S. C. PANDA

Crop Management and Integrated Farming

CROP MANAGEMENT AND INTEGRATED FARMING

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AT THE FEET OF
LORD SHREE JAGANNATH,
PURI, ORISSA

DEDICATED TO MY
FATHER, SHYAM SUNDAR PANDA
AND MOTHER, SHNEHALATA PANDA

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FOREWORD

The pressure of an ever increasing population and periodic famine due to unexpected flood and drought have forced and awakened the agricultural scientists of India to evolve new plant types and to develop a suitable production technology for such high input responsive crop plants. The last two decades had been an era of real revolution in agriculture, especially in the field of crop production which has brought a spectacular change in the existing cropping system in various agro-climatic zones of the country. The breakthrough in crop yields has made our nation self-sufficient in food grains and even some quantity of these grains is being exported to other needy countries. Thus, the modern technology has changed us from net importer to exporter of the food grains. The Indian farmers have shown a surprising dynamism, adaptability and progressiveness in accepting the recent crop production technology and predominant subsistence farming is being changed into an enthusiastic enterprise however, it lacks perfection. Moreover, even today the national average yield of various crops is miserably poor and incomparable to that obtained in other counties. Transfer of technology from research level to the farmers had been probably the major hurdle in achieving the targeted yield. Illiteracy and ignorance of our poor farmers are creating hindrance for new plant types to express their full yield potential when grown under faulty management in the field. Higher input levels, faulty planning coupled with poor marketing facilities often result in a marginal profit from farming due to which majority of marginal and sub-marginal farmers are obviously discouraged.

The technology of crop production is a vastly developing subject. In recent years, there has been such rapid progress in the research efforts in this branch in many of the developing countries of the world that has become difficult to keep pace with the subject. This is particularly true in the tropical regions of the world and in the Indian sub-continent. The students of Agronomy in the Agricultural Colleges need to be taught the latest technology so as to make them effective as extension workers as also to train them for becoming competent teachers and researchers. A comprehensive treatise on crop production would not only help the students but also the teachers in the Agricultural Colleges. In modern agricultural technology 'management' forms an essential part. If agriculture were to compete with other small and medium scale industries in rural areas, there should be

proper management of the natural resources and the various inputs which go with it. Unfortunately, this aspect is mostly neglected in Indian agriculture.

Besides, the modern production technologies with high input requirement offers on tangible solution to the small and medium farmers' problem of low income and low productivity from cropping. To meet the growing demands, to solve small and medium farmers' problems and to achieve the targeted production levels with stability, ecological sustainability and equitability in the 21st century, a viable technology called 'Integrated Farming System Approach' suited to varied farm situations and agro-climatic conditions seem to be the answer. The farming system approach incorporated in this book has taken due importance through recycling of no cost/low cost material of one enterprise as input on the other enterprise thus achieving great reduction in the cost of cultivation. Agronomists have made efforts to develop low-cost farming systems based on the principles of productive utilization of farm wastes and available resources with restricted use of purchased inputs.

Farming Systems represent integration of farm enterprises as cropping systems, animal husbandry, fisheries, poultry farming, etc. for optimal utilization of resources bringing prosperity to the farmers. A judicious mix of cropping systems with associated enterprises like dairy, poultry, piggery, fishery, sericulture, etc. suited to the given agro-climatic conditions and socio-economic status of farmers would bring prosperity to the farmer.

The text-cum-reference book to meet precisely the felt need is an outcome of the author's active involvement in teaching, research and extension guidance in the field of agronomy for over thirty years. The author presented the book entitled, **"Crop Management and Integrated Farming"** in a scientific and systematic manner to understand the fundamentals clearly and easily which is the beauty of this book. I believe that this book will be very useful to the undergraduate and postgraduate students in agriculture, teachers in agricultural institutions and those who are interested in the subject. The book is divided into twenty-one chapters and covers comprehensively the content of the courses of crop management and integrated farming in agronomy for undergraduate and post graduate students of Agricultural Universities in the country. The chapters have been arranged in such a manner as to lead the students through the entire gamut of Agronomy.

I am confident that this book will serve as a text book for agronomy and veterinary students, a reference for research scientists and teachers in the areas of crop production, integrated farming systems, dry land agriculture, cropping systems, production technology management under different situations, soil fertility management, water management, weed management, nutrient management, and avian and animal sciences. This book will also serve as a guide to the extension officials of the department of agriculture. I congratulate Dr. S. C. Panda for his pains taking effort in bringing out this book covering comprehensively the content of all courses in agronomy offered for U.G. and P.G. students of the agricultural universities in the country and the latest technologies for crop production associated with integrated enterprises in farming systems to meet the growing interest in sustainable agriculture. I am confident that this book will be widely accepted among the students. I extend my best wishes to Dr. Sharat Chandra Panda for the success of this book.

Bhubaneswar **Dr. Bhagabat Panda**
Date. 5. 1. 2006

PREFACE

Agriculture has been a mainstay of human being since time immemorial. Agriculture in any form has been practiced in those areas where men have been living permanently. They have been restrained from plundering and/or indiscriminate hunting rather domesticated a number of facultative organisms. They have been utilizing their diligence and intelligence to integrate natural germplasms of plants and animals with natural resources like land, light, air and other biotic and abiotic factors of production to produce usable products directly or after processing by their own muscle power or any aid found in nature or developed by them for ease, cheap and swiftness.

Agricultural development is multidirectional having galloping speed and rapid spread with respect to time and space. After the introduction of modern varieties of various durations with improved plant types along with improvement of input resources, farmers started using improved cultural practices in intensive cropping systems with labour-intensive programmes to improve production potential per unit land, time and input. A large number of alternate genotypes are available to the farmers. Agronomists provided suitable environment to these genotypes to foster them and to manifest their yield potential in newer areas and seasons.

Dealing with various types of soils and climatic conditions is a pre-requisite to grow crops. Understanding of relationships between crop plants and natural and manmade factors of production is a guideline to provide better environment to crop plants and to increase use-efficiency of these factors. A wide spectrum knowledge of soil, water, nutrients, weeds etc. helps to manage them efficiently in favour of crop production for years. A comprehensive idea on seeds and their handling, sowing and planting of different crop varieties under different agro-climatic conditions, cropping pattern and cropping systems helps to raise crops together or one after another considering prevailing conditions and available facilities.

Modern concept on improved cropping system is found to be successful in shifting the direction of agricultural practices from crop oriented one to system oriented approach. Modern agro-techniques on crop production, protection and preservation have opened the opportunities to absorb, adapt and apply new knowledge and technology to the farmers. Recently introduced methods of cropping also approach diversified farming systems with components complementary to each other. Non-traditional crops with respect to zone and season showed their promise. All these have declined the earlier traditional agriculture and established the scientific agribusiness.

India, with one of the biggest scientific manpower of the world, made a spectacular increase in its food grains production, after independence, especially after late sixties, when the country ushered into the world famous **'Green Revolution'.** The Green Revolution is manifested of the advances made in the agricultural sciences and can be summed up in three words, (1) seeds (High yielding Varieties), (2) water, and (3) fertilizers. The management of the last two factors of production, with a view to achieving the production potential of the first, i.e., High yielding varieties (seeds) is exclusively an agronomic domain.

The future of Indian agriculture depends on the development of appropriate farming system as applicable to resource poor farm families and as suited to different agro-ecological zones. Restricting the use of purchased inputs in farming could be achieved through multiple cropping and diversified farming including animal husbandry, forestry, dairy, duckery, fisheries, apiary, sericulture, etc. The demand must be met from limited resources such as land, water, energy and labour. Increasing food supplies with limited natural resources is a great challenge to the scientific communities. Under this situation, Integrated Farming System (IFS) seems to be the answer, considering the current scenario in agriculture in India. Besides, facilitating cash income and increased employment opportunities, Integrated Farming Systems minimize the quantum of purchased inputs in farming by effective recycling of products and by-products among the component enterprises, reduce the ill effects of inorganic fertilizers and chemicals (pesticides, herbicides etc.) or pollution hazards. Integrated farming system is not only a reliable way of obtaining fairly high productivity with substantial fertilizer economy, but also a concept of ecological soundness leading to sustainable agriculture.

Integrated farming system will generate appreciable employment potentialities providing more man-days in a year. Even for the educated person's particularly agricultural graduates, such farming systems are likely to be more profitable than white collar jobs thus partially reducing the job demands by the graduates. As a whole, such system will increase production of agriculture in the state, particularly, fruits, vegetables and produce from dairy, poultry, duckery and fishery which are of very much shortage in the state.

At present, there is no comprehensive text book on **'Crop Management and Integrated Farming'** and applied aspects suitable for farmers. This book will provide comprehensive information on the subject matter and fulfil the needs of students and other professionals. This is a book containing all sorts of valuable information in twenty-one chapters on crop management and integrated farming. Though this book primarily written to serve as a text book/reference for the students of agriculture in under graduate and post graduate levels and technologists in developing organizations, it is hoped that this book will be valuable for similar groups in the third world countries of Asia and Africa. This book also serves as a valuable reference for the candidates preparing Agricultural Research Services and other competitive examinations. Professional Institutions in Soil Conservation, Krishi Vigyna Kendras and Rural Institutions and similar other Institutions would find this book very much helpful. The farmers may refer this book to practice integrated farming and cropping systems as the considerable emphasis is placed for obtaining maximum, profitable production per unit area per unit time.

The author acknowledges his indebtedness to authors of books from which most of the material in the text has been drawn. In several cases, it has not been possible to obtain permission for reproduction for which the author and publishers offer their sincere apologies.

The author is deeply indebted to ICAR for its assistance provided at various levels for preparing the manuscript. Special mention is made for the valuable help received from Sri K.C. Sahoo, Research Fellow of the Emeritus Scientist Project, OUAT, Bhubaneswar.

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In preparing this book, I have received helps, suggestions and encouragements from Dr. B. C. Nayak, Dean, College of Agriculture; Dr. P. K. Mahapatra,, Professor and Head, Agronomy; Dr. L. M. Garnayak, Associate Professor, Agronomy and other staff members of the Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar. I am grateful to all of them who communicated the encouraging comments regarding the text and constructing suggestions for the improvement of the book.

I express my profound love and affection to my wife Mrs Kalpana Panda and son Ar. Mrutyunjay Panda, Architect for their immense help in preparing this manuscript.

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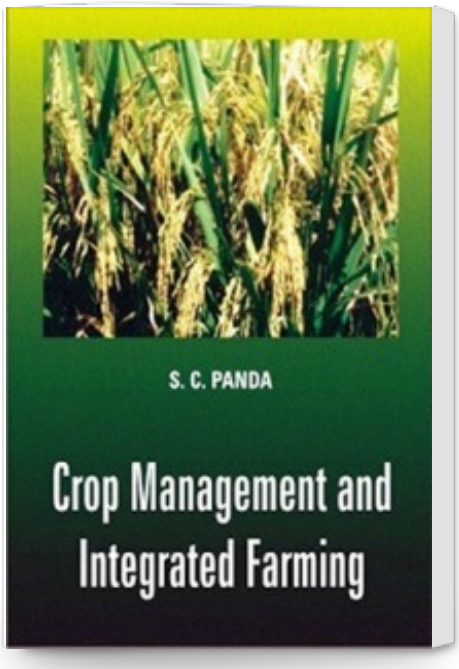

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