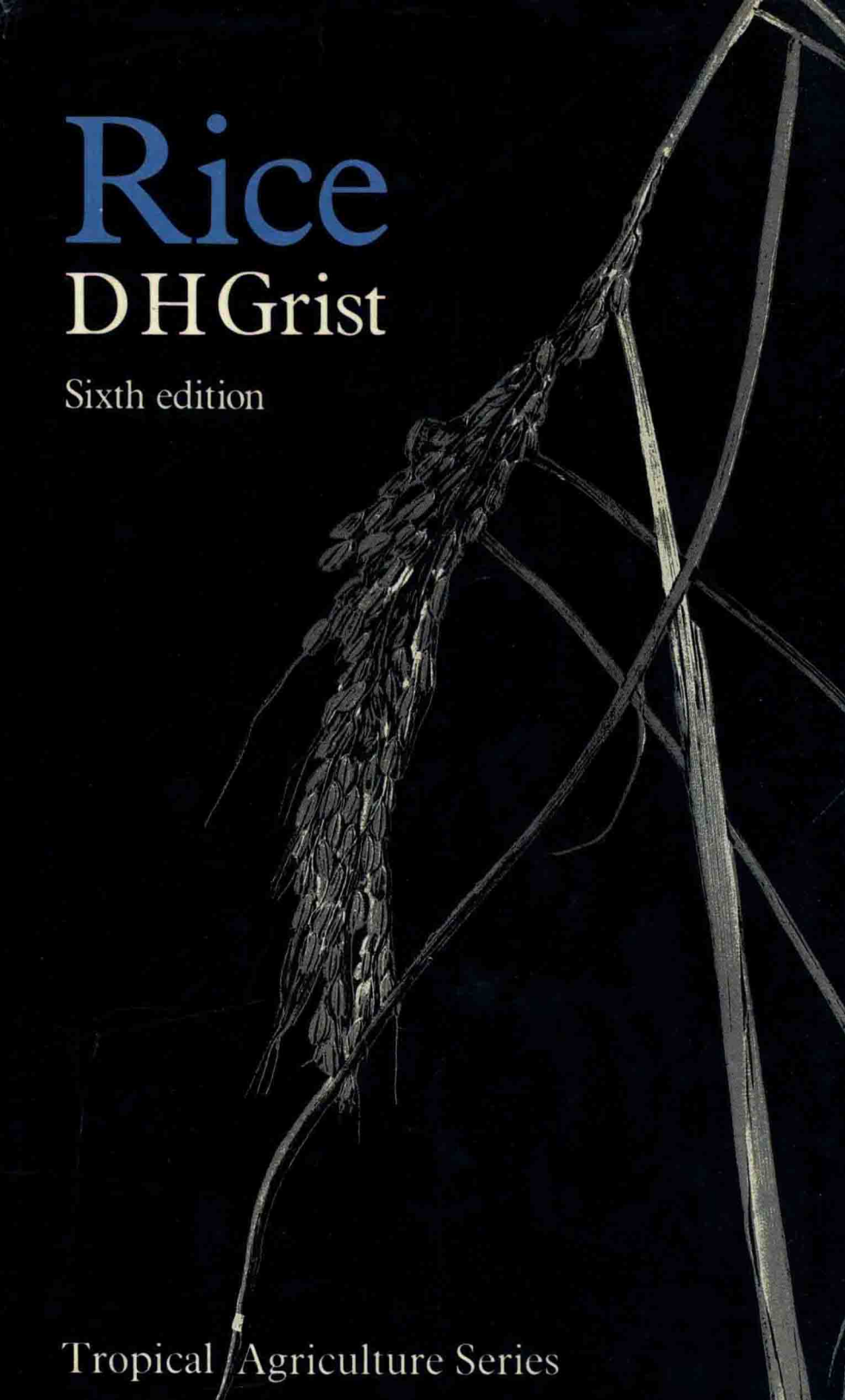
Rice

D H Grist

Sixth edition



Tropical Agriculture Series

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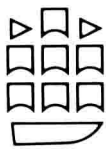

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Preface to first edition

Rice is perhaps the most remarkable of cultivated crops, for although possessing the roots of a dryland plant, it flourishes in swamps or under irrigation, and in Asia has produced one or more crops annually for centuries. This continuous rice-growing – almost unexampled in the crop world – produces yields at a surprisingly high level, despite the fact that in many regions the land is never manured.

The crop is grown over a wide range of climatic, soil and water conditions, from wet tropical to regions of semi-arid, warm-temperate climate; in heavy clays or poor sandy soils; on dry land or in swamp land in water that may be 15 to 20 ft deep; in fresh or brackish water. The thousands of varieties of rice that exist account for this cosmopolitan nature, for it is true to say that a variety may be found to suit almost any condition, provided that the plant is subject to abundant sunshine and given water sufficient for the requirements of the particular variety.

While rice is not a complete food in itself, as a grain it has a very high nutritive value, second only to wheat. Unfortunately, many of these nutrients (proteins, fats and water-soluble vitamins of the B complex) are eliminated in the processes of milling and cooking. Many of the diseases suffered by rice-eaters are caused by malnutrition and are preventable by such means as improved milling, parboiling and cooking, by which the vitamins, in particular, are retained in the finished product. Improvements in health are already evident in some countries as a result of the application of scientific research to this subject.

It is estimated that an annual increase of 1.3 million tons of rice is necessary to meet the needs of the growing rice-eating population. While the ultimate solution of the problem of meeting demand by supply must be by limitation of population, the immediate necessity for large rice supplies may be met by an increased area under the crop and by improved yields. If the price of rice is maintained at a reasonably high level, the area may be expected to increase in many countries, the deterrent to development being the high cost of bringing land into cultivation.

The possibility of improving productivity is discussed in some detail in the following pages. The four main channels leading to improvements

in yield appear to be, in order of importance: improved drainage and irrigation; more effective control of pests; the addition of humus to the land, with or without fertilizers; and the selection and breeding of varieties.

Drainage and irrigation are of paramount importance; efficient water control results in direct improvement in yield; in addition, it aids in the control of pests, diseases and weeds, and renders fertilizers more effective.

Losses caused by pests are enormous, and largely preventable; for this reason the necessity for better control over pests is given priority over manuring or the improvement of varieties. It is possible that the new and very potent insecticides now on the market may prove of value against certain pests of the rice crop which hitherto have been difficult to control.

It is usual to assume that increased yields will result from fertilizing the crop. While some improvement may be expected by this means, it is probable that undue emphasis has been given in some quarters to the need for fertilizers. The requirement of first importance in many areas is humus, with or without the addition of fertilizers. It is probable, therefore, that by such means as green manuring, fallowing, rotation of rice with grass ley and cattle grazing, the application of fertilizers on a more modest scale may be found sufficient, while in many areas fertilizers may be found unnecessary.

Considerable research work has been directed towards the improvement of varieties and in the study of varieties in relation to their environment. This will, for a long time, be a fruitful line of research, leading to the production of varieties resistant to particular pests and diseases and capable of producing optimum yields under varying conditions.

Rice is intimately bound up with the economy and well-being of Asia. The total area under the crop exceeds 200 million acres, of which over 90 per cent is grown in Asia. Yet the demand for rice in Asia exceeds present world supplies. It is the staple diet of over half the world population, including countless millions in Asia who subsist almost entirely on rice. If, therefore, in the following pages the author appears to have laid undue stress on rice in Asia, his defence is the urgency of the many problems as they affect the life of an immense population that lives near to starvation and which is sustained almost entirely on rice.

Stoke-by-Nayland
Suffolk

D. H. Grist

August 1951

Preface to sixth edition

In the first half of the present century the area planted to paddy increased by about 50 per cent. Research resulted in much additional knowledge of the crop, particularly as regards its pests and diseases, but investigations on rice breeding and fertilizing gave only small improvements in yield of grain.

Notable advances in research during the second half century resulted in a 50 per cent increase in yield of paddy, for which two outstanding factors were responsible. Firstly, the discovery of oxidation–reduction zones in inundated soils, expounded by Pearsall and Mortimer, resulted in adoption of the practice of deep placement of nitrogenous fertilizers, enabling the rice plant to absorb more of this element and thereby increase the yield of grain. Secondly, the adoption of new dwarf varieties of rice, developed at the International Rice Research Institute (IRRI) and elsewhere, made an impact on yields throughout Asia and America. Coupled with this, the use of larger applications of fertilizers, chemical pesticides, herbicides and fungicides has improved yields in Asia by about 30 per cent. In Europe and the United States, where large-scale units are cultivated, and input of chemicals is extremely high, the increased yield during this period exceeds 70 per cent.

The influence of the IRRI on rice research has been very marked. Not only has the institute produced a succession of valuable improvements in every branch of research on the crop but they have revitalized and largely co-ordinated rice research throughout the world.

It would appear that research in the immediate future will be directed to the adoption of more rational use of fertilizers and of chemicals designed to destroy pests and diseases. Realization of the fertilizing value of *Azolla* has directed attention to the value of organic sources of nitrogen, while the wide publicity of 'integrated pest control' will reduce the use of chemicals upon which control has hitherto relied.

Recently, it was shown that a system of continuous rice production gave a yield exceeding 20 tonne/ha per annum, while in other experiments, continuous cropping with paddy did not, as expected, result in the build-up of pests, since there was a corresponding increase

in the population of their predators. Results such as these will encourage closer investigation into new methods of cultivating the crop.

London D. H. Grist

September 1984

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Throughout this book and in the Bibliography, I have endeavoured to acknowledge and do justice to the research work on rice. There can, however, be no finality to a book such as this. I am constantly coming across both old and new work to which I should make reference. The subject is such a wide one and the literature on it so scattered that mention of important research work may have escaped my attention and therefore been omitted. I can but offer my apologies for such omissions both to the scientists concerned and to my readers.

In previous editions of this book I have expressed my gratitude to the following for their kind assistance in various directions: Dr T. Ban, Mr R. Baxter, Mr E. B. Boerema, Mr D. S. Byers, Dr T. T. Chang, Dr F. P. Coyne, Dr H Ezaki, Dr D. S. Fernandes, Mr D. S. Ferguson, Mr F. Garibaldi, Dr R. M. Gorrie, Mr J. M. Hector, Dr G. A. C. Herklots, CBE, Dr C. F. Hickling, CMG, Dr J. C. Hinton, Dr S. Hoshima, Dr C. E. Hubbard, CBE, Dr J. F. Jepson, OBE, Mr J. E. Jessup, Professor M. C. Kik, Mr A. G. Leeks, Mr G. E. Mann, MC, Mr J. E. Mayne, Mr E. J. McNaughton, Mr P. McNee, CBE, Mr N. C. E. Miller, Mr Ng Beng Cheng, Dr G. Watts Padwick, Mr H. C. Pagden, Professor R. L. Pendleton, Professor B. S. Platt, Mr W. Poggendorff, Mr Soong Min Kong, Mr J. W. Purseglove, Mr R. Vamos and Mr G. Wrigley: also to members of the staffs of Plant Protection Ltd, Fisons Pest Control Ltd and Shell Petroleum Co. Ltd for advice.

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For the past thirty years I have been a frequent visitor to the library of the Tropical Products Institute, London. I take this opportunity of thanking the Director for allowing me access to this fruitful source of information and to the library staff for their unfailing courtesy and help. Since the inception of this book I have also consulted a number of other libraries, in particular the Colonial Office Library, India House, Rothamsted Experimental Station, the Commonwealth Relations Library, the Royal Botanic Gardens, Kew, The Linnean Society of London and the library at the School of Agriculture, Cambridge University. I extend my thanks to the staffs of these excellent libraries who have always been helpful.

Rice owes its inception to the encouragement and wise guidance of my former chief, the late Sir Harold Tempany. The late Mr D. Rhind contributed the chapter on rice genetics and supplied material on rice selection and breeding techniques, which I have freely used.

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