

Sterile Insect Technique

Principles and Practice in Area-Wide Integrated Pest Management

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About this Book

The sterile insect technique (SIT) is an environment-friendly method of pest control that integrates well into area-wide integrated pest management (AW-IPM) programmes. A first of its kind, this book takes a generic, thematic, comprehensive, and global approach in describing the principles and practice of the SIT. The strengths and weaknesses, and successes and failures, of the SIT are evaluated openly and fairly from a scientific perspective. The SIT is applicable to some major pests of plant, animal and human health importance, and criteria are provided to guide in the selection of pests appropriate for the SIT.

This technology, using radiation to sterilize insects, was first developed in the USA, and is currently applied on six continents. For four decades it has been a major subject for research and development in the Joint FAO/IAEA Programme on Nuclear Techniques in Food and Agriculture, involving both research and the transfer of this technology to Member States so that they can benefit from improved plant, animal and human health, cleaner environments, increased production of plants and animals in agricultural systems, and accelerated economic development.

A great variety of subjects are covered, from the history of the SIT to improved prospects for its future application. The major chapters discuss the principles, technical components, and application of sterile insects. The four main strategic options in using the SIT — suppression, containment, prevention, and eradication — with examples of each option, are described in detail. Other chapters deal with supportive technologies, economic, environmental, and management considerations, and the socio-economic impact of AW-IPM programmes that integrate the SIT. The 28 chapters were all peer reviewed before final editing.

This book provides a wealth of information and reference material never before available in one volume. It will be a standard reference on the subject for many years. The 50 authors, from 19 countries, are highly experienced in the subject, and reflect the international character of SIT activities.

Since no university offers courses on the SIT, the book's audience will be mainly students in general animal and plant health courses, but the in-depth reviews of all aspects of the SIT and its integration into AW-IPM programmes will be of great value to teachers, researchers, animal and plant health practitioners, and policy makers.

From the Introductory Remarks

As evidenced by the successful area-wide insect pest control programmes described in this book, the sterile insect technique (SIT), a component of these programmes, has come of age. The technology has expanded rapidly — additional target species, new rearing techniques, studies on genetics and insect behaviour, and especially integration into operational area-wide integrated pest management (AW-IPM) programmes. The SIT has matured to the point where a critical overview of its principles and practice will greatly facilitate further research, development, and application in the field.

The SIT was among the first biological insect control methods designed for area-wide application. While the SIT gained its reputation in insect eradication programmes, it is essential that the scientific community now recognizes its potential as a part of IPM strategies for the area-wide suppression, containment, prevention and, where advisable, eradication of pests.

Insect control methods in the first 70 years of the 20th century were based largely on chemical insecticides; this was especially so after the Second World War with the introduction of synthetic

insecticides. The concept of IPM became popular after 1970, and a more selective use of insecticides was emphasized. Attempts to significantly reduce insecticide applications have only gradually become more prominent. Biological control of pest insects, together with the breeding of insect-tolerant or resistant plants, is probably now receiving the major emphasis in IPM programmes. According to an international standard under the International Plant Protection Convention (IPPC), the SIT is now officially considered as one type of biological control, and it is ideally suited for incorporation into AW-IPM programmes.

The scientific underpinning of SIT programmes has broadened as new areas of science have developed, e.g. insect mass production and quality, geographic information systems and data management systems, genetics and molecular biology, insect behaviour, aerial release of sterile insects, and modelling of AW-IPM. The practical success of a programme incorporating the SIT requires a holistic and multidisciplinary approach, and effective management, since in the last analysis programmes must produce substantial economic benefits. This is clearly evident in the major successes using the SIT against screwworms, fruit flies, and moths.

In spite of documented successes, many colleagues in the scientific community are partially or inadequately informed on the application and importance of this powerful addition to the biological weapons that can be used against insect pests that are economically important or a threat to human health. The credibility and impact of the technology needs to be described in an objective, comprehensive, and balanced fashion, and in an accessible format. New insect pest problems, new restrictive legislation, as well as older problems such as insecticide resistance and maximum residue levels, require new solutions. There is a real need, and an increasing demand, for information on the SIT so that its potential for addressing some of these problems can be assessed.

The chapters have been written by well-known experts on the SIT and other technologies that are integrated into IPM systems. A “first” in its field and worldwide in scope, this book will provide an in-depth resource for the whole range of documented scientific information about the SIT. The target audience of the book is the scientific community worldwide. It will assist animal health and plant protection practitioners, as well as students, teachers, and researchers, in understanding and applying the SIT. It is anticipated that the book will have a considerable impact on the science and practice of pest control systems.

Research workers new to this field have difficulty accessing the literature — it tends to be widely scattered in multiple publications (some with very limited distribution), in conference proceedings, and in unpublished programme reports. To further the science and application of the SIT, the accumulated knowledge and experience needs to be integrated and synthesized from a generic standpoint. The consolidation of comprehensive information into one volume, with references to the large amount of previous work, is long overdue. Such a consolidation will facilitate the application of the SIT to those pest problems for which it is appropriate. It will also lay the groundwork for future applications. The present book is uniquely designed to fill this gap. The strengths and weaknesses, and successes and failures, of the SIT have rarely been evaluated openly and fairly from a scientific perspective.

This is just the beginning. This book will help develop further the use of the SIT for pest suppression, and where advisable, eradication. It will be a gold mine for graduate students who want to learn about the history, accomplishments, problems, and promises of the SIT. As an “autocidal” biological control method, it fits into present-day concerns regarding human health and the environment. There is great potential for significant advances that will make the SIT more effective and economically viable, such as commercializing the different components, developing genetic sexing strains that permit the release of only males, treating sterile insects hormonally and semiochemically to increase their quality and competitiveness, releasing insects from improved aerial systems, and using modern biotechnology.

Table of Contents

Part I. Introduction. 1.1. History of the Sterile Insect Technique; W. Klassen, C.F. Curtis.

Part II. Principles of the Sterile Insect Technique. 2.1. Area-Wide Integrated Pest Management and the Sterile Insect Technique; W. Klassen. **2.2.** Biological Basis of the Sterile Insect Technique; D.R. Lance, D.O. McInnis. **2.3.** Genetic Basis of the Sterile Insect Technique; A.S. Robinson. **2.4.** Inherited

Sterility in Insects; J.E. Carpenter et al. **2.5.** Mathematical Models for the Use of Sterile Insects; H.J. Barclay.

Part III. Technical Components of the Sterile Insect Technique. **3.1.** Role of Population and Behavioural Ecology in the Sterile Insect Technique; Y. Itô, K. Yamamura. **3.2.** Mass-Rearing for Sterile Insect Release; A.G. Parker. **3.3.** Sterilizing Insects with Ionizing Radiation; A. Bakri et al. **3.4.** Sterile Insect Quality; C.O. Calkins, A.G. Parker. **3.5.** Sterile Insect Supply, Emergence, and Release; R.V. Dowell et al. **3.6.** Monitoring Sterile and Wild Insects in Area-Wide Integrated Pest Management Programmes; M.J.B. Vreysen. **3.7.** Procedures for Declaring Pest Free Status; H.J. Barclay et al.

Part IV. Supportive Technologies to improve the Sterile Insect Technique. **4.1.** Role of Population Genetics in the Sterile Insect Technique; E.S. Krafur. **4.2.** Population Suppression in Support of the Sterile Insect Technique; R.L. Mangan. **4.3.** Genetic Sexing Strains in Mediterranean Fruit Fly, an Example for Other Species Amenable to Large-Scale Rearing for the Sterile Insect Technique; G. Franz. **4.4.** Use of Geographic Information Systems and Spatial Analysis in Area-Wide Integrated Pest Management Programmes that Integrate the Sterile Insect Technique; J.St.H. Cox, M.J.B. Vreysen.

Part V. Economic, Environmental, and Management Considerations. **5.1.** Application of Benefit/Cost Analysis to Insect Pest Control Using the Sterile Insect Technique; J.D. Mumford. **5.2.** Environment and the Sterile Insect Technique; P. Nagel, R. Peveling. **5.3.** Management of Area-Wide Integrated Pest Management Programmes that Integrate the Sterile Insect Technique; V.A. Dyck et al. **5.4.** Public Relations and Political Support in Area-Wide Integrated Pest Management Programmes that Integrate the Sterile Insect Technique; V.A. Dyck et al.

Part VI. Application of the Sterile Insect Technique. **6.1.** Strategic Options in Using Sterile Insects for Area-Wide Integrated Pest Management; J. Hendrichs et al. **6.2.** Misconceptions and Constraints; M. Whitten, R. Mahon.

Part VII. Impact of Area-Wide Integrated Pest Management Programmes that integrate the Sterile Insect Technique. **7.1.** Impact of Screwworm Eradication Programmes Using the Sterile Insect Technique; M. Vargas-Terán et al. **7.2.** Impact of Fruit Fly Control Programmes Using the Sterile Insect Technique; W.R. Enkerlin. **7.3.** Impact of Moth Suppression/Eradiation Programmes Using the Sterile Insect Technique or Inherited Sterility; K.A. Bloem et al. **7.4.** Potential Impact of Tsetse Fly Control Involving the Sterile Insect Technique; U. Feldmann et al.

Part VIII. Future Development of the Sterile Insect Technique. **8.1.** Prospects for the Future Development and Application of the Sterile Insect Technique; A.S. Robinson, J. Hendrichs.

Author Index. Subject Index.