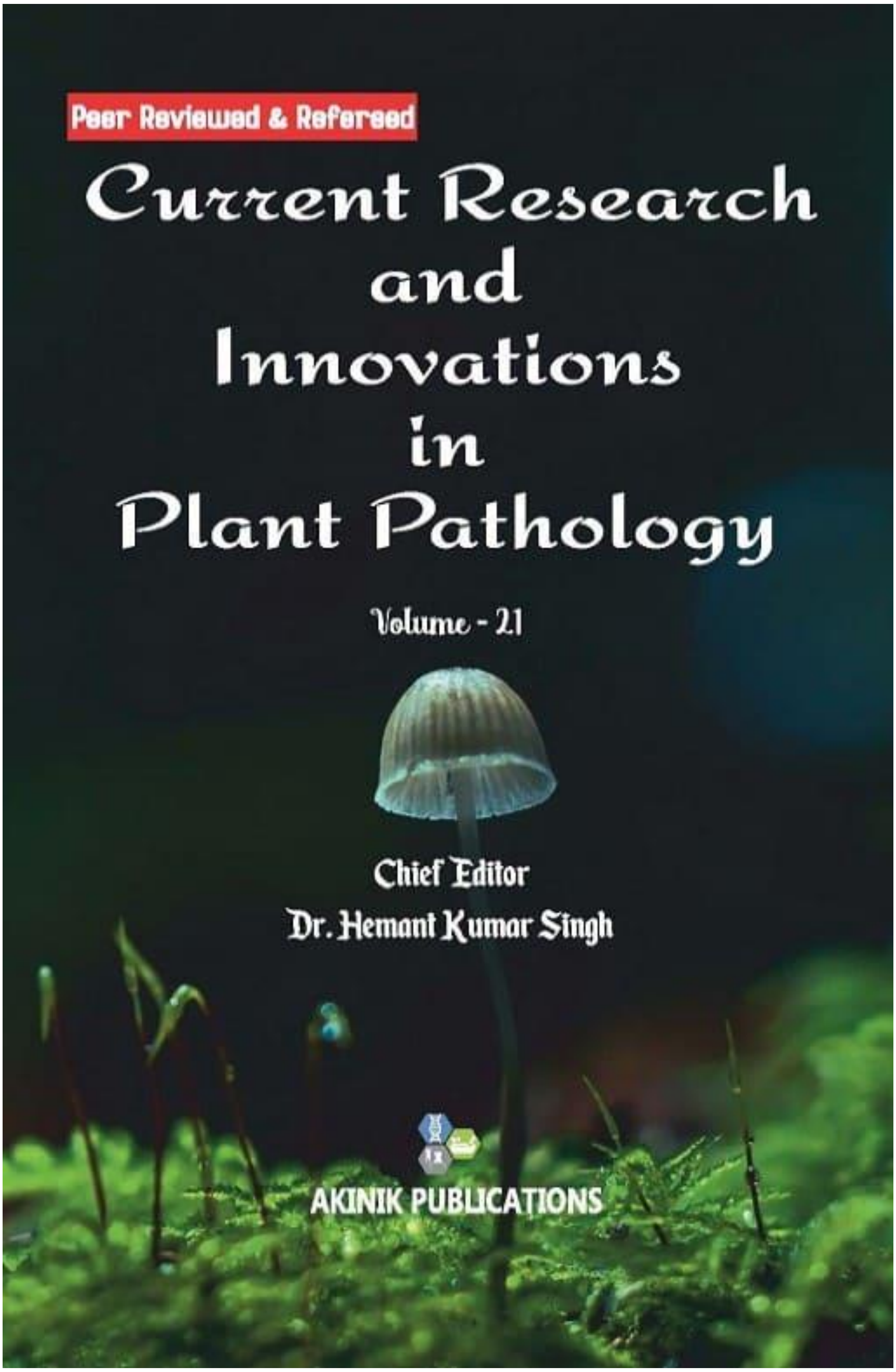
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## Chapter - 7
# Molecular Mechanism of Transgenerational Epigenetic Inheritance through Paramutation


**Authors**

**Piyusha Singh**
Department of Genetics and Plant Breeding, College of Agriculture ANDUAT Campus Azamgarh, Uttar Pradesh, India

**Akanksha Tiwari**
Department of Genetics and Plant Breeding, College of Agriculture ANDUAT Campus Azamgarh, Uttar Pradesh, India

**Vimlesh Kumar**
Department of Horticulture, College of Agriculture ANDUAT Campus Azamgarh, Uttar Pradesh, India

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# ADVANCES IN THE DIAGNOSIS AND CLINICAL MANAGEMENT IN VETERINARY PRACTICE

आचार्य नरेन्द्र देव कृषि एवं प्रौद्योगिक विश्वविद्यालय
Acharya Narendra Deva University of Agriculture And Technology
Kumarganj, Ayodhya-224229, U.P.

# Question Bank on Veterinary Public Health and Food Safety

*for Ready Reference to the Students, Teachers and Researchers, Civil Service Examinations (State and Central), NET, Ph.D. and Allied Examinations*

Namita Joshi

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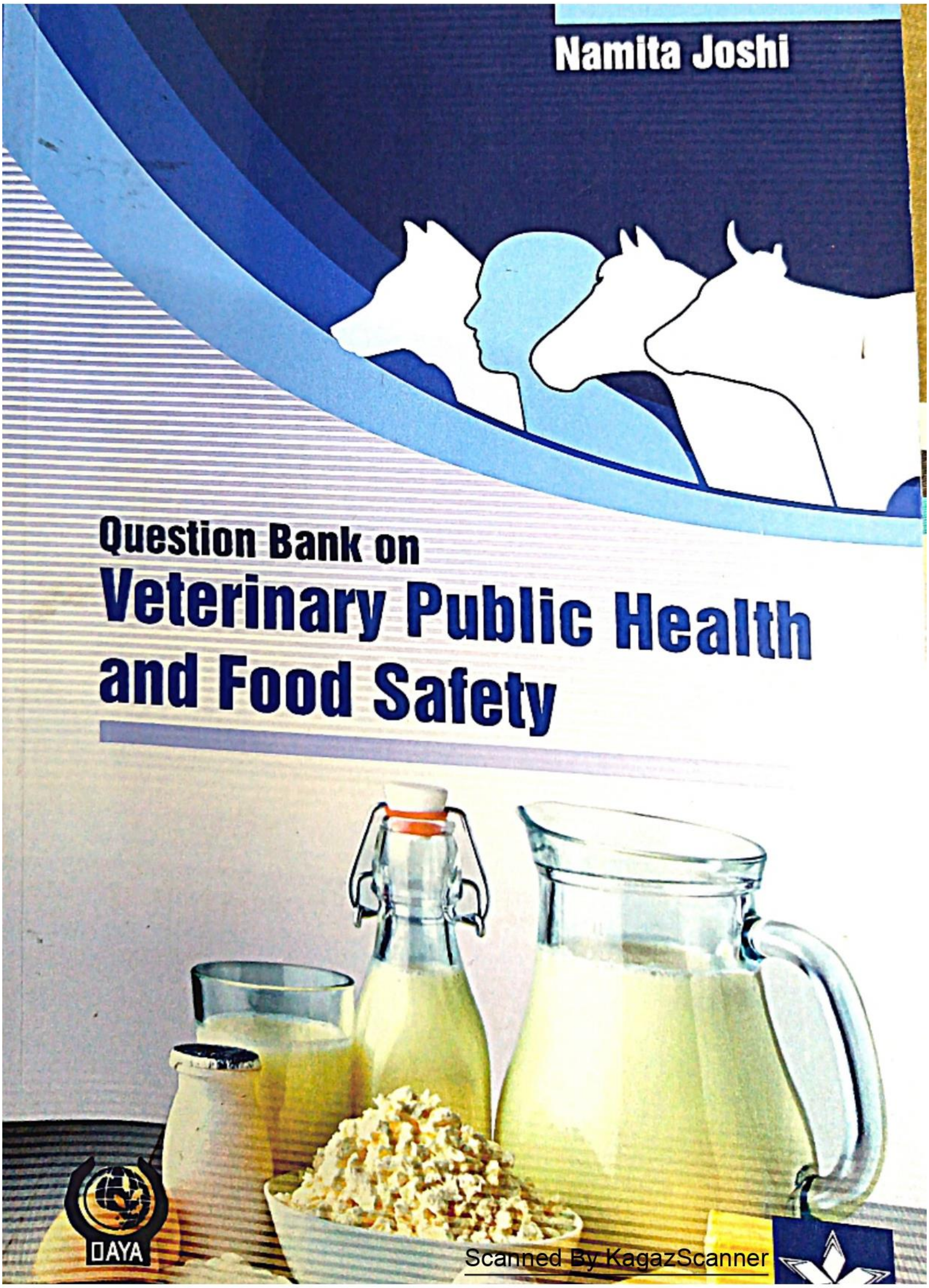
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Question Bank on
Veterinary Public Health
and Food Safety
DAYA

REVIEW OF

# VETERINARY SCIENCE


## Dr. Rakesh Kumar Gupta

M.V.Sc., Ph.D. (Persuing)
Department of Veterinary Pathology
College of Veterinary Science & Animal Husbandry
Acharya Narendra Deva University of Agriculture and Technology
Ayodhya-224229, Uttar Pradesh, India

## Dr. Debasish Niyogi

M.V.Sc., Ph.D.
Professor and Head
Department of Veterinary Pathology
College of Veterinary Science & Animal Husbandry
Acharya Narendra Deva University of Agriculture and Technology
Ayodhya-224229, Uttar Pradesh, India

## Dr. Satyvrat Singh

M.V.Sc., Ph.D.
Assistant Professor
Department of Veterinary Medicine
College of Veterinary Science & Animal Husbandry
Acharya Narendra Deva University of Agriculture and Technology
Ayodhya-224229, Uttar Pradesh, India

## Dr. Sonu Jaiswal

M.V.Sc., Ph.D.
Associate Professor and Head
Department of Veterinary Clinical Complex
College of Veterinary Science & Animal Husbandry
Acharya Narendra Deva University of Agriculture and Technology
Ayodhya-224229, Uttar Pradesh, India

RAKESH KUMAR GUPTA
DEBASISH NIYOGI
SATYAVRAT SINGH
SONU JAISWAL

# REVIEW OF VETERINARY SCIENCE

FOR COMPETITIVE EXAMINATIONS

VETERINARY MEDICAL OFFICER
ASRB-ICAR-NET
ICAR-JRF/SRF
IAS/PCS

# Chapter - 7

## Molecular Mechanism of Transgenerational Epigenetic Inheritance through Paramutation

Piyusha Singh, Akanksha Tiwari and Vimlesh Kumar

**Abstract**

Gene silencing is associated with heritable changes in gene expression which occur without changes in DNA sequence. In eukaryotes these phenomena are common and control important processes, such as development, imprinting, viral and transposon sequence silencing, as well as transgene silencing. Among the epigenetic events, paramutation occurs when a silenced allele (named paramutagenic) is able to silence another allele (paramutable) in Trans and this change is heritable. These behaviors are recognized by non-Mendelian inheritance patterns that are found independently of chromosome transmission ratio distortions and, at least in plants, in the absence of parent-of-origin effects.

Paramutations are associated with repeated sequences in Z. mays, D. melanogaster and possibly in mammals, and are recognized when changes occur at regulatory regions of specific genes affecting discernible traits. In the 1950s, Alexander Brink described for the first time the phenomenon of paramutation, occurring in maize at the *colored1* (*r1*) gene. Paramutation and paramutation-like interactions have been discovered in other plants and animals, suggesting that they may underlie important mechanisms for gene expression. The molecular bases of these phenomena are unknown. However in some cases, the event of paramutation has been correlated with changes in DNA methylation, chromatin structure and recently several studies suggest that RNA could play a fundamental role. The meaning of paramutation in the life cycle and in evolution remains to be determined even though we might conjecture that this phenomenon could be involved in a fast heritability of favourable epigenetic states across generations in a non-Mendelian way.

**Keywords:** DNA methylation, gene silencing, paramutation, repeated sequences, epigenetics

# Chapter - 4
# Role of Biotechnology for Biotic and Abiotic Stress Management


**Authors**

**Dr. Akanksha Tiwari**
Assistant Professor (Genetics and Plant Breeding), College of Agriculture, Kotwa, Azamgarh, A.N.D.U.A. & T. Kumarganj, Ayodhya, Uttar Pradesh, India

**Dr. Yogendra Singh**
Assistant Professor (Senior Scale)-Biotechnology
Department of Plant Breeding & Genetics, JNKVV
Jabalpur, Madhya Pradesh, India

**Dr. Piyusha Singh**
Assistant Professor (Genetics and Plant Breeding), College of Agriculture, Kotwa, Azamgarh, A.N.D.U.A. & T. Kumarganj, Ayodhya, Uttar Pradesh, India

**Nitesh Kumar Panwar**
Ph.D. Scholar, Department of Plant Breeding & Genetics, JNKVV, Jabalpur, Madhya Pradesh, India

# Chapter - 4

## Role of Biotechnology for Biotic and Abiotic Stress Management

Akanksha Tiwari, Yogendra Singh, Piyusha Singh and Nitesh Kumar Panwar

**Abstract**

Plant stress is a state where the plant is growing in non-ideal growth conditions that increase the demands made upon it. The effects of stress can lead to deficiencies in growth, crop yields, permanent damage or death if the stress exceeds the plant tolerance limits. Agriculture Biotechnology has been contributing to sustainable agriculture through the following ways: Increased resistance against biotic stresses (insect pests and diseases); Increased resistance against abiotic stresses (drought, cold, flooding, and problem soils); Bioremediation of polluted soils and bio detectors for monitoring pollution etc. In other words Biotechnology is one of the best way by which the productivity of crops can be enhanced by increasing their ability to resist or tolerate biotic and abiotic stresses. It has offered tremendous scope and potential to conventional methods of crop improvement, crop protection, crop quality management and improving other important traits.

**keywords:** biotechnology, biotic stress, abiotic stress, genetic engineering, crop improvement

**Introduction**

Agriculture and climate change are internally correlated with each other in various aspects, as climate change is the main cause of biotic and abiotic stresses, which have adverse effects on the agriculture of a region. Climate-smart agriculture is the only way to lower the negative impact of climate variations on crop adaptation, before it might affect global crop production drastically. Biotechnology is one of the best way by which the productivity of crops can be enhanced by increasing their ability to resist or tolerate biotic and abiotic stresses. It has offered tremendous scope and potential to conventional methods of crop improvement, crop protection, crop quality management and improving other important traits. The whole-plant response

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herbicide resistance will surely be developed if it is continuously used in the same area for long period. No case of herbicide resistance was reported from any of the centres of AICRP-Weed Control like UAS, Bangalore; Visva-Bharati, Sriniktan; GBPAU &T, Pantnagar and 19 other centres where the same herbicide has been used during last 10-12 years in long term permanent trial. This confirms that herbicide *per se* does not cause any mutation. Rather resistant gene is present in any of the single individual naturally in a large population over a large area. As evident from the definition of resistance, it is not due to the mutation caused by the herbicide as chemical, rather resistance appears from the selection of natural mutation that exists as a small fraction of population of resistant plants. Herbicide-resistant plant biotypes are believed to be emerging from only one or a few plants that are already present in a population. It may be a single plant in a population of several million.

Although they look morphologically identical, minor invisible genetic differences do exist among them that confer inherent resistance against herbicides. Such a minute number of resistant plants continue to grow and expand by generation over time and seasons. When we apply a herbicide continuously for consecutive seasons, the susceptible plants of a weed decrease drastically and those resistant biotypes increase gradually to the extent that we find that the herbicide appears to be ineffective at one point. At this stage, we say that the weed has developed resistance against a herbicide or in other words called selection pressure of herbicides reached to maximum (Duke *et al.* 1991).

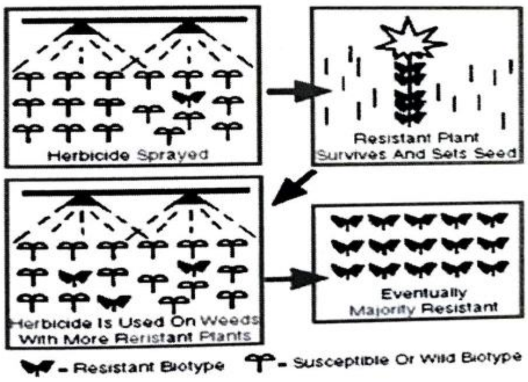


**Fig. 1 Choice for herbicide resistance occurs** (Gunsolus JL. 2008)

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**Keywords:** Biotype, herbicide, mutation, resistance, weeds

**Contact Author**
**T. Pandiaraj**
College of Agriculture (Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya), Kotwa, Azamgarh, Uttar Pradesh

**Introduction**

Like any other pests, weeds also have witnessed resistance development against herbicide whe weeds exposed to the same herbicide over many years. As illustrated in Fig. 1, while simil herbicide group or herbicide chemical is used frequent times in agricultural land, susceptib weeds are destroyed, leaving resistant weeds to mature and lead the population.

**Herbicide tolerance:** It is the ability of a species to survive and reproduce after herbici treatment. It is the ability to compensate for the damaging effect of herbicides with physiological mechanisms involved (Menalled and Dyer 2006).

**Herbicide resistance:** Refers to the inherited ability of a weed or crop biotype to survive herbicide application to which the original population was susceptible. Thus, herbicide resistan is simply an altered response to a herbicide by a species which was earlier susceptible and it is t naturally occurring, irreversible and inheritable ability of some weed biotypes within a populati (Duary and Yaduraju 1999).

**Development of resistance**

Frequent use of the same group of herbicide and/ or herbicides having similar action mode modern agriculture involving mono-cropping system and zero tillage could be the main grounds the event of herbicide resistance. It is apparent from the meaning of herbicide that if som herbicides do not show a lethal effect on a weed species, it should not wrap that resistance ha developed. There are several factors governing the efficacy of chemicals in herbicide. The reaso for poor herbicide efficacy should be honestly assessed prior to concluding herbicide resistance Often, use of the term herbicide resistance is a misconception. It does not always mean tha

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# Herbicide Resistance in Weeds and Its Efficient Management

**T. Pandiaraj, Prakash Yadav, D.K. Singh**
College of Agriculture (Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya), Kotwa, Azamgarh, Uttar Pradesh

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**Abstract:**

As a management of weed is a vital constituent of agronomic methods of crop cultivation, chemical method of weed (herbicide) control is used greatly to harvest maximum yield. This herbicide has transformed the management of weed in global agriculture. However, there are some demerits like herbicide resistance, weed shift flora and environmental pollution. Of which, herbicide resistance is a major concern in the world agriculture. In the last three decades, many dozens of herbicide resistant weeds were reported from all over the world. Most of them are resistance to triazine group of herbicides. Herbicide resistance is considered global phenomenon and number of resistant weeds biotypes is rising at an alarming rate. It is necessary to accurately realize the herbicide resistance, its evolution as well as mode and mechanism of resistance to deal the problem. The use of herbicides having different sites of action and herbicide rotation in weed management programme may prevent or delay the development of herbicide resistance in weed. The most successful long-term planning for management of weed resistance is the adoption of Integrated Weed Management (IWM) with different suitable methods in a combined manner and also provides positive beneficial towards the ecological standpoint. Given the challenges in management of herbicide-resistant weeds, IWM will possibly play a significant role in enhancing future food security for an increasing world population. However, fundamental research and facilities are essential for healthy perceptive of herbicide resistance and its management.

This book "VARIABILITY AND DISEASE MANAGEMENT OF ALTERNARIA BLIGHT OF INDIAN MUSTARD" is the compendium of wide ranging modern topics on microbial variability and eco-friendly disease management strategy. This book has been written for the eco-friendly management of most destructive Alternaria blight disease of mustard. The chapters on control of plant diseases have been recognized and expanded to include recent developments on several aspects of IDM and of new chemicals and biological agents used for plant disease control. The data of key potential diseases and their management along with photographs will help the readers to identify diseases symptoms, the damage caused by pathogen. The disease management practices are also environment-friendly and safer for farmers.

VARIABILITY AND DISEASE MANAGEMENT

Mahesh Singh
Hemant Kumar Singh

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# Variability and Disease Management of Alternaria Blight of Mustard

Dr. Mahesh Singh is presently working as Assistant Professor at School of Agriculture, ITM University Gwalior (M.P.) Dr. Singh did his M.Sc.(Ag.) from AAIDU, Allahabad and Ph.D (Plant Pathology) from NDUAT, Faizabad. Dr. H. K. Singh is Assistant Professor, Plant Pathology posted in N.D. Univ. of Agric. and Tech., Kumarganj, Faizabad, (U.P.) India.

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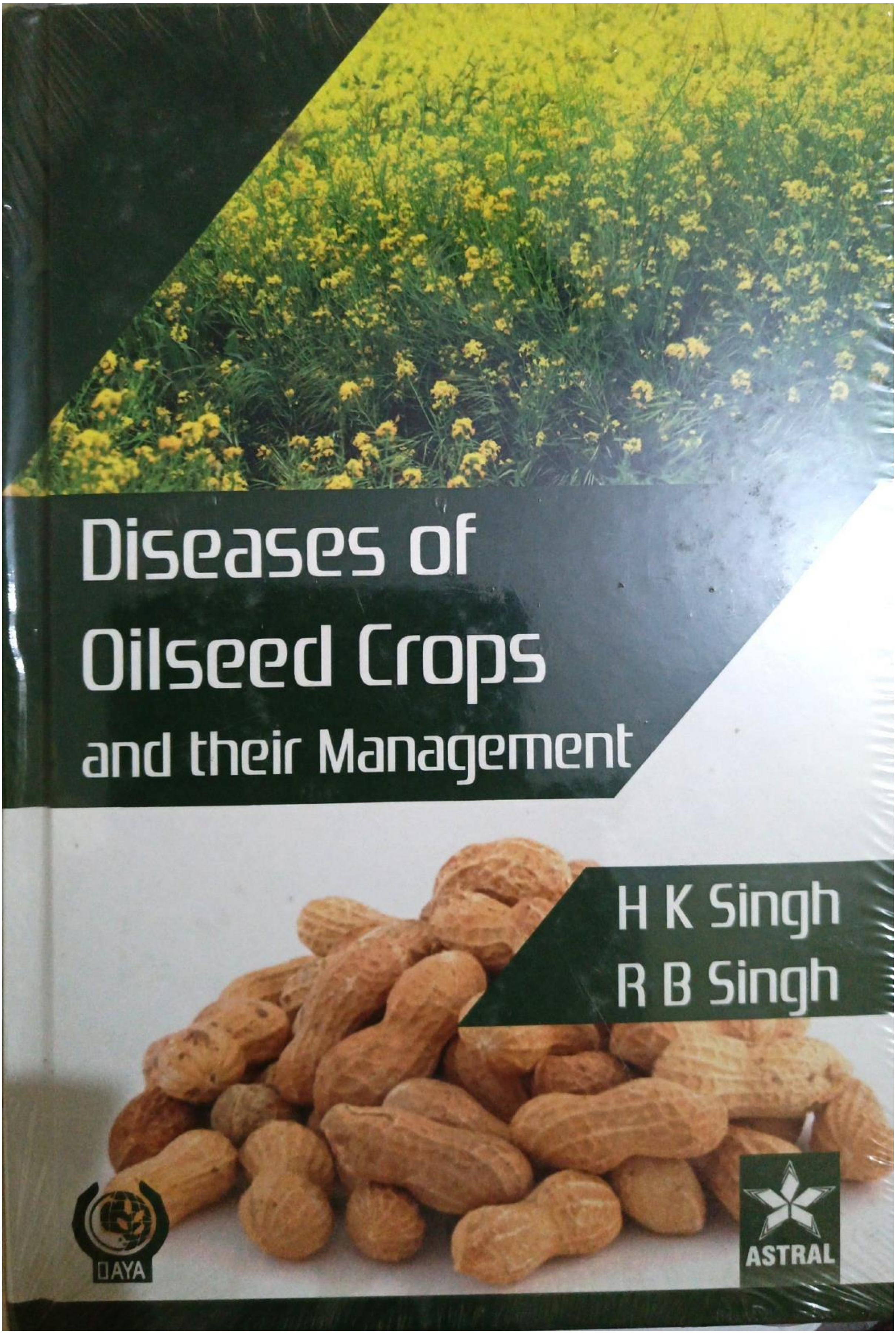
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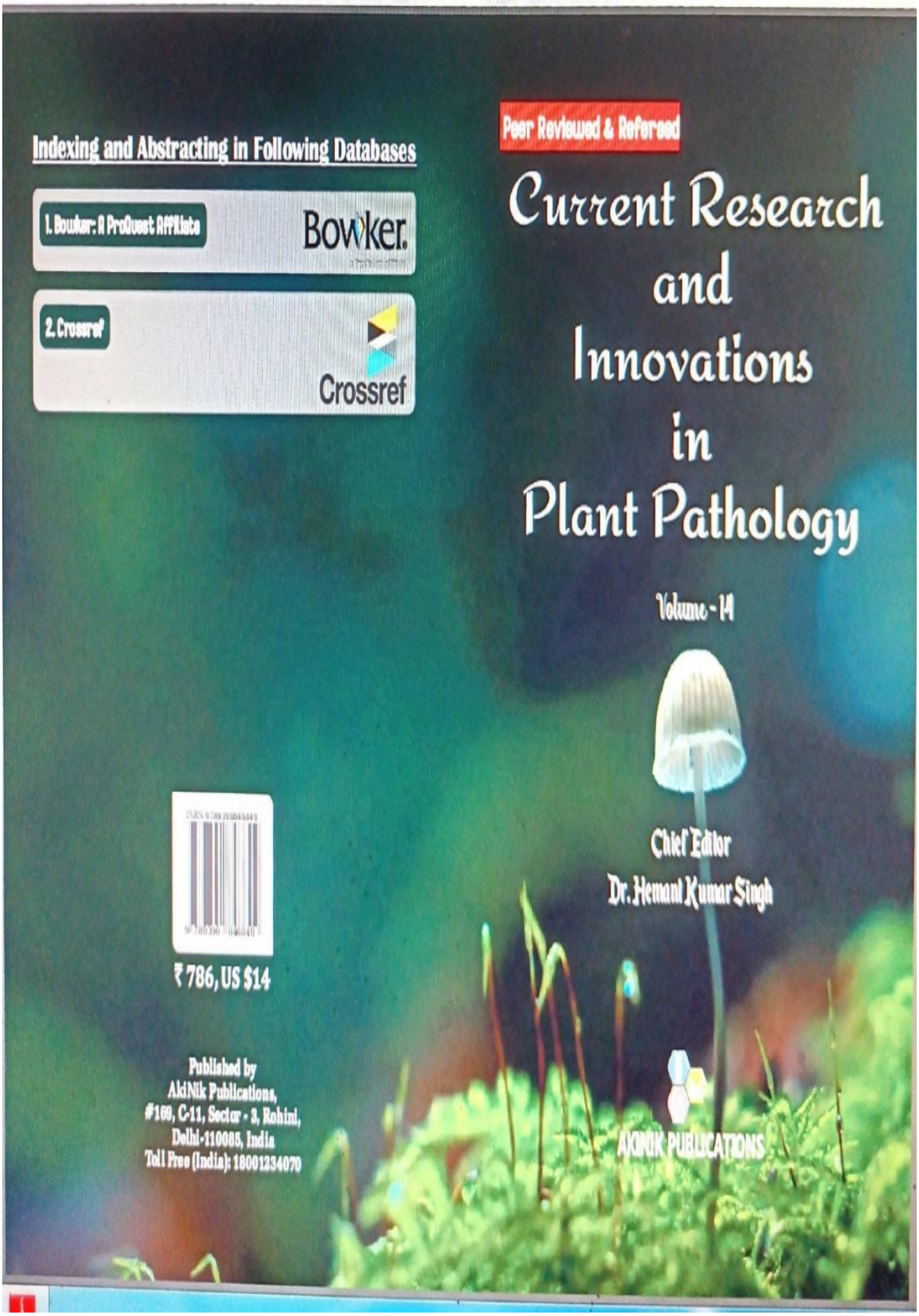
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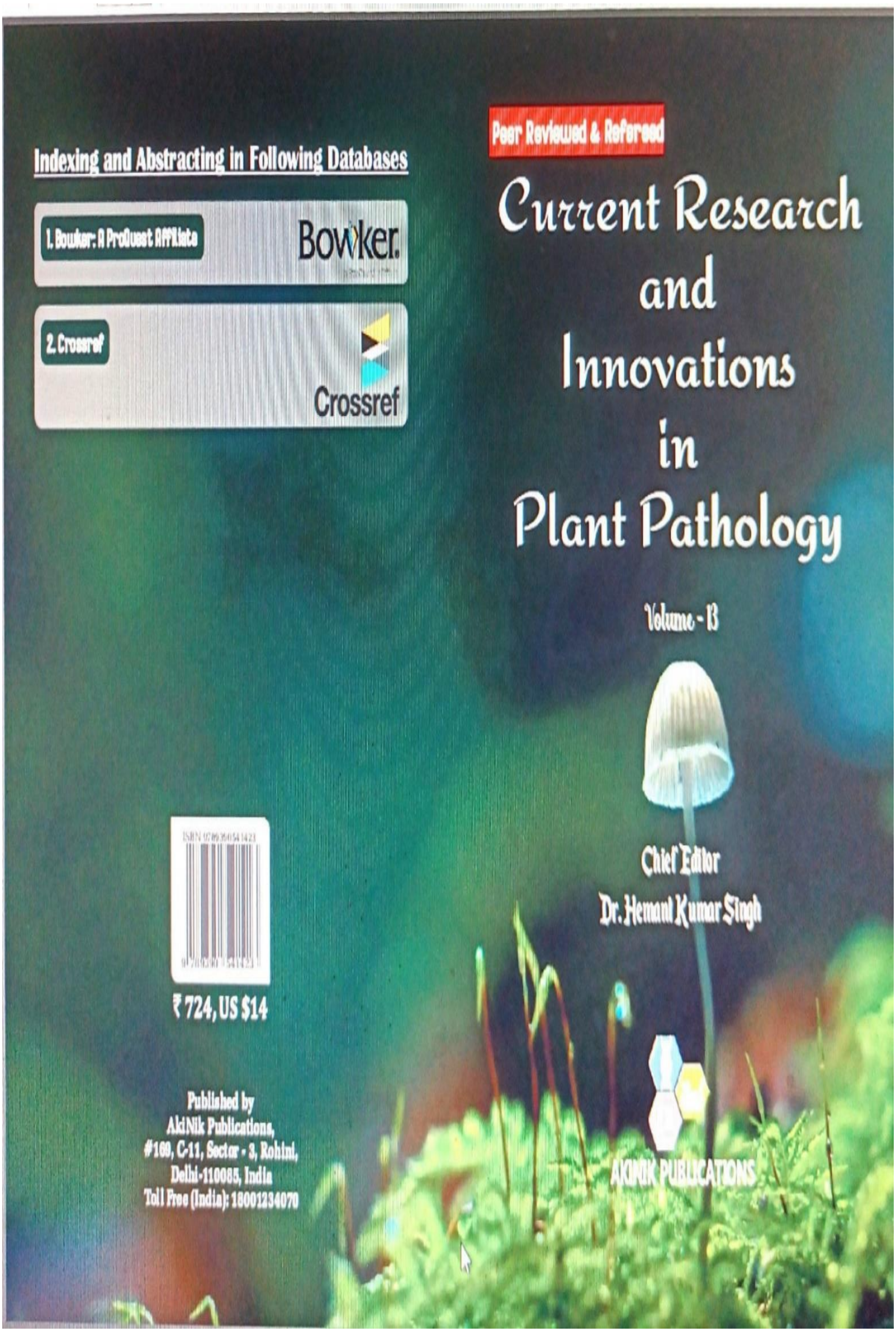

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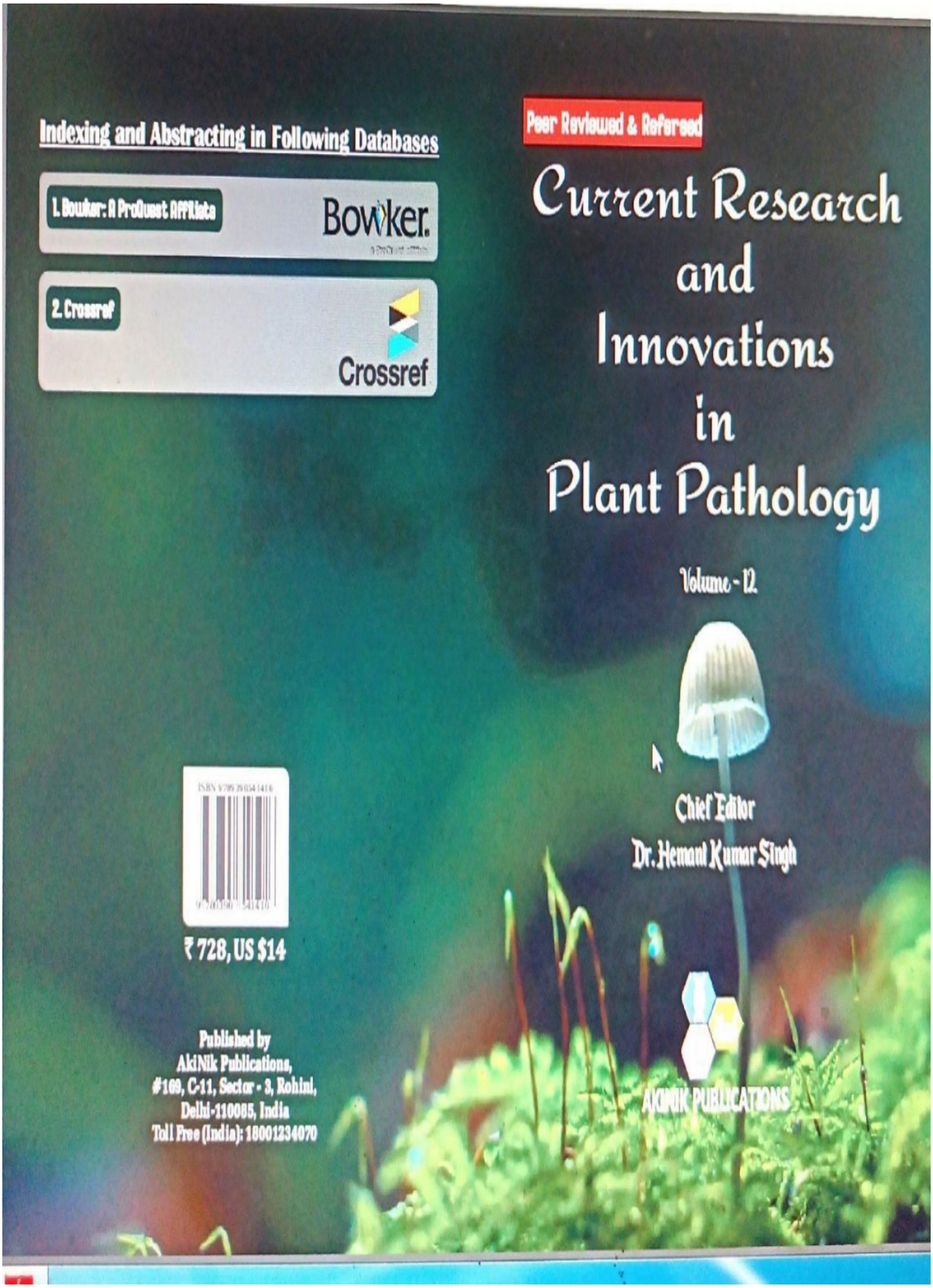
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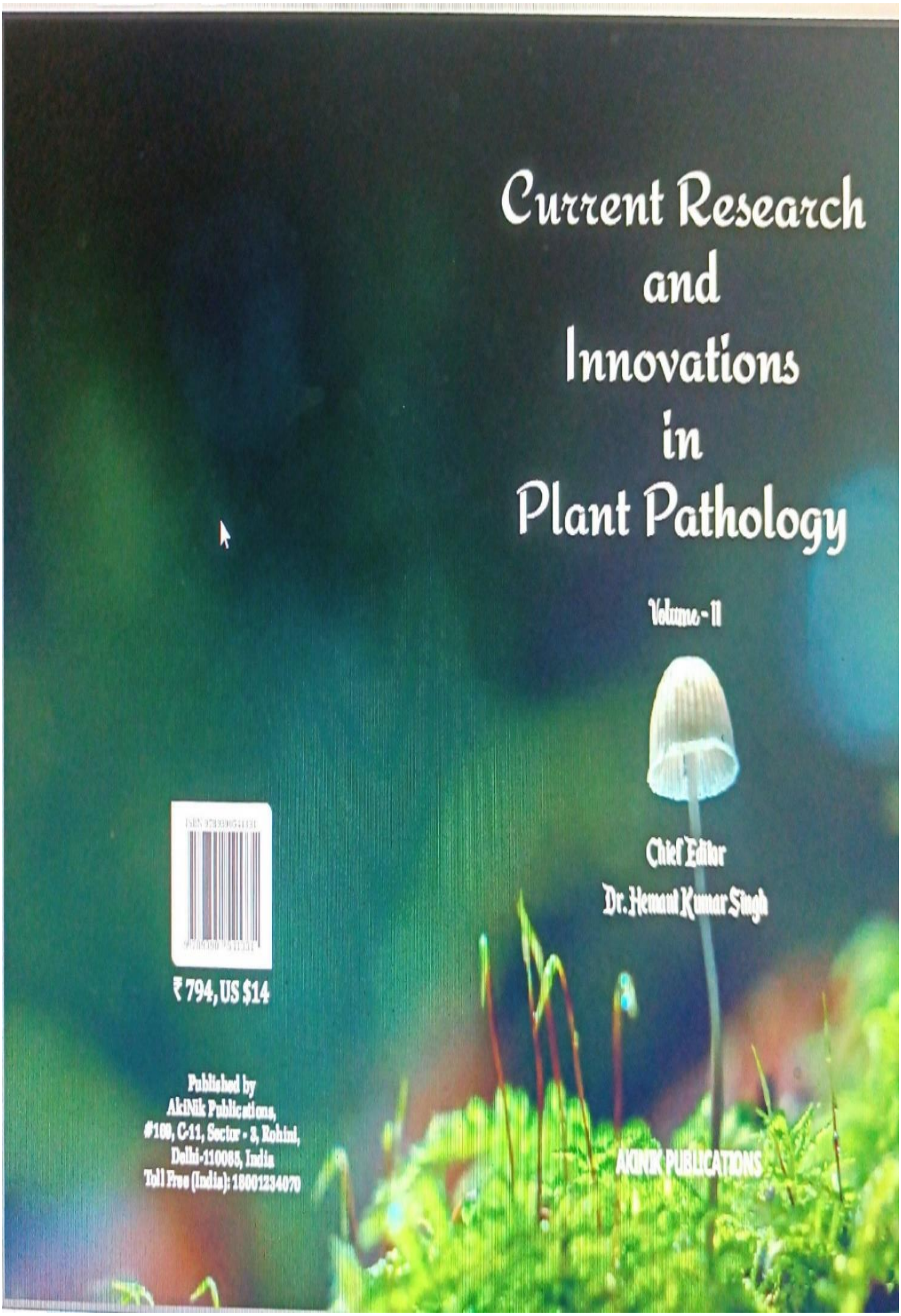
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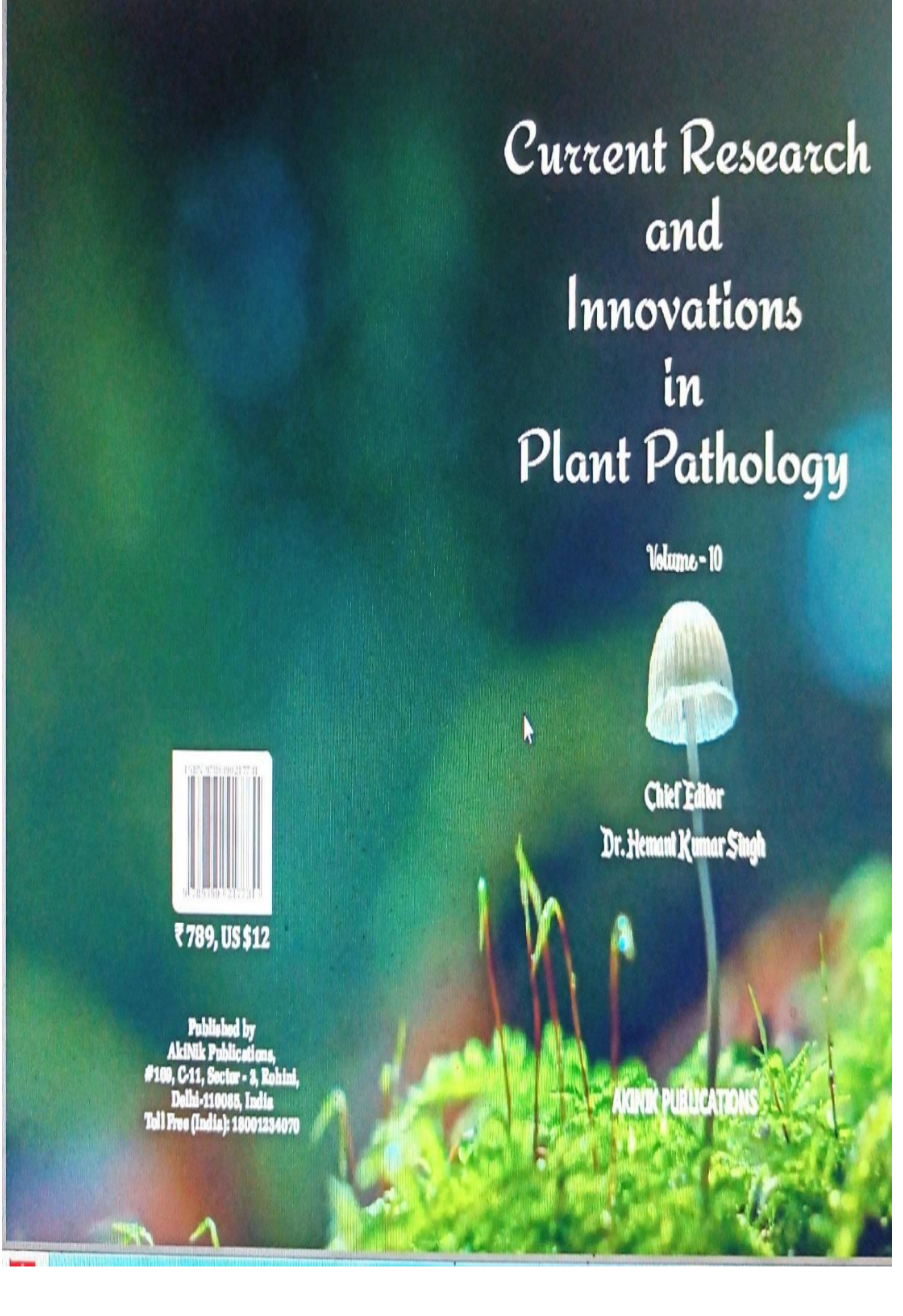
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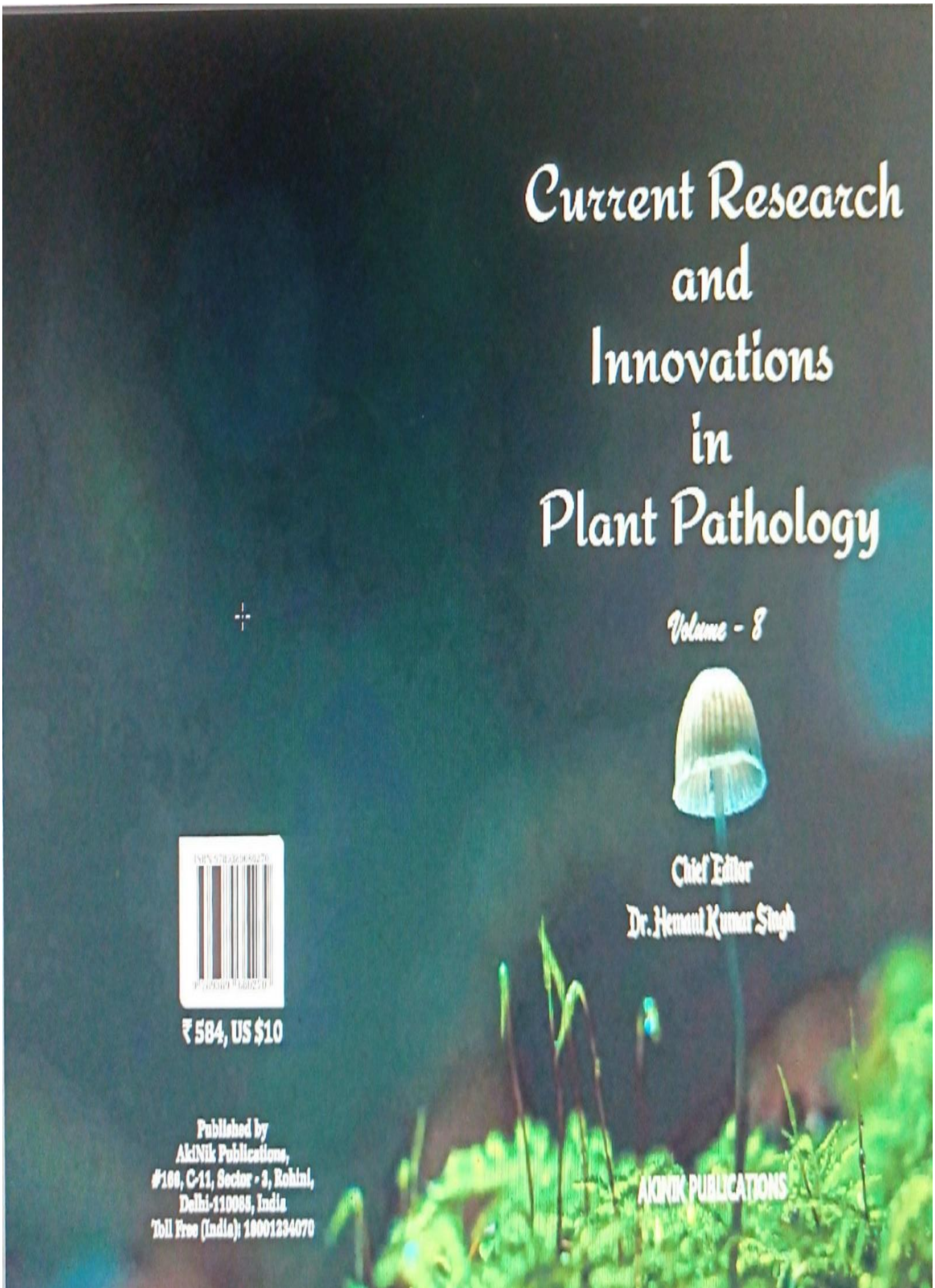

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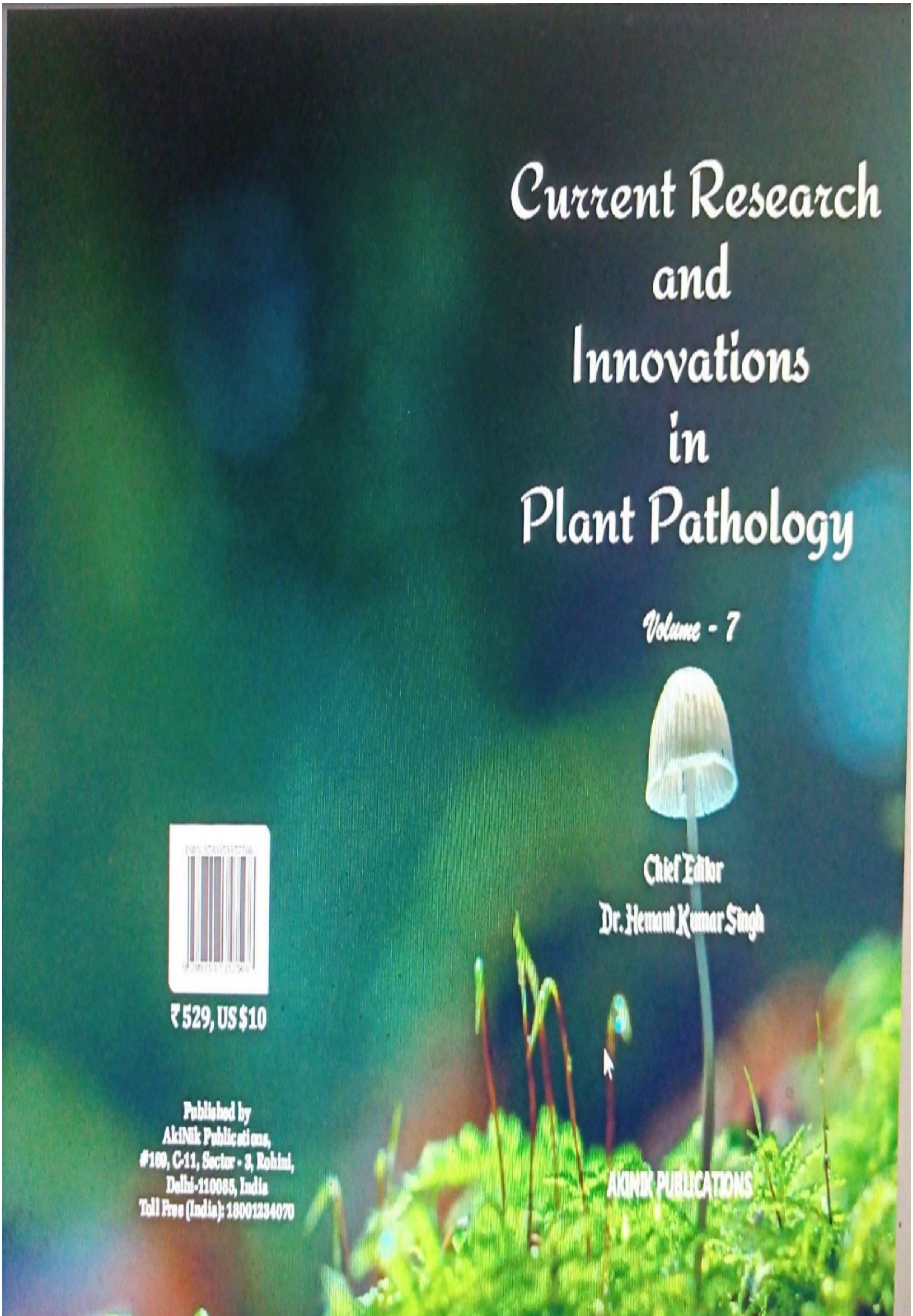
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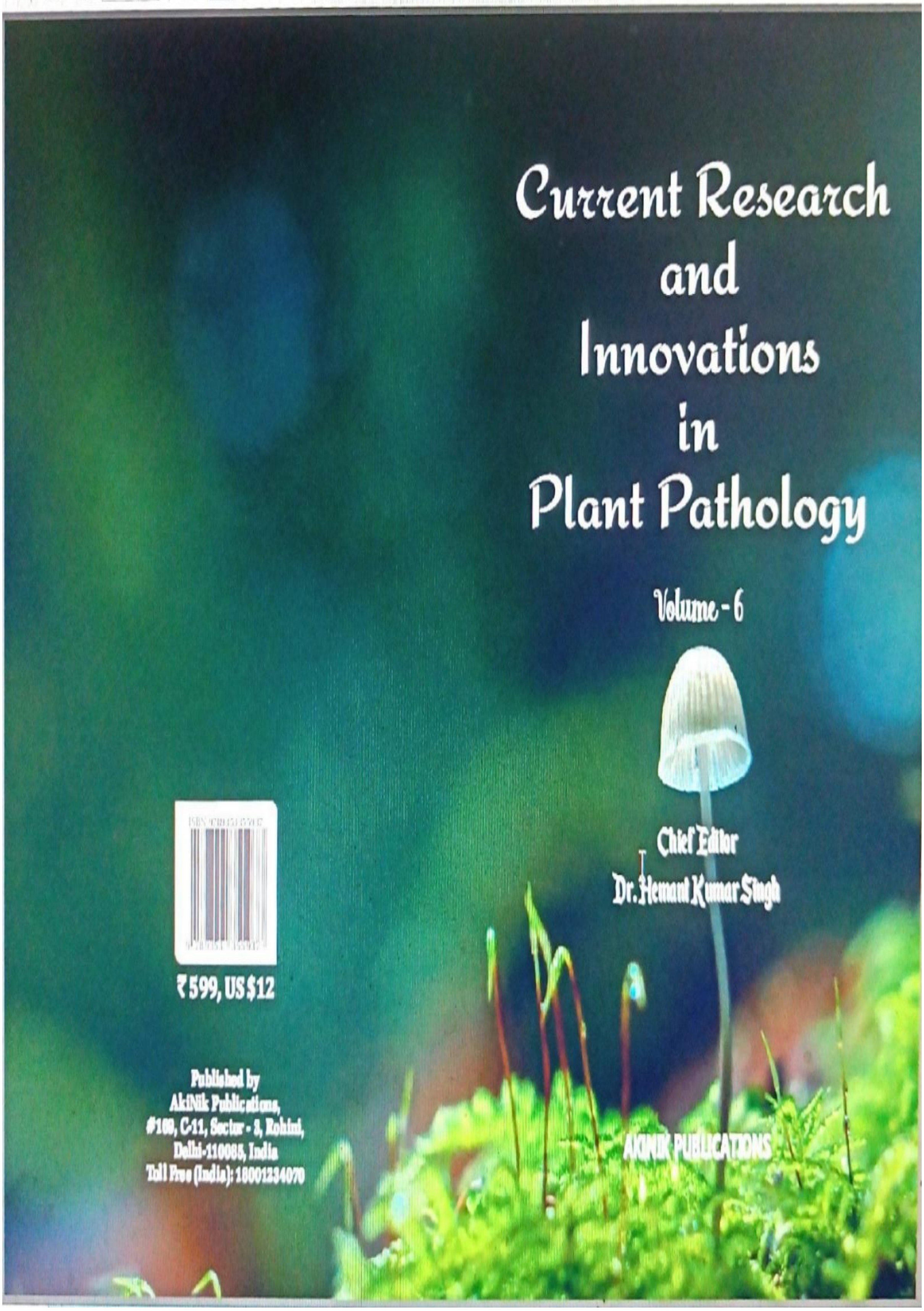
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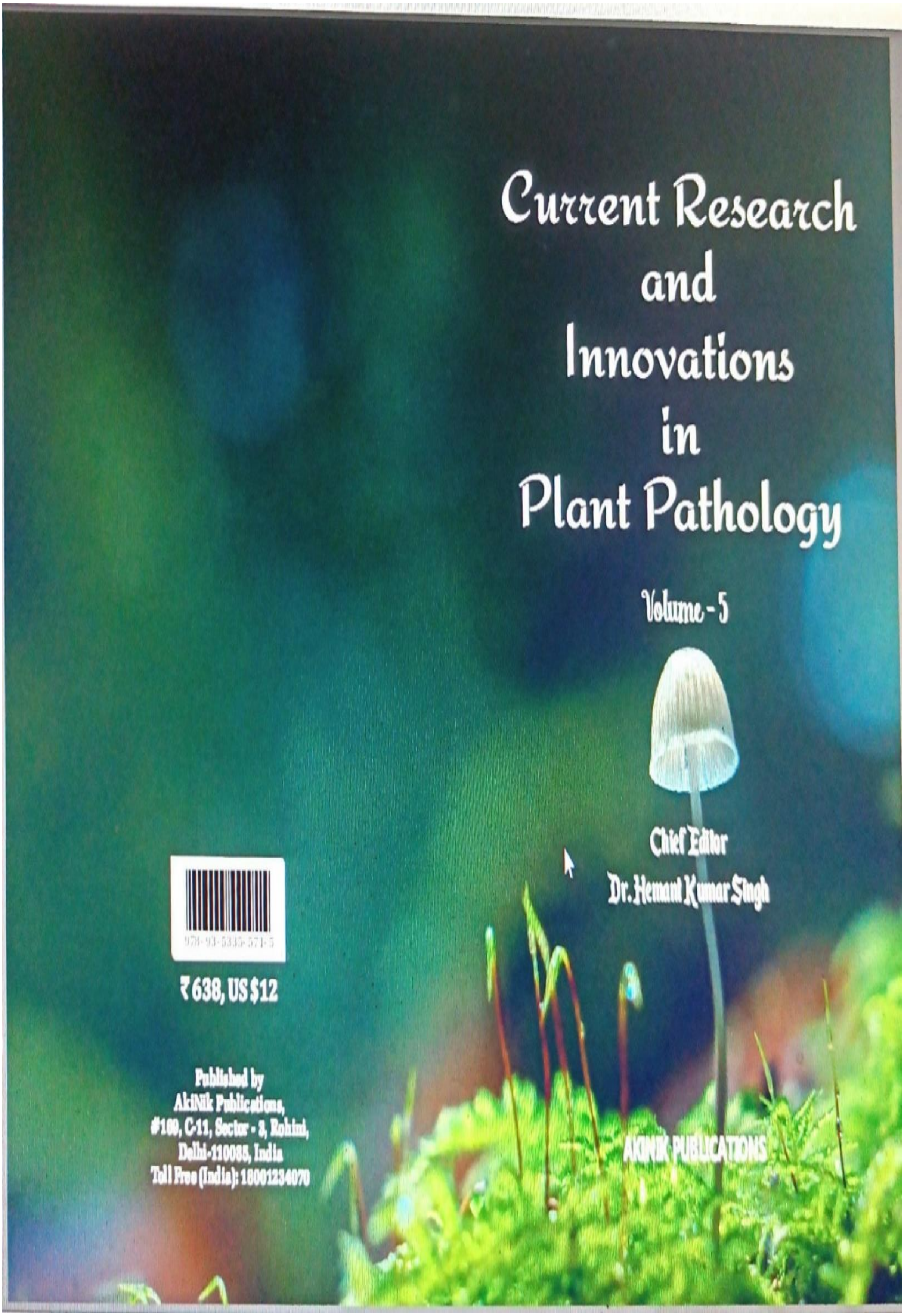

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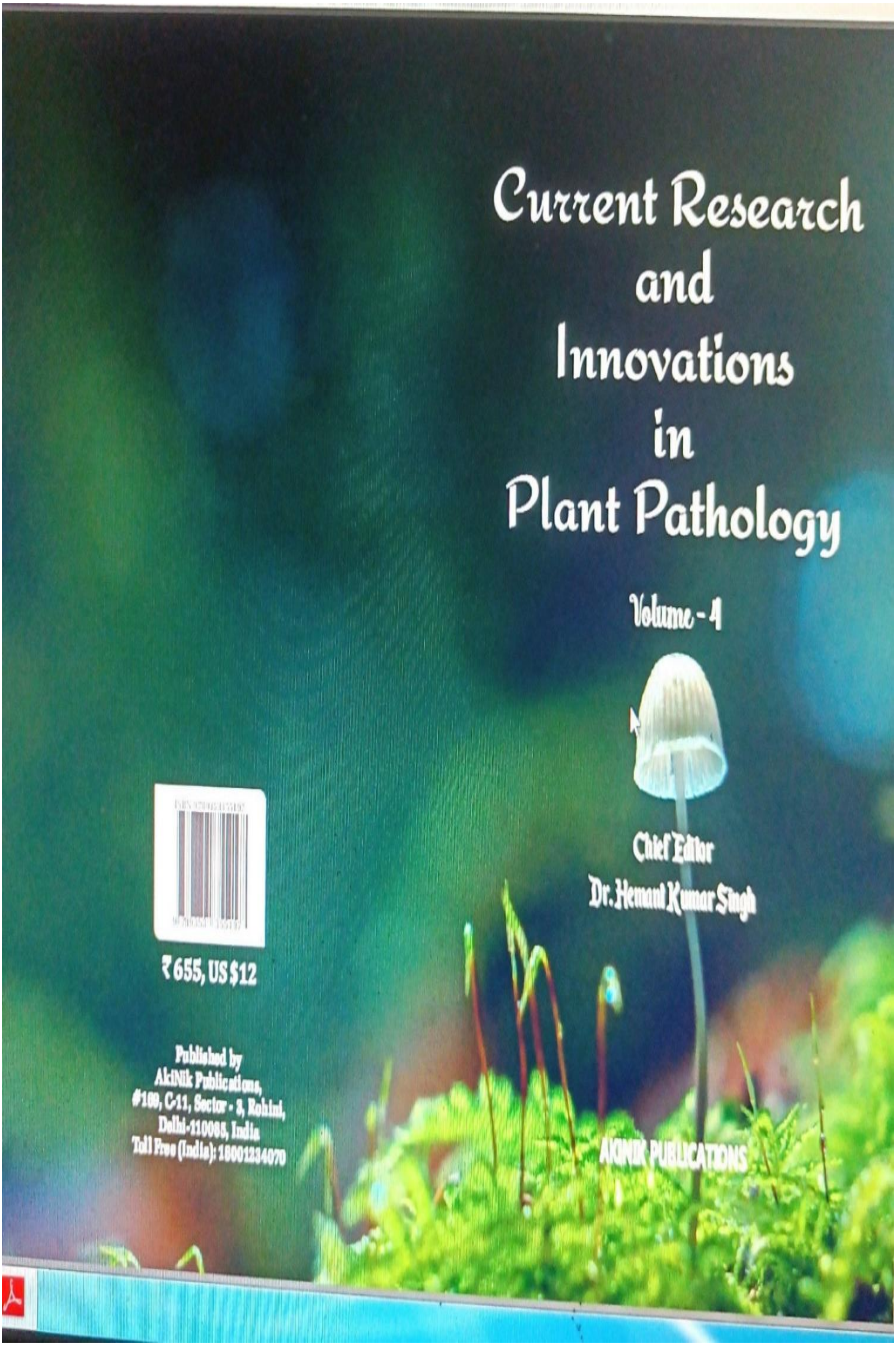

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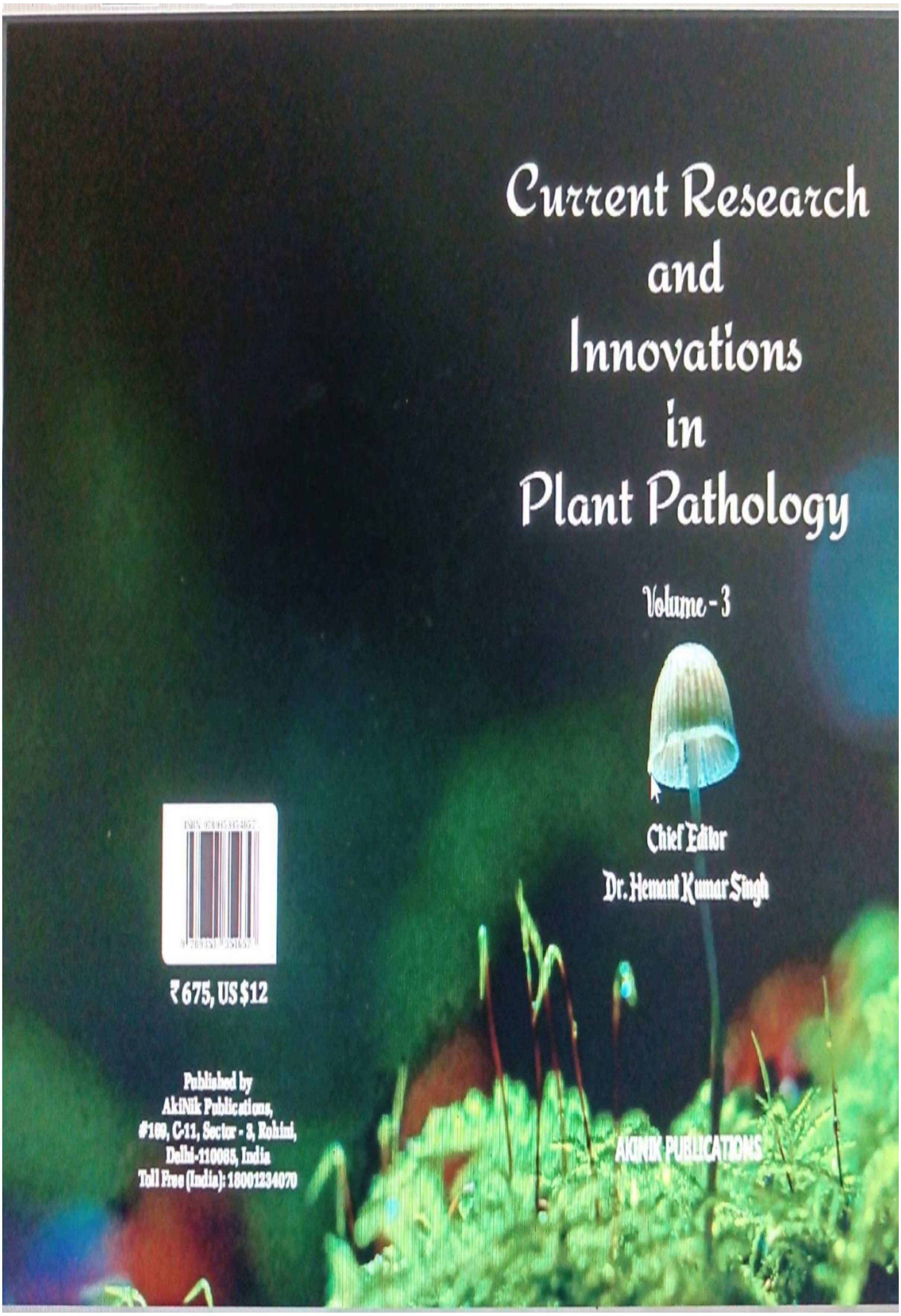
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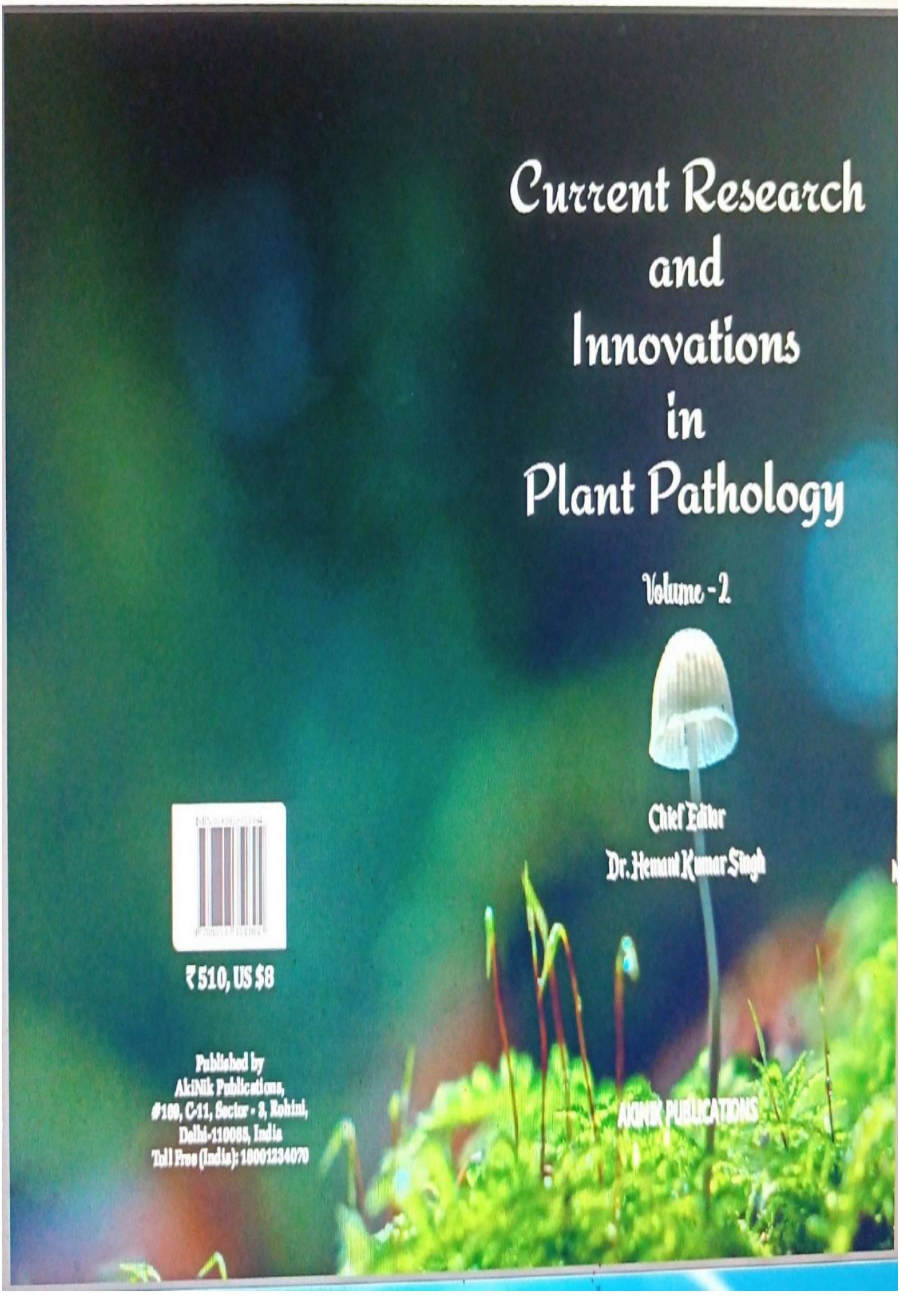
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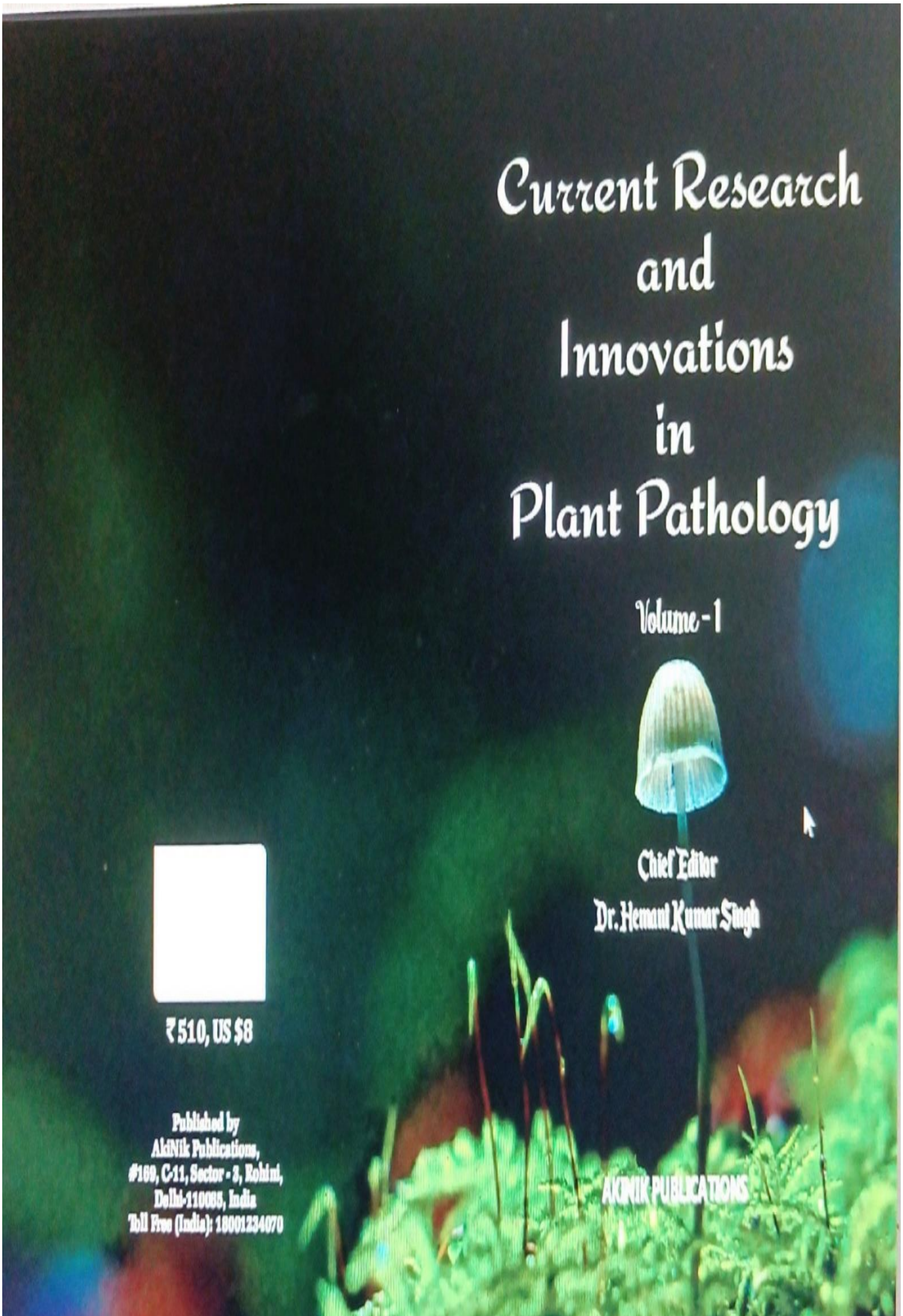
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# Emerging Tools for Sustainable Agriculture and Food Security

Editors
Vishnu D. Rajput • Abhishek Singh
Awani Kumar Singh • Tatiana Minkina

# Emerging Tools for Sustainable Agriculture and Food Security

Sustainable agriculture is a rapidly growing field aiming at producing food and energy in a sustainable way for the fast-growing population. It is a discipline that addresses current agricultural issues: climate change, increasing food and fuel prices, poor-nation starvation, rich-nation obesity, water pollution, soil erosion, fertility loss, pest control, and biodiversity depletion. This book is divided into 7 sections included 15 chapters that presented current agricultural issues, updates, and propose alternative solutions. It will therefore helpful for all the scientists, decision-makers, professors, students, farmers, and politicians who wish to build safe agriculture, energy, and food security system for the future generation.

**Vishnu D. Rajput** earned degrees in Agriculture Science, B.Sc. Ag, subsequently M.Sc. Ag (CSAUA&T, Kanpur, India), PhD. (Chinese Academy of Sciences, China) and PDF (Southern Federal University (SFedU), Russia). Working as a Leading Researcher (Assoc. Prof.) at SFedU, Russia.

**Abhishek Singh** is presently a PhD. Research Scholar at Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, India.

**Awani Kumar Singh** is presently working as Principal Scientist, Horticulture-Vegetable Science, at ICAR-Indian Agricultural Research Institute, New Delhi, India.

**Tatiana Minkina** is the Head of Soil Science Department, SFedU, Russia. Prof. Minkina is also a "Head of International Master's Degree Educational Program "Management and estimation of land resources" (2015-2022 years, accreditation by ACQUIN).

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# 14

# Smart Farming for Sustainable Agriculture: A Review

**Vijay Laxmi Rai[1*] and Rudra Pratap Singh[2]**

[1]Acharya Narendra Deva University of Agriculture & Technology, College of Agriculture Campus, Kotwa, Azamgarh, Uttar Pradesh, India
[2]Acharya Narendra Deva University of Agriculture & Technology, KVK, Kotwa, Azamgarh Uttar Pradesh, India
*✉ Corresponding author Email: vijaylaxmi31981@gmail.com

**Abstract**

Smart Farming involves the suitable use of advanced Information and Communication Technologies (ICTs) in agriculture which seems very effective as it will enable the agriculture sector to flourish in terms of farm productivity and profitability. Artificial Intelligence is going to be an emerging technology in the field of agriculture. AI-based equipment and machines are very promising which has taken today's agriculture system to a new level which is the need of the hour for food security. These new technologies have enhanced crop production by providing improved real-time monitoring, harvesting, processing and marketing. Various hi-tech computer-based systems are designed to help ininsect–pest detection, weed detection, yield detection and crop quality etc. With current ICTs, one can create a sensor network allowing for almost continuous monitoring of the farm. Similarly, theoretical and practical frameworks to connect the states of plants, animals, and soils with the needs for production inputs, such as water, fertilizer, and medications, are in reach with current ICTs globally. Apart from these, through the use of Geographic Information Systems (GIS) one can manage field data displayed on maps and culminate with a practical solution for many agronomical issues related to weather, soil or pest problems. This set of computer-based tools (or data platforms) allows storing, analyzing, manipulating and mapping any type of geo-referenced information. For sustainable agriculture, it seems to be the right time to move forward

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herbicide resistance will surely be developed if it is continuously used in the same area for long period. No case of herbicide resistance was reported from any of the centres of AICRP-Weed Control like UAS, Bangalore; Visva-Bharati, Sriniktan; GBPAU &T, Pantnagar and 19 other centres where the same herbicide has been used during last 10-12 years in long term permanent trial. This confirms that herbicide *per se* does not cause any mutation. Rather resistant gene is present in any of the single individual naturally in a large population over a large area. As evident from the definition of resistance, it is not due to the mutation caused by the herbicide as chemical, rather resistance appears from the selection of natural mutation that exists as a small fraction of population of resistant plants. Herbicide-resistant plant biotypes are believed to be emerging from only one or a few plants that are already present in a population. It may be a single plant in a population of several million.

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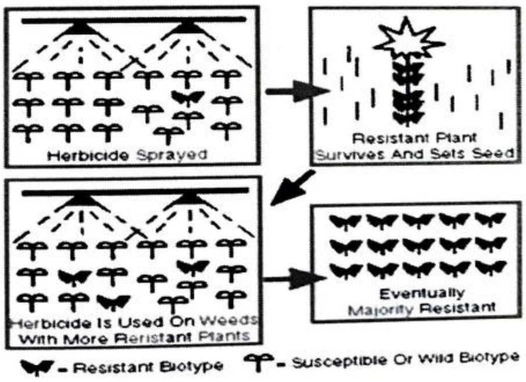


**Fig. 1 Choice for herbicide resistance occurs** (Gunsolus JL. 2008)

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**Contact Author**
**T. Pandiaraj**
College of Agriculture (Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya), Kotwa, Azamgarh, Uttar Pradesh

## Introduction

Like any other pests, weeds also have witnessed resistance development against herbicide whe weeds exposed to the same herbicide over many years. As illustrated in Fig. 1, while simil herbicide group or herbicide chemical is used frequent times in agricultural land, susceptib weeds are destroyed, leaving resistant weeds to mature and lead the population.

**Herbicide tolerance:** It is the ability of a species to survive and reproduce after herbici treatment. It is the ability to compensate for the damaging effect of herbicides with physiological mechanisms involved (Menalled and Dyer 2006).

**Herbicide resistance:** Refers to the inherited ability of a weed or crop biotype to survive herbicide application to which the original population was susceptible. Thus, herbicide resistan is simply an altered response to a herbicide by a species which was earlier susceptible and it is t naturally occurring, irreversible and inheritable ability of some weed biotypes within a populati (Duary and Yaduraju 1999).

## Development of resistance

Frequent use of the same group of herbicide and/ or herbicides having similar action mode i modern agriculture involving mono-cropping system and zero tillage could be the main grounds the event of herbicide resistance. It is apparent from the meaning of herbicide that if som herbicides do not show a lethal effect on a weed species, it should not wrap that resistance ha developed. There are several factors governing the efficacy of chemicals in herbicide. The reaso for poor herbicide efficacy should be honestly assessed prior to concluding herbicide resistance Often, use of the term herbicide resistance is a misconception. It does not always mean th

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# Herbicide Resistance in Weeds and Its Efficient Management

**T. Pandiaraj, Prakash Yadav, D.K. Singh**
College of Agriculture (Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya), Kotwa, Azamgarh, Uttar Pradesh

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**Abstract:**
As a management of weed is a vital constituent of agronomic methods of crop cultivation, chemical method of weed (herbicide) control is used greatly to harvest maximum yield. This herbicide has transformed the management of weed in global agriculture. However, there are some demerits like herbicide resistance, weed shift flora and environmental pollution. Of which, herbicide resistance is a major concern in the world agriculture. In the last three decades, many dozens of herbicide resistant weeds were reported from all over the world. Most of them are resistance to triazine group of herbicides. Herbicide resistance is considered global phenomenon and number of resistant weeds biotypes is rising at an alarming rate. It is necessary to accurately realize the herbicide resistance, its evolution as well as mode and mechanism of resistance to deal the problem. The use of herbicides having different sites of action and herbicide rotation in weed management programme may prevent or delay the development of herbicide resistance in weed. The most successful long-term planning for management of weed resistance is the adoption of Integrated Weed Management (IWM) with different suitable methods in a combined manner and also provides positive beneficial towards the ecological standpoint. Given the challenges in management of herbicide-resistant weeds, IWM will possibly play a significant role in enhancing future food security for an increasing world population. However, fundamental research and facilities are essential for healthy perceptive of herbicide resistance and its management.

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# AGRICULTURE AND FORESTRY: CURRENT TRENDS, PERSPECTIVES, ISSUES - IV

SANDEEP ROUT

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Chapter 16

# Role of Weather and Climatic Data for Agricultural Crop Production and Protection

**Jitendra Singh[1], Susmita Das[1], D.K. Das[2] and T. Pandiaraj[3]**
[1]Central Tasar Research and Training Institute, Central Silk Board, Ranchi
[2]Division of Agricultural Physics, IARI, New Delhi
[3]College of Agriculture Campus (ANDUAT., Kumarganj, Ayodhya), Azamgarh, U.P.
***Corresponding author:** jitendrasingh.iari@gmail.com

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**Abstract**

Weather and climate play an important role for selection of all the farm operations from sowing to harvesting in agriculture. The characterization of the climatic parameters of any location would reveal the selection of proper technologies to exploits the favorable agro-climatic condition and climatic requirements for optimal growth, development and yield of crops, incidence, multiplication and spread of pests and diseases and susceptibility to weather-induced stresses and affliction by pests and diseases vary amongst crops, with the same crop with the varieties and with the same crop variety with its growth stages. Decision on land use and management, selecting plants, and crop management practices such as irrigation, pest and disease control and crop-weather relationships should not be made without knowing climate conditions. Increased temperature causes migration of insect species towards higher latitudes, while in the tropics higher temperatures might adversely affect specific pest species. The impacts of climate change can be positive, negative or neutral, since these changes can decrease, increase or have no impact on insect pests and diseases, depending on specific location of each region or period. web enabled weather-based decision support system is an important component of Integrated pest management which not only enhances the production of agricultural crop but also reduces the pesticides application for management of pest.

**Keywords**: Climate Change, Crop Pests, Decision Support System, Forewarning.

## Introduction

Climate is defined as the prevalent pattern of weather observed over a prolonged period of time. Climate variables (e.g., temperature, precipitation, wind speed) can be time-averaged on a daily, monthly, yearly or decade basis. Agricultural crop production is influenced by weather and climatic events. The benefits of understanding these events help in the establishment of techniques. The effect of climatic parameters on agricultural production are given below.

### 1. Temperature

Temperature is an important weather parameter because the information generated from it can help planning of agricultural activities such as date of sowing, flowering, physical maturity and harvesting

## Chapter 12

# Precision Nitrogen Management in Rice Crop through Chlorophyll Meter (SPAD) in Rice-Wheat Cropping System under Resource Conserving Technology

**T. Pandiaraj* and D. K. Singh**
College of Agriculture Campus (ANDUAT, Kumarganj, Ayodhya), Kotwa, Azamgarh, U.P.
***Corresponding author:** pandianeagro@gmail.com

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**Abstract**

The human population continues to grow steadily with the shrinking resources being used for agricultural production situates great challenge against Indian agricultural system to attain food and environmental security. The rice-wheat cropping system (RWCS) is a major production system in the Indo-Gangetic Plains of India covering nearly 10.5 million hectares. In India, more than 90% area of the RW area is irrigated and is facing yield stagnation, soil degradation, declining ground water table and air pollution. Conventional agricultural practices that rely heavily on blanket fertilizer recommendation, eventually leading to deteriorated partial factor productivity and N use efficiency. We investigated the effect of SPAD-based N-management on productivity and N use efficiency of rice under resource conservation technology practices. The treatments consisted of two tillage (direct seeded rice and transplanted rice) and two levels of mulching (no mulch and paddy straw mulch) in main plots and two levels of fertility (100% RDF and 75% RDF) in sub-plot. The experiment was laid out in factorial-split plot design, replicated thrice with a single plot size of 21.6 $m^2$. The results revealed that SPAD value an index for leaf chlorophyll content was observed higher in TPR compared to DSR. Similarly, both mulch and 100% RDF application recorded superior for leaf chlorophyll content of rice. Hence, the N is substantially required to DSR method of establishment over TPR.

**Keywords**: Direct Seeded, Resource Conservation Technology, Rice, SPAD, Transplanted Rice.

## Introduction

The main staple food crops which have been cultivated and consumed worldwide in different countries are the rice (*Oryza sativa* L.) and wheat (*Triticum aestivum* L.). Together, the two crops contribute 80% of the total cereal production in the south Asian countries (Timsina & Connor, 2001). The rice-wheat cropping system is the most widely adopted production system in Asian countries and worldwide. Rice (*Oryza Sativa* L.) and wheat (*Triticum aestivum* L.) are grown in sequence over 26 m ha of South and East Asia to meet the food demands of rapidly expanding human population and brings together conflicting and complementary practices (Timsina and Connor, 2001). This system covers about 12 m ha in India (Tripathi *et al.*, 2011) and is the backbone of country's food

Chapter 11

# Tasar Sericulture: Impact of INM on Nutritional Status of Leaf

**Soma Karmakar[1]*, A.K. Srivastava[1] and T. Pandiaraj[2]**
[1]University Department of Botany, Ranchi University, Ranchi, India
[2]College of Agriculture, Azamgarh (ANDUA&T., Kumarganj, Ayodhya), U.P. India
***Corresponding author:** smarten436@gmail.com

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**Abstract**

*Terminalia tomentosa* is a primary food plant of *Antheraea mylitta* Drury, a polyphagous insect of Saturniidae family which is exploited commercially for the production of silk. Good quality of silk production depends on the nutrient of leaf. So, to optimize the growth and nutrient of leaf, Integrated Nutrient Management Practices (INM) has been used to increase soil fertility and to supply plant nutrient at an optimum. In order to evaluate the effect of INM practices on the different leaf parameters of *Terminalia tomentosa* food plant of *Antheraea mylitta* Drury, an experiment in Randomized Complete Block Design consisting of 20 treatments with three replication was conducted at Central Tasar Research & Training Institute, Nagri, Ranchi. Results revealed that the application of INM treatments are significant on various leaf parameters. Highest single leaf length and breadth mean was observed in $T_{19}$ (23.29cm; 11.96cm, respectively) which was applied with 75% RDF through fertilizer+25% through vermicompost+ *Azotobacter*+PSB. Weight of single leaf was found to be highest in $T_{13}$ (5.19g). The number of leaves was recorded highest in $T_{19}$ (1892). The fresh leaf yield ranged from 1617.32 - 5208.22g with a mean of 4085.72g. The treatment $T_{19}$ (5032.1g) recorded the highest fresh leaf yield. Highest total N was recorded as 1.65% in $T_9$ which was applied with 50% RDF+ Phosphorus Solubilizing Bacteria followed by $T_{19}$ (1.63%). Highest total P was observed in $T_4$ (0.97%) over the control and total K was recorded highest in $T_7$ (1.8%) followed by $T_8$ (1.74%). The crude protein was recorded highest in $T_9$ (10.3324%) followed by $T_{19}$ (10.157%) and total carbohydrate recorded highest in $T_4$ (222.5 mg/g) followed by $T_{20}$ (182.9mg/g). The study indicates that INM practices significantly influenced the different parameters.

**Keywords:** *Azotobacter*, *Antheraea mylitta*, Crude protein, Moisture, Vermicompost.

## Introduction

Tussar silk in sanskrit is known as "Kosa Silk" (Nakpathom *et al*., 2009; Pilanee Vaithanomsat *et al*.,2008) and is valued for its rich texture and natural deep gold colour (Vigneswaran *et al.*, 2015). Aboriginals residing in the central India plateau mainly in the states of Jharkhand, Bihar, Chhattisgarh, Madhya Pradesh, Orissa and West Bengal extending Uttar Pradesh, Andhra Pradesh and Maharashtra practices this old age tradition of Tasar culture (Sinha, 2003) i.e., rearing of Tasar silkworm and other activities of silk production. Tropical Tasar is produced by the larvae of yellow orange moth known as *Antheraea mylitta* Drury (Roychoudhury, 2006). *Antheraea mylitta* the wild

# Chapter 3

## The Need of Precision Agriculture for Indian Scenario

**S. Sathya[1*] and T. Pandiaraj[2]**
[1]Adhi Parasakthi Agricultural College (Affiliated to Tamil Nadu Agricultural University, Coimbatore), Kalavai, Vellore District, Tamil Nadu
[2]College of Agriculture (ANDUAT, Kumarganj, Ayodhya), Kotwa, Azamgarh, Uttar Pradesh.
*Corresponding Author E-mail: sathiyatryguy@gmail.com

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**Abstract**

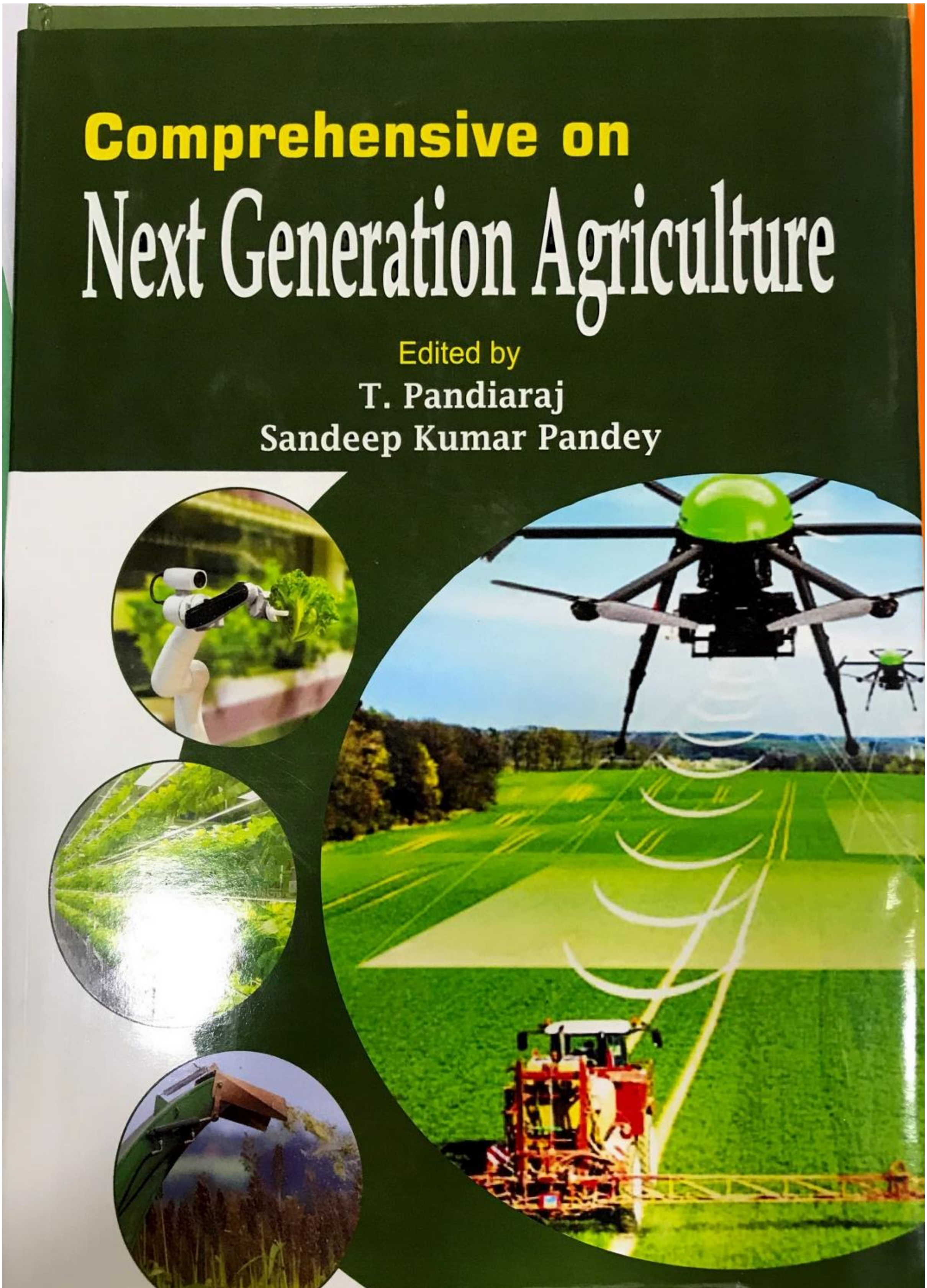
While agriculture in India has achieved grain self-sufficiency but the production is, resource intensive, cereal centric and regionally biased. The resource intensive ways of Indian agriculture have raised serious sustainability issues too. Precision farming has a most prominent technology to improve the food grain production in terms of quantity and quality. Precision farming or precision agriculture is about doing the right thing, in the right place, in the right way, at the right time. Managing crop production inputs such as water, seed, fertilizer etc., to increase yield, quality, profit, reduce waste and becomes eco-friendly. This has wide implications for economic development, urbanization and energy-use for such nations. Transplantation of High-tech PA technologies developed from advanced countries to the developing countries posed a real dilemma for scientists for making them compatible to the needs of developing countries. Application of balanced soft and hard PA technologies based on the need of specific domestic conditions of a country is expected to eventually prove suitable for developing countries also. Therefore, the objective of this paper is to find out feasibility and scope for adoption of PA in India.

**Keywords:** Monitoring, Remote Sensing, Scouting, Sensor, VRT.

### Indian Agriculture: A Scenario

With a population of 1.27 billion, India is the world's second most populous country. It is the seventh largest country in the world with an area of 3.288 million sq kms. With the highest mountain range in the world, the Himalayas to its North, the Thar Desert to its West, the Gangetic delta to its East and the Deccan Plateau in the South, the country is home to vast agro-ecological diversity. India is the world's largest producer of milk, pulses and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, livestock and plantation crops.

India's climate varies from humid and dry tropical in the south to temperate alpine in the northern reaches and has a great diversity of ecosystems. Four out of the 34 global biodiversity hotspots and 15 WWF global 200 eco-regions fall fully or partly within India. Having only 2.4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Sandeep Kumar Pandey

ABOUT THE AUTHORS

Dr. Sonu Jaiswal, Associate Professor and Head in the Department of Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, ANDUAT, Kumarganj, Ayodhya has 18 years of experience in teaching, research and extension activities. He did his basic education from Uttar Pradesh and Ph.D. in Veterinary Surgery and Radiology from G.B. Pant University of Agriculture and Technology, Pantnagar with first division throughout his academic degrees. He has guided 16 master and doctoral degree students as Guide and Co-guide. He has published more than 40 research papers and 2 review articles in various reputed journals, one book and several book chapters. He has attended more than 25 conferences/ seminars/ symposiums and workshops and presented about 10 lead papers. He has received 6 Best Paper awards and one Excellence in Teaching award.

Dr. Rakesh Kumar Gupta, did his basic education from Central Academy, Lucknow. He completed his B.V.Sc and M.V.Sc in Veterinary Pathology from College of Veterinary Science and Animal Husbandry, ANDUAT, Kumarganj, Ayodhya. He obtained Gold Medal in his bachelor and master degree. He has published more than 20 research papers and 5 review article in various international and national journals. He wrote more than 20 popular articles in various English and Hindi magazines, periodicals and newspaper. He has received many awards including Young Scientist Award 2019 by GAPS and Young Researcher Award 2019 by GOREA, several Best Poster and Paper presentation awards in various conferences/ seminars/ symposium. He is author of two books entitled "Question Bank of Veterinary Pathology" and "Romanthak Pashuon ke Pramukh Rog". He has qualified ICAR-NET two times (75%) and UGC-NET three times with JRF. He is currently working as Guest Faculty in Department of Veterinary Pathology, C.V.Sc & A.H., ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh.


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SERIES - I

# VETERINARY SURGERY

SONU JAISWAL    RAKESH KUMAR GUPTA

"रोमांथक पशुओं के प्रमुख रोग" पुस्तक पशु चिकित्सकों, विद्यार्थियों एवं पशुपालकों को ध्यान में रखकर लिखी गयी है। इस पुस्तक में लिखें कुल 19 अध्याय के द्वारा रोमांथक पशुओं का भारत में परिदृश्य के साथ रोगी पशु का विषयक परीक्षण के तरीकों एवं इनमें पायी जाने वाली समस्त बीमारियों को बड़े ही सरल भाषा में दर्शाया गया है। उपचार एवं बचाव पर विशेष ध्यान देते हुए इसमें प्रारम्भिक चिकित्सा का भी वर्णन है। पशुओं में होने वाले प्रमुख विषग्रता खासतौर से सर्पदंश को भी विसतृत रूप में लिखा गया है। विषय विशेषज्ञों द्वारा प्रजनन संबंधित रोग एवं जुनोटिक रोग की जानकारी भी उपलब्ध है। पशु विकृति विशेषज्ञों ने बड़े ही सुन्दर तरीके से पशु रोग निदान हेतु नमूनों का एकत्रण एवं पशु शव परीक्षण एवं विसर्जन को लिखा है। साथ ही बकरी में होने वाले प्रमुख रोगों पर एक अलग अध्याय है। इस पुस्तक के द्वारा लेखकों ने रोमांथक पशुओं के समस्त रोगों का निदान, उपचार एवं बचाव को दर्शाया है। पशुपालन एवं पशुचिकित्सा क्षेत्र के लिए यह पुस्तक अत्यन्त उपयोगी है।

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# रोमांथक पशुओं के प्रमुख रोग

- सत्यव्रत सिंह
- रमाकान्त
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- राकेश कुमार गुप्ता

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# Surgeon's Role in Animal Welfare with Special Reference to Bovine Acute Abdomen

A.K. Gangwar, Khangembam Sangeeta Devi and Ashish Kumar Srivastava
College of Veterinary Science & Animal Husbandry
Narendra Dev University of Agriculture & Technology, Kumarganj, Faizabad (UP)-224 229

ll surgeons who work with farm animals play a crucial role in protecting animal health. Poor health f the animal contributes to poor welfare. The surgeon's role is related to the prevention, cure or lleviation of pain and treatment of injuries in animals. Apart from this, veterinary surgeons have layed significant and contributory roles in animal health and welfare and biomedical research. ivestock contributes about 40 percent of agricultural GDP. Healthy and productive livestock make mportant contributions to food production, income generation, job creation, economic growth, and overty alleviation is often overlooked or taken for granted. The main source of income of the farmer s agriculture and livestock. If the animal is diseased, definitely the farmer will suffer from the conomic loss. There are so many surgical conditions in the cattle which causes great loss to the vestock producers and dairy farmers.

ertainly amongst the most challenging situations in bovine medicine, the acute abdomen can ecome a nightmare and result in difficult situations with client, especially in valuable animals. The cute abdomen represents both a diagnostic and therapeutic challenge. In the bovine, the cost and sk of a standing laparotomy is such that in many situations, it almost appears more economical to uickly move toward a surgical approach since both diagnostic and therapeutic purposes can be chieved simultaneously.

cute abdomen includes the gastrointestinal diseases ( esophageal obstruction, ruminal tympany, omasal displacement, caecal dilation, gastric ulcers, intestinal obstruction, intestinal/mesenteric olvulus, gastroenteritis, hemorrhagic gastroenteritis etc), reproductive tract disorders ( pyometra, terine torsion and dystocia), urinary tract affections (obstructive urolithiasis, nephritis, cystitis, rinary bladder stones), peritoneal affections (peritonitis, non traumatic hemoabdomen), abdominal mors (tumors leading to obstruction and hemoabdomen), splenic torsion, biliary obstruction and ncreatitis/pancreatic abscess.

e clinical signs of acute abdominal disorders vary greatly. Typically, the veterinarian is presented h a cow that has become ill suddenly and has stopped eating and defaecating. The abdomen may be ated on the left side, right side or both sides, and the entire side of the abdomen or only the dorsal pect may be affected. The dilated abdomen may be "papple", barrel or pear-shaped. Occasionally, ected cows have colic symptoms, which are usually mild and include restlessness, shifting of ight from one hind foot to the other, spastic flexion of a hind limb, lowering of the back and tail hing. Rarely, colic symptoms are severe in which case kicking at the abdomen, kicking out with a d limb, lying down and standing up and sweating are seen. The back may be arched or sunken, and abdominal wall may be relaxed or tense. An arched back indicates parietal pain and a sunken back sponds with visceral pain. Sometimes, urination is abnormal.

attle with acute abdominal disease and severe symptoms, a rapid diagnosis is paramount to avoid parable organ damage. In the past, an exploratory laparotomy was often quickly resorted to as a nostic aid in acute abdomen in cattle with no clear diagnosis. Today, many farmers will consent to oratory laparotomy only when the prognosis is good and the procedure has a reaso-nable chance ing curative. If the prognosis is poor, an exploratory laparotomy should be avoided; it causes

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# Polycyclic Aromatic Hydrocarbons (PAH) in Food: A Serious Threat To Human Health

**Shivesh Singh Sengar and Ruma Devi**

Department of Livestock Products Technology

College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## INTRODUCTION

Polycyclic Aromatic Hydrocarbons (PAHs) refer to a large group of organic chemicals containing two or more fused aromatic rings made up of carbon and hydrogen atoms. PAHs are lipophilic and chemically stable. PAHs are a group of chemicals that are formed during the incomplete burning of coal, oil, gas, wood, garbage or other organic substances, such as tobacco and charbroiled meat. There are more than 100 different PHSs. PAHs generally occur as complex mixtures, not as single compounds. As pure chemicals, PAHs generally exist as colorless, white, or pale yellow-green solids. They can have a faint, pleasant odour. PAHs are present in tobacco smoke, smoke from wood fires, creosote-treated wood products, cereals, grains, flour, bread, vegetables, fruits, meat, processed or pickled foods, and contaminated cow's milk or human breast milk. Cooking meat or other food at high temperatures, which happens during grilling or charring, increases the amount of PAHs in the food. Under normal conditions of environmental exposure, PAHs could enter your body if your skin comes into contact with soil that contains high levels of PAHs (this could occur near a hazardous waste site) or with used crankcase oil or other products (such as creosote) that contain PAHs. The rate at which PAHs enter your body by eating, drinking, or through the skin can be influenced by the presence of other compounds that you may be exposed to at the same time with PAHs. PAHs can enter all the tissues of your body that contain fat. They tend to be stored mostly in your kidneys, liver, and fat. Smaller amounts are stored in your spleen, adrenal glands, and ovaries. PAHs are changed by all tissues in the body into many different substances. Some of these substances are more harmful and some are less than the original PAHs. Most PAHs that enter the body leave within a few days. Food processing or cooking steps such as roasting, grilling, barbecuing and smoking generate PAHs and increase the level of PAHs in the food being cooked. Charred food of almost any composition contains PAHs while only very low level of PAHs was detected when food was cooked by some cooking steps such as steaming. The exact mechanism of PAHs formation in food processing or cooking is not precisely known. However, it is generally considered that incomplete combustion is involved. Regarding cooking methods, a dry heat cooking method is often involved. People with a diet rich in roasted, barbecued or grilled, smoked food may have significant intake of PAHs. Formation of PAHs occurs through pyrolysis of fat at temperatures of above 200°C, and is favoured at a temperature range of 500-900°C, especially above 700°C. When food is in direct contact with a flame, pyrolysis of fats in the meat generates PAHs Alternatively, the melted fat from food dripping onto the heat source generates PAHs and the PAHs will in turn be deposited on the meat surface as the smoke rises. Another possible mechanism for the formation of PAHs is the incomplete combustion of the fuel itself. Incomplete combustion of charcoal generates PAHs, which are brought onto the surface of the food and are adsorbed.

## HUMAN HEALTH EFFECTS

### 1. Acute or Short-term Health Effects

The effects on human health will depend mainly on the length and route of exposure, the amount of concentration of PAHs one is exposed to, and of course the innate toxicity of PAHs. A variety of other factors can also affect health impacts including subjective factors

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# Effect of Melatonin on Reproduction and Infertility Treatment

**Pankaj Kumar Choudhary, Pankaj Kumar Maurya, Pramod Kumar and S. K. Maurya**
Department of Veterinary Physiology and Biochemistry
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## INTRODUCTION

In the past few decades, a lot of studies regarding the biochemistry and physiology of hormone called melatonin ( N-acetyl-5-methoxytryptamine) have taken place. This hormone is secreted during the dark hours at night by the pineal gland and is responsible for the regulation of variety of important central and peripheral actions related to circadian rhythms and reproduction (Tamura *et al.*,2012). Although melatonin is primarily synthesized and secreted by the pineal gland, it is has been reported that it is also formed in the tiny amounts by other organs such as the retina, harderian gland, gastrointestinal tract, lymphocytes and the skin. The role of melatonin in other animal species is related to seasonal reproductive cycle.

Melatonin has also been reported to have free radical scavenging properties (Zang *et al.*, 1998) as well as stimulating several other antioxidant enzymes. Can melatonin supplementation during assisted reproductive technologies increase the success rate. Since the body is capable of producing melatonin does endogenous melatonin production or exogenous melatonin supplementation has any effect on the reproductive process of animals.

More recently, it has been discovered that an imbalance of reactive oxygen species or 'oxidative stress' can have a negative impact on the success of infertility treatment, and furthermore, investigators have begun addressing potential mechanisms of preventing these effects with the use of novel oxygen scavengers such as melatonin. It may be that these agents have a positive effect on pregnancy success rates following IVF treatment. We present a summary of the most recent work investigating melatonin and its effect on reproductive system and the treatment of infertility.

## EFFECT OF MELATONIN ON REPRODUCTIVE PROCESS

There is accumulation of evidence suggesting that the pattern of melatonin secretion, which is mediated by photoperiod, directly influences reproductive function. Much of the evidence has been generated from seasonally breeding mammals. Short-day breeder such as sheep, and white-tailed deer were shown to be sexually very active and capable during the shortest days of the year, when melatonin levels are highest in terms of their nocturnal duration (Chemineau *et al.*, 2008).

Investigation using long-day and short-day breeding animals have enormously contributed to the understanding of the mechanisms whereby day length and melatonin govern seasonal reproduction. These findings have led to the successful use of melatonin as a pharmacological agent to advance the breeding season of sheep and to induce estrous cycle and increase lambing during the interval when these animals would normally be experiencing seasonal anestrus (Abecia *et. al.*, 2005).

## EFFECT OF MELATONIN ON TESTICULAR FUNCTION

In animal studies, it has been shown that melatonin may modulate testicular function. In mice and rats it was reported that melatonin has an inhibitory effect on Leydig cells (Persengiev and Kehajova, 1991). There are contradictory reports concerning the effect of melatonin on spermatozoa function. It has been reported that long term administration of melatonin to healthy men is associated with decreased semen quality (Luboshitzky *et al.*, 2002). Sperm concentration, motility as well as testosterone levels were found to be significantly decreased in healthy men administered with melatonin. On the other hand, an *in vitro* study demonstrated that administration of melatonin to human spermatozoa improved progressive motility and reduced the number of static cells (Ortiz et

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# Sustainable Food Security Through Mitigation of Enteric Methane Emission

V.B. Singh, V.K. Singh, D. Tewari, S. Gautam, S. Chaturvedi, P. Singh and S.P. Singh
Department of Animal Nutrition
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## INTRODUCTION

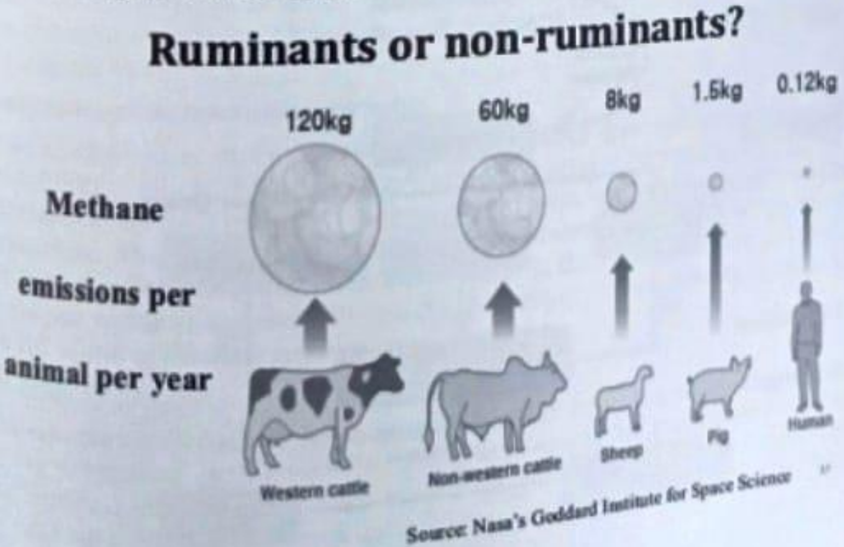
...minants are essential to livelihood of millions of farmers and critical to human health, food and ...ritional security. Ruminants convert their feed into high value food products for human (milk and ...at) through enteric fermentation. Ruminant production system with low productivity loses more ...ergy per unit of animal product than those with high productivity. Increasing productivity across ...duction system increases food security and strengthens farmer's livelihoods. This strong ...relation between animal productivity increases and enteric methane reduction could be implies for ...d security. Fully avoiding of enteric methane emission is not possible due to significant growth in ...e demand for ruminant products. But there are opportunities to substantially reduce emission per ...it of product. These opportunities generally consist of improving the efficiency of production via ...e implementation of known practices or technologies that result in greater yields per animal and per ...it of feed.

...ruminants hydrogen ($H_2$) is one of the major end products of fermentation by bacteria, protozoa ...d fungi. This $H_2$ is utilized by the rumen microbes to produce methane ($CH_4$). The short chain fatty ...ids produced in the rumen are used as a source of energy and the hydrogen generated as an ...ermediate, which is converted rapidly in to methane by the methanogens. In the rumen, formation ...f methane is the major way of hydrogen elimination through the following reaction:

$$CO_2 + 4\,H_2 \longrightarrow CH_4 + 2\,H_2O$$

...thane that produced in the rumen as a product of normal fermentation of feed stuffs, is exhaled ...to the atmosphere which contributes in global warming.

...thanogens belong to the domain *Archaea* and the phylum *Euryarchaeota.* About 113 species of ...thanogens are recognized in the ecosystem but only few species are found in rumen. Methanogens




Source: Nasa's Goddard Institute for Space Science

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# Ovine Pulmonary Adenomatosis: An Update (Jaagziekte)

K.K. Tripathi, D. Niyogi, R.P.Diwakar[1] and Pramod Kumar[2]
Department of Veterinary Pathology
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)
[1]Department of Veterinary Microbiology
[2]Department of Veterinary Physiology

## INTRODUCTION

Ovine pulmonary adenomatosis, previously known as Pulmonary carcinomatosis (OPC), is a contagious, highly transmissible, retroviral induced bronchioloalveolar carcinoma of ovine lung .It was previously known as jaagziekte. The disease is caused by retrovirus which cannot be cultured in vitro .The disease is transmitted by inhalation of infected droplets, when sheep are kept in close contact .OPA usually affects mature sheep between 1-4 years of age and disease onset is infectious .Of these, OPA occurs naturally in sheep and rarely in goats due to the presence of the host species barriers to JSRV replication and carcinogenesis in goats .The macroscopic and histological features of lung tumors in goat also differ from those in sheep (Caporale et al., 2013).

OPA was first described in South Africa during 19[th] century and was called jaagziekte derived from Afrikans for "chasing or driving sickness" because the affected sheep have the appearance of having being chased and the disease is most noticeable when the sheep are being herded (Querat,2003) and since then it has identified in many countries including India(Rama Devi et al., 2001). For the first time Damodaran reported in India in four bikaneri sheep maintained at hosur cattle farm. In the U.K and south Africa ,OPA accounts for almost 70% of all sheep tumors(De Las Heres et al., 2003).OPA is responsible for economic losses and the subclinical form of the disease affects growth rate ,carcass weight ,milk and wool productation . Many times it goes unnoticed during commercial life span of sheep and is mostly recognized at slaughter. Hence, the prevalence of OPA is not known exactly and with in the affected flock is prevalence is usually 2-5% although it can be high as 30%(De Las Heres et al., 2003). In India the incidence rate ranging from 0.51 to 4.45% (Raman and Iyer,1979).

In addition to its importance as a veterinary problem, OPA has wider relevance for fundamental studies on cancer since it provide a new model for understanding the molecular event involve in the development of epithelial tumor of lung (Palmarini and Fan, 2001) .OPA has similarity to human bronchioloalveolar carcinoma (BAC) and sheep is large animal model of pulmonary carcinogenesis. OPA originated alveolar type II pneumocytes and rarely from non ciliated bronchiolar (Clara) cells. The virus is able to replicate only in pulmonary secretary cells .In a study conducted in natural and experimentally induced OPA, 82% of tumor cells had ultra structure feature consistent with alveolar type II cells, 7% of tumor cells had feature of Clara cells and 11% were undifferentiated cell.

## ETIOLOGY

Ovine pulmonary adenocarcinoma results from infection by jaagziekte sheep retrovirus (JSRV), which is also known as the pulmonary adenomatosis virus. This virus is a member of the genus *Beta retrovirus* in the Retroviridae.

## TRANSMISSION

Ovine pulmonary adenocarcinoma can be transmitted by the respiratory route, probably via aerosols or droplets. Infectious virus occurs in the respiratory exudates of infected sheep. Jaagziekte sheep retrovirus can be found in tumors, lung fluids, peripheral blood leucocytes and lymphoid organs; before tumors develop, the virus is detected in lymphoreticular cells. Horizontal transmission has been demonstrated among sheep of all ages, but neonates seem to be particularly susceptible to infection. There is no evidence that *in utero* transmission is significant in the epidemiology of this

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# A Review on Epidemiology and Diagnosis of Brucellosis In India

**Vibha Yadav, R. K. Joshi and R. P. Diwakar**
Department of Veterinary Microbiology
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## INTRODUCTION

Brucellosis is a highly contagious and an important re-emerging zoonosis caused by ingestion of unpasteurized milk or undercooked meat from infected animals, or close contact with their secretions. It is also known as undulant fever, malta fever and mediterranean fever (Radostits, O.M. et al 2000). The disease is closely associated with the evolution of mankind as an agrarian society linked to the practice of shepherding and popularization of animal husbandry. Brucellosis was predominant in the Mediterranean region and its history has been associated with military campaigns. Brucellosis has undoubtedly evolved as a disease since man first domesticated animals.

## EPIDEMIOLOGY

Since the discovery of *B. melitensis* by Bruce, brucellosis has been an emerging disease. The transmission of *Brucella* infection and its prevalence in a region depends upon several factors like food habits, methods of processing milk and milk products, social customs, husbandry practices, climatic conditions, socioeconomic status, and environment hygiene. Brucellosis is almost invariably transmitted to man from infected domestic animals. However, it has been documented beyond doubt, the possibility of human to human transmission of *Brucella* infection (Naparstek et al 1982; Lubani et al 1988; Mantur et al 1996; Tikare et al 2008). Human brucellosis was once thought to be predominantly transmitted through animal contact. However, it is now being realized increasingly that animal products such as milk and meat products also play a important role in the disease transmission. Dairy products prepared from unpasteurized milk such as soft cheeses, yoghurts, and ice-creams may contain high concentration of the bacteria and consumption of these is an important cause of brucellosis. It is the commonest mode of transmission in case of *B.melitensis* and *B.abortus* infections in general population. Bacterial load in animal muscle tissues is low, but consumption of undercooked traditional delicacies such as liver has been implicated in human infection. Crushing the umbilical cord of newborn lambs and kids with the teeth is another risky habit. Consuming fresh goat's milk combined with herbal extracts to obtain relief from chronic ailments is reported to be one more risky habit. Other means of infection include skin abrasions or inhalation of airborne animal manure particles. Contamination of skin wounds may be a problem for persons working in slaughterhouses or meat packing plants or for veterinarians. Hunters may be infected through skin wounds or by accidentally ingesting the bacteria after deer, elk, moose, or wild pigs that they have killed. Inhalation is often responsible for a significant percentage of cases in abattoir employees (Robson et al 1993). The disease has been recognized as one of the common laboratory- transmitted infections and has been reported to occur in clinical, research, and production laboratories (Bouza et al 2005; Centre for Disease Control and Prevention [CDC] 2008). The presence of brucellosis in wild animals, with a potential for continuous transfer to domestic animals and from them to humans is another epidemiological issue (Cutler et al 2005). Those with a professional risk of acquiring infection include livestock producers, abattoir workers, shepherds, farmers, veterinarians, and laboratory personnel. Brucellosis is common in rural areas because farmers live in close contact with their animals and often consume fresh unpasteurized dairy products. However, the vending of dairy

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# Meeting the Challenges of Health and Welfare of Livestock and Food Security: Where Does a Veterinarian Stand?

**Shiv Kumar Yadav, Alok Kumar Yadav[1], Anand Kumar[2], S. K. Maurya[3] and Shailendra Kumar Verma[1]**
Department of Veterinary Biochemistry, Ranchi Veterinary College, Ranchi, Jharkhand
[1]Veterinary Officer, Central Cattle Breeding Farm, Andeshnagar, Lakhimpur-Kheri (U.P.)
[2]Department of Veterinary Gynaecology & Obstetrics, Ranchi Veterinary College, Ranchi, Jharkhand
[3]College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, (UP) India.

## INTRODUCTION

"Being admitted to the profession of veterinary science, I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health and welfare, the prevention and relief of animal suffering, the conservation of animal resources, the promotion of public health, and the advancement of medical knowledge". Every graduate entering into veterinary profession swears an oath not only to protect animal health but also welfare, to not only relieve animal suffering but to prevent it, this is what defines the goals, responsibilities of a veterinarian. W Rogers once said, "The best doctor in the world is a veterinarian. He can't ask his patients what is the matter– he's got to just know." Veterinarians rely on their training to ascertain ailments and diseases. The ability to identify ailments in a variety of species demands intensive multi-disciplinary training including anatomy, physiology, microbiology, parasitology, pathology, biochemistry, diagnostic imaging, medicine and surgery. In most circumstances, this training enables veterinarians to see cases through from start to finish, which is often not the case for human health professionals. Even their work environment is too vast, ranging from long hours spent in research labs and pet clinics, to farms and in the wild dealing with often confused and scared animals. Veterinarian and animal health In animal clinics, veterinarians work with companion, farm and exotic animals to diagnose and treat acute and chronic diseases, provide targeted vaccines, treat parasitic infection and infestation and perform minor surgeries like dressing wounds, mending broken bones, performing dental work to major ones like caesarean sections and also humanely euthanize whenever necessary. Veterinarians are also key contributors to ethical review processes in Vetero-legal cases, speaking with authority and pragmatism as the animals' advocate. That is what these animals deserve, not only the five freedoms- freedom from hunger, freedom from discomfort i.e. having shelter, freedom from pain and suffering from disease, freedom to express its normal behaviour, freedom from fear and distress; but proper internationally achievable and respected standards for their whole life.

## VETERINARIAN AND PUBLIC HEALTH

More than half of all human diseases are animal originated, caused by multi-host pathogens. Effective prevention and control of infectious diseases at the animal-human-ecosystems interface is the key to prevent the spread of diseases in animals and humans, enhancing food security and fostering poverty reduction. Increased transparency in the animal health situation contributes to better public health. All activities of animal science affect human health either directly through biomedical research and public health or indirectly by addressing domestic animal, wildlife, and environmental health. The Veterinary research transcends species boundaries and includes the study of spontaneously occurring and experimentally induced models of both human and animal disease and research at human-animal interfaces, such as food safety, wildlife and ecosystem health, zoonotic diseases and public policy. By its nature, veterinary science is comparative and gives rise to the basic science disciplines of comparative anatomy, comparative physiology, comparative pathology, and so forth; but its ability to reach its peak potential relies on adequate infrastructure

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# The Roles of Veterinarians in Welfare of Livestock and Global Food Security

**Mukesh Kumar and Krishna Nand Singh**
Department of Veterinary Anatomy & Histology
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## INTRODUCTION

The *Global Livestock Alliance* aims to create a safer, fairer and more sustainable livestock sector. The Alliance stresses that social equity, global health and the environment should be considered among the strategic pillars of the global livestock agenda. We share these aims and additionally believe that good standards of animal welfare should be included in this agenda, both because animal welfare is important to people around the world and because it can contribute to the main aims of the Alliance.

The role of livestock can helpfully be considered through assessment of its contribution to the diverse objectives of food and farming policy. This policy area must aim to end hunger and achieve food security, ensuring that all people have access to safe and sufficient food. It has to provide food of good nutritional quality and promote diets that support good health. It must be environmentally sustainable, as our ability to feed the growing world population is dependent on the continuing availability of healthy and plentiful soils, land, water and biodiversity. Finally, it should ensure that animals are farmed to high welfare standards – which will help in achieving the other objectives. Food and farming policy needs to take an integrated approach, ensuring that one objective is not achieved at the expense of another.

## FOOD SECURITY

Achieving food security is often presented as a primarily quantitative challenge. However, more than enough food is already produced to feed the anticipated world population in 2050 of 9.6 billion. The real challenge lies not so much in producing more but in wasting less, and ensuring a more equitable distribution of food and agricultural resources.iv Sufficient caloric availability at the national or global level, while a critical component of food security, neither ensures equitable distribution of those calories, nor does it ensure that those calories are nutritionally appropriate.v Further, over 50% of global crop calories are lost or wasted or otherwise used in ways that do not contribute to the human food supply.

A classical definition of a veterinarian is that of a person that is qualified to practice veterinary medicine, and by this most people think of clinical practices related to the prevention, cure, or alleviation of pain and treatment of injuries in animals, especially domestic animals. But the contemporary roles of veterinarians go far beyond these more visible tasks. As the world becomes intricately interconnected and more complex, so are the various obligations and responsibilities that veterinary professionals must undertake. To give an example, veterinarians at FAO work to reduce hunger and poverty across the globe through the development of animal production and health strategies that improve efficiency in production parameters while upholding environmental and natural resource management principles.

Broadly speaking, veterinarians are involved in more than administering vaccines, cleaning wounds, insert microchips in pets, and inspecting animal food products. Over the years veterinary professionals have played significant and contributory roles in animal and human health and welfare, food quality, food safety, food security, ecology, ethology, epidemiology, physiology, psychology, development of drugs and pharmaceuticals, biomedical research, as educators, trainers and policymakers, and in wildlife conservation, and the protection of the environment and

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# Enhancing Animal Health and Increase Productivity to Reduce Poverty

**Pramod Kumar, P.K.Maurya, P.K.Chaudhary and S.K.Maurya**

Department of Veterinary Physiology & Biochemisry

College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## NTRODUCTION

arge part of the Indian population lives in rural areas where animals are indispensable for their elihood and access to food. Many farmers in these areas depend on animals as the main source of come. For many households, animals are also the best means to preserve the necessary resources to pe with agricultural crises, to reduce poverty, or to help to keep the soil fertile and provide traction r ploughing and transport.

comparison of livestock performance trends with the evolution of rural poverty in India indicates at growth in livestock production alone is not enough to reduce rural poverty. To help reduce verty, sustainable production should be based on productivity gains. Prerequisites for enhancing oductivity include better public and government policies, enhanced research and the reduction of imal disease risk.

ased on data from scientific publications, statistics and field observations, the study shows the portance of livestock in the economy and in the risk management strategies implemented by poor rmer. It compares the capacity of intensive growth and extensive growth in livestock production to duce poverty, as well as the experiences of countries that have achieved differing results in fighting verty. It concludes by examining the conditions needed for enhancing livestock productivity and he barriers that animal diseases pose to this improvement.

## THE EVOLUTION OF POVERTYIN INDIA

overty is a significant issue in India, despite having one of the fastest-growing economies in the orld, clocked at a growth rate of 7.6% in 2015, and a sizable consumer economy. The World Bank nd United Nations define poverty as a multidimensional phenomenon leading to 'pronounced eprivation of well-being. While the monetary dimension is the most important one, poverty is usually ssociated with undernourishment, severely curtailed access to housing, education and health care, nd discrimination, affecting either individuals or groups. Extreme poverty is considered to stem mainly from public policy shortcomings and to be exacerbated by a host of factors, including: climate-related crises, conflict, ill-defined or unfair land ownership in the case of rural poverty, and lack of education. Most social groups living in extreme poverty are at a severe economic disadvantage from the outset and are caught in a vicious circle where the causes of poverty are hard to distinguish from ts effects. Most poor people lived in rural areas. In addition, progress has been uneven across regions.

The World Bank reviewed and proposed revisions in May 2014, to its poverty calculation methodology and purchasing power parity basis for measuring poverty worldwide, including India. According to this revised methodology, the world had 872.3 million people below the new poverty line, of which 179.6 million people lived in India. In other words, India with 17.5% of total world's population had 20.6% share of world's poorest in 2011. As of 2014, 58% of the total population were living on less than $3.10 per day. According to the *Modified Mixed Reference Period (MMRP)* concept proposed by World Bank in 2015, India's poverty rate for period 2011-12 stood at 12.4% of the total population, or about 172 million people; taking the revised poverty line as$1.90.

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# Roles of Veterinarians in the Challenges of Livestock Health, Welfare and Food Security

**R.P.Diwakar, Vibha Yadav, R.K.Joshi, Prerit K. Singh, Rishikant, D.Niyogi and K.K.Tripathi**
Department of Veterinary Microbiology
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

The veterinarian as a person qualified to practice veterinary medicine has lead most people to thi[nk] that their clinical practices are related to the prevention, cure or alleviation of pain and treatment [of] injuries in animals, mainly domestic animals. Though these roles are very important, t[he] contemporary roles undertaken by veterinarians go far beyond these more visible tasks, and this is th[e] reason why there is a need for far greater awareness in the public eye. It must be recognized that as th[e] world becomes intricately inter-connected and more complex, so are the various obligations an[d] responsibilities that veterinary professionals must undertake.

Veterinary professionals have played significant and contributory roles in animal health and human health as well as welfare, biomedical research, food quality, food safety, food security, ecolo[gy] ethology, epidemiology, microbiology, parasitology, pathology, physiology, psychology, radiolo[gy] research and development of pharmaceuticals, remedies, vaccines, and toxicology; also as educator[s] trainers, and policymakers, and also interlinked with wildlife conservation efforts and the protectio[n] of the environment and biodiversity. As challenges have risen, veterinarians have found ways to ad[apt] given that their knowledge and training makes them multifunctional professionals. This ai[ds] societies so that its animals stay healthy and productive. It is not surprising that becoming [a] veterinarian is a highly popular career choice.

Healthy and productive livestock make important contributions to food production, inco[me] generation, economic growth, and poverty alleviation is often overlooked or taken for granted. On average, livestock contribute some 40 percent of agricultural GDP.

As population grows and middleclass incomes rise, demand for livestock products are increases— consumption boom shaped by two decade of rapid economic growth and globalization. But there a[re] certain serious or zoonotic diseases that do not allow animal husbandry to flourish. Less seri[ous] diseases also impact the performance of farm animals, leading to lower production efficiencies a[nd] associated financial losses due to mortality and morbidity. Also, poor animal health in turn negative[ly] influences animal welfare. There is a direct correlation between the qualities of livestock productio[n]

In this regard, farm-oriented veterinary professionals should advise farmers and owners of livesto[ck] or managers of animal production systems on the most appropriate herd health management practices according to local and regional agro-ecological contexts. This extends beyond the treatment of animal illnesses or the implementation of preventive measures, such as strengthened bio security programmed de-worming or vaccination, but also addresses housing, nutrition, cleaning, a[nd] environmental sanitation.

The veterinarian's job extends to advisory and hands-on tasks throughout the value chain such as, f[or] instance, in ante- and post-mortem inspections and food safety interventions to ensure a safe a[nd] wholesome food supply to consumers. Also, veterinarians make sure that healthy animals a[re] exported, imported, and distributed, thus preventing the risk of introducing detrimental, high-imp[act] diseases into distant regions or neighboring countries.

The Livestock Emergency Guidelines and Standards (LEGS) have been developed as a set

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# Gut Health: Its Importance and Management in Chickens

D. Niyogi, K.K. Tripathi and S.V.Singh[1]
Department of Veterinary Pathology
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)
[1]Department of Veterinary Medicine

## TRODUCTION

t health' is a term increasingly used in the medical literature and by the food industry. It covers ltiple positive aspects of the gastrointestinal (GI) tract, such as effective digestion and absorption food, the absence of GI illness, normal and stable microbiota, effective immune status and a state of ell being. From a scientific point of view, however, it is still extremely unclear exactly what gut alth is, how it can be defined and how it can be measured. The GI barrier adjacent to the GI crobiota appears to be the key in understanding the complex mechanisms that maintain the gut alth. Any impairment of the GI barrier can increase the risk of developing infectious, inflammatory d functional GI diseases, as well as extra-intestinal diseases such as immune-mediated and etabolic disorders.

aintenance or enhancement of gut health is essential for the welfare and productivity of animals hen antibiotics are not allowed in feed. Gut health research has its origin in human health ogrammes when nutritional interventions, such as probiotics and prebiotics, are used to ameliorate nditions such as inflammatory bowel disease, Crohn's disease and irritable bowel syndrome. Today, t health is a major topic for research not only in humans but also in animals. It is now generally nceded that maintenance or enhancement of 'gut health' is far more complex than just the odulation of the gut microflora through probiotics or prebiotics. It is not surprising considering that e gut harbours more than 640 different species of bacteria, contains over 20 different hormones, gests and absorbs the vast majority of nutrients, and accounts for 20% of body energy expenditure. is also the largest immune organ of the body. Thus, anything that affects the health of the gut will doubtedly influence the animal as a whole and consequently alter its nutrient uptake and quirements. Consequently, 'gut health' is highly complex and encompasses the macro-and micro-uctural integrity of the gut, the balance of the microflora and the status of the immune system. rther, complexity arises from their interactions and the resulting changes in gene expression, and ssibly, endocrine regulation. This, in turn, may affect the way nutrients are partitioned and utilized r organ development, tissue growth and immune system maturation. This paper will discuss the link etween gut health and performance, covering gut development & microstructure, gut microflora and tential pathogens of gut in poultry.

## VELOPMENT AND STRUCTURE OF GUT

day, a newly hatched chick increase its body weight by 25% overnight and 5000% by 6 weeks, to 2 . As the growth period is progressively shortened and feed efficiency continuously improved, the alth care and nutrition of the birds are becoming more demanding. This makes it more important to y attention to the minute changes that occur in the gut, which are often overlooked because the mage is subtle and usually characterized by microscopic changes in the mucosal layer. These nute changes underpin the efficiency of nutrient assimilation because underneath the mucosa is a t surface of epithelial cells of the absorptive type essential for the transport of nutrients into terocytes.

evelopment of the GIT is an important aspect of growth, especially during the early post-hatching

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# The Food Security and Animal Welfare Issue

**Krishna Nand Singh and Mukesh Kumar**
Department of Veterinary Anatomy & Histology
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

Livestock play a central role in food security; livestock contribute directly to food security through proving food, employment and income. Wellbeing of animals had been public concern since the beginning of human kind history; recent years have seen an increase public call for animal welfare. Over the years animals has intensified with more and more animals moved to indoor housing systems with higher stocking densities, use of performance enhancers and transportation to abattoirs have drastically affected the welfare of these animals.

Animal products are critical to the nutrition, food security, livelihoods and resilience of hundreds of millions of people throughout the world. Livestock accounts for 40% of worldwide income from agriculture. Demand for animal products is set to continue increasing in the next three decades, as is their market price. If not carefully managed, a worldwide increase in the production of animal-derived products would increase pressure on natural resources (particularly water and land) significantly raising levels of dangerous greenhouse gas emissions and increasing the risk of people contracting zoonotic diseases. These realities are informing governments as they encourage the managed intensification of livestock production. They seek to do this in ways that take account of poorer people's contributions to the growth of rural economies. They look for ways to link together work on agricultural productivity, efficient food

Systems; infrastructure development; access to energy, water and affordable health care; and the sustenance of environmental services. Managed intensification of livestock production would also require long-term application of a One Health approach with its focus on mitigating health risks at the interfaces between animals and humans in different ecosystems. It will stimulate the joint working of multiple interests in pursuit of a common goal – ending hunger and malnutrition.

Feeding the growing global population is one of the key challenges facing the world today. There are clear signs that so far, we are failing to address this. The inequalities in terms of food distribution are staggering: nearly one billion people experience hunger and one billion lack important micronutrients in their diets. Meanwhile, a further one billion are over-consuming food, spawning a new public health epidemic involving chronic conditions such as type-2 diabetes and cardiovascular disease1. Overall, there are nearly three billion people with inadequate diets. Livestock play a central role in food security – but livestock production requires considerable resources. Around one-quarter of all global freshwater use and three-quarters of all agricultural land relates to livestock production. The pressure to deliver ever increasing quantities of cheap meat, eggs and dairy products is causing major animal production and welfare challenges while still failing to address the vast inequalities in human diets. Further pressure to increase production to feed the world's growing population must not follow this spiral of unsustainable production and consumption. It is time to question the direction of livestock production and invest in solutions that feed the planet while being economically viable, environmentally resilient and respectful of animal welfare.

The aspect of food security most commonly studied is that of food availability (supply). However increased food supply alone does not guarantee food security. The concept of food security builds strongly on central aspects of sustainability, such as equity, but often excludes issues such as human livelihoods or animal welfare. Livestock play a central role in food security – both directly and

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# Genetic Improvement of Livestock in India Through Effective Implementation of Breeding Strategies

**Jaswant Singh, M.K. Verma and V.K. Singh**
Department of Animal Genetics and Breeding
College of Veterinary Sc. & A.H., NDUAT, Kumarganj- Faizabad

## INTRODUCTION

Dairy farming in India has largely been considered as subsidiary to rural farmer's main avocation crop production, however during the last two –three decades, dairy production had undergone major transformation thus resulting into a substantial increase in milk production and becoming the most viable tool to diversify the agriculture production. The country has already achieved the distinction of top position in the milk production in the world. This achievement to some extent could be attributed to increase in the population of high yielding crossbred cattle and buffaloes coupled with launching of various breed improvement programmes by different research and development organizations. Various animal breeding and reproductive technologies for selection and faster multiplication of genetically superior cattle and buffalo germplasm, expansion of infrastructure development on network of AI, animal health care, milk procurement and marketing facilities and adoption of improved animal management practices etc. have contributed significantly to increase the milk production.

However, there is large number of constraints hampering these programmes increasing average animal productivity, therefore there is a need to mitigate the gap and further optimize the use of resources for proper implementation of programmes. Past experiences underline that the breed improvement are long term programme which require clear breeding goals, good planning, a certain infrastructure and complete administrative and financial support from government as well as active participation from the breeders and farmers.

## BOVINE GENETIC RESOURCES AND BREEDING PROGRAMMES:

India has a rich and a diverse repository of bovine genetic resources with 37 well defined breeds of cattle and 14 breeds of buffaloes. Although, we possess a large number of well defined cattle and buffalo breeds, yet these constitute hardly 20-25% of total cattle and buffalo population of the country. The cattle and buffalo genetic resources with vast populations of 190.906 millions and 108.702 millions comprising large populations of crossbred and non-descript cattle and buffaloes are widely distributed in diverse agro-ecological regions of the country. These diverse population groups reared in small herd size of 2-3 animals mainly by small, marginal and landless farmers of different socioeconomic levels under different ecologies do not have a uniform national cattle and buffalo breeding policy. However, the government of India on the basis of recommendations of National Commission on Agriculture as well as subsequently constituted expert panels has laid down broad guidelines of breeding policy for bovines. The recommended breeding policies are:

- Selective breeding of well defined indigenous dairy breeds of cattle and buffalo for milk production
- Selective breeding of well defined indigenous draught breeds of cattle for better draught power
- Selective breeding of dual- purpose breeds of cattle for improving both milk and draught power
- Grading up of non-descript cattle with improved indigenous cattle breeds for improving milk and draught power

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# Implementation of HACCP in the Meat Industry

**Chandra Shekhar**
Department of Veterinary Public Health & Epidemiology
College of Veterinary Science & A. H., NDUAT, Kumarganj- 224 229 Faizabad (U.P.) India

## INTRODUCTION

The HACCP is a system of food quality control. It ensures the food safety by preventing objectionable chemical contamination, growth or survival of microbiological agents and physical agents or factors. The concept of HACCP was the first time introduced by H. E. Bauman and other scientists in 1971 in the USA. HACCP and microbiological specifications are two excellent means of ensuring safety and good keeping quality of the food products. Food-borne risks can be easily accessed by adopting HACCP. There is a global challenge to maintain a safe food system. Highly contagious diseases like Foot and Mouth disease (FMD), Mad Cow disease (BSE) etc. cause the severe food safety problems. The primary purpose of HACCP is to help processors and suppliers to identify and to control potential hazards in meat and meat products and to ensure that the finished product will be safe for consumers. The HACCP approach directs attention to the key factors in controlling food safety, defines both safety parameters and the action to be taken when safe limits are exceeded and provides documentary evidence of regular process monitoring.

ICMSF (1988) defined hazard as "Unacceptable contamination, growth of microorganisms, undesirable chemicals and physical agents or factors in foods". An outline of the HACCP system for red meat production is given by the International Commission on Microbiological Specifications for Foods (ICMSF 1988). Hathaway and McKenzie (1991) supported the application of HACCP principles in the abattoir and emphasised the importance of exchanging information between farm and abattoir to reinforce the preventive nature of the HACCP approach.

In the case of beef, the critical control points (CCPs) in abattoirs include chilling (CCP1) and skinning, eviscerating and transporting (CCP2). In poultry processing plant, Chilling is the only CCP1 because it prevents any significant microbial growth during processing. On the other hand, scalding and spray-washing are CCP2s because, when these processes are properly controlled, carcass contamination is reduced. However, cross-contamination of carcasses occurs continuously throughout the process and cannot be prevented by any known means. The problem is most acute during scalding, plucking and evisceration and is favoured by the close proximity of carcasses.

In a study that attempted to reduce cross-contamination during processing, Mead *et al.* (1994) using non-pathogenic strain of *E. coli,* which was used experimentally to inoculate carcasses, equipment or working surfaces. The spread of the organism was followed both before and after introducing additional control measures, which included the use of chlorinated water sprays to prevent an accumulation of organisms on equipment, increasing chlorine concentrations in process water and eliminating all unnecessary carcass contact surfaces. The results showed that cross-contamination could be reduced or even prevented at some points in the process. Introducing hand rinsing in chlorinated water after handling of one carcass and before touching another reduced the spread.

Specifically for meat processing plants, the hazards may be provoked by failure of the following-

1. Batches of incoming raw meat materials with abnormal tissues or heavy contamination.
2. Technical problems in sealing of vacuum packages or cans with the risk of recontamination.
3. Breakdowns in refrigeration.
4. Failure in cooking/sterilization operations.

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# Role of Micronutrient Supplementation During Transition Period in Dairy Animals

**Pankaj Kumar Maurya, P. K. Choudhary, Pramod Kumar and S. K. Maurya**
Department of Veterinary Physiology and Biochemistry
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, UP, (India)

## INTRODUCTION

Transition period is the period of 3-4 week prepartum to 3-4 week postpartum also called periparturient period. Transition period is critical for health and subsequent performance of dairy cows. It is a very important phase for the dairy animals and is characterized by a depleted immunity and antioxidant status. Endocrine and cellular adaptations during dry period and early lactation play an important role in animal productivity. Physiological changes during transition period associated with rapid differentiation of secretory parenchyma, intense mammary gland growth, and the onset of copious milk synthesis and secretion are accompanied by a high-energy demand and an increased oxygen requirement (Gitto et al., 2002). During the transition period cows experience oxidative stress which may contribute to periparturient disorders, and may be associated with metabolic diseases. Oxidative stress leads to peroxidative damage of lipids and other macromolecules with consequent alteration of cell membranes and other cellular components. Antioxidants can be broadly defined as any substance that delays, prevents, or removes oxidative damage to target molecules. Some vitamins like vitamin E, vitamin C and minerals like zinc and copper acts as antioxidant. Most of the fat soluble antioxidant vitamins such as vitamin A, beta carotene and vitamin E decrease at the time of parturition and are associated with severe health problems (Rajiv, 2001). Vitamin E is natural antioxidant vitamins associated with immunity and metabolic disorders in animals. Zn is also known to be associated with enzymes involved in the phagocytic oxidative burst, in cellular maturation and functioning of B and T-lymphocytes (Chandra and Au, 1980).

## OXIDATIVE STRESS

Free radical reactions are the part of normal cellular metabolism. Oxidative stress is experienced by the living organisms from both exogenous and endogenous sources. Oxidative stress continues to be a problem in transition cows. During lactation onset, mammary gland epithelial cells are exposed to significant levels of free radicals because of higher oxygen demand for milk synthesis and secretion. The dietary and tissue balance of antioxidant nutrients is important in protecting tissues against free radical damage. The antioxidant function could, at least in part, enhance immunity by maintaining the structural and functional integrity of the important immune cells. A compromised immune system will result in reduced animal production efficiency through increased susceptibility to diseases, thereby leading to increased animal morbidity and mortality.

The antioxidant vitamins A and E, and the micronutrients zinc, iron and copper have the greatest impact on pregnancy outcome as both copper and iron may elicit changes in prenatal development through the generation of free radicals whereas zinc is associated with regulation of antioxidant enzymes. Micronutrient imbalance can affect pregnancy outcome through alterations in maternal and conceptus metabolism, as a consequence of their essential role in enzymes and transcription factors and through their involvement in signal transduction pathways that regulate development. Metabolic disorders associated with negative energy balance may impair fertility, immune status and antioxidant status.

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# Role of Accreditation of Veterinary Diagnostic Laboratories in Indian Livestock Health

R. K. Verma, S. Jaiswal and N. K. Singh
Department of Teaching Veterinary Clinical Complex
College of Veterinary Science & A.H., NDUAT Kumarganj Faizabad (UP) 224229

## INTRODUCTION

Demand for animal food products is increasing rapidly so livestock sector is expected to emerge as engine of agricultural growth. Growth rate of livestock sector and poultry is filling the shortage feed and fodder (nutrition). Prevention of infectious diseases through various strategies of treatme containment and control in animals is necessary to increase the growth rate of livesto sector.Development of a strong veterinary healthcare infrastructure throughout the country necessary. It can be done only through Creation of corporatized veterinary diagnostic facilities in Indian livestock sector.The laboratories are an integral part of disease diagnosis, treatme monitoring response to treatment, disease surveillance programmes and clinical research.Go Laboratory Practices (cGLP) provides test resultsreliable, accurate and reproducible.The exist veterinary diagnostic laboratories need updation to obtain the accreditation,in this scenario. If want to open newer ones it should be kept in mind so as to have such certifications to support the ne of the sector to meet the international standards.

## LABORATORYACCREDITATION IMPORTANCE

Accreditation accrues to both laboratories and livestock. A third party third-party certification of competence of laboratories is required to perform particular types of testing. Accreditation laboratory is necessary to enhanced credibility and livestock owners' confidence. Purity of sample must before analyzing because impure sample affect test results adversely.Lab accreditation ensur quality both (functional and technical) that is absolutely essential in diagnostics and removes fa related with processing of samples. Ethical practices come under functional quality. Techni quality is reflected in the latest lab equipment, processes and the soundness of the technicians scientists, etc.The standards help businesses increase productivity while minimizing errors and was By enabling results from different labs across the country and globe to be directly compared, the standards facilitate labs in entering new areas and assist in the development of global trade on a basis.

The International Organization for Standardization (ISO) is an international standard- setting bo is world's largest developer of voluntary international standards and facilitates world trade providing common standards between nations, promotes worldwide proprietary, industrial commercial standards.

For initiation of the process of such standard system, a quality management system (QMS) must be place. Numerous certification bodies exist, which audit organizations and, upon success, issue I 9001 compliance certificates. Many countries have formed accreditation bodies to autho (accredit) the certification bodies. Both the accreditation bodies and the certification bodies ch fees for their services. Accredited certification bodies (CB) are accepted worldwide and the certi issued by them are acceptable every globally.

## COMPETENCE OF TESTING AND CALIBRATION LABORATORIES

In many cases, suppliers and regulatory authorities will not accept test or calibration results fr

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# Exploring Immune Mechanism to Enhance Disease Resistant Capability of Animals Against G.I. Helminths

V. K. Pal and A. Singh
Department of Veterinary Parasitology
College of Veterinary Science & Animal Husbandry
Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad, UP

## INTRODUCTION

Many species of helminths are parasitic multicellular organisms of medical and economic importance as they infect humans and animals and sometimes provoke fatal diseases such as schistosomiasis. They can also be responsible for economic losses due to decreased milk or meat production and the cost of anthelminthic treatments of parasitized individuals. Helminths are extremely diverse. They can be classified into 3 taxonomic groups, that is, nematodes, trematodes, and cestodes, often with very different parasitic cycles. For example, (i) they may be transmitted orally (Strongyles, Fasciola sp., etc.) (ii) their definitive and intermediate hosts range from mammals, birds, reptiles to fish, molluscs and arthropods, and so forth (iii) they may be localized in organ lumen or in tissues such as gut, liver (parenchyma and bile ducts), lung, lymphatic vessels, and so forth; (iv) the successive developmental stages of parasitic species may infect different tissues and cells of different organs.

## MECHANISM OF IMMUNE RESPONSE AGAINST HELMINTHS

'Helminth' is the main example of T helper type 2 (Th2) responses which protect against gastro-intestinal nematodes infection. Evidence suggests that a response dominated by the production of Th2 cytokines, such as IL-4, IL-13, IL-5 and IL-10, eosinophils, basophils, mast cells and goblet cells may play a crucial role in reducing the severity of acute disease and allowing survival. Th2 cytokines, eosinophils, basophils, mast cells, non- lymphoide epithelial cells and goblet cells to induse the expultion of parasites through the physiological reactions such as mucus production and muscle hypercontractivity. Immunoglobulin such as IgE and IgG1 are formed through responding B cells. Th2 responses play a crucial role in resistance to helminthes as well as curative role in many diseases. Initially, CD4 T cells bound to major histocompatibility complex (MHC) class II molecules on the surface of antigen-presenting cells of gastri intestinal parasites. Most of the cells such as Dendritic cells (DCs), macrophages and B cells have possessed the ability to present antigen/MHC class II complexes. Amongst these, DCs are considered to be the cells that possess the ability to activate T helper cells. A major role of DCs in this context is to interpret pathogen-inherent signals to provide information for T helper cell for inducing stimulus.

Ligation of different Toll-like receptors (TLRs) on dendritic cells (DCs) initiated stereotypically. It is characterized by gene expression that leads to DC 'maturation'. It is begin processing previously acquired antigen for presentation in MHC molecules. It also expresses important molecules such as CD80 and CD86. These changes initiation of mitogen-activated protein kinases (MAPKs) and nuclear factor (NF) signalling by TLRs and effects of type 1 interferon (IFN) production. TLR signalling is predominantly MyD88-dependent but some are independently of MyD88. So, DC maturation is to be essential for DCs to be able to induce T-cell responses. Other studies describe targeted analyses of potentially important molecules expressed in response to exposure to helminth products. In contrast, proteins secreted by some nematode such as *Nippostrongylus brasiliensis* were found to induction of activation of DCs. Dendritic cells induces the expression of CD40, CD86 and

# Strategy of Fodder Production Technology and Their Management in Present Scenario for Providing the Green Fodder to Animals

**Vishuddha Nand, A.K. Shrivastav, K.D Singh and Ajeet Kumar**
Livestock Farm Complex, C.V.Sc &A.H, NDUAT, Kumarganj Faizabad (UP) 224229

## INTRODUCTION

In India approximately 70% population depends on livestock production, it is back bone of the Indian agriculture and providing employment in the rural population. Livestock rearing plays a significant role in the economy of the Indian people. India inhabits 5% of world's livestock on 2% geographical area with 5.23 % cultivated fodder area. Feeding accounts 60-70 % of total cost milk production. Feeding based on green fodder are cost effective, so green fodder production must be encouraged. Present availability of green fodder is 462 m.t. and dry fodder is 394 m.t. Fodder crops are the plant species that are cultivated and harvested for feeding the animals in the form of forage (cut green and fed fresh), silage (preserved under anaerobic condition) and hay (dehydrated green fodder). The total area under cultivated fodder is 8.3 million ha on individual crop basis. Sorghum among the *kharif* crops (2.6 million ha) and berseem (Egyptian clover) among the *rabi* crops (1.9 million ha) occupy about 54 percent of the total cultivated crops has been declining too. Green fodder is an economic sources of nutrients for the dairy animals. It is highly palatable and digestible. Micro-organisms present in green fodder help in improving digestibility of crop residues under mix feeding efficiency of animals. Increase use of green fodder in the ration of animals may reduce cost of milk production.Cultivated fodder including dual purpose crops (green fodder as well as grain purpose), residue of field crops, rangeland and pastures, fodder trees and shrubs, etc. are multiple sources of fodder for animals. The improved cultivation and management practices of all these fodder resources along with fodder conservation and utilization strategy need to be developed.

## CULTIVATED FODDER CROPS

**1. High yielding varieties of cultivated fodder crops**

**Table-1 High yielding varieties of cultivated fodder crops.**

| Crop | High yielding varieties |
|---|---|
| Multi-cut pear millet | Giant bajra, raj bajra chari-2 |
| Single -cut pear millet | Raj-171, JBV-2, JBV-3, AVKB-19, pusa-266 |
| Multi- cut sorghum | CSH-24 MF, SSG-59-3, M.P. Chari, COFS-29, PC-6 |
| Single –cut sorghum | SU-1080, |
| Maize | Pratap makka chari-6, J-1006, African tall |
| Napier x bajra hybrid | APBN-1, CO-4, CO-3, PBN-233 |
| Cow pea | Bundel lobia-1, UPC-9202, EC-4216 |
| Cluster been (guar) | HC-75, Bundel guar-2, Bundel guar-3, RGC-1031, RGC- |
| 986 | |
| Oat | UPO-212, OL-125,Kent, OS-6, RO-19, JHO-851 |
| Lucerne | Anand-2, Anand-3, RL-88 |
| Berseem | Wardan, Miscavi, Bundel Berseem-2, |
| Methi | HFM-65, T-8 |
| Mustard | Japanese rape, Chinese cabbage |

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# Livestock Based Integrated Farming System: A Sustainable Approach for Livelihood Security

**Subodh Kumar, A. K. Verma, S. P. Singh, A. K. Srivastava, K. D. Singh and V. Nand**
College of Veterinary Science & Animal Husbandry
Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad, (UP) 224229

## INTRODUCTION

The growth rate of agriculture in the recent past is very slow inspite of the rapid economic growth in India. Due to ever increasing population and decline in per capita availability of land in the country, practically there is no scope for horizontal expansion of land for agriculture. Only vertical expansion is possible by integrating farming components requiring lesser space and time and ensuring reasonable returns to farm families. The Integrated Farming Systems (IFS) therefore assumes greater importance for sound management of farm resources to enhance the farm productivity and reduce the environmental degradation, improve the quality of life among resource poor farmers and maintain sustainability. In order to sustain a positive growth rate in agriculture, a holistic approach is needed.

## GOALS OF INTEGRATED FARMING SYSTEM

Maximization of yield of all component enterprises to provide steady and stable income.
Improvement in system's productivity and achieve agro-ecological equilibrium.
Avoid build-up of insect-pests, diseases and weed population through natural cropping system management and keep them at low level of intensity.
Reducing the use of chemicals (fertilizers and pesticides) to provide chemical free healthy produce and environment to the society.

## LIVESTOCK BASED INTEGRATED FARMING SYSTEM

Livestock based integrated farming system is one of the rising agriculture systems in developing countries like India. The practice of this type of farming system has been continued here in a traditional way from time immemorial. The basic principles of the farming system are productive recycling of farm wastes. In this approach different farm enterprises work together resulting in a greater total productivity than the sum of their individual production. These farm enterprises may be crop, livestock, aquaculture, agro-forestry, agri-horticulture and sericulture. Some viable livestock based integrated farming modules are discussed here.

## 1. FISH - LIVESTOCK FARMING SYSTEMS

Fish- livestock farming systems are recognized as highly assured technology where predetermined quantum of livestock waste obtained by rearing the live stock is applied in pond to raise the fish crop without any other additional supply of nutrients. The main potential linkages between livestock and fish production concern use of nutrients, particularly reuse of livestock manures for fish production. The term nutrients mainly refer to elements such as nitrogen (N) and phosphorus (P) which function as fertilizers to stimulate natural food webs. Both production and processing of livestock generate by-products that can be used for aquaculture. Production wastes include manure, urine and spilled feed; and they may be used as fresh inputs or be processed in some way before use.

Based on the type of livestock used for integration there are many combinations in livestock-fish systems. Some of the combination are listed and discussed below.

## 2. CATTLE-FISH CULTURE

Manuring of fish pond by using cow dung is one of the common practices all-over the world. A healthy

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# Addition of Dietary Fibre and Antioxidants in Meat Products for Boosting Human Health

**Ruma Devi and Shivesh Singh Sengar**
Department of Livestock Products Technology,
College of Veterinary Science and Animal Husbandry, NDUAT, Kumarganj Faizabad (UP) 224229

## INTRODUCTION

The increasing consumer demand for foods with health benefits has led the food industry to diver its products. Meat with its intrinsic beneficial attributes is a natural functional food. The attentio nowtuned to adding more value to meat and studying its health implications.

Convergences of Functional foods are two major factors in our society- food and health. Now a the link between diet and disease has been widely accepted. Functional foods used to refer to food isolated food ingredients that deliver specific physiological benefits that may enhance health. M and meat products are important sources of proteins, vitamins, and minerals. Certain approache modification in meat and meat products includes alteration of the fatty acid and cholesterol leve meat, addition of natural extracts with antioxidant properties, limiting sodium chlor incorporation of dietary fibers etc. Recently, negative image of meat foods, and their possible he hazard effects, shows that consumers are increasingly interested about health oriented functio meat products. Consumers require not only improved taste but also are attractive, safe and healthy

Meat is marketed in the country in various forms and conveniences to suit the consum choice. The use of meat on development of convenience products is emphasized due to better nutr contents like high quality protein, vitamins, minerals, essential amino acids, fatty acids and lo calorie content. Today's consumers are no longer satisfied with the traditional meat products. Ra they prefer more nutrients and convenient ready to eat meat products. These convenient items mus economical and cost-effective and interesting changes of menu besides better in shelf-life quality acceptability than traditional products. Some potential means to alter meat compositio nutritional approaches so as to achieve specific health and processing opportunities are discus hereunder.

## IMPACT OF DIETARYFIBRES ON MEAT PRODUCTS

Fibre is the main important current wave of interest in functional meat product components. Die fibre is made by the edible plant cells which include cellulose, lignin, pectins, and variety of gu hemicellulose and mucilages. Fibers are naturally occurring compounds present in varie vegetables, fruits, cereal flours etc in abundance, and act through their solubility, viscosity forming ability, water-binding capacity, oil adsorption capacity, fermentability, and mineral organic molecule binding capacity which affect product quality and characteristics.

In meat and meat products Fibre is very suitable. Previously it has been used in meat emulsion products because it, decreasing cooking losses, retains water without affecting flavour of co product. Wheat, oat, pea, Sugarbeet fibre have been used, mainly in cooked meat products.

The most important function of fibre is that of ability to bind water from a technological standp The objective of fibres incorporation in meat and meat product are to restructuring of the prod Moreover, based on their physiochemical properties, many fibers can help to improve colour, tex and sensorial characteristics instead of nutritional benefits. It has been claimed that Pork sau products which contain indigestible dextrin, a water soluble dietary fibre made from potato st

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# Vaccination: An Effective Savior of Animal

**Ramakant, S.V. Singh and N. K. Singh***

Department of Veterinary Medicine

College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad (UP) 224229

* Veterinary Clinical Complex

## INTRODUCTION

Vaccination is generally accepted as an adequate tool to control infectious diseases in man and animals (Lütticken , *et al.,* 2007). Vaccination is used primarily to promote animal health by preventing disease outbreaks that can have a devastating effect on animal production, as well as on human and animal health (Morton, 2007). Vaccination helps to provide sustainable and economic stability for farmers and the communities they serve (Kaasschieter *et al.,* 1992,). However, vaccines have to be affordable and animal stock-keepers have to have the knowledge, ability and inclination to use them (Buyle, *et al.,* 1997). In addition to farm animal productivity and food safety, vaccination plays an important role in human health through the control of some zoonotic diseases in wildlife, such as rabies, where the wild animal reservoirs of infection can be reduced through the use of vaccine baits (Mellor, *et al.,* 1991). The overall concept of vaccination aims to mimic the development of naturally acquired immunity by inoculation of non-pathogenic but still immunogenic contents of the pathogens or closely related organism. The term "vaccine" ( from the latin term vacca meaning cow) was first coined by Edward Jenner to describe the inoculation of humans with the cowpox virus to confer the protection against the related human small pox virus and illustrate the close relationship between the human and animal infectious diseases (Meeusem,*et al.*,2007).

## IMPORTANCE OF VETERINARYVACCINES

The burden of infectious disease in the animals is a major constraint to sustained animal productivity, food security and economic benefits. Targeted measures must be instituted to reduce the occurrence of infection especially through the development of quality veterinary vaccine. More recently, vaccines have also found application in animal production and reproduction process. Veterinary vaccine has already made enormous impacts not only on animal health, welfare and production but also on human health (Maiti and Hota, 2018). The importance of veterinary vaccine given below (James A Roth, 2011):

**1. Safe and efficient food production:** More efficient animal production and better access to high-quality protein are essential to feed the growing population. Veterinary vaccines are used in livestock and poultry to maintain animal health and to improve overall production.

**2. Control of zoonotic diseases:** Vaccines through control of zoonotic diseases in food animals, companion animals, and even wildlife have a major impact on reducing the incidence of zoonotic diseases in people. Veterinary vaccines used for the zoonotic diseases have been, used to control infections in animals, thereby reducing transmission of the infectious agent to people are given below:

- Rabies
- Brucellosis
- Leptospirosis
- Influenza
- Rift Valley fever
- Nipah and Hendra
- Japanese encephalitis
- Q fever

# Strategies and Challenges of Veterinary Profession to Improve Livelihood, Food Security and Safety

**EDITORS:**


**S. K. Maurya**
**Satyavrat Singh**
**Naveen Kumar Singh**
**Ramakant**
**D. Niyogi**
**A. K. Gangwar**
**Bhoopendra Singh**
**Vijay Singh**





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College of Veterinary Science & Animal Husbandry

Narendra Deva University of Agriculture & Technology,

Kumarganj Faizabad- 224 229

# Steps to Sustainable Livestock Production for Livelihood Improvement

**P. S. Pramanik, K.D. Singh, A.K. Verma, Subodh Kumar, and A.K. Srivastava**
College of Veterinary Science & Animal Husbandry
Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (UP) 224229

## INTRODUCTION

The classical view of a veterinarian as a person qualified to practice veterinary medicine has lead most people to think that their clinical practices are related to the prevention, cure or alleviation of pain and treatment of injuries in animals, especially domestic animals. Though these roles are very important, the contemporary roles undertaken by veterinarian go beyond these and this is the reason why there is need for far greater awareness in the public eye. The veterinarians have pivotal role in rural development by livelihood improvement through sustainable livestock production. Andrew Mude, an economist at the International Livestock Research Institute, Nairobi, Kenya, won the 2016 Norman Borlaug Award for developing an index-based insurance scheme providing a safety net for herders in drought-prone East Africa, in which the loss of livestock equals to loss of livelihood and cultural identity.

With improved breeding and cultivation, livestock can yield food that is better for people and the planet. The need for efficient food production has never been greater, one in seven is undernourished. Urbanization and bio-fuel production are reducing land availability where as climate change, lack of water and soil degradation are decreasing harvests. Over the past decades, cereal yields per hectare have fallen in one –fourth of countries. Meanwhile, developing nations and the growing world population are demanding more animal protein. The increasing consumption of animal protein is generally considered at odds with Earth's ability to feed its people. The one billion ton of wheat, barley, oat, rye, maize, sorghum and millet poured annually into livestock troughs could feed some 3.5 billion humans. But such reasoning discounts the health benefits of eating modest amount of meat and the fact that foraging animal can consume foods that humans can feed.

Crop and livestock farming complement each other. Half the world's food comes from farms that raise both. Animals pull ploughs and carts and their manure fertilize crops, which supply post-harvest residues to livestock. But efforts to maximize yields of milk and meat can disrupt finely balanced systems. The quest for 'intensification' in livestock farming has thundered ahead with little regard for sustainability and overall efficiency (the net amount of food produced in terms of inputs such as land and water). With animal protein set to remain part of the food supply, we must pursue sustainable intensification and figure out how to keep livestock in ways that work best for individuals, communities and the planet.

Here we highlight some strategies to cut the environment and economic costs of keeping these animals while boosting net gains for the quality and quantity of the food they produce.

1. **Feed animals less human food:** Around 70% of the grains used by developed countries are fed to animals. Livestock consume an estimated one third or more of the world's cereal grains with 40% of such feed going to ruminants mainly cattle. Some of this is avoidable.
2. **Raise regionally appropriate animals:** The lure of high productivity has led to ill-advised schemes to import livestock to places where they are genetically unsuited. Kerala is home to the smallest breed of cattle in the world. Vechur cows stand at about 90 cm tall and make only around 3l of milk per day- a dribble compared to the 30l per day produced on average by Holstein. But they lack resistance to heat, humidity, tropical diseases and parasites, and so must be kept in

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# Phytotherapy: The Status and Scope

**Piyusha singh, Naveen Kumar Singh, S.V. Singh, Ramakant, Sonu Jaiswal and R.K. Verma**

Narendra Deva University of Agriculture & Technology Kumarganj Faizabad – 224 229, U.P.

## INTRODUCTION

As terms referring to medicinal or dietary practices of using botanical products, herbalism, her medicine or phytotherapy are used interchangeably in many countries, including Canada, Norw United Kingdom, other countries in Europe and South America, South Africa, the United States a in India.

General practices include ancient methods of traditional Chinese medicine and Ayurve Practitioners of herbalism or phytotherapy are referred to as herbalists or phytotherapists. Produ used in herbalism may be called herbal medicines, botanicals, natural health products, her remedies, herbal supplements or phytotherapies.

Archaeological evidence indicates that the use of medicinal plants dates back to the Paleolithic a approximately 60,000 years ago. Written evidence of herbal remedies dates back over 5,000 years the Sumerians, who compiled lists of plants. A number of ancient cultures wrote about plants a their medical uses in books called herbals. In ancient Egypt, herbs are mentioned in Egyptian medi papyri, depicted in tomb illustrations, or on rare occasions found in medical jars containing tra amounts of herbs. Among the oldest, lengthiest, and most important medical papyri of ancient Egy the Ebers Papyrus dates from about 1550 BC, and covers more than 700 drugs, mainly of plant orig The earliest known Greek herbals come from Theophrastus of Eresos who in the 4th c. B.C. wrote Greek Historia Plantarum, from Diocles of Carystus who wrote during the 3rd century B.C, and fr Krateuas who wrote in the 1st century B.C. Only a few fragments of these works have survived inta but from what remains scholars have noted a large amount of overlap with the Egyptian herba Seeds likely used for herbalism have been found in archaeological sites of Bronze Age China dat from the Shang Dynasty (c. 1600 BC–c. 1046 BC). Over a hundred of the 224 drugs mentioned in Huangdi Neijing, an early Chinese medical text, are herbs. Herbs also commonly featured in medicine of ancient India, where the principal treatment for diseases was diet. De Materia Medi originally written in Greek by Pedanius Dioscorides (c.40 – 90 AD) of Anazarbus, Cilicia, a Gre physician, pharmacologist and botanist, is a particularly important example of herbal writing dominated for some 1500 years until the 1600s.

## MODERN HERBAL MEDICINE

The World Health Organization (WHO) estimates that 80 percent of the population of some Asian a African countries presently use herbal medicine for some aspect of primary health ca Pharmaceuticals are prohibitively expensive for most of the world's population. In comparis herbal medicines can be grown from seed or gathered from nature for little or no cost.

Many of the pharmaceuticals currently available to physicians have a long history of use as her remedies, including opium, aspirin, digitalis, and quinine. According to the World Hea Organization, approximately 25% of modern drugs used in the United States have been derived fr plants. At least 7,000 medical compounds in the modern pharmacopoeia are derived from pla Among the 120 active compounds currently isolated from the higher plants and widely used modern medicine today, 80% show a positive correlation between their modern therapeutic use a the traditional use of the plants from which they are derived.

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# Goat Farming In Uttar Pradesh: The Present Status And Future Strategies

Naveen Kumar Singh*, S.V. Singh, Ramakant, Dinesh Kumar Yadav and Ram Jatan
*Department of TVCC
Department of Veterinary Medicine
College of Veterinary Sciences & Animal Husbandry, NDUAT, Kumarganj Faizabad 224 229, U.P.

## INTRODUCTION

Livestock sector constitutes an important component of agricultural economy of developing countries, a contribution that goes beyond direct food production and includes multipurpose products and uses, such as skin, feather, fiber, manure for fertilizer and fuel, power and transportation, as well as means of capital accumulation and a barter product in societies where there is no circulation of currency (Satyanarayan and Jagadeeswary, 2010).

Goats are considered to be adapted to water scarcity and feed shortage. They have the ability to utilize various types of forages and tolerate harsh environments in marginal and semi-arid regions, considered unfavourable for other domestic ruminants (Silanikove, 2000). They use pastures and plant leaves of the many hilly and mountainous areas in our country (Dini *et al.*, 2016). Goats are animals with basic demands and have been rightly acknowledged as 'Poor Man's cow'. For a considerable production just a minimal investment is needed. Goats are very adaptable species.

Goat rearing is a good source of capital storage, income and employment generation and house hold nutrition. Goat contributes milk, meat, fiber, skins and manure to the subsistence of small holders and landless rural poor. Majority of the households in rural areas are below poverty line and most of them belong to landless agricultural labours, marginal, small farmers and rural crafts person. Goat Rearing can be managed by spare family labour and do not require any serious housing facilities and management skills. Goat farming suits the small, marginal and large farmers equally well since it provides continuous income throughout the year even in the face of natural vagaries of drought. Goat is a multi-functional animal and plays a significant role in the economy and nutrition of landless, small and marginal farmers in the country. Goat rearing is an enterprise which has been practiced by a large section of population in rural areas (Rawat *et al.*, 2015).

Goat rearing is the most dominant activity in the goat based farming systems in terms of both contribution to household's total income and employment generation (Kumar and Upadhyay, 2009). It also acts as cash buffer, reduces the risk of crop failure in mixed farming and tremendous potential for improving the food, employment and livelihood security of rural people (Singh *et al.*, 2013). Goat rearing is immerging as an important source of livelihood particularly for landless labourers and marginal farmers across the country. Education, Family educational status and exposure to the communication sources are vital in goat keeping (Chandra *et al.*, 2005).

Among livestock, goat is most common and is reared by more than 75 per cent households, irrespective of landholding size or caste. Besides assured income, employment and nutrition, goat rearing supports crop production by providing cash for the purchase of critical inputs in financial distress and risk aversion in case of crop failure. Therefore, goat has one of the most inclusive growth rates among livestock. In the mixed species grazing system, goats browse on plants which are less preferred by other livestock species and thus add flexibility to the management of livestock (Singh *et al.*, 2013).

Agriculture and livestock production is severely affected by frequent climatic variation or disaster. Inadequate rainfall, extreme temperature, and poor quality of land and groundwater further restrict

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# Acaricide Resistance: Challenge to Sustainable Livestock Health and Productivity

**Amit Singh, V. K. Pal and Amit Jaiswal**[1]
Department of Veterinary Parasitology
College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad-224 229
[1]Department of Veterinary Parasitology, DUVASU, Mathura 281001

## INTRODUCTION

Livestock sector plays an important role in Indian economy and is an important subsector of agriculture. According to National Accounts Statistics-2014; Central statistical organization; GOI estimates, gross domestic product from livestock sector during the year 2013-14 was 3.9%. Due to concerted and tireless efforts of government, scientists and farmers, India now finds itself among leading nations in milk and meat productions. Productions of our livestock can further be improved if their health status is given proper attention. Ticks and ticks –borne diseases (TTBDs) are a major problem to livestock health in the world and its severity depends on region, species involved, host population and socioeconomic conditions. Losses attributable to ticks are caused either directly through blood loss, tick worry, damage to hides and udders and the injections of toxins, or indirectly through mortality or debility caused by the diseases particularly haemoprotozoan transmitted by ticks. The global loss due to ticks and tick borne diseases was estimated as US$ 13.9 and 18.7 billion annually (de Castro, 1997) while in India, the cost of controlling TTBDs has been estimated as US$ 498.7 million /annum (Minjauw, 2003). Control of ticks is largely depended upon chemotherapeutic intervention. Large scale and indiscriminate use of chemical acaricides has generated ticks populations resistant to all major classes of acaricides. As documented by the FAO in 2004, the main hindrance for successful pest and vector control program in livestock is the development of resistance in ticks due to repeated application of chemical acaricides. Development of resistant ticks has dented the efforts of controlling ticks and ticks borne diseases. Periodic monitoring of the efficacy of commonly used acaricides is, therefore, very important for economic livestock production.

## WHAT IS RESISTANCE?

Resistance is the ability of the parasite strain to withstand or survive or to multiply when exposed to doses equal or higher than usually recommended but within the limits of tolerance of the subject. Resistance can be acquired which can be defined as the heritable decreases in sensitivity to drugs with the passage of time. Persistent and indiscriminate exposure to an acaricides may allow for the selection of resistant mutants as continuous use leads to removal of susceptible strain with concomitant increase in proportion of resistant populations. When resistance is shown to different acaricides with similar mode of action, then it is said cross-resistance and when resistance is present to more than one drug, even though they have different mode of action, then it is called multiple resistance.

Genetic and operational factors influence the development of resistance in ticks population. Either the gene responsible for resistance is already present in population before the introduction of new drugs or the resistance has developed due to gene mutation. The frequency of resistant alleles increase in the population with the continued selection pressure of the acaricide. Initially the population of resistant alleles is low but with the continuous exposure to a drug, numbers of homozygous resistant alleles increase which ultimately increase in the population. Application of drugs also influences the selection pressure. Drug resistant alleles are more likely to be selected if the

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# Role of Extension Services in Food Security and Livelihood Generation Through Sustainable Livestock Farming

H.C. Verma, R.K. Singh, Puspendra Kumar Singh and Amandeep Singh*
Department of Veterinary and Animal Husbandry Extension Education
C.V.Sc. & A.H., NDUAT, Kumarganj, Faizabad (UP) 224 229.
*Division of Extension Education IVRI Bareilly.

## INTRODUCTION

With the second largest population of the world to feed, innumerable malnourished souls to prov balanced nutrition, largest demographic dividend to reap for development, India stands at forefront both with challenges in one hand and opportunities in the other. Food security for 1 billion population and livelihood generation for the capable are two sectors in which India need ponder upon. Food security, as defined by the United Nations' Committee on World Food Securit the condition in which all people, at all times, have physical, social and economic access to suffici safe and nutritious food that meets their dietary needs and food preferences for an active and heal life. With growing population and limited food resources, there comes a great responsibility livestock sector to produce safe, nutritious, healthy and optimum food. In 1992 Robert Chambers a Gordon Conway proposed the following composite definition of a sustainable rural livelihood, whi is applied most commonly at the household level: 'A livelihood comprises the capabilities, ass (stores, resources, claims and access) and activities required for a means of living: a livelihoo sustainable which can cope with and recover from stress and shocks, maintain or enhance capabilities and assets, and provide sustainable livelihood opportunities for the next generation; which contributes net benefits to other livelihoods at the local and global levels and in the short a long term.'According to World Bank (2016), 30 per cent of Indian population lives below poverty and more than 70 per cent of these reside in rural areas with meagre means of nutrition and he food insecurity. These masses can be targeted and brought under the umbrella of food securit promoting livestock farming amongst them and helping them to sustain their food demands throu livestock farming. Also most of the rural masses earn their livelihood from agriculture sector a handicrafts with limited agricultural land. With increase in population, the land remains the same number of persons surviving on the land increases which creates a net deficit of food and livelih Such people can raise livestock for their livelihood generation and it also ensures food safety. T above definition of food security fits well when it comes to food derived from livestock species as protein derived from the animal sources is said to be complete. Certain livestock species like go backyard poultry, pigs, rabbits, etc. can be reared easily without using many inputs and their produ lead to food security and livelihood generation. Extension and advisory services plays very vital a pivotal role in the dissemination of information, capacity building and diffusing the new technolog related to livestock amongst the new farmers and already existing farmer. Extension has the poten to sustain the livelihoods by creating new pool of farmers by motivating them to undertake livest farming for food security and livelihood generation and strengthening the existing farmers for same cause.

## SYSTEMS OF LIVESTOCK FARMING FOR FOOD SECURITY

### 1. DAIRY FARMING

India is blessed with the largest population of the bovine progeny which has helped us to reach at number one position in the world in terms of milk production. Dairying is the main sourc livelihood for our milk producers, majority of them either landless or marginal farmers posses non-descript low producing dairy animals. These farmers can be trained to switch to scientific d

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# Strategies and Challenges of Veterinary Profession to Improve Livelihood, Food Security And Safety

**Anand Kumar, Shiv Kumar Yadav[1], Alok Kumar Yadav[2], S. K. Maurya[3] and Shailendra Kumar Verma**
Department of Veterinary Gynaecology & Obstetrics, Ranchi Veterinary College, Ranchi, Jharkhand
[1]Department of Veterinary Biochemistry, Ranchi Veterinary College, Ranchi, Jharkhand
[2]Veterinary Officer, Central Cattle Breeding Farm, Andeshnagar, Lakhimpur-Kheri (U.P.)
[3]College of Veterinary Science & Animal Husbandry, NDUAT, Kumarganj, Faizabad, (UP) India

The classical view of a veterinarian as a person qualified to practice veterinary medicine has lead mas people to think that their clinical practices are related to the prevention, cure or alleviation of pain an treatment of injuries in animals, especially domestic animals. Though these roles are very importa the contemporary roles undertaken by veterinarians go far beyond these more visible tasks, and tho the reason why there is a need for far greater awareness in the public eye. It must be recognized tha the world becomes intricately inter-connected and more complex, so are the various obligations a responsibilities that veterinary professionals must undertake.

Over the years veterinary professionals have played significant and contributory roles in animal human health and welfare, biomedical research, food quality, food safety, food security, ecolo ethology, epidemiology, microbiology, parasitology, pathology, physiology, psychology, radiolo research and development of pharmaceuticals, remedies, vaccines, and toxicology; also as educat trainers, and policymakers, and also interlinked with wildlife conservation efforts and the protect of the environment and biodiversity. As challenges have risen, veterinarians have found ways to ad given that their knowledge and training makes them multifunctional professionals. This a societies so that its animals stay healthy and productive. It is not surprising that becomin veterinarian is a highly popular career choice.

Recognition that healthy and productive livestock make important contributions to food producti income generation, job creation, economic growth, and poverty alleviation is often overlooked taken for granted. Yet, on average, livestock contribute some 40 percent of agricultural GDP.

As the world population grows and middleclass incomes rise, demand for livestock produ increases—a consumption boom shaped by two decade of rapid economic growth and globalizati But there are certain high impact diseases that do not allow animal husbandry to flourish. L dramatic diseases also impact the performance of farm animals, leading to lower producti efficiencies and associated financial losses due to mortality and morbidity. Also, poor animal healt turn negatively influences animal welfare. In fact, studies have demonstrated that there is a dir correlation between the quality of livestock production and the provision of veterinary services. Gi that food animals support the livelihoods and nourishment of almost a billion people, efforts sho be directed at upholding food security.

In this regard, farm-oriented veterinary professionals should advise farmers and owners of livest or managers of animal production systems on the most appropriate herd health managem practices according to local and regional agro-ecological contexts. This extends beyond the treatm of animal illnesses or the implementation of preventive measures, such as strengthened biosecur programmed de-worming or vaccination, but also addresses housing, nutrition, cleaning, environmental sanitation. The correct undertaking of latter practices will likely reduce the usage veterinary medications and care, thereby reducing input and labor costs, which in turn positiv influences farm productivity and profit margins.

# Livestock and Poultry Sector in India: Challenges and Strategies

S. V. Singh, Ramakant, N. K. Singh[1] and D. Niyogi[2]
Department of Veterinary Medicine
College of Veterinary Science and Animal Husbandry, NDUAT, Kumarganj, Faizabad- 224229
[1]Veterinary Clinical Complex
[2]Department of Veterinary Pathology

## SCENARIO OF LIVESTOCK AND POULTRY INDUSTRY IN INDIA

India is bestowed with large livestock resources that support the livelihood of 200 million rural people (Pradhan, 2014). The role of livestock in social and economic empowerment and in alleviating poverty cannot be overlooked. Numerically India ranks first in respect to cattle and buffalo population, second in goats, third in sheep and fifth in poultry in the world. The buffalo alone constitutes more than 58 percent of world's total population. It holds a top position in milk production, fourth in egg production and third in fish production. During the past three decades, the per capita consumption of poultry meat, eggs and milk in India has increased at the rate of 7.5%, 4.0 % and 2.4 % per annum, respectively, in contrast to the decline in consumption of pulses and cereals (Bardhan *et al.*2008). Undoubtedly the livestock wealth of our country is impressive in numbers providing a natural resource base with immense livelihood implications. But per animal productivity and per capita availability of livestock products is too low and livestock sector is under tremendous pressure to suffice the needs of population explosion. Also in this "Make in India" there is a need to expedite both the quality animal production and livestock and poultry product production as per global standards to actually lead the world.

The projected data of growth in poultry and dairy sectors witnessed in our country is mainly in organized commercial farms and organizations. The Poultry farming has attained the industrial status with modern technologies and massive farm size and corporate type of management. The Poultry Industry is fortunate to be in the hands of eminent entrepreneurs, who are all well equipped with the required knowledge, skill and resources to overcome the challenges But the majority of the dairy farming continue to remain as unorganized and maintained as backyard family affair, mainly on non scientific conventional lines. Thus actual development and exponential growth in numerical values can only be expected if these actual animal owners are targeted. There are around 70 million such rural small livestock (mainly indigenous cattle, buffalo, goat, sheep and pigs) holders who are in reality the micro economists. The need of an hour is to target the backyard livestock and educate the rural folk to adopt livestock as an enterprise. Then only a change in their economy can be expected. Such a small change will act as a catalyst for bigger gains and hike in our economy.

## CHALLENGES

The major problem for the Indian dairy farmer is the poor productive and reproductive efficiency of the cattle apart from high feed cost, disease out breaks and inadequate fodder etc. the changing policies and priorities of national policy makers have reduced funding and support for large number that animal health services have traditionally performed. There has been a constant increase in demand for livestock products in developing world owing to the increasing population, increasing income and urbanization. Also globalization and increasing trade and travel have greatly increased the risk of disease transmission. In this scenario Indian livestock and poultry industry faces the following challenges:

- To organize the unorganized backyard sector grass root constraints like illiteracy, lack of skilled

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# Status of Livestock and Poultry in India and their Contribution to National Economy

A.K.Verma, Subodh Kumar, K.D.Singh, S.P.Singh, A.K.Srivatava and V. Nand
Livestock Farm Complex
College of Veterinary Science & A. H., NDUAT, Kumarganj, Faizabad-224 229

## INTRODUCTION

Humans are utilizing different animal species from the dawn of civilization for a Variety of purposes viz. production of milk, meat, wool, egg and leather. India is endowed with the largest livestock population in the world. Livestock rearing is one of the most important economic activities in the rural areas of the country providing supplementary income for most of the families dependent on agriculture. Apart from providing a subsidiary income to the families, rearing of livestock such as cattle, buffaloes, sheep, goats, pigs, poultry etc. is a source of protein supplement to the family members of the household in the form of milk, eggs and meat. Animal Husbandry and Dairying Programme have attained considerable importance in various Five Year Plans and several schemes/ projects have been taken up by the States and the Centre for the development of this sector. Livestock sector plays a crucial role in rural economy and livelihood. As per report of the working group on animal husbandry and dairying- 11th five year plan: 2007-12, the livestock sector employs eight percent of the countries labour force, including many small and marginal farmers, women and landless agricultural workers.

## LIVESTOCKPOPULATION IN INDIA

As per 19th Livestock census, 2012 (GOI, 2014) India's livestock sector is one of the largest in the world with a holding of 11.6% of world livestock population which consists buffaloes (57.83%), cattle (15.06%), sheep (7.14%), goats (17.93%), camel (2.18%), equine (1.3%), pigs (1.2%), chickens (4.72%) and ducks (1.94%). India has huge livestock population of 512 million which mainly includes cattle, buffaloes, goats, sheep and pigs. The total livestock population in India has decreased by 3.33% over the previous census. Contribution of cattle, buffalo, sheep, goat, pig and others in total livestock population is 37.28, 21.23, 12.71, 26.4, 2.01 and 0.5%, respectively. Livestock population in India has increased substantially in Gujarat (15.36%), Uttar Pradesh (14.01%), Assam (10.77%), Punjab (9.57%), Bihar (8.56%), Sikkim (7.96%), Meghalaya (7.41%) and Chhattisgarh (4.34%). During the last inter-censual period, there was decrease in the population of cattle, sheep, goats and pigs by 4.1, 9.07, 3.82 and 7.54%, respectively while the population of buffalo and poultry increased by 3.19 and 19%, respectively. Population of exotic and crossbred cattle registered a significant increase of 20.18% while the indigenous cattle decreased by 8.94%. Total poultry population in India is 729.21 million, which includes 692.65, 23.54 and 13.02 million chickens, duck and turkeys & other poultry, respectively

## LIVESTOCKAND POULTRYPRODUCTS

India has a competitive advantage in production of different livestock products (Birthal and Taneja, 2006). As per report of the working group on animal husbandry & dairying- 12th five year plan: 2012-17, demand for animal food products is responsive to income changes and is expected to increase in future. By the end of 12th Plan, demand for milk is expected to increase to 141 million tons and for meat, eggs and fish together to15.8 million tons. Global market for animal products is expanding fast, and it is an opportunity for India to improve its participation in global market. During the year 2013-14, livestock sector produced 137.7 million tonnes of milk, 74.7 billion nos. of eggs, 47.9 million kg of wool and 6.2 million tonnes of meat (BAHS, 2015).

## MILKPRODUCTION

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# Coping With Global Warming For Sustainable Livestock Production

**S. K. Maurya, P. K. Choudhary, P. K. Maurya and Pramod Kumar**
Department of Veterinary Physiology & Biochemistry
College of Veterinary Science & Animal Husbandry
Narendra Deva University of Agriculture & Technology, Kummarganj, Faizabad, UP

## INTRODUCTION

Livestock sector provides livelihoods to about 1.3 billion people and contributes about 40 percent to global agricultural output. In India, livestock are also a source of renewable energy for draft and an essential source of organic fertilizer for their crops. A population increase of 33%, is expected by 2050, but as the global standard of living increases, demand for agricultural products will increase by about 70% in the same period. Meanwhile, total global cultivated land area has not been changed, reflecting increased productivity and intensification efforts.

India has a fast growing livestock sector and is taking steps to achieve self sufficiency in production of animal products. India ranks first in the world in production of milk, seventh in production of egg and eighth in export of meat. There is a growing demand for livestock products, and worldwide milk production is expected to increase from 664 million tonnes (in 2006) to 1077 million tonnes (by 2050), and meat production will double from 258 to 455 million tonnes (Alexandratos and Bruinsma, 2012).

## CLIMATE CHANGE: EFFECT ON LIVESTOCK

Livestock sector is now using around 30 percent of the earth's entire land surface, mostly permanent pasture but also including 33 percent of the global arable land used for producing feed for livestock. As forests are cleared to create new pastures, it is a major driver of deforestation. At the same time herds cause wide-scale land degradation, with about 20 percent of pastures considered as degraded through overgrazing, compaction and erosion. At the same time, the livestock industry is also being affected due to change in climate and it can be summarized as—

- Quantity and quality of feed will be affected mainly due to an increase in atmospheric $CO_2$ levels and temperature (Chapman et al., 2012).
- The quality and quality of forage produced is being affected. An increase of 2°C will produce negative impacts on pasture and livestock production in arid and semiarid regions and positive impacts in humid temperate regions. The length of growing season is also an important factor for forage quality and quantity because it determines the duration and periods of available forage.
- Water availability issues will influence the livestock sector, which uses water for animal drinking, feed crops, and product processes. The livestock sector accounts for about 8% of global human water use and an increase in temperature may increase animal water consumption by a factor of two to three (Nardone et al., 2010).
- Water salination could affect animal metabolism, fertility, and digestion. Chemical contaminants and heavy metals could impair cardiovascular, excretory, skeletal, nervous and respiratory systems, and impair hygienic quality of production.
- Animal health can be affected directly or indirectly by climate change, especially rising temperatures. The direct effects are related to the increase of temperature, which increases the potential for morbidity and death. The indirect effects are related to the impacts of climate change on microbial communities (pathogens or parasites), spreading of vector-borne diseases, food-borne diseases, host resistance, and feed and water scarcity (Nardone et al., 2010). Temperature

Chapter-29

# Veterinary Laboratory Diagnosis

**Rakesh Kumar Gupta and Rajesh Kumar Verma**
**Department of Veterinary Pathology**
**Departmemt of Veterinary Clinical Complex**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

| Type of microscopes | |
|---|---|
| **Optical/Light microscope** | **Electron microscope** |
| **Two basic types:**<br>1. **Simple microscope** (only one convex lens is used)<br>2. **Compound microscope** (More than one lens are used)<br>**Alternatives**<br>• Phase contrast microscope (for colourless and transparent samples)<br>• Inverted microscope<br>• Dark field microscope<br>• Confocal microscope<br>• Polarized microscope (isotropic samples)<br>• Stereo microscope/ Dissecting microscope (give 3D view of samples)<br>• Fluorescent microscope (uses UV light) | Lens is made up of magnetic coils (magnetic lens)<br>• **Transmission Electron microscope-TEM** (traditional) Gives 2D view of samples<br>• **Scanning Electron microscope-SEM**<br>➢ Use of secondary electrons<br>➢ Gives 3D view of samples but lower magnification than TEM<br>**Scanning probe microscope:**<br>use of probe for study of magnetic property of samples, nanoparticles study |
| **Electron microscopy** | |
| Preparation of tissue follows 5 main steps: fixation-dehydartion-embedding-sectioning-staining<br>Fixation of tissues: by 2.5 % glutaraldehyde and Osmium tetraoxide<br>Dehydration by use of ethanol or acetone<br>Embedding by use of raisin termed as Raisinoid<br>Staining- Uranyl acetate and lead citrate<br>Magnification up to 10 lakh times | |

| Type of Microtomes | |
|---|---|
| **Rotatory microtome** | Most widely used microtome; tissue moves along stationary knife<br>Knife is fixed in vertical position |
| **Sledge/ sliding microtome** | for cutting large blocks of paraffin and resin embedded tissue including whole organs |
| **Cryostat (Cryotome/ freezing microtome)** | For cutting frozen tissue<br>Advantage- tissue require less preparation |
| **Ultra-microtome** | For cutting very thin sections (between 40 & 100 nm for TEM) |
| **Rocking/Vibrating microtome (Vibratome)** | Sections are cut by moving horizontal handle forward and backward |

Chapter-28

# Developmental Anatomy

**MPS Tomar**
**Department of Veterinary Anatomy and Histology**
**NTR College of Veterinary Science, Gannavaram (A.P.)**

- Embryology is the study of formation and development of an embryo and foetus
- Von Baer is the father of modern embryology
- Teratology- study of birth defects (congenital abnormalities and abnormal formations) and teratogens

| Type of eggs | | | |
|---|---|---|---|
| **On the basis of yolk distribution** | | **On basis of yolk content** | |
| **Egg** | **Species** | **Egg** | **Species** |
| **Isolecithal** | Human, marsupials | **Microlecithal** | Mammals |
| **Centrolecithal** | Insects | **Mesolecithal** | Amphibians |
| **Telolecithal** | Amphibians, fishes, birds and reptiles | **Megalecithal** | Reptiles and birds |

| Type of cleavage | |
|---|---|
| **Holoblastic equal** | Mammals, amphioxus |
| **Holoblastic unequal** | Amphibians and lower fishes |
| **Meroblastic equal** | Reptiles, birds and higher fishes |
| **Meroblastic superficial** | Insects |
| Cell division without growth is called Cleavage<br>Cleavage is inversely proportional to amount of yolk | |

| Implantation time | |
|---|---|
| **Cattle** | 17-35 days |
| **Horse** | 17-36 days |
| **Dog** | 14-18 days |
| **Pig** | 12-16 days |
| **Rabbit** | 7-8 days |
| Implantation in ruminants is superficial & Non-invasive while in rodent, primate, pig is Invasive (with the help of proteolytic action) | |

| Type of placenta | | | |
|---|---|---|---|
| **On the basis of maternal tissue lost at birth time** | **On the basis of villi distribution** | **On the basis of histology** | **Animals** |
| Non-deciduate | **Cotyledonary** | Syndesmochorial | **Ruminants** |
| Non-deciduate | **Diffuse** | Epitheliochorial | **Mare, sow, camel** |

Chapter-27

# Veterinary Angiology and Neurology

**Dangeti VVN Durgaprasad**
**Section of Veterinary Anatomy**
**IVRI, Izatnagar, Bareily**

| Circulatory system | |
|---|---|
| **Artery** | **Vein** |
| Blood vessels carrying blood away from heart are known as arteries | Blood vessels carrying blood toward heart are known as veins |
| They carry oxygenated blood except pulmonary artery | They carry deoxygenated blood except pulmonary vein |
| Generally Deep seated | Generally Superficial |
| Lumen of artery is narrow | Lumen of vein is wider |
| Wall of artery is thick | Wall of vein is thin |
| They do not have valve | They have valve to prevent backflow of blood as pressure of blood is lesser in vein |

The wall of artery or vein is composed of 3 layer:
- Tunica adventitia or tunica externa
- Tunica media
- Tunica intima

## Heart

Heart is enclosed in pericardium (membrane or sac that surrounds heart) having parietal and visceral layer

The heart wall is composed of 3 layers:
- **Epicardium (visceral layer of pericardium):** space between parietal and visceral layer is filled with pericardial fluid which protect hear from any shock, jerks and keep heart in its position.
- **Myocardium:** muscular layer composed of cardiac muscles
- **Endocardium:**

Heart consist of 4 chamber

| | |
|---|---|
| **Left atrium** | • Receive oxygenated blood from 4 pulmonary veins, pectinate muscles are less in number<br>• The left atrioventricular opening is guarded by **bicuspid valve** |
| **Left ventricle** | • Thickest of all 4 chambers Chordae tendineae are muscular thread like structure running between bicuspid and tricuspid valve to papillary muscles<br>• The apex of heart is made by left ventricle only<br>• Trabeculae carneae (column carneae/ meaty ridges/papillary muscles) are muscular columns project from **inner surface of right and left ventricle of heart**<br>• **Moderator band** (septomarginal trabecula-very prominent is sheep)- muscular band extend from anterior papillary muscle to ventricular septum<br>• **Aorta (largest artery in body) originate from left ventricle and guarded by semilunar valves** |

## Chapter-26

# Veterinary Splanchnology and Aesthesiology

**Mukesh Kumar and Amit Singh Vishen**
**Department of Veterinary Anatomy and Histology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

Splanchnology: anatomical study of digestive system, respiratory system and urogenital system
Aesthesiology: study of sense organs

| **Digestive system** | |
|---|---|
| **Mouth** | C/B presence of muzzle (planum nasolabiale), frenum labii inferioris, papilla salivalis (opening of parotid duct), Hard palate (presence of transverse ridges), papilla incisive, soft palate (presence of palatopharyngeal arch- posterior pillar; palatoglossal arch- anterior pillar), frenum linguae, sublingual caruncle |
| **Tongue** | C/B presence of dorsum linguae, torus linguae, lingual fossa, various papillae, lingual tonsils |

| **Papillae of tongue** | |
|---|---|
| **Taste buds present (gustatory)** | **Taste buds absent (mechanical)** |
| • Fungiform papillae<br>• Foliate papillae (absent in ruminants)<br>• Circumvallate papillae (largest)- only 2 in horse and 7 in dog | • Conical papillae<br>• Filiform papillae<br>• Lenticular papillae |

| **Salivary glands** | | |
|---|---|---|
| **Parotid gland Largest in all animals except dog** | **Mandibular gland (largest in dog)** | **Sublingual gland** |
| Capsulated | Non-capsulated | capsulated |
| Stenson's duct open at Papilla salivalis | Wharton's duct open at carancula sublingualis | |
| Serous (watery secretion) | Mixed (serous + mucous) | Mixed (serous + mucous) Mainly mucous |
| Shape- V shape in horse<br>Triangular in ox, dog & pig<br>Rectangular in sheep & goat | | |
| **In dog**, one more salivary gland is present known as **Zygomatic salivary gland** open opposite to last upper molar | | |

| | |
|---|---|
| **Oesophagus** | Abdominal part of oesophagus is absent in cattle |
| **Peritoneum** | Serous membrane that lines the abdominal cavity |
| **Epiploic foramen** | Also known as Foramen of winslow: passage between greater sac (peritoneal cavity) and lesser sac (omental bursa) |
| **Stomach of ruminants (4 parts)** | |
| **Rumen** | C/B presence of rumen papillae and extend from $7^{th}$ intercostal space to pelvic inlet |
| **Reticulum (smallest in bovine)** | C/B honey comb like structure and extend from $6^{th}$ to $8^{th}$ rib |

Chapter-25

# Veterinary Osteology and Arthrology

**KN Singh and Nripendra Singh**
**Department of Veterinary Anatomy and Histology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

## Bone

Bone is a connective tissue having hard matrix, specialized cells, mineral salts and collagen fibres.

| Cells of bone | Structure of bone |
|---|---|
| • **Osteoprogenitor cells:** are stem cells that divide to produce osteoblasts<br>• **Osteoblasts:** are the main cells responsible for bone formation and synthesize inorganic part of intracellular matrix and collagen fibres and ultimately differentiated into osteocytes<br>• **Osteocytes:** are mature cells and cannot divide and control mineral and calcium content<br>• **Osteoclasts:** are known as multinucleated bone eating cells responsible for remodelling of bones, breakdown of old bone tissue.<br>**Classification of bones**<br>• **Long bones:** are longer than they are wide and characterized by a long shaft (diaphysis) and two ends (epiphysis). Eg- femur, humerus<br>• **Aborted long bones:** long bones that do not develop completely. Eg. Ulna of horse and small metacarpals of horse<br>• **Short bones:** absence of diaphysis. Eg. Carpal bones<br>• **Flat bones:** are bones with flattened and broad surface. Eg. Scapula, ilium, ischium, pubis<br>• **Irregular bone:** has shape that does not confirm to above 3 types. Eg. Vertebral bones<br>• **Sutural (Wormian) bones:** small flat irregular shaped present at suture joints of skull<br>• **Sesamoid bones:** small flat bones similar to sesame seed. Eg. Patella | • **Peristoeum:** is a membrane which covers outer surface of bone and made up of two distinct layer- outer fibrous layer (provide structural integrity) and inner cellular layer (possess osteogenic potential).<br>Periosteum is not present on sesamoid bone and those areas where bone is covered by cartilage and where tendons and ligaments are attached to bones<br>• **Compact bone (Cortical bone) tissue:** Forms hard external layer of all bones and protect medullary cavity or bone marrow and characterized by haversian system (osteons). Each osteon consists of lamellae (layer of compact matrix) surrounding haversian canal. Haversian canal contains blood vessels and nerve fibres and run parallel to long axis of bone.<br>• **Spongy (cancellous) bone tissue:** Forms inner layer of all bones and characterized by absence of osteons and presence of trabeculae in which red bone marrow is present.<br>• **Endosteum:** is a vascular membrane that lines the medullary cavity<br>• **Bone marrow:** are spongy tissue that fills medullary cavity and contains stem cells They are of two types: Red bone marrow (contain hemopoeitic stem cells that develop into RBCs, WBCs and platelets.) and yellow bone marrow (contain mesenchymal stem cells that develop into fat, cartilage and bone). |

## Chapter-24

# Veterinary Andrology

**Atul Kumar Verma**
**Department of Veterinary Gynaecology and Obstetrics**
**COVAS, SVPUAT, Meerut**

- SRY protein (testes determining factor)- initiate male sex determination
- Gonadal ridge is visible in bovine embryo at about 28-29 days of age and differentiated into testes at about 45 days

| | **Bull** | **Stallion** | **Dog** | **Boar** | **Ram/Buck** |
|---|---|---|---|---|---|
| **Length of penis** | 100cm | 90cm | 8-10cm | 55cm | 35cm |
| **Type of penis** | Fibroelastic | Vasculomuscular | Os-penis | Fibroelastic | Fibroelastic |
| **Glans penis** | Pointed | Urethral process | Bulbus glandis and Longa glandis | Absent | Urethral process |
| **Orientation of testis** | Vertical | Horizontal | Oblique<br>Cat-Vertical | Oblique | Vertical |
| **Weight of testis** | **300gm** | 250gm | - | 150gm | 250gm |
| **Sigmoid flexure** | Present | **Absent** | **Absent** | Present | Present |
| **Mediastinum testis** | Present | **Absent** | Present | Present | Present |
| **Ejaculate volume** | 4-15 ml (6 ml) | 30-250 ml (80ml) | 10 ml (1.25-12 ml)<br>Cat- 0.04 ml | **25-500ml (250ml)** | 0.5-2ml (1ml) |
| **Sperm concentration (million per ml)** | 300-2500 (1200) | 30-600 (150) | - | 25-1000 (200) | **1500-4000 (2500)** |
| **Time lapse for ejaculation** | 1 second<br>Short copulator | 30-60 second<br>Intermediate copulator | **5-25min**<br>**Sustained copulator** | **5-25min**<br>**Sustained copulator** | 1 second<br>Short copulator |
| **Motile sperm(%)** | 40-70 | 40-75 | | 50-80 | **60-80** |
| **pH** | 6.4-7.8 (6.8) acidic | 7.0-7.8 (7.4) Alkaline | 6.7<br>Cat-7.4 | 7.0-7.8 (6.8) alkaline | 6.2-7.0 (6.8) acidic |
| **Seminal vesicle** | Lobulated | Non- Lobulated (pyriform like) | - | Lobulated | Lobulated |
| **Rate of dilution of semen** | 100-105 times | 2 times | | 4 times | 9 times |
| **Preferred diluent** | Egg yolk citrate | Glucose gelatin | | Egg yolk glucose bicarbonate | Egg yolk glucose citrate |
| Time lapse for ejaculation is defined as average interval of time from contact of glans penis with vulva to ejaculation | | | | | |

## Chapter- 23

# Veterinary Gynaecology and Obstetrics

**Bhoopendra Singh and Pushkar Sharma**
**Department of Veterinary Gynaecology and Obstetrics**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

## FEMALE REPRODUCTIVE TRACT

**Mesodermal origin-** Oviduct, uterus, cervix and cranial vagina

**Endodermal origin-** germ cells, caudal vagina, vulva, vestibule, urethra and associated gland

| Species | Cow | Sheep/goat | Mare | Bitch | Sow |
|---|---|---|---|---|---|
| **Comparison of reproductive tract** | | | | | |
| Oviduct length | 25cm | 15-20cm | 20-30cm | | 15-30cm |
| Uterus type | **Bicornuate** | **Bicornuate** | **Bipartite (T-shape)** | **Bicornuate (V-shaped)** | **Bicornuate** |
| Endometrium | **caruncles** | **caruncles** | **Longitudinal fold** | **absent** | **Longitudinal fold** |
| **Hymen** | Ill defined | Well developed | Well developed | | Ill defined |

- Bitch and queen-uterus lies in abdominal cavity
- Horn length highest in sow
- Body length of uterus and ovary weight is highest in mare

| Species | Cow | Sheep/goat | Mare | Bitch | Sow |
|---|---|---|---|---|---|
| **Comparison of ovary** | | | | | |
| More functional | **Right** | **Right** | Left | | Left |
| Shape | **Almond** | **Almond** | Kidney | **Oval/Berry** | Berry |
| **Weight(gm)** | 5-10gm | 3-4gm | 70-100gm | | 3-5gm |
| Mature graffian follicle | 1-2 | 1-4 | 1-2 | | 10-25 |
| **Follicle diameter** | 12-20mm | 5-10mm | 25-70mm | | 8-12mm |
| **Egg diameter(u)** | 120-160 | 140-185 | 120-180 | | 120-170 |
| **Corpus luteum shape** | **Spheroid** | **Spheroid** | **Pear/ Cauliflower** | | **Spheroid** |

- Ovary is divided into cortex and medulla but not in mare
- Size of buffalo ovaries are generally smaller than cattle
- Size of sheep and goat ovary is approx. half of cattle ovary

| Species | Cow | Sheep/goat | Mare | Bitch | Sow |
|---|---|---|---|---|---|
| **Artificial Insemination** | | | | | |
| **Site of deposition** | **Mid cervix** | **cervix** | **Uterus** | **cervix** | **Uterus** |
| **Insemination volume** | 0.2-1ml | 0.005-0.2ml | 20-50ml | 1.5ml | 30-50ml |
| **Insemination time** | 8-16 hour after onset of estrus | 10-24 hour after onset of estrus | Every 2nd day during estrus | 10-12 days after onset of pro-estrus | 12-30 hour after onset of estrus |

Chapter-22

# Regional Surgery and Lameness

Sonu Jaiswal
Department of Veterinary Clinical Complex
C.V.Sc. & A.H., ANDUAT, Ayodhya

| Important operation/test and purpose | |
|---|---|
| **Operation name** | **Purpose** |
| Cotton ball test | used to access eye sight in dogs |
| Vinsot's operation | Amputation of penis to remove diseases part |
| Grid iron technique | Separation of muscles/ for removal of ovary |
| Hyovertebrotomy<br>White House technique | Empyema of guttural pouch |
| Hellers' myotomy | Stricture of lower oesophageal sphincter |
| Staphylectomy | Resection of posterior soft palate to open airway mainly in brachycephalic dogs |
| Zepp's operation (Lateral/Vertical ear canal Resection) | Ootitis externa |
| Lateral Bulla osteotomy with Total ear canal ablation & myringotomy | Ootitis media |
| Boccar's operation | Stringhalt |
| Perrier's operation | Quittor |
| Ascheim operation | Bowed tendon |
| Formstone operation | Ottorhoea |
| Flexor tendon tenotomy | Knuckling |
| Cherry's operation | Broken knee or open knee |
| Campbells' test | Assess integrity of collateral ligament of elbow in dogs |
| Paatsama's operation | Rupture of anterior cruciate ligament |
| Hemilaminectomy | Intervertebral disc protrusion |
| Forssell's operation | Recto-vaginal fistula |
| Omentalization/Marsupialization | Pyometra |
| Vander Kay's operation | Chronic gastric tympany in ox |
| Vennerhalm's operation | Removal of integument of penis |
| Moussu's method & Gold's method | Teat fistula |
| Hugs teat tumor extractor | Teat tumor/polyp |
| Stenson operation/Hudson operation | Stricture or blocked teat by Hudson teat spiral instrument |
| Litchy teat knife | To enlarge teat canal/remove growth inside canal |
| Larson teat tube | Maintain milk flow for sore, injuredand hard-to-milk teats |
| Teat slitter | Used for closed tear surgery |
| Smith operation | Contracted hoof |
| Hobday's operation | Roaring in horse (paralysis of left recurrent laryngeal nerve) |
| Cunean tenectomy | Bone spavin |
| Mule's operation | Prevention of blow fly strike |
| Whipple's operation | Vaginal prolapse in bitch |
| Caslick operation | Pneumovagina in horse (vaginal wind sucking) |
| Colopexy | Recurrent rectal prolapse |
| Enteroplication | Intussusception |

Chapter-21

# Veterinary General Surgery

**Vipin Kumar Yadav**
**Department of Veterinary Surgery and Radiology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- Father of surgery- Sushruta
- Father of veterinary radiology- Richard Eberlein
- Major surgery- Duration is more than 30-45 minutes and involve risk on the life of patient
- Minor surgery- Duration is less than 30-45 minutes
- Radical/extirpative surgery- removal of diseases part
- Explorative surgery- for confirmatory diagnosis
- Elective surgery- can be postponed
- Cryosurgery
  - ✓ Liquid nitrogen (-196 $^{0}$C)
  - ✓ Liquid $N_2O$- (-80 $^{0}$C)
  - ✓ Gas $N_2O$- (-70 $^{0}$C)
- Principles of modern surgery was first given by Halsted

| **Wound** | |
|---|---|
| **On the basis of extent of injury** | **On the basis of time involved** |
| **Close wound** | 1. Clean wound/ surgical wound/ incised wound- **0 hour wound** |
| Abrasion wound | 2. Contaminated wound- **less than 6-8 hours old** |
| Contusion wound | 3. Infected wound/ open wound- **more than 6-8 hours old** |
| Haematoma | |
| **Open wound** | |
| Lacerated wound-Wound margin zig-zag | |
| Penetrating wound | |
| Avulsion wound- Substantial tissue lost from body | |
| Punctured wound- Deep and prone to anaerobic infection | |
| Gunshot wound | |
| Virulent wound | |
| Granulating wound- tendency to heal | |
| Ulcerative wound- No tendency to heal | |

- Contusion wound: by compression or blow of blunt Weapon
- Proud flesh/Exuberant granulation-excessive growth of granulation tissue and blood vessels during healing process.
- Keloid: abnormal proliferation of scar tissue at the site of injury, seen in horse mainly
- Haematoma: collection of blood in an abnormal cavity
- Contractures- excess of contraction seen after serious burns and interfere with joint movements

Chapter- 20

# Metabolic and deficiency diseases

VK Varun and MV Jithin
Department of Veterinary Clinical Complex
COVAS, SVPUAT, Meerut

| Disease | Characteristic findings | Diagnosis & Remarks |
|---|---|---|
| **Milk fever** **(Paturient paresis/ calving Paralysis/ Parturient Apoplexy)** Etiology: Hypocalcemia Cations (Na & K) rich diet favours milk fever Jersey cow & Jaffarabadi buffalo is highly susceptible | Occurs within 48 hours after parturition & between 3[rd] to 7[th] calving mainly Characterized by 3 stages: 1. Stage of excitement- tetany & hyperaesthesia 2. Stage of Sternal Recumbency- S- shaped head, pupillary & rectal reflex lost- subnormal temperature 3. Stage of Lateral Recumbency- subnormal temperature, inaudible heart sound | Increase in CPK & AST levels Sulkowich test for calcium in urine Treatment of choice **25 % calciumborogluconate** $NH_4Cl$- prevent milk fever |
| **Downer Cow Syndrome** (Post Parturient recumbency) Unknown etiology Occurs after 2-3 days of calving | • Holstein Friesian is most susceptible • Characterized by prolong recumbency (Frog-like posture/Creeper cow) and Ischemic myopathy • Death is due to myocarditis & decubital ulcer Urination normal but urine has excess protein & ketone bodies | Low level of Ca, P, Mg, K Increase in CPK & ALT levels |
| **Eclampsia in bitches** **(Milk fever in bitch/ Post parturient tetany/ Peurperal tetany/ Lactational tetany)** Etiology: hypocalcemia and hypoglycemia | • Occurs 2-4 weeks after whelping • Restricted to small breeds • C/B opisthotonus condition, tonoclonic convulsion, head & tail upward, swollen vulva & mammary gland, bitch cry & restlessness • Temperature is above normal | Treatment of choice **10 % calciumborogluconate** |
| **Eclampsia in mare** **(Lactational tetany of mare/ Transit Tetany)** Etiology: Hypocalcemia | • Occurs at about 10[th] day of foaling or 1-2 days after weaning or after prolong exercise or transport • Thumping sound of diaphragm | • High producing & hard working-more susceptible |
| **Hypomagnesemic tetany** (Lactational tetany/ Grass tetany/ Grass Staggers/ Wheat Pasture poisoning) | Xylidil Blue dye test & AKZ paper test **Cattle. Sheep, goat** Twitching of muscles & ears, hyperaesthesia, champing of jaws Normal Mg level: 1.5-3 mg/dL In deficiency: 0.5 mg/dL | Increase in CPK & AST serum levels Treatment of choice **25 % calciumborogluconate & 5 % Magnesium hypophosphate** |
| **Hypomagnesemic tetany in calves** **(Whole milk tetany)** | 2-4 month calves more susceptible Shaking of head, stamping of feet, involuntary urination & defaecation | |

Chapter- 19

# Veterinary Medicine

**SV Singh and JP Singh**
**Department of Veterinary Medicine**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- Veterinary medicine- deals with diagnosis, treatment, prevention and general study of diseases of animals.
- Clinical Veterinary medicine also k/a Bed side medicine/ Internal medicine/ Curative medicine.
- Disease- Any deviation from normal, physical or physiological condition
- Father of medicine: Hippocrates
- Father of veterinary Medicine: Renatius Vegatius

| **Species** | **Site of pulse rate** | **Site of blood collection** | **Site of CSF collection** | **Type of respiration** |
|---|---|---|---|---|
| **Cattle/Buffalo** | Coccygeal artery, Maxillary artery, Facial artery | Jugular vein, ear vein | Lumbo-sacral/1st, 2nd coccygeal region | Abdominal |
| **Sheep/Goat** | Femoral artery | Jugular vein, ear vein | Sub-occipital/ Lumbo-sacral region | Abdominal |
| **Dog/Cat** | Femoral artery | Recurrent tarsal vein, cephalic vein | Cisterna magna (atlanto-occipital joint) | Thoracic (Costal) |
| **Horse** | External maxillary artery | Jugular vein | Sub-occipital/Lumbo-sacral region | Costo-abdominal |

| **Methods of close physical examination** | |
|---|---|
| **Palpation** | Method to touch any body parts in which direct hands are used (direct palpation) or probes are used (indirect palpation) |
| **Percussion** | Body surface is struck in such a way that vibration is produced and emit audible sounds. It is done with help of finger tips (immediate percussion) or with pleximeter and hammer (mediate percussion) |
| **Auscultation** | Listening to internal sounds of body. It is usually done with help of stethoscope for heart sounds, breath sounds and bowel sounds |
| **William's method of auscultation** | Auscultation of reticulum and palpation of rumen, mainly done to diagnose TRP |
| **Succussion** | It involves shaking of body to detect presence of fluid and air in a body cavity and simultaneously auscultation is done |
| **Ballotment** | Method for feeling a floating object in body in which a push is given to move organ away and then allow it to rebound on finger tips (palpation and percussion |

# Chapter-18

# Veterinary Chemotherapy

**Rishikant and Mohd Saif**
**Department of Veterinary Pharmacology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

| Antibiotics based on mode of action | |
|---|---|
| **Bacteriostatics** | **Bactericidals** |
| Tetracyclins | Penicillins |
| Spectinomycin | Cephalosporins |
| Sulphonamides | Fluoroquinolones |
| Macrolides | Glycopeptides |
| Chloramphenicols | Monobactums |
| Trimethoprim | Carbapenems |
| Lincosamide | Polymixins |
| Tylosin | Nitrofurans |
| Tiamulin | Novobiocin |
| Ethambutol | Isoniazid |
| Fusidic acid | Rifampicin |
| Linezolid | Vancomycin, Bacitracin |

| Narrow spectrum and broad spectrum antibiotics | |
|---|---|
| **Narrow spectrum** | **Broad spectrum** |
| Penicillin-G | Ampicillin |
| Streptomycin | Carbenicillin |
| Erythromycin | Clhloramphenicol |
| Lincomycin | Tetracyclins |
| Vancomycin | Cephalosporins |
| Polymixin-B | Sulphonamides |

| Classification based on chemical structure | |
|---|---|
| Diaminopyrimidines | Trimethoprim |
| Nitrobenzene derivatives | Chloramphenicol |
| Polypeptides | Polymixin B, Colistin, Bacitracin |
| Glycopeptides | Vancomycin |
| Nicotinic acid derivatives | Isoniazid, Pyrizinamide |
| Polyene antibiotics | Nystatin, Amphotericin-B |

| Classification based on mechanism of action | |
|---|---|
| **Mechanism** | **Antibiotics** |
| **Inhibition of bacterial cell wall synthesis** | Penicillin, Cephalosporins, Vancomycin, Bacitracin Cycloserine |

Chapter- 17

# Veterinary Pharmacology

**Rishikant and Mohd Saif**
**Department of Veterinary Pharmacology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- Father of pharmacology: J.J. Abel
- Father of Modern Pharmacology- Rudolf Buchheim
- Father of modern veterinary pharmacology- Meyer Jones
- Father of Indian pharmacology- Ram Nath Chopra
- Pharmacognosy- study of source of drug
- Posology-study of drug dosage
- Prodrug- active metabolite of inactive drug
- Placebo is also known as sham treatment by giving inert inactive substances
- Pharmacy- collection, compounding and dispensing of drugs
- Affinity-bonding strength between receptors and drugs
- Potency- Dose of drug to produce effective response. It depends on efficacy and affinity of drug. It is non-absolute expression
- Efficacy- it is maximum response a drug can produce. It is an absolute expression
- Dose is inversely proportional to potency
- Agonist possess both affinity and efficacy
- Antagonist lack efficacy
- Dose- response curve: Hyperbola
- Log- Dose-Response curve: Sigmoid
- Desensitization- Failure of an animal to respond at normal therapeutic dose. Down regulation of receptor. This is important for development of tolerance.
- Tolerance- Decrease in response on repeated administration of drugs
- Super-sensitization- Up-regulation of receptor
- Sensitization- Reverse tolerance
- Tolerance- Gradual decrease in response on repeated administration of drug.
- Dale- coined the term receptor
- Albumin is plasma carrier protein for acidic drugs while alpha-acid glycoprotein for basic drugs
- Basic drugs are ionized to greater extent in an acidic medium
- low ionization and high lipid solubility promotes absorption of drugs
- Enterohepatic circulation of drugs increases duration of action of drugs
- Passive diffusion involves crossing of drugs across cell membrane from high concentration to lower concentration (followed by majority of drugs)
- Idiosyncrasy- atypical abnormal reaction of body to drugs
- First pass effect is also termed as pre-systemic metabolism of drug

Chapter-16

# Environmental Hygiene

Namita Joshi
Department of Veterinary Public Health and Epidemiology
C.V.Sc. & A.H., ANDUAT, Ayodhya

- **Ecosystem:** It is the structural and functional unit of ecology where living organism interact with their environment
- **Biotope**- an area of uniform environmental conditions acting as living place for particular plant and animals
- **Biocoenosis (biotic community)**- interation (collection) of living organism in a habitat (biotope)
- **Biome**- It is a **large** well differentiated and climatically uniform geographical region. Many ecosystems join together to form a biome.
- **Ecology**- Study of plant or animal in relation to their habit and habitat. Ecology is also known as Bionomics or natural history.
- **Ecological climax**- When plant, animal, microbes, soil and macroclimate have evolved to a stable balanced relationship than an ecological climax has occurred.
- **Ecological interface**- It is a junction of two ecosystems. Infectious diseases can be transmitted across interface.
- **Ecological mosaics**- It is a modified patch of vegetation created by man with in a biome that has reached a climax.
- Network of interconnected food chain is termed as **Food web while** position occupied by an organism in food chain is termed as their **trophic level**
- Graphical representation of food or energy relationship between organisms at each trophic level is termed as **Ecological pyramid**
- **Germ cloud**- aggregation of large number of microbes in atmosphere
- Environmental (Protection) Act, 1986; Air (Prevention and Control of pollution) Act, 1981
- Water (Prevention and Control of pollution) Act, 1974
- After secondary treatment of sewage waste, the solid waste is termed as **Effluent**
- Coliforms must be absent in any 100 ml sample of water
- Dry weather flow rate is defined as sewage flow in 24 hours through sewage system
- Presumptive coliform test (Multiple Tube Method): It is a screening test for coliforms in drinking water & used for bacteriological surveillance of water samples
- Emporiatrics deals with the health of-**Travellers**
- Environmental manipulation which enables genes to express themselves readily is known as **Euthenics**
- Best way to dispose e-waste is **Recycling**
- Nalgonda Technique is used in **Endemic fluorosis**
- The characteristics of the waste suitable for incineration are low heating volume, content of non-combustible fines below 20% & moisture content below 50%
- Waste water from kitchen is called **Sullage**
- The type of Pneumoconiosis that cotton dust causes is known as **Byssinosis;** Bagassosis-Cane sugar fibres; Argyrosis- Silver dust
- Strength of sewage is expressed in terms of Suspended particles, Chemical oxygen demand and Biological oxygen demand
- Arrange the following disasters in chronological order of their occurrence-
  - Bombing on Hiroshima and Nagasaki

## Chapter-15

# Epidemiology and Zoonosis

**Chandra Shekhar**
**Department of Veterinary Public Health and Epidemiology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- Epidemiology: The study of disease in population and factors that determine the occurrence of disease.
- Father of epidemiology/Modern Epidemiology: **John Snow.** His contribution in the form of study on cholera causation is well known to all
- Components of epidemiology: disease frequency (ratio, rate and proportion), disease distribution (with respect to time, place and person) and determinants (causes or risk factors) of diseases.
- Predisposing factor: make animal more susceptible for a disease
- Precipitating factors: initiate disease
- Perpetuating factors: maintain disease once established
- **Basic (broad) types** of epidemiology- descriptive and analytical
- The study of time, place and person distribution of disease is known as Descriptive epidemiology and is first step in disease investigation
- Analytical epidemiology- this involves analysis of observation using suitable diagnostic and statistical tests
- **Theoretical epidemiology-** disease representation using mathematical models that simulate natural pattern of disease occurrence
- Shoe-leather epidemiology or **field epidemiology**-personal investigation of disease at field level
- **Landscape**/Horizontal epidemiology/Ecology- study of disease in relation to ecosystem
- The epidemiological triads are- host, agent and environment that determine the onset of disease in population
- The occurrence of disease can be measured by incidence and prevalence.
- **Sporadic-** The pattern of occurrence of disease is irregular or scattered.
- **Endemic-**The pattern of occurrence of diseases in a single area over and over again.
- **Epidemic-** The occurrence of disease clearly in excess of expected number in a community.
- **Pandemic-** The occurrence of a disease involving multiple nations
- Direct Standardization-age specific health related event rates in study population are applied to the reference population.
- Indirect standardization- age specific rates in reference population are applied to the study population.
- Interruption of transmission of disease from a large geographic area is called as **Elimination**
- In an epidemic, first case to occur in community is known as **primary case** and first case to come to notice of an investigator is known as **index case.**
- A graph of time distribution of cases is termed as **Epidemic Curve.**
- Stages of epidemic curve
    - ➢ Period of accrescence
    - ➢ Culmination point

# Chapter- 14

# Veterinary Public Health

**Namita Joshi**
**Department of Veterinary Public Health and Epidemiology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- Health is a state of physical, mental and social well-being in which disease and infirmity are absent (WHO).
- Public Health: The science and art of preventing disease, prolonging life and promoting health and efficiency through organized community measures such as control of infection, sanitation, health education, health services and legislation, etc. (Winslow, 1851)
- Father of Public health- **Cholera**
- Veterinary Public Health- is a multidisciplinary approach that focuses on application of veterinary science to protect and improve physical, mental and social well-being of humans
- **Father of Veterinary Public health- J.H. Steele**
- Illness- Subjective state of the person who feels aware of not being well.
- Hygiene- set of practices performed for the preservation of health
- **All India Institute of Hygiene and Public Health is located at Kolkata, West Bengal**
- 'The Sanitary Condition of the Labouring Population' was published by **Edwin Chadwick** in 1842.
- 1st Public Health Act was passed in United Kingdom in 1848.
- Publication of the Health Belief Model (HBM) in 1958 by **Rosenstock and Kegels**
- Since both in importance and in time health precedes the disease, so, we ought to consider first how health may be preserved and then how one may best cure the disease- by **Galen.**
- Ist International sanitary conference in 1851- Paris
- WHO declared TB a global public health emergency-1993
- Nothing on earth is more International than disease- **Paul Russel**
- The President of USA having polio before 1945- **Franklin Roosevelt**
- Father of epidemiology or father of modern epidemiology- **John Snow**
- **Father of Veterinary epidemiology- Schwabe**
- **John Last** defined epidemiology
- The concept of Public Health in India started after 1858 when there was heavy mortality and morbidity among European troops in India due to malaria and other preventable diseases.
- Milk- it is wholesome, fresh, clear, lacteal secretion obtained from complete milking of healthy udder 15 days before & 5 days after parturition
- Wholesome milk- milk having minimum bacterial load and free from antibiotic residue
- Food safety- is a systemic preventive approach describing handling, preparation & storage of food in ways that prevent food borne illness
- Good manufacturing Practices (GMP)- production & testing practices that helps to ensure a quality product.

Chapter- 13

# Toxicopathology

**Rakesh Kumar Gupta and Ashutosh Kumar**
**Department of Veterinary Pathology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

| Poisoning/Toxicity | Features | Diagnosis/Treatment |
|---|---|---|
| **Lead poisoning**<br>• Most common in dog and cattle<br>• Cross placenta and blood brain barrier | • Basophilic stippling<br>• Horse- roaring<br>• Birds- paresis of wings/wing drop condition<br>• Blue line at tooth (plumbism) as a result of lead sulphide | Potassium Iodine test<br>DOC- Calcium disodium EDTA |
| **Mercury Poisoning**<br>**More common in bovine and feline**<br>Inorganic mercury is more toxic than organic<br>Inorganic mercury- Gastroenteritis and renal disease<br>Organic- CNS disease | • Inorganic Hg –slow absorption from GIT & excreted in urine<br>• Organic Hg- fast absorption from GIT & excreted in faeces<br>• All Hg forms crosses placenta<br>• Perforation in intestine | |
| **Arsenic poisoning**<br>• Order: Arsine> Trivalent> pentavalent> organic arsenic<br>• Cross Placenta but not blood brain barrier<br>• Effect glycolysis, TCA, inhibit pyruvate dehydrogenase | • Swine assume Dog sitting posture<br>• GIT mucosa- Brick red colour<br>• Haemorrhagic gastroenteritis<br>• (Rice water diarrhoea)<br>• Preserved carcass is feature of post mortem<br>• Mee's line across nails | Marsh test<br>DOC:<br>• BAL (Dimercaprol)<br>• Sodium arsenite<br>• Acetylcysteine |
| **Copper poisoning**<br>Sheep more susceptible than cattle<br>• Damage liver and lowers concentration of glutathione<br>• Genetic defect in Bedlington terrier | • Haemolytic crisis in ruminants<br>• Haemoglobinuria<br>• Deep green colour faeces<br>• Port wine colour urine<br>• Bluish black kidney/Gun metal kidney<br>• Spleen-black berry jam like<br>• Kayser-Fleischer (KF) rings in eyes | DOC:<br>• Ammonium molybdate<br>• D-penicillamine |

Chapter- 12

# Laboratory and Wild Animal Diseases

Rakesh Kumar Gupta and Abhishek Mishra
Department of Veterinary Pathology
C.V.Sc. & A.H., ANDUAT, Ayodhya

| Disease | characteristics |
|---|---|
| **Diseases of rat & mice** | |
| **Tyzzer's Disease**<br>**(Fat Rat Syndrome)** | ***Clostridium piliformae***<br>• Ingestion- main mode of transmission<br>• Necrotic lesions on liver<br>• Megaloileitis and haemorrhagic enteritis is most important lesion characterized by profuse watery diarrhoea |
| **Haverhill fever**<br>(Rat bite Fever/ Epidemic Arthritic erythema) | ***Streptobacillus moniliformis***<br>Swollen joints (Arthritis), oedema of extremities & tail |
| **Murine respiratory mycoplasmosis**<br>(Chronic respiratory disease) | ***Mycoplasma pulmonis*** |
| **Rolling disease** | ***Mycoplasma neurolyticum*** |
| **Transmissible murine colonic hyperplasia** | ***Citrobacter freundii*** |
| **Wasp waist**<br>**(contracted abdomen)** | ***Clostridium botulinum*** |
| **Seropurulent conjunctivitis** | ***Chlamydia caviae*** |
| **Pasteurella infection** | ***Pasteurella pneumotropica*** |
| **Pseudotuberculosis** | ***Corynaebacterium kutscheri*** |
| **Wet tail**<br>(Proliferative ileitis/ regional enteritis/ Proliferative enteropathy/ Transmissible ileal hyperplasia) | It is a disease of hamster mainly, having multifactorial etiology namely:<br>• ***Lawsonia intracellularis*** (Proliferative enteropathy)<br>• ***E. coli***<br>• ***Campylobacter jejuni*** (Proliferative ileitis)<br>Characterized by severe diarrhoea, wet tail matted with faeces<br>Stress is predisposing factor |
| **Mouse Typhoid (Salmonellosis)** | *Salmonella typhimurium & S. enteritidis* |
| **Epidemic Mouse Septicaemia** | ***Erysipelothrix muriseptica*** |
| **Salivary gland tumour** | **Polyoma virus** |
| **Epizootic diarrhoea**<br>**(infantile diarrhoea)** | **Rota virus**<br>Characterized by yellow watery diarrhoea, dried perianal faecal plug, gaseous distention of intestine |

# Chapter-11

# Pathology of Poultry Diseases

**Rakesh Kumar Gupta and DP Shrivastava**
**Department of Veterinary Pathology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

| Viral Diseases of Poultry | | |
|---|---|---|
| **Disease** | **Characteristics findings** | **Diagnosis & remark** |
| **Infectious Bursal Disease** (Gumboro disease/ Infectious Bursitis/ Avian Nephrosis) **Birna virus** Virus interfere with blood clotting mechanism | • **3-6 week** birds mostly affected<br>• C/B classical spike mortality<br>• Initially swelling in Bursa of fabricus then atrophy occurs<br>• Deposition of urates in kidney & ureter<br>**Pathognomic lesions:**<br>1. haemaorrhage at junction of proventriculus & gizzard<br>2. Paint brush haemorrhage in breast & thigh muscle | **No Vertical transmission** Immunosuppressive disease (mainly affect B lymphocytes but also affect T cells) Virus isolation is rarely used GD is common sequel to IBD |
| **Infectious bronchitis** **Corona virus** (Serotypes: Massachussets & Connecticut- **affect respiratory tract** T, Gray, Holte- **affect kidney** 793B- affect muscles) | • Cheesy exudate in bronchi<br>• Deposition of urates in kidney<br>• Interstitial nephritis<br>• Effect on **egg quality & egg production**<br>• WATERY WHITES (albumen loses its viscosity in eggs- thin & watery yolk)<br>• Birds known as BLIND LAYERS | **No Vertical transmission** Dwarfing & curling of embryo take place in 10 day embryonated egg |
| **Marek's Disease (MD)** (Fowl paralysis/ Range paralysis/ Avian Reticulitis/ Skin leucosis/ Neural leucosis/ Grey eye/ Pearl eye) **Herpes virus** **3-6 month** mostly susceptible | Inhalation (primary route of transmission)<br>• **<u>Classical Form/ Neural leucosis-</u>** Split leg stance (sport man posture) & enlargement of peripheral nerves mainly sciatic nerves (2-3 times)<br>• **<u>Visceral form:</u>** lymphoma in gonads and other visceral organ characterized by pleomorphic lymphoid cells<br>• **<u>Occular form/ Grey eye/ Pearl eye:</u>** anterior uveitis or iridocyclitis<br>• **<u>Cutaneous form/ Skin leucosis:</u>** Nodular lesions at base of feathers | **No Vertical transmission** Mainly affect T cells (also affect B cells) **MATSA (Marek Associated T cell Surface Antigen)** is demonstrated in T cells |
| **Avian Leucosis** **Type C Retrovirus** Tumorous growth of bursa of fabricus is seen only in LL not in MD | C/B tumorous growth of lymphocytes in liver spleen lungs & other visceral organs<br>Avian leucosis complex includes:<br>• **<u>Lymphoid leucosis (LL)/ Big liver disease/ Visceral lymphoma:</u>** C/B | **Both** vertical & Horizontal transmission take place Affect B cells |

# Chapter- 10

# Special Veterinary Pathology

**Rakesh Kumar Gupta and Desh Deepak Singh**
**Department of Veterinary Pathology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

| Disease & Etiology | Characteristics symptoms & lesions | Diagnosis & remark |
|---|---|---|
| **Foot and mouth disease** (Apthous fever/ Khurkut/ Aftosa) **Apthovirus of picornaviridae family** | • **Inhalation-** is main mode of transmission<br>• Vesicle formation in oral mucosa (stratum spinosum layer) and foot of cloven footed animal<br>• Fever, drooling of saliva and lameness<br>• In dead calves, heart gives **Tigroid appearance** due to necrotizing myocarditis<br>• Muscle fibre having hyaline degeneration | Competitive ELISA<br>Animal inoculation test- Guinea pig<br>Pig- amplifier host<br>CFT is used for virus serotyping |
| **Vesicular stomatitis** (PseudoFMD/ Malde Yerbe) **Vesiculovirus of Rhabdoviridae** | **Sporadic aptha/ Estomatitis/ Sore nose/ Sore mouth**<br>• Vesicle formation in oral mucosa<br>• Transmitted through insect | Animal inoculation test- Guinea pig<br>Dear- amplifier host |
| **Vesicular exanthema Calcivirus** | • Occurs only in pig<br>• Vesicle formation in snout, lips, nostril, tongue, tongue, feet and mammary gland | |
| **Rinderpest** (Cattle plague/ Bovine typhus/ Bulkandi) **Morbilivirus of paramyxoviridae family** | • **Inhalation-** is main route of infection<br>• Erosive stomatitis and haemorrhagic enteritis<br>• Mucus membrane of lips, gums and tongue have small eruptions resembling Bran-like deposits<br>• Virus has affinity to lymphoid tissue (leucopenia) and alimentary tract<br>• Haemorrhage in intestine leads to Zebra markings mainly in caecum and colon | Eradicated from India in 1995<br>**CFT-** confirmatory test<br>Intracytoplasmic and intranuclear eosinophilic inclusion bodies |
| **Malignant Catarrhal fever**/ Gangrenous coryza/ Snotsiekte/ Epitheliosis **Herpes virus** | • Catarrhal and mucopurulent conjunctivitis<br>• Ulcer on oral mucosa, intestine<br>• Panopthalmitis<br>• Enlargement of superficial lymph nodes<br>• Cooked up appearance of brain | No inclusion bodies formation<br>Cattle-dead end host |
| **Bovine Viral Diarrhoea (BVD)**/ Mucosal Disease (MD) **Pestivirus of Togaviridae** | • Virus is transmitted by direct contact and by transplacental route to foetus<br>• Ulcer in oral mucosa, oesophagus, abomasum, intestine characterized by high rise of temperature and diarrhoea<br>• Hypoplasia of cerebellum | BVD (acute) & MD (chronic) are clinically dissimilar |

Chapter-9

# General Veterinary Pathology

**Debasish Niyogi and KK Tripathi**
**Department of Veterinary Pathology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- Hyperplasia- increase in size of tissue with increase in number of cells (eg. Wart)
- Hypertrophy- increase in size of tissue with increase in size of cells
- Metaplasia- conversion of one type of tissue (cell) into another type in same germinal layer
- Atrophy- decrease in size of organ/tissue after its full development
- Dysplasia (atypical hyperplasia)- change in shape, size and orientation of cell within organ/tissue
- Renal epithelial cells don't develop hyperplasia
- Degeneration- change in tissue itself
- Infiltration- abnormal deposits in tissue

## Type of Degeneration

### Cellular swelling

- The most common disturbances of cell metabolism and first reaction of a cell to injury occurs as a result of failure of sodium pump in cells.
- **Earlier it was known as Cloudy swelling, parenchymatous swelling, albuminous degeneration**
- Most common cause is bacterial toxins
- Cytoplasm of cell become granular giving Ground glass appearance and hazy cytoplasm due to swelling of endoplasmic reticulum and mitochondria.
- Granules are soluble in acetic acid but not in lipid solvents such as chloroform.
- Par-boiled (swollen) appearance of organ.

**Note:** Eosinophilic intracytoplasmic composed of intermediate filaments.

| | |
|---|---|
| **Hydropic degeneration (Vacuolar degeneration)-** Etiology is similar to cellular swelling but more severe | • Hydropic fluid stain pink with eosin due to protein content<br>• Observed in vesicular exanthema, pox, neoplasm of cervi, blister on skin |
| **Mucous or mucinous degeneration** In response to mild irritant | • Mucin (glycoprotein) is produced by columnar or cuboidal epithelial cell (subcellular level by mitochondria)<br>• Mucin stain **Blue with Alcian blue, haematoxylin** and **Red with thionine, mucicarmine, PAS,** |
| **Mucoid or myxomatous degeneration** In response to mild irritant | • Mucin like glycoprotein (stain blue with haematoxylin) normally produced in foetus but abnormal in adult<br>• Observed in myxoma, myxosarcoma, myxoedema |

Chapter-8

# Veterinary Protozoology

**VK Pal**
**Department of Veterinary Parasitology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

| Protozoology | | |
|---|---|---|
| **Genera/ Species** | **Characteristics** | **Lesions/Disease/Remark** |
| **Family: Trypanosomatidae** | | |
| • Trypanosoma spp. are extracellular except *T. cruzi & T. theleri*<br>• Transmitted by Tabanus mainly except *T. cruzi*<br>• Pathogenesis (progressive anaemia-intravascular coagulation- haemodilution)<br>• **Earlier test used to diagnose surra**<br>• Mercuric chloride test (camel), Formol gel test (camel), Stilbamide test (bovine), Thymol turbidity test- these test detect only a rise in globulin level | **Diagnosis**<br>Thick & thin blood smear<br>Haematocrit centrifugation technique (Woo's technique)<br>CFT, CATT (card Agglutination trypanosomosis test-for specific antibodies), LAT (Latex agglutination test- for circulating antigen), PCR<br>**OIE** recommends use of Ab-ELISA & CATT for declaring a surra free status of a geographical area or herd. | |
| ***Trypanosoma evansi*** | 1st pathogenic tryps discovered in India by Griffith Evans in 1880 in camel | Surra or Tibersa in India<br>Deleban in Algeria<br>Murrina in Panama<br>Guifar in Islam country |
| ***Trypanosoma equinum*** | | Malde cadaras in equine |
| ***Trypanosoma equiperdum*** | | Dourine or Equine syphilis or breeding paralysis or Veneral trypanosomiasis |
| *Trypanosoma theileri* | Largest trypanosome | Occult trypanosome |
| *Trypanosoma rhodensi* | | Sleeping sickness in humans |
| *Trypanosoma gambiense* | | Sleeping sickness in humans |
| *Trypanosoma cruzi* | Transmitted by Triatoma bug | Chagas disease in humans |
| *Trypanosoma congolense* | Shortest trypanosome<br>Transmitted by *Glossina spp.* | Nagana disease in cattle |
| *Trypanosoma vivax* | | Nagana disease in cattle |
| *Trypanosoma lewisi* | | Trypanosomiasis in mice |
| ***Leishmania spp.*** | | |
| • Multiply in macrophages<br>• LD bodies- are amastigotes which are seen in vertebrate host<br>• PKDL- multiple nodule infiltration without ulceration | | |
| *Leishmania donovani* | Transmitted by *Phlebotamus argentipus* | Kala-azar/ Visceral leishmaniasis/ black fever/ Dum dum fever/ Death |

Chapter-7

# Veterinary Entomology and Acarology

**Amit Singh**
**Department of Veterinary Parasitology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

| **PHYLUM- ARTHROPODA** | |
|---|---|
| 2 Class of Veterinary importance | |
| **INSECTA:** It has 5 order<br>1. DIPTERA **(Mosquitoes, Midges, Gnats & Flies)**<br>2. SIPHONOPTERA (APHANIPTERA) **(Fleas)**<br>3. MALLOPHAGA **(Biting lice)**<br>4. SIPHUNCULATA (ANOPLURA) **(Sucking lice)**<br>5. HEMIPTERA **(Bugs)** | **ARACHNIDA**<br>It has one order: ACARINA having 2 suborder<br>1. IXODOIDEA (has 2 sub family)<br>A. **Argasidae (Soft ticks)**<br>B. **Ixodidae (Hard ticks)**<br>2. SARCOPTIFORMEA |

- Nymph is only seen in hemimetabolus (Incomplete metamorphosis) condition and found in life cycle of Lice, Bugs, ticks and mites. Nymph never enters in pupal stage.
- Pupa Stage: characteristics of holometabolus (complete metamorphosis) condition and found in life cycle of flies, fleas

**Order: DIPTERA**

**Family: Culicidae (Mosquitoes)**

Pupa - tumbler
Larva – Wriggler

| **Genera/ Species** | **Characteristics** | **Lesions/Disease/Remark** |
|---|---|---|
| ***Anopheles spp.*** | Egg with floats (winged)<br>Breeding place-running water | Spotted wings |
| ***Aedes spp.***<br>(Tiger/Forest mosquito) | Egg without floats<br>Breeding place-water in cans | Abdomen has black & white rings |
| ***Culex spp.***<br>(Nuisance mosquito) | Breeding place-stagnant water<br>Eggs are layed in group and are of cigar shaped | Better flier<br>Transmit avian malaria and JE, West Nile virus |
| **Family: Ceratopogonidae (Biting midges/No-see-ums)** | | |
| Culicoides spp. | Minute (very small) in size | Transmit Blue tongue, African Horse sickness, Bovine ephemeral fever |
| **Family: Psychodidae (Sandflies)** | | |
| Phlebotomus spp. | They resemble mosquitoes but are hairy and active at night | Eggs have black eye spot<br>V-shaped wings |
| **Family: Simulidae** | | |
| **Simulium spp**<br>(Buffalo gnats/ Black fly/Turkey gnats/White socks) | Hump backed dark colour wing veination, Active at sunset<br>Boiling water with mass emergence appearance | Beaded Antenaa like horns<br>Obtectate pupa<br>Male and female both suck blood |

Chapter-6

# Veterinary Helminthology

**Amit Singh**
**Department of Veterinary Parasitology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- The word 'parasite' is derived from the Greek word and means 'besides food" (Para-beside, sitos - food).
- Erratic or aberrant or ectopic parasites are present in locations that are not their usual site
- Parasites with a narrow host range are referred to as Stenoxenous parasites
- parasites with a wide host range are known as Euryxenous parasites
- Transport host: host which transfer only non-developing phase of parasite to another host
- Protelean parasite: parasite which is parasitic in its larval stage
- Paedogenesis: reproduction by larval or young form of parasites
- SNOAPAD- Standard Nomenclature of Animal Parasitic Diseases

## Class: Trematoda (Flukes)

- Characterized by composite eggs
- Life cycle: egg- miracidium (infects 1st intermediate host) -sporocyst- redia- cercaria- metacercaria
- **Redia stage is absent** in Dicrocoeliidae, Schistosmatidae, Prosthogonimidae
- Paedogenesis: common in trematodes

### Family- Fasciolidae

| Species | Synonym/ Host | Disease/ lesions/ remark |
|---|---|---|
| ***Fasciola hepatica***<br>(Gymnocephalous cercaria) | Common liver fluke/Sheep liver fluke<br>I.H- Water Snail (*Lymnae truncatula*)<br>Apical cone is very prominent<br>Found in Semi-temperate region | Acute fascioliosis (fluke > 1000)- common in sheep<br>Chronic fascioliosis (200+)- hyperplastic cholangitis, hepatic fibrosis **(Clay Pipe stem liver)**, sub-mandibular oedema (**Bottle Jaw)**<br>Egg- Golden yellow colour (not distinct operculum)<br>MM3 coprotest is done |
| ***Fasciola gigantica*** | I.H- Snail (*Lymnae auricularia*)<br>Apical cone is not prominent<br>Found in tropical region | |
| ***Fascioloides magna*** | | |
| ***Fasciolopsis buski***<br>(pig and man) | Water chest nut<br>I.H- Snail (*Helicorbis coenosus*) | |

### Family- Dicrocoeliidae

Redia stage absent
Two intermediate host

1. **Land snail**
2. Ants

Chapter- 5

# Veterinary Immunology

**Vibha Yadav**
**Department of Veterinary Microbiology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- **Immunity** can be defined as complex biological system to prevent the invasion of harmful microorganisms into the body
- The cells, tissues, structures and secretions which confers immunity to infectious agents are known as Immune system
- **Innate immunity** can be defined as immunity which is present since birth and persists lifelong. Eg. Skin, mucous coating of epithelium lining the gastrointestinal tract, respiratory tract, urogenital tract, acid in stomach, saliva in mouth, tears from eyes, natural killer cells, granulocytes etc.
- **Acquired (adaptive) immunity** can be defined as immunity which is acquired/developed in response to antigen. It is highly pathogen specific and its response is slow as compared to innate immunity

| **Adaptive immunity** | | | |
|---|---|---|---|
| **Active immunity** | | **Passive immunity** | |
| **Natural active immunity**- Developed with recovery from disease (clinical or subclinical ) | **Artificial active immunity**- As a result of vaccination | **Natural passive immunity**- Result of colostrum uptake | **Artificial passive immunity**- Oral or injection of antiserum to new-born animals |

- **Primary lymphoid organs:** Bone marrow, Thymus, Bursa of fabricus (birds). All lymphocytes originate from stem cells in bone marrow. Differentiation of B lymphocytes take place in Bone marrow (BM) in mammals and Bursa of fabricus in birds. Differentiation of T lymphocytes take place in thymus. BM also act as secondary lymphoid organ
- **Secondary lymphoid organs:** Lymph nodes, spleen, peyer's patches, tonsils and diffused lymphoid tissue (Bronchial associated lymphoid tissue- BALT in respiratory tract and Mucosal Associated Lymphoid tissue- MALT in digestive tract). These organs provide environment for proliferation and maturation of lymphocytes and also for filtering and trapping antigens. They also provide sites for interaction of lymphocytes with antigens.
- Cells of Immune system: Macrophages, monocytes, neutrophils, dendritic cells and most important Lymphocytes
- Macrophages are involved in phagocytosis, production of various cytokines and are also act as antigen presenting cell.
- **Antigen Presenting Cells (APC):** are cells that process and present antigens in conjunction with MHC II for recognition by T lymphocytes. Eg. Macrophages, dendritic cells and B cells.
- **Dendritic cells:** are antigen presenting cells present in lining of nose, lungs, stomach, intestine, heart and in lymphoid tissues. In skin, these cells are known as Langerhans cells.
- Lymphocytes: are of 3 types- B lymphocytes, T lymphocytes and natural Killer cells

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Chapter-4

# Veterinary Virology and Mycology

**RP Diwakar**
**Department of Veterinary Microbiology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

## Virus

- Name virus was given by Pasteur
- WM Stanley crystallized viruses and crystals composed of proteins
- The protein coat of virus is termed as capsid (made up of capsomeres which are held together by non-covalent bonds)
- Baltimore classification used to classify viruses based on pattern of messenger RNA synthesis
- Viruses are named by International Committee on Taxonomy of Viruses (ICTV)

### Classification of Viruses

#### RNA viruses

| Family | Genetic material | Nucleocapsid Symmetry | Envelope | Remark |
|---|---|---|---|---|
| **Nidovirales:** order of viruses having positive sense ssRNA and are enveloped, include Coronaviridae and Arteriviridae | | | | |
| **Coronaviridae** | ssRNA (+ sense) | Helical or Doughnut shaped | Enveloped | Largest RNA virus |
| Two subfamily: Coronavirinae (helical shaped nucleocapsid); Torovirinae (doughnut shaped) | | | | |
| **Arteriviridae** | ssRNA (+ sense) | Icosahedral | Enveloped | |
| **Mononegavirales-** order of negative sense RNA viruses having non-segmented genome and include Rhabdoviridae, Paramyxoviridae, Bornaviridae | | | | |
| **Rhabdoviridae** | ssRNA (- sense) | Helical symmetry (Bullet shaped) | Enveloped | Bullet shaped virions |
| **Paramyxoviridae** | ssRNA (- sense) | Pleomorphic | Enveloped | Herring bone nucleocapsid |
| **Bornaviridae** | ssRNA (- sense) | Helical symmetry | Enveloped | |
| Articulavirales: order of negative sense RNA viruses having segmented genome and include Orthomyxoviridae | | | | |
| **Orthomyxoviridae** (segmented genome) | ssRNA (- sense) 6-8 segments | Pleomorphic | Enveloped | |
| **Bunyaviridae** | ssRNA (- sense) | Spherical | Enveloped | |
| **Togaviridae** | ssRNA (+ sense) | Spherical | Enveloped | |
| **Arenaviridae** (bisegmented) | ssRNA (ambisense) | Pleomorphic (Spherical) | Enveloped | Contains sand like particle |
| **Retroviridae** | ssRNA | Icosahedral | Enveloped | |
| **Reoviridae** | **dsRNA** | Icosahedral | Non-enveloped | |
| **Picornaviridae** | ssRNA | Icosahedral | Non-enveloped | |

Chapter-3

# Veterinary Bacteriology

**Rajesh Kumar Joshi**
**Department of Veterinary Microbiology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

Father of Bacteriology: Leuwenhoek
Father of Microbiology: Louis Pasteur

| Gram positive bacteria | Gram negative bacteria |
|---|---|
| Cell wall is thick and single layered | Cell wall is thin walled but double layered |
| Cell wall is smooth and rigid | Cell wall is wavy & elastic |
| Lipid and lipoprotein content is low in cell wall | Lipid and lipoprotein content is high in cell wall |
| Peptidoglycan layer is thick and multi-layered | Peptidoglycan layer is thin and single-layered |
| Basal body has one pair of ring (2 ring) | Basal body has two pair of ring (4 ring) |
| Baer's junction absent | Bayer's junction- present |
| Absence of outer membrane | Presence of outer membrane |
| Periplasmic space-absent | Periplasmic space present |
| No porin channel | Porin channel present |
| Lysozyme destroy the gram positive bacteria Protoplast- | Cannot destroy the bacteria Spheroplast- |
| Greater amount of peptidoglycan | Lesser amount of peptidoglycan |
| Techoic acid present in cell wall (act as surface antigen) | Absent |
| Mainly produce exotoxins | Mainly produce endotoxin |
| Pili- absent | Present on some bacteria |
| More susceptible to anionic detergents | Less susceptible to anionic detergents |
| Resistance to drying is high | Low |
| Sensitive to penicillin | Less sensitive to penicillin |
| Complement lysis (MAC)- Resistant | Sensitive |

| Exotoxin | Endotoxin |
|---|---|
| Heat labile | Heat stable |
| Made of protein (regulated by genes of plasmid) | Made of lipopolysaccharide |
| Highly toxic | Weakly toxic |
| Highly specific for particular tissue | Non-specific in action |
| Mostly in gram positive but also in gram negative | Located at outer membrane of gram negative bacteria |
| Excreted or secreted by microorganism | Liberated when the bacteria disintegrated |
| Converted into harmless toxoid by formaldehyde | Cannot be converted into any harmless substance |
| Don't produce fever in host | Often produce fever |

Chapter-2

# Animal Welfare and Acts

**Rakesh Kumar Gupta**
**Department of Veterinary Pathology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

| SECTION | INDIAN PENAL CODE |
|---|---|
| 44 | Word 'Injury' |
| 47 | Word 'Animal' |
| 51 | Word 'Oath' |
| 52 | Nothing is said to be done or believed in 'good faith' |
| 53 | Punishments |
| 80 | Nothing is an offence which is done by accident/misfortune |
| 81 | Act likely to cause harm, but done without criminal intent, and to prevent other harm |
| 172 | Not present in court after receiving summon (Summon-fine) |
| 173 | Preventing service of Summon or other proceedings |
| 178 | Refusing oath or affirmation when duly required by public servant to make it |
| 192 | False entry in record |
| 193 | False evidence in proceeding of court |
| 197 | Issue/sign any certificate/false certification |
| 204 | Destroy any document |
| 269 | Done by negligence to spread infectious disease |
| 270 | Done by intention to spread infectious disease |
| 271 | Not following quarantine rule- 6-month prison+ Rs. 1000 fine |
| 272 | Adulteration of any food or drink-6-month prison+ Rs. 1000 fine |
| 273 | Sale of unfit food/drink- 6-month prison + Rs. 1000 fine |
| 274 | Adulteration of medicinal item for sale- 6-month prison + Rs. 1000 fine |
| 275 | Sale of adulterated medicine- 6-month prison + Rs. 1000 fine |
| 289. | Disobey any order with any animal in his possession- 6-month prison+ Rs. 1000 fine |
| 304 | Negligently causing death of any person |
| 377 | Bestiality – 10-year prison + Rs. 10000 fine |
| 420 | Fraudulent cheating of altered animals- 7 year prison |
| 428 & 429 | Mischief, killing, poisoning, maiming- 2 year |
| 430 | Decrease of water supply to animals |

Chapter-1

# Veterinary Science- An Introduction

**Rakesh Kumar Gupta**
**Department of Veterinary Pathology**
**C.V.Sc. & A.H., ANDUAT, Ayodhya**

- World Organization for Animal Health (formerly **OIE**- Office International des Epizooties) was established on **25th January 1924 - HQ- Paris**
- IVRI (Indian Veterinary Research Institute) was established in **1889** and earlier known as Imperial Veterinary Research Institute
- ICAR (Indian Council of Agriculture Research) was established on **29th July 1929** and earlier known as Imperial Council of Agriculture Research)
- World Health Organization was established on 7th April, 1948- HQ: Geneva, Switzerland
- Veterinary Council of India (VCI) was established in 1984 and governed by Veterinary Council Act, 1984
- TANUVAS (Tamil Nadu veterinary and Animal Sciences University) was **first veterinary university** established in 1989
- The first veterinary school in world was established in 1761 in Lyon, France by Claude Bourgelat

| **Animal Division of ICAR has 6 National research centre** | |
|---|---|
| National Research Centre on Pig | Guwahati |
| National Research Centre on Mithoon | Medziphema (Nagaland) |
| National Research Centre on Camel | Bikaner |
| National Research Centre on Equine | Hisar |
| National Research Centre on Yak | Dirang (Arunachal Pradesh) |
| National Research Centre on Meat | Hyderabad |
| **Animal Division of ICAR has 8 Central/National Research Institute** | |
| Central Institute for Research on Goat | Makhdoom (Mathura) |
| Central Sheep and wool research Institute | Avikanagar (Rajasthan) |
| Central Institute for Research on Buffaloes | Hisar |
| Central Avian Research Institute | Izzatnagar |
| Central Institute for Research on Cattle | Meerut |
| National Institute of Animal Nutrition and Physiology | Bengaluru |
| National Institute of Veterinary Epidemiology and Disease Informatics | Bengaluru |
| National Institute of High Security Animal Diseases | Bhopal |

Dr. Rakesh Kumar Gupta, did his basic education from Central Academy, Lucknow. He completed his B.V.Sc and M.V.Sc in Pathology from College of Veterinary Science, ANDUAT, Ayodhya. He obtained Gold Medal in his bachelor and master degree. He has received many awards including Young Scientist Award and Young Researcher Award. He is author of three books entitled 'Question Bank of Veterinary Pathology', 'Series- I Veterinary Surgery' and "Romanthak Pashuon ke Pramukh Rog". He has qualified UGC-NET three times with JRF in subject of SOCIAL MEDICINE AND COMMUNITY HEALTH and ICAR-NET two times (75%).

Dr. Pravesh Dwivedi, MPH (Community Medicine), Ph. D (Women's Studies), is currently working as Guest Faculty for postgraduate courses, Lucknow University. He has more than 16 years of experience working with National/International organizations. He had worked with MHRD in Siksha Abhiyaan as a Gender Coordinator looking after 18 states. He has also worked with renowned organizations- PSI, PHFI, CARE and has also collaborated with many international donors like UCSF USA, Stanford School of Medicine USA, London School of Hygiene and Tropical Medicine etc.

Dr. Maitri Bajpai has done her basic schooling from Central Academy Lucknow. She completed her BDS from Chandra Dental College, Lucknow, then she done Master of Public Health (Community Medicine). She has also done PGDRCH (Postgraduate Diploma in Reproductive Child Health) from Lucknow University. She has topped in her BDS course got Certificate of Excellence. She has also topped in MPH. She has done various national and international public health projects. She has been a part of Colgate Pocket Dentist Program and various research projects in KGMU.

This book entitled "Social Medicine and Community Health" is an attempt to provide success to the students mainly preparing for competitive examinations viz. UGC- NET JRF, Community Health Officer examination and Common Entrance Test related to field of Public Health by assessing their knowledge in the subject through subjective and multiple choice questions. The course content of this book is totally based as per the Syllabus of UGC-NET JRF and divided into twelve chapters including Basics of Public Health, Health Policies and Health Services, Epidemiology, Biostatistics, Social Science and Health, Common Health Problems, Environment and Health, Nutrition, Reproductive and Child Health, Health Education, Vaccination, International Health, Planning and Management, Assertion and Reason.

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Rakesh Kumar Gupta

Pravesh Dwivedi

Maitri Bajpai

With Multiple Choice Questions

# SOCIAL MEDICINE AND COMMUNITY HEALTH

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Dr. Debasish Niyogi, Professor and Head in the department of Veterinary Pathology, College of Veterinary Science and Animal Husbandry, ANDUAT, Kumarganj, Ayodhya, has 20 years of experience in teaching, research and extension activities. He has received more than 20 awards including Best Toxicopathologist Award - 2019 by IAVP, Distinguished Scientist Award - 2018 by SAID, Fellow Award - 2017 by SAID, Scientist of the Year Award - 2017 by DISHA.

Dr. Satyavrat Singh, Assistant Professor in department of Veterinary Medicine, College of Veterinary Science and Animal Husbandry, ANDUAT, Kumarganj, Ayodhya, has 18 years of experience in teaching, research and extension activities with major contribution in establishment of Veterinary Clinical Complex. He is author of two books entitled 'Bovine Mastitis and Udder Affections and "Romanthak Pashuon ke Pramukh Rog".

Dr. Sonu Jaiswal, Associate Professor and Head in the Department of Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, ANDUAT, Kumarganj, Ayodhya has 18 years of experience in teaching, research and extension activities. He did his basic education from Uttar Pradesh and Ph.D. in Veterinary Surgery and Radiology from G.B. Pant University of Agriculture and Technology, Pantnagar with first division throughout his academic degrees. He has received 6 Best Paper awards and one Excellence in Teaching award.

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REVIEW OF VETERINARY SCIENCE

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FOR COMPETITIVE EXAMINATIONS

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Dr. Rajesh Kumar Verma, Assistant Professor- Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, ANDUAT, Ayodhya, did his basic education from Uttar Pradesh and Ph.D. in Veterinary Microbiology from College of Veterinary Science and Animal Husbandry, ANDUAT, Ayodhya. He qualified ICAR-NET and authored book entitled Laboratory Diagnosis and Clinical Biochemistry in Animals.

Dr. Naveen Kumar Singh, Assistant Professor- Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, ANDUAT, Ayodhya, did his basic education from Uttar Pradesh, B.V.Sc. & A.H. from Madras Veterinary College, Chennai and M.V.Sc. in Veterinary Medicine from College of Veterinary Science and Animal Husbandry, RAJUVAS, Bikaner. He is also Incharge of NCC Unit of Acharya Narendra Deva University of Agriculture & Technology, Ayodhya.

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Dr. Pravesh Dwivedi, MPH (Community Medicine), Ph. D (Women's Studies), is currently working as Guest Faculty for postgraduate courses, Lucknow University. He has more than 16 years of experience working with National/International organizations. He had worked with MHRD in Siksha Abhiyaan as a Gender Coordinator looking after 18 states. He has also worked with renowned organizations- PSI, PHFI, CARE and has also collaborated with many international donors like UCSF USA, Stanford School of Medicine USA, London School of Hygiene and Tropical Medicine etc.

Dr. Maitri Bajpai has done her basic schooling from Central Academy Lucknow. She completed her BDS from Chandra Dental College, Lucknow, then she done Master of Public Health (Community Medicine). She has also done PGDRCH (Postgraduate Diploma in Reproductive Child Health) from Lucknow University. She has topped in her BDS course got Certificate of Excellence. She has also topped in MPH. She has done various national and international public health projects. She has been a part of Colgate Pocket Dentist Program and various research projects in KGMU.

This book entitled "Social Medicine and Community Health" is an attempt to provide success to the students mainly preparing for competitive examinations viz. UGC- NET JRF, Community Health Officer examination and Common Entrance Test related to field of Public Health by assessing their knowledge in the subject through subjective and multiple choice questions. The course content of this book is totally based as per the Syllabus of UGC-NET JRF and divided into twelve chapters including Basics of Public Health, Health Policies and Health Services, Epidemiology, Biostatistics, Social Science and Health, Common Health Problems, Environment and Health, Nutrition, Reproductive and Child Health, Health Education, Vaccination, International Health, Planning and Management, Assertion and Reason.

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# Strategies and Challenges of Veterinary Profession to Improve Livelihood, Food Security and Safety

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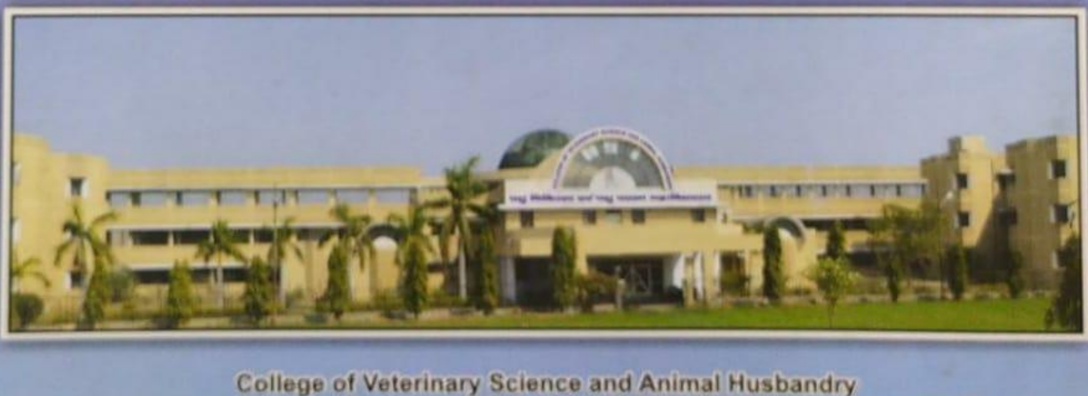

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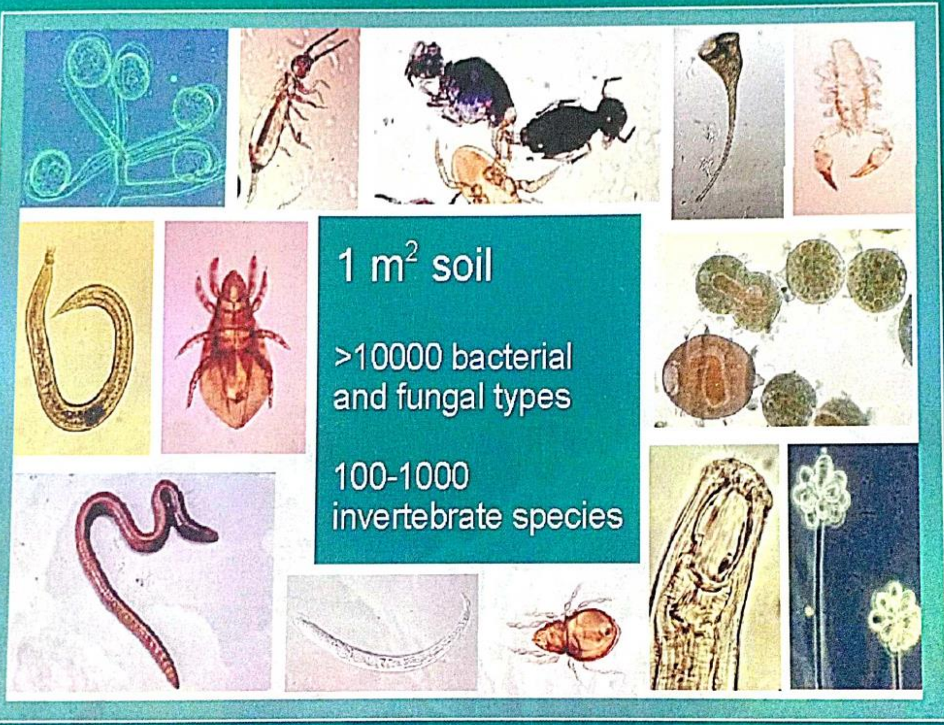


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AUTHORS

**Dr Gopal Singh**
(Professor and Head, department of Plant Pathology, SVPUAT,Meerut,UP)

**Nidhika Rani**
(Assistant Professor, Aisect University, Hazaribag, Jharkhand)

**Dr Vindeshwari Prasad**
(Assistant Professor, Pathology, CRS,Masodha)

**Dr. Subhash Chandra**
(Assistant Professor, Pathology, NDUAT,Faizabaad)

**Dr. Amarendra Kumar**
(Assistant Professor, Department of Plant Pathology
Bihar Agricultural University, Sabour,Bhagalpur, )

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**Authors**

**Rajesh kumar**
(Department of Genetics and Plant breeding, BAU Ranchi)

**Mr. Gorappanavara Bharamappa**
(Senior Research Fellow in AICRP on Weed Control in *UAS, Dharwad)*

**V.Laxman**
(SRF , Soil science, ICAR-IIRR, Hyderabad)

**Dr. Subhash Chandra**
(Plant Pathologist. Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya (UP)

**Miss Diksha Vishwakarma**
(Teaching Associate, Deptt. Soil Science & Agricultural Chemistry,RAK College of Agriculture Sehore- 466001 (M.P.)

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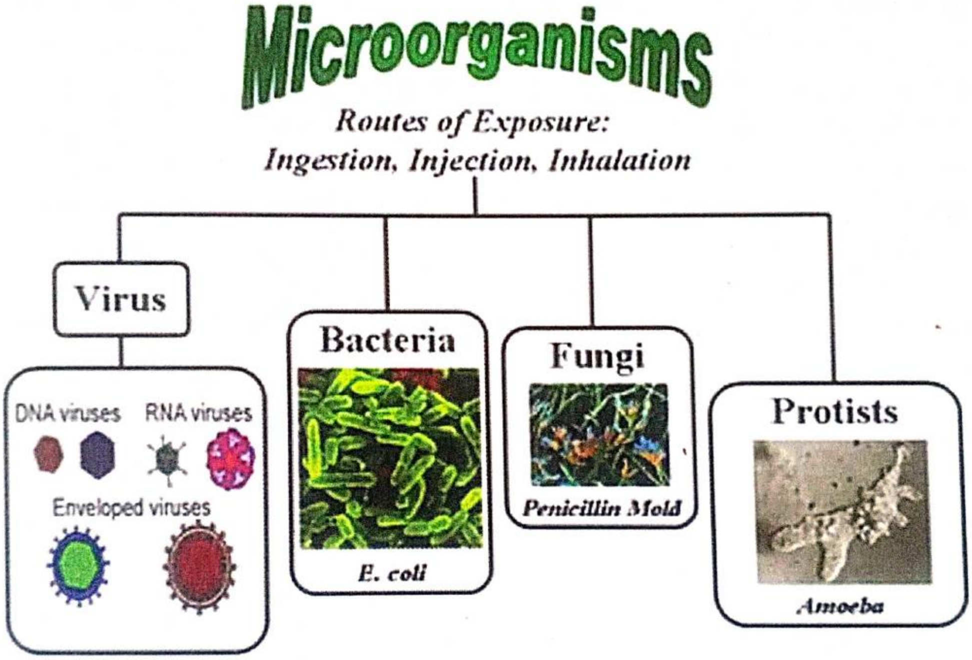



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**Dr. AMARENDRA KUMAR**
Assistant Professor, Department of Plant Pathology
Bihar Agricultural University, Sabour, Bhagalpur, Bihar

**Dr. NISHANT PRAKASH**
(SMS, Plant Pathology, KVK,Arwal)

**PRAVEEN KUMAR**
Scientist (Plant Protection) KVK,Hazaribagh,Jharkhand

**Dr. S K PANDE**
Assistant Professor, Department of Plant pathology,NDUAT, Faizabad

**Dr. VINDESHWARI PRASAD**
Assistant Professor, Plant Pathology ,Crop Research Station
Masodha,NDUAT, Faizabad

**JAY KUMAR YADAV**
Department of Plant Pathology, NDUAT, Faizabad

**Dr. SUBHASH CHANDRA**
(Assistant Professor, Pathology, NDUAT,Faizabaad)

**Dr. HEM CHANDRA LAL**
Assistant Professor, Department of Plant Pathology
Birsa Agricultural University,Kanke, Ranchi-834006.

**P.M. YADAV**
Ph.D. Scholar, Dept of Plant Pathology,
Navasari Agricultural University,Navsari, Gujrat

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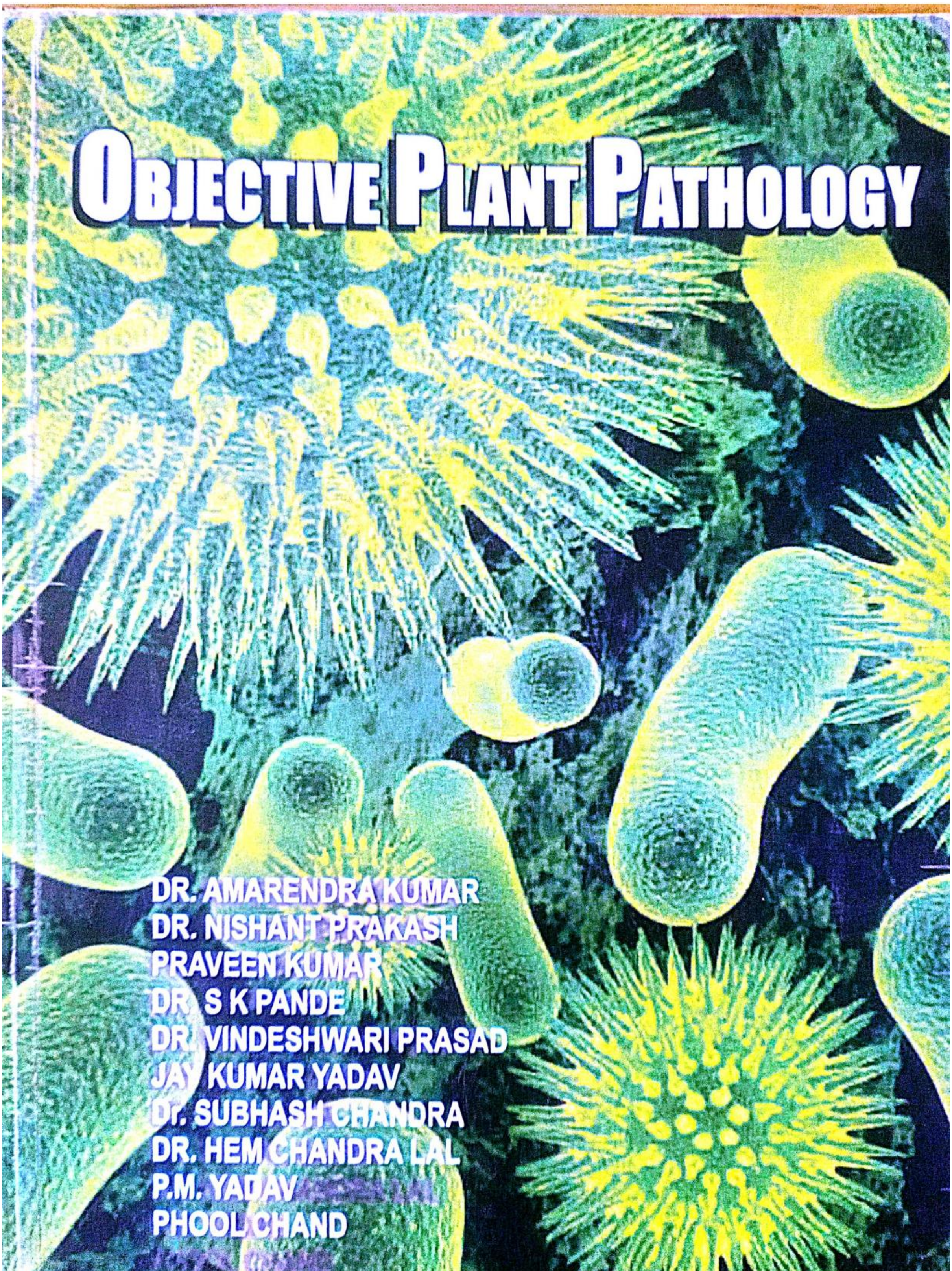
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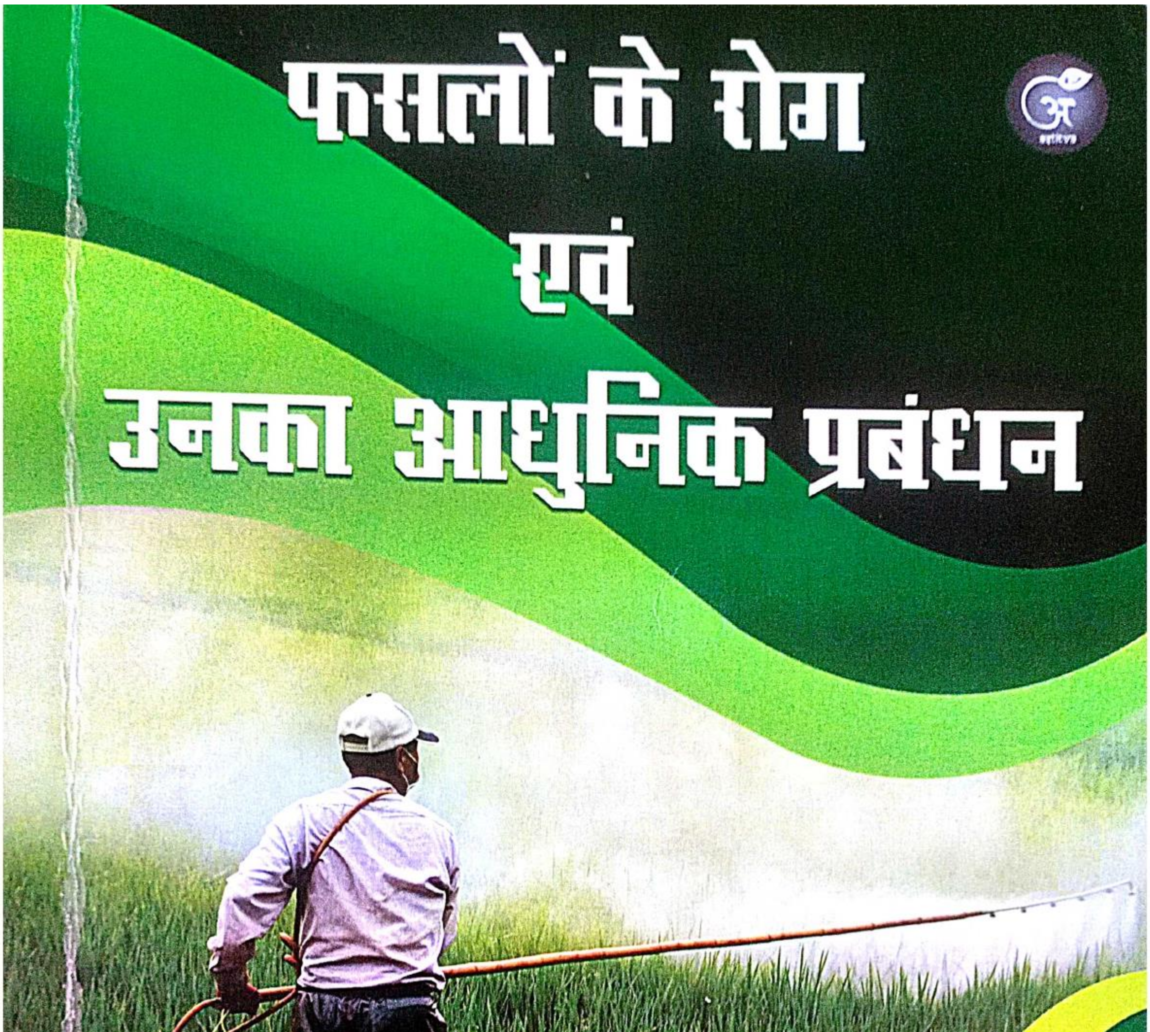
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*Author*

**Dr Subhash Chandra**

Scientist,Dept. Of Plant Pathology
A. N. D. University of Agriculture and Tech.,Kumarganj,
Ayodhya 224001 (UP)

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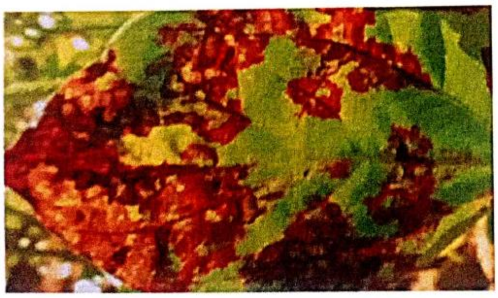

Subhash Chandra

First edition: October ,2019



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**Mobile:7004023179**

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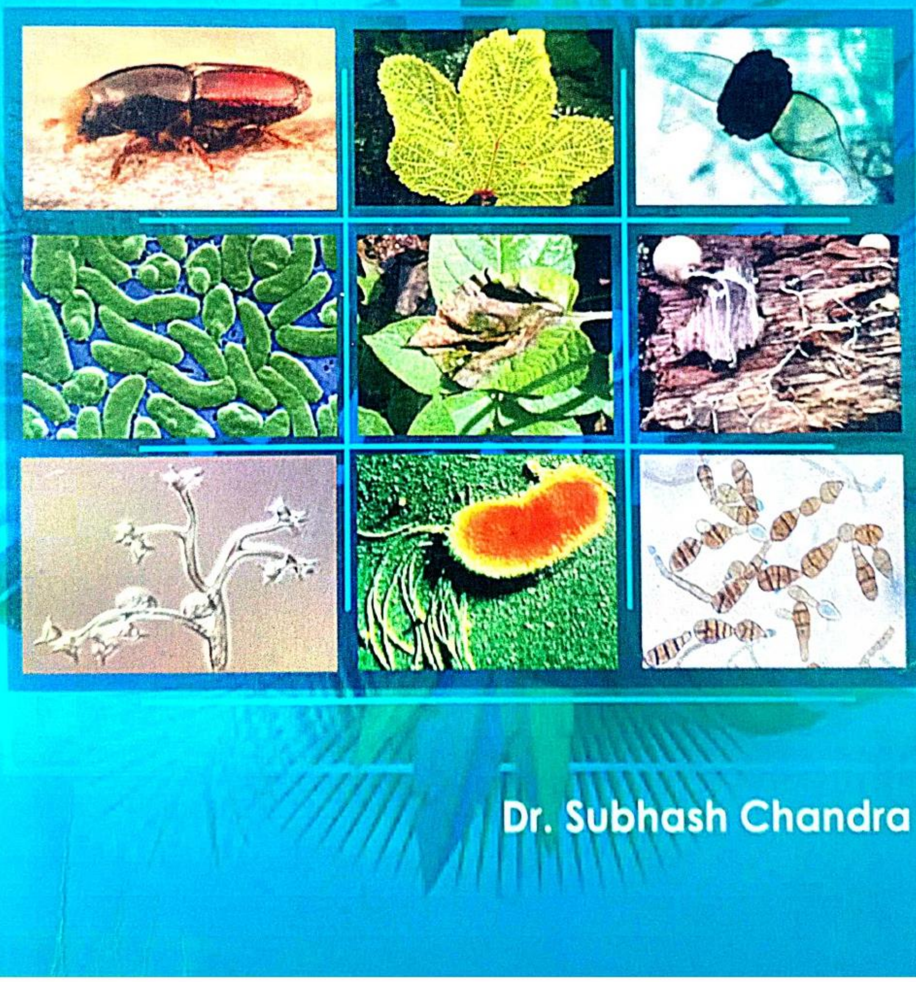

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# ADVANCES IN PLANT DISEASE MANAGEMENT


**Editors**

**Dr. Amarendra Kumar**
(Assistant Professor, Department of Plant Pathology
Bihar Agricultural University, Sabour,Bhagalpur, )

**Praveen Kumar**
(Directorate of Plant Protection Quarantine & Storage, Govt of India)

**Nidhika Rani**
(Assistant Professor, Aisect University, Hazaribag, Jharkhand)

**Dr Vindeshwari Prasad**
(Assistant Professor, Pathology, CRS,Masodha)

**Dr. Subhash Chandra**
(Assistant Professor, Pathology, NDUAT,Faizabaad)

**Dr. Satendra K Magrauthia**
(Senior Scientist, ICAR-IIRR,Hyderabad)

**Avinash Kumar Paswan**
( Department- Plant Pathology,Birsa Agricultural University,Ranchi)