

International Journal of the Faculty of Agriculture and Biology,
Warsaw University of Life Sciences, Poland

BOOK REVIEWS

HANDBOOK OF PRECISION AGRICULTURE - PRINCIPLES AND APPLICATIONS edited by Ancha Srinivasan. Food Product Press, an imprint of The Haworth Press, Inc. New York. Published in 2006, (soft cover), price \$89.95, 684 pp., ISBN-13: 978-1-56022-955-1.

PRECISION AGRICULTURE by Terry A. Brase. Thomson Delmar Learning, New York, USA. Published in 2006, (hardcover), price \$69.95, 224 pp., ISBN 10: 1-4018-8105-X.

PRECISION AGRICULTURE '05 edited by John V. Stafford. Wageningen Academic Publishers, Wageningen, The Netherlands. Published in 2005, (hardcover), price \$165, 1005 pp., ISBN-13: 978-90-76998-69-8.

Precision agriculture (PA) is a term, which has recently become very popular in agronomy. In short this term means crop production based on site-specific crop management (SSCM). Precision agriculture is an integrated agricultural management system incorporating different science disciplines e.g. crop science, agricultural engineering and geostatistics. It also uses numerous tools i.e., geographic information system (GIS), Global Positioning System (GPS), remote sensing yield monitors. Because of the multidisciplinary character of precision agriculture, books published on this subject differ in their content. The first books on this topic appeared in the mid 90' of the last century.

The intention of this paper is to present reviews of three books the titles of which each contains the term "precision agriculture". The books are as follows:

- 1) Handbook of Precision Agriculture - Principles and Applications (2006) edited by Ancha Srinivasan.
- 2) Precision Agriculture'05 (2005) edited by John V. Stafford
- 3) Precision Agriculture (2006) by Terry A. Brasse.

Handbook of Precision Agriculture - Principles and Applications edited by Ancha Srinivasan. Food Product Press, an imprint of The Haworth Press, Inc. New York. Published in 2006, (soft cover), price \$89.95, 684 pp., ISBN-13: 978-1-56022-955-1.

This book is a comprehensive source of information on the present state of precision agriculture. Fifty authors from around the world wrote it and its chapters were peer-reviewed by more than 100 reviewers.

This handbook is divided into 22 chapters, which are grouped in three parts as follows:

- I. Principles, technologies and management issues
- II. Applications in crops and cropping systems
- III. Current status

The first part of the book provides general information on precision agriculture and principles, which are important in crop production while using PA technologies.

The first chapter "Precision agriculture: an overview" was written by the editor Ancha Srinivasan. It is an essential part of the book because it presents elements of the whole process of crop management in precision agriculture and tools for implementation of PA. It provides a good introduction to subsequent chapters, especially for readers who are not familiar with PA. The second chapter "The role of technology in the emergence and current status of precision agriculture" was written by John V. Stafford, a world foremost authority on PA. The chapter covers aspects of history and development of PA technology and describes the tools (e.g. GPS, sensors) needed for PA implementation. The remaining chapters (3-9) deal with technologies used in PA. The reader is introduced to principles of site-specific nutrient, water, weed, disease, pest and grain quality management.

One of the most important of these chapters is chapter 4 "Site-specific nutrient management: objectives, current status, and future research needs" (p. 91-151). This chapter provides information sources in PA (e.g. field sampling, remote sensing) related to spatial variability of soil and plant properties in the field. Further, use of the information for optimal fertilization is described. Presentation of economic, ecological and social aspects of site-specific nutrient management (SSNM) definitively adds value to the whole chapter. It is because often novices in PA ask questions which refer to the above aspects of PA.

The second part of the book "Applications in crops and cropping systems" contains 7 further chapters (10-16). Six of them give information on the incorporation of PA technology in the production of particular crops (rice, corn and soybean, cotton, potatoes, sugar beet and grapes).

Different authors wrote each chapter and the arrangement and content of the presentations is variable. Each of these chapters gives information on soil management, plant field spatial variability and site-specific techniques for particular crops. These examples of PA applications come from field experiments conducted at different locations in the world. All chapters end by describing the opportunities and limitations of PA technology implementation and the future research needs for the specific crop. The final chapter in the second part of the book "Site-specific management from a cropping system perspective" provides possible explanations of yield variability in fields. Introduction of the most important factors causing yield variability and solutions for its management make the book more practical.

The third part of the book "Current status" gives the status of adoption of PA on different continents including some countries. This part is divided into the six following chapters: Africa, Asia, Australia, Europe, Argentina, and Brazil. Most of the chapters give information on the history, research programs, current status, constraints in implementation of PA, and future prospects.

Unfortunately there is a lack of information on the current status of PA in North America, especially in the United States, the birthplace of precision agriculture and from where PA technologies have spread.

The layout of the book text is generally very good. But a small disadvantage is the different approach of the authors to the topics they describe. For example in the chapters which, deal with site-specific crop protection methods (e.g. site-specific weed management; site-specific management of crop diseases) the sections are organized differently. Repetition of similar information in several chapters leads to the conclusion that the reviewers work was not coordinated well enough. The book is printed in black and white, but in the middle

of the book there is a supplement with 18 pages of colorful photos, maps and diagrams what give readers a better perception of the information.

This book is destined for readers who are crop scientists, agriculture students, farmers and others who are interested in the practical application of PA. The up-to-date information it provides will be useful to people who want to start to learn about PA technology as well as those who already have experience in PA.

Precision Agriculture by Terry A. Brase. Thomson Delmar Learning, New York, USA. Published in 2006, (hardcover), price \$69.95, 224 pp., ISBN 10: 1-4018-8105-X.

The author of this book is an Associate Professor at Kirkwood Community College (Department of Agriculture Science) where he teaches a number of courses connected with spatial analysis. Most of the book's content was probably based on the author's knowledge and educational experience as the "Reference" section includes only 8 references, almost all related to GIS and spatial analysis.

This book is divided into 9 chapters. The first chapter "Introduction" discusses the definition of precision agriculture; important tools, which are required for implementation of PA (GPS, GIS, sensors and controllers, remote sensing) and processes for decision making in PA. The second chapter "Basics of a GIS" presents the elements of GIS (i.e. spatial data, hardware, software and personnel) and its functions for data acquisition, storage, spatial analyses and interpretation. This chapter gives an example of ArcGIS software application in precision agriculture. In chapter 3 "Basic map principles" the author gives information on the basics of cartography (e.g. coordinate systems, projections, datum, scales) and describes two basic types of thematic maps, which can be used in agriculture (i.e. choropleth and isoline maps). In chapter 4 "Basic statistics" the most common statistical terms such as variables and data types are defined. A short introduction to sampling and some of the statistical methods, which are useful for agricultural data analysis (e.g. descriptive statistics, correlation and regression, basics of hypothesis testing) are covered.

Chapter 5 "Data structure" gives a description of the two main data formats used in GIS software, i.e. vector and raster data. Possible data sources, their data formats and the advantages and disadvantages are also presented. Chapter 6 "Analysis and manipulation tools" gives the basics of spatial data analysis. Variable ArcGIS software tools are also presented here and show how the reader can summarize and prepare spatial data for further interpretation. Chapter 7 is a continuation of the previous one. Additional techniques such as: histograms, charts, normalization, reclassification, neighborhood statistics and modeling are discussed; an understanding of them may help the reader to summarize information and create an interpretive map. Chapter "Interpretive maps" presents methods for obtaining maps, which summarize all the data, which has been gathered and processed. The methods are based on spatial and temporal analysis of different data types. Interpretative maps, included in this chapter, are the final product of the whole data processing procedure. These, after conversion to application maps, are given as an example of input data for variable hardware used for optimization of fertilization.

Chapter 9 "Issues and concerns" presents possibilities and obstacles for the use of PA techniques (e.g. variable rate application) in practice.

The book ends with a glossary, which contains more than 100 terms specific to PA, GIS and spatial data analysis, and an index, which indicates the pages where specific terms are most often used.

This book is not a handbook of PA, but is a book on GIS software use and spatial analyses in PA. It presents a very important aspect of PA but it is not as comprehensive as the "Handbook of Precision Agriculture" edited by A. Srinivasan. A more appropriate title of the Terry A. Brase's book would be "Spatial analysis in precision agriculture". However, this book could be a good introduction to PA and may serve as a supplement to A. Srinivasan's

book since it gives a basis for understanding PA research and interpretation. All examples in Terry A. Brase's book are based on the use of ArcGIS software; this can be a disadvantage for users of different GIS software. This book is destined mainly for agriculture students who want to learn basics of GIS and spatial analysis for PA purposes. Each chapter, except chapters 8 and 9, ends with a subsection "Chapter review". This facilitates the use of this book for educational purposes, especially for self-study. A clear introduction to each chapter and colorful figures make the content of the book accessible prospective, or not advanced readers on PA aspects.

Precision Agriculture '05 edited by John V. Stafford. Wageningen Academic Publishers, Wageningen, The Netherlands. Published in 2005, (hardcover), price \$165, 1005 pp., ISBN-13: 978-90-76998-69-8.

This book contains papers, which were presented at the 5th European Conference on Precision Agriculture, held in Uppsala, Sweden in 2005. Therefore it is not a handbook but a collection of more than 100 peer-reviewed papers, organized thematically, which cover a wide range topics on PA (e.g. crop science, technology for PA, spatial plant and soil variability).

The papers are grouped into 9 chapters. The 1st chapter "Keynotes" contains 5 papers, which prove that PA is a crop management system, which demands multi-disciplinary research for its implementation into practice. Papers 1 to 4 are review or research papers and the 5th paper, entitled "Precision agriculture: a Western Australian perspective" is an example of implementation of PA technology. It shows how PA can be used on large farms. Chapter 2 "Spatial variability in weeds and pests" groups papers, which deal with site-specific crop protection problems in PA. The papers present various methods based on remote sensing and sampling and used for evaluation of fungal infection and weed infestation and their control in the field.

Chapter "Spatial variability in crops" contains more than 20 papers, which discuss the evaluation of crop spatial and temporal variability. The authors present different approaches based on remote sensing and on-the-go sensors (e.g. NIR spectroscopy, NDVI readings, fluorescence sensing), which allow measurement of spatial variability of plant growth, development and stress. This chapter contains a section "Yield and quality" (6 papers) which give information on methods used to measure field spatial variability of yield and its quality (e.g. grain protein content).

The next chapter "Spatial variability in soils" contains 16 papers in 2 sections: "Soil variability" and "Soil sensors". These papers present methods, which allow the user to investigate soil spatial and temporal variability. The methods are based on on-the-go soil sensors used for evaluation of soil physical and chemical properties (e.g. pH, EC, bulk density).

Chapter 5 "Technology for precision agriculture" (25 papers in 5 sections). The broadest section is "Guidance, autosteer and robotics (9 papers) and give the message that most of the navigation systems and agricultural robotics described in these papers were integrated with different kinds of GPS receivers. Many of the papers indicate that agricultural robotics will be the future of mechanization. The section in this chapter - "Variable rate application" shows technical problems connected with variable rate technology (VRT). Five papers present different technical solution for precise fertilization, sowing and spraying. The final section in this chapter - "Spatial analysis and mapping" (7 papers) considers spatial data analysis. Different methods, including spatial multivariate statistical methods used in the analysis of agricultural data are described.

Chapter 6 "Management" has 15 papers in 2 sections. The first section "Soil - and crop modeling" contains papers, which present different simulation models. Methods of modeling based on different types of spatial data are introduced. The second section of the

chapter "Site-specific management and decision support systems" (9 papers) covers the aspect of crop management optimization problems. Various optimization methods of variable rate application of fertilizers, delineation of management zones and support systems are presented.

Chapter 7 "Precision viticulture" (7 papers) is devoted to applications of PA techniques in vineyards. The chapter deals with specific problems of precision viticulture (e.g. delineation of management zones, yield maps).

In chapter 8 "Precision irrigation" (3 papers) presents possibilities for water conservation and optimal irrigation.

Chapter 9 "Economic and environmental effects of precision agriculture" (3 papers) considers the economical efficiency and environmental advantages of implementation of PA in practice.

At the end of the book there are an: "Authors index", which contains nearly 300 paper author's names and a "Keyword index" which lists words and phrases referring to PA.

The high number of papers grouped in as a conference proceedings did not impede the flow of the book content for a reader familiar with PA. Moreover, its good structure makes it a comprehensive and a clear source of multi-disciplinary information on precision agriculture. Many respected authors and paper reviewers have created a well-organized book, which is a great source of information for researchers interested in PA. However, papers, without a strong connection between them grouped in a chapter could be seen as a disadvantage of this book, especially for readers who are not well acquainted with PA problems. Therefore, we conclude that this book is mainly destined for professionals, especially researchers and teachers who are already engaged in topics relating to PA.

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