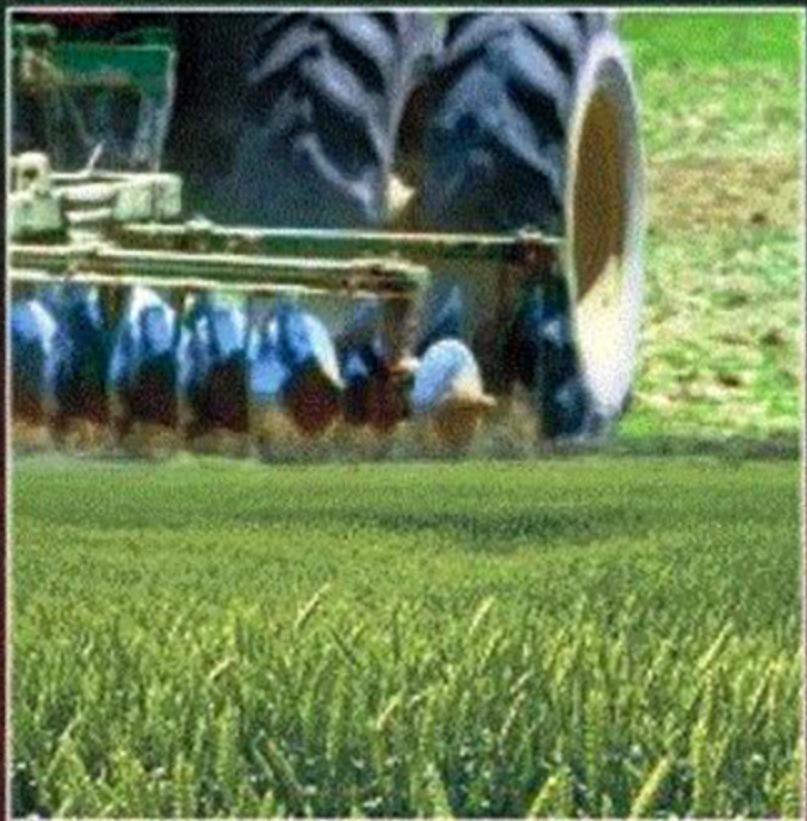


CROP PRODUCTION AND TILLAGE



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FOREWORD

Agriculture is the oldest and most important avocation of the world. The human society is dependent upon agriculture for its food, clothing and shelter. At certain stages of human development it is used to be the only known means of living. Even to-day, in the highly developed industrial countries, agriculture plays a major role as the supplier of raw materials for industries and commerce apart from its basic role in supplying food, clothing and shelter. Therefore, the welfare of a state to a large extent is dependent upon the prosperity of its agriculture. Agriculture includes science of crop and animal husbandry, horticulture, dairy, forestry, fishery, etc. Agronomy deals with the principles and practices of field crop production. In the management of field along with the soils and crops, the science of biology, chemistry, physics, economics, engineering, etc., are made use of. Thus, for better management of crop production, knowledge of such allied sciences is found necessary.

National progress is dependent upon the rapid development of agriculture. Agricultural production is mainly dependent upon the maintenance and improvement of soil productivity. Farmers should be educated to use lands according to their capability and to adopt proper soil conservation measures. The students of agriculture today, will be the architects of the agricultural development of the country, in future they will serve the agricultural departments of the different

states of India. They must therefore, be well trained in different agricultural subjects especially, soil science, agronomic aspects of soil water conservation, tillage and farming.

Quite a variety of implements and machinery is required for carrying out various agricultural operations, starting from opening of the land to harvesting, threshing, winnowing, and storage. These operations include ploughing, harrowing, leveling, sowing, inter-cultivation, application of fertilizer and manure, harvesting, threshing, and winnowing. India is a big sub-continent and a variety of indigenous or *desi* implements are in use in different parts of the country for the last so many centuries. Before efforts are made to introduce foreign implements it was thought that a survey of indigenous agricultural implements used in India should be made. Therefore, under the Indian Council of Agricultural Research, a country-wide survey was made to improve upon the indigenous implements in order to increase their efficiency and thus, give to the Indian farmers something, which is within their reach.

In recent years, attention of the Indian farmers has been drawn to power operated machines and equipments such as tractors, oil engines, pump sets, etc. Quite a large number of farmers are using. These implements and firms have also been established in India to manufacture them. This trend towards mechanized farming is bound to increase.

It is not merely the knowledge of agricultural engineering including implements and machinery that is necessary for increasing agricultural production, but also the knowledge about the sources of their availability, prices, and upkeep, which is essential.

Improvised implements are always meant for economy. To suit the economy of an average farmer in India, suitable implements have been developed as per agro-climatic conditions of the different states under different conditions. Rationalization of all implements is not possible nor advisable, since, it will not work to the prevailing conditions. The implements are mostly either bullock drawn or manually operated and developed keeping in view, the requirement and financial condition of an average farmer.

The maintenance and improvement of soil productivity for sustained agricultural production necessitates the acquisition of thorough knowledge of soil science, agricultural engineering and agronomy. Therefore, the teaching of soil science, agricultural engineering and agronomy is at least one of the most important factors for the agricultural development of the country because the tillage of the soil is involved in every kind of farming.

The author presented the book entitled, "**Crop Production and Tillage**" in a scientific and systematic manner to understand the fundamentals clearly and easily which is the beauty of this book. The text-cum-reference book to meet precisely the felt need is an outcome of the author's activity involved in teaching, research and extension guidance in the field of agronomy for over thirty years.

Potential can only be achieved under ideal management in an optimal physical, chemical and biological environment. Thus, this is a well recognized and urgent need for development of farm machinery and implements for increasing agricultural production in the areas of low rainfall and its erratic distribution. The whole philosophy of crop production by using the implements and machinery in time that water is a limiting factor in these areas, and one needs to maximize the efficiency of the natural rain water for agricultural production. This book is very comprehensive covering all the basic principles of agronomy, agricultural engineering and soil science towards crop production and tillage.

I am confident that this book will serve a text book for agronomy, soil science and engineering 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, and agricultural implements and machinery. This book will also serve as a guide to extension officials of the department of agriculture, and also the departments of soil science, agriculture engineering farm machinery and power, agronomy, and water conservation engineering. I congratulate Dr. S. C. Panda for his pain taking effort in bringing out this book covering the latest technologies

for crop production conserving factors affecting crop production, systems of crop production and use of farm machinery and power for efficient management. 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 the book.

Bhubaneswar

Dr. Bhagabat Panda

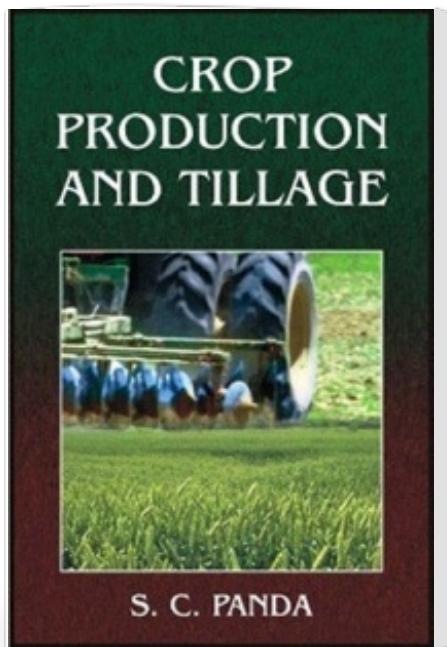
PREFACE

Speedy development of agriculture is vital to the progress of our country. For securing maximum crop production, the best use of the available land has to be made and the latest methods of crop husbandry put into practice. But this depends on the availability of scientific information and guidance on all aspects of agriculture in an easily digestible form.

With world population doubling every four decades, the water resources of the world are becoming one of its most important assets. Water is essential for human consumption and sanitation, for the production of many industrial goods and for the production of food and fiber. Water is important means of transport in many parts of the world and a significant factor in recreation. Even a valuable resource can be a hazard and excessive water like floods cause substantial damage and loss of life throughout the world. Water is unequally distributed about the earth. In his use of this resource, man pollutes much of the available fresh water and degrades it so that it is unfit for any other use. In agriculture, water plays the major role for successful crop production. Without water either through precipitation or irrigation, there may not be plant growth, since it is essential for the maintenance of turgidity, absorption of nutrients and the metabolic process of the plants.

With the explosive increase in world population, there is increasing pressure on the dry lands, which with their semiarid fringes, constitutes fully one-third of the land areas of the globe. This increased pressure applies both to the area with primitive agriculture and low standard of living as in the arid regions of Asia and North

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