

# Concepts of Integrated Pest Management

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# Concepts of Integrated Pest Management

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## Preface

Integrated Pest Management (IPM) is a crucial strategy in agriculture, aiming to address pest issues sustainably while minimizing environmental damage and ensuring economic prosperity. The book "**Concepts of Integrated Pest Management**" provides a thorough guide to understanding and implementing IPM principles across various agricultural settings. It begins by exploring the history of IPM and explaining key terms related to pest management. The book emphasizes the important role of resistance in controlling pests, covering the basic principles and mechanisms of resistance. Additionally, it discusses the complex regulations governing pesticide use and registration, shedding light on the challenges and considerations involved in labelling pesticides.

The philosophy of IPM revolves around ecological principles and economic thresholds, which are explained in detail. Readers learn about the complex relationships between pests and their host plants, gaining insight into how pests select their hosts. This foundational knowledge helps in developing effective pest management strategies that are environmentally friendly and economically feasible. Practical implementation of IPM strategies is a significant focus, covering aspects such as characterizing agroecosystems, estimating pest populations, and assessing crop losses. Through case studies and real-world examples, readers gain valuable insights into designing and implementing IPM systems suited to their specific agricultural contexts. Breeding techniques for developing insect-resistant crop varieties are also explored, showcasing successful examples from around the world. This highlights the potential of biotechnological advancements in enhancing crop resilience to pests while reducing reliance on chemical interventions.

Throughout the book, emphasis is placed on the practical relevance and applicability of IPM principles in addressing contemporary agricultural challenges. Whether it's combating emerging pest threats or integrating new technologies into pest management strategies, the book equips readers with the knowledge and tools necessary for success. The book also delves into the various tools and methods used in IPM, from legislative measures to cultural

practices and biological interventions. It discusses practical surveillance techniques, forecasting methods, and risk analyses, equipping readers with the necessary tools for making informed pest management decisions. Furthermore, it addresses the social, political, and legal aspects of IPM, emphasizing the importance of considering broader societal implications. In a world facing food security, environmental sustainability, and climate change challenges, IPM emerges as a vital approach. **"Concepts of Integrated Pest Management"** serves as a valuable resource for researchers, students, and practitioners, offering a holistic understanding of IPM principles and their practical application in agriculture. By embracing IPM principles, stakeholders in agriculture can promote resilient and sustainable food production systems that meet the needs of present and future generations.

## About the Authors



**Dr. Shahid Sami Siddique** gained varied experience after completing Ph.D. Zoology with specialization in Entomology. Immediately at postgraduation, he earned experience in the collection, preservation, and maintenance of hilly insect pests of vegetable crops. Later on, he also gained a diploma in Biodiversity conservation concerning biotic components of Ecology. He worked as a Research Associate in IPM in Uttaranchal Hills and completed our project successfully with Vivekananda Institute for Hill Agriculture (Indian Council of Agriculture Research), Almora, and Uttarakhand, Presently Dr Siddiqui working as an Assistant Professor in Govt. P. G. College, Rudrapur, U.S.N, Uttrakhand India. Dr. Siddique has 15 years of teaching and research experience he has published more than 20 research papers in Indian and international journals he has published 3 books on zoology and 1 book on genetics. He got national and international awards from different government institutions. Dr. Siddique has a patent. He is a member of different research associations like AZRA, BIOVED, SOMA, and the Journal of Experimental Zoology. Dr. Shahid Sami Siddique has been awarded by Young Scientist Award ICRAAHS 2016 New Delhi Young Scientist Award by BIOVED 2017, the Uttarakhand Achiever Award 2018 by MONAL Society Uttarakhand, the Environmental Science Award by Tribhuvan University Nepal 2019, etc. Dr. Shahid Sami Siddique is deputed currently as a state general manager minority Department government of Uttarakhand.



**Dr. Wajid Hasan, PhD PDF**, is devoted to research and extension activities in Agriculture Entomology. Dr Hasan is a Subject Matter Specialist in Entomology at KVK Jehanabad, Bihar Agricultural University in Bihar. He was awarded Dr DS Kothari UGC-Post Doctoral Fellow (PDF) in 2010, offered by the University Grant Commission of India. He holds a doctorate in Agricultural Entomology from GB Pant University of Agri & Tech, Pantnagar, UK, India. He has good terms with farmers, and he serves them as an adviser for plant protection measures. Dr Hasan has received eleven awards from several societies for his outstanding contribution to the relevant discipline. He has 68 research papers, 41 books, 67 book chapters, 42 popular articles, 140 success stories, 3 Practical Manuals, 16 success stories and 52 delivered lectures in different seminars/symposia/conferences/workshops and seven radio talks. Dr Hasan stayed as the chief organizer for eleven international conferences with more than three thousand participants each and managed a team of about three hundred co-organizers each. He has also organized 811 training programs for farmers, rural youth and agricultural professionals with 25411 participants. In addition, he has conducted three skill development training programs of 200 hours each and 49 On-Farm Trials (OFT). Dr Hasan has a lifetime membership in 6 scientific societies. He is the Editor-in-Chief of the International Journal of Agricultural and Applied Sciences (IJAAS) and an Editorial board member for 5 scientific International Journals.



**Dr. Rudra P. Singh** has a 19-year-long career dedicated to the implementation of different programs/schemes for the transfer of agriculture technology among farmers in India. He served in many organizations with different capacities viz., Joint Director (Extension) in Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & FW, Govt. of India; District Project



Coordinator in Uttar Pradesh Diversified Agriculture Support Project (UPDASP) (funded by Rashtriya Krishi Vikas Yojana, Govt. of India), Govt. of Uttar Pradesh. Dr Singh had his education in India with B.Sc. (Agric.) from Udai Pratap College (Autonomous), Varanasi (U.P.) and M.Sc. (Entomology) & Ph.D. (Entomology) from N.D. University of Agric. & Tech, Faizabad (U.P.). After securing the highest marks in M.Sc. (Ag.), he was awarded gold medal and cleared the National Eligibility Test (NET) conducted by ICAR, New Delhi. Dr. Singh, an outstanding Plant Protection Scientist, has disseminated systematic scientific information on the judicious use of pesticides especially of plant origin has important implications for improving crop productivity in terms of both yield and quality and environmental benefits by reducing pesticide load. He has presented many papers at several national conferences/symposia. He is also life member of many societies. He had performed many duties as deputed by the University and was actively involved in teaching students, question paper setting, evaluation/ assessment of answer scripts of U.P. Board, Allahabad, and other examinations. His innovative research has resulted in more than 84 publications in international and national journals, bulletins, manuals, book chapters, scientific reviews, conference proceedings, and technology-transfer papers. Dr. Singh is the author of two books, published by LAP Lambert Academic Press, Germany. He has served as Editor & Associate Editor of many reputed magazines and journals. He has completed 05 ad-hoc research projects as sponsored by ICAR & DBT Principal Investigator and Co-Principal Investigator. Dr. Singh is a highly decorated Agricultural Scientist with several coveted awards, honors, appreciations, and recognitions.



**Dr. Milind D. Joshi**, Subject Matter Specialist (Plant Protection), Agricultural Development Trust's Krishi Vigyan Kendra, Baramati, has more than 15 years of experience in research and extension. He has a Ph.D. in Agricultural Entomology. He has been awarded 8 various state & national-level awards for his contribution to the field of agriculture. He has visited 6 countries viz. The Netherlands, Turkey, Belgium, France, Spain & Indonesia for exposure. He is also the Editorial Member for various journals and magazines. He is also the Technical Committee Member and Advisor for various organizations. He has attended more than 31 seminars, conferences, and workshops and about 19 trainings, summer schools and winter schools. He has published over 35 professional research papers in International and National refereed Journals in agriculture. He also has more than 50 popular articles and about 30 radio talks for the benefit of the farming community. He is the Principal Investigator for the ICAR-funded Project on All India Coordinated Research Project on Honey Bee & Pollinators for Maharashtra State. He also has been the Principal Investigator for DBT and other projects of government & private funding.



**Dr. Asutosh Kumar Srivastava** has a D.Phil. in Zoology from Allahabad Central University presently serving as an Assistant Professor and Head (In-charge) in the Zoology Department at Dr Shyama Prasad Mukherjee Government Degree College Bhadohi UP. He is a passionate teacher having more than 15 years of teaching experience. He has published more than a dozen research papers in journals of International and National repute and in Proceedings and Edited books. Dr Srivastava has published books for the students of undergraduate classes.



**Dr. Syed Abuzar Ph.D; RAC**, possesses a distinguished career spanning 18 years in agricultural sciences, with expertise in Plant Pathology, Nematology, Biocontrol Agents, and Integrated Pest Management (IPM) in Agriculture. Currently serving as the Head of Regulatory Affairs & Registrations-Asia Pacific at Rovensa Group, based in Malaysia, he has previously held roles at prestigious institutions such as ICAR, DBT, and UGC, contributing significantly to various projects. Dr. Syed has been honored with multiple awards from esteemed scientific societies, recognizing his substantial contributions to the field and his advocacy for the farming community. He actively engages as a reviewer for numerous reputable national and international journals, leveraging his expertise to advance scholarly discourse. Additionally, he maintains active membership in several global scientific communities, including the American Chemical Society, (ACS) USA, and the Regulatory Affairs Professional Society (RAPS) UK, further demonstrating his commitment to advancing scientific knowledge and regulatory practices.



**Dr. Md. Humayoon Akhtar** presently is working as an Assistant Professor & Head, Department of Zoology, Koshi College, Khagaria, Munger University, Munger, Bihar. He has completed his Ph.D. in Zoology with Entomology as specialization from Aligarh Muslim University, Aligarh, Uttar Pradesh, India. His expertise is in the field of agriculture entomology and biocontrol and worked as Research Fellow at Indian Institute of Pulses Research, Kanpur and G.B. Pant University of Agriculture and Technology. He has published many research papers, book chapters in various national and international reputed journals and books. He is a life member of Institute of Scholars, Bangalore and Trends in biosciences journal, Kanpur.

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**I. Course Title: Concepts of Integrated Pest Management**

**II. Course Code: ENT 508**

**III. Credit Hours: 2 (2+0)**

**THEORY**

**Unit I**

History, origin, definition, and evolution of various terminologies. Importance of resistance, principles, classification, components, types, and mechanisms of resistance. National and international level crop protection organizations; insecticide regulatory bodies; synthetic insecticide, bio-pesticide, and pheromone registration procedures; label claim of pesticides – the pros and cons.

**Unit II**

Concept and philosophy, ecological principles, economic threshold concept, and economic consideration. Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects.

**Unit III**

Tools of pest management and their integration- legislative, quarantine regulations, cultural, physical, and mechanical methods; semiochemicals, biotechnological and bio-rational approaches in IPM. Pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys; political, social, and legal implications of IPM; pest risk analysis; pesticide risk analysis; cost-benefit ratios and partial budgeting; and case studies of successful IPM programs. ITK-s in IPM, area-wide IPM, and IPM for organic farming; components of ecological engineering with successful examples.

**Unit IV**

Characterization of agro-ecosystems; sampling methods and factors affecting sampling; population estimation methods; crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses; global and Indian scenario of crop losses. Computation of EIL and ETL; crop modeling; designing and implementing IPM system. Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and the world.

## ABOUT THE BOOK

Integrated Pest Management (IPM) is a crucial approach in agriculture, aiming for sustainable pest control while protecting the environment and ensuring economic success. This book provides a thorough understanding of IPM principles and practices. It explores the history of IPM and essential concepts, including the significance of resistance in pest control. Additionally, it discusses the regulations governing pesticide use and registration. The book delves into the philosophy behind IPM, focusing on ecological principles and economic thresholds. It also examines how insects interact with host plants. Various tools and methods used in IPM are explored, including legislation, cultural practices, and biological interventions. It also covers surveillance techniques and the social and legal aspects of IPM. Practical aspects of implementing IPM strategies are discussed, such as characterizing agroecosystems and assessing crop losses. Breeding techniques for insect-resistant crops are also examined. This book is an essential resource for anyone involved in pest management in agriculture, offering practical insights and guidance.



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