



普通高等教育“十一五”国家级规划教材

农业机械化技术经济学

Technical Economics of Agricultural Mechanization

杨敏丽 主编



中国农业大学出版社

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内 容 简 介

本书分上、下两篇共10章内容。上篇为理论与方法篇,主要包括导论、农业机械化技术经济效果与评价、农业机械化技术经济分析方法、农业机械化项目可行性的技术经济分析4章内容。下篇为应用分析篇,主要包括农业机械化技术进步的宏观经济效果分析、农业机械运用管理的技术经济分析、农机社会化服务的技术经济分析、农业机械商品流通的技术经济分析、节能降耗与农业机械化技术经济分析以及农业机械化技术创新与价值工程6章内容。

本书具有实用性和系统性的特点,既可供高等院校农业机械化工程专业高年级本科生和硕士研究生使用,亦可供农业机械化管理、科研、推广等相关人员参考。

Abstract

The book consists of two parts, ten chapters. Part I is Theory and Method, including Introduction, Technical Economic Effect and Evaluation of Agricultural Mechanization, Technical Economic Analysis Methods of Agricultural Mechanization, and Technical Economic Analysis of Agricultural Mechanization Project Feasibility. Part II is Application and Analysis, including Macroeconomic Effect of Agricultural Mechanization Technical Progress, Technical Economic Analysis of Agricultural Machinery Management and Upgrading, Technical Economic Analysis of Agricultural Machinery Socialized Service, Technical Economic Analysis of Agricultural Machinery Distribution, Technical Economic Analysis of Energy Saving and Consumption Reducing of Agricultural Mechanization, and Technology Innovation and Value Engineering of Agricultural Mechanization.

The book can be a textbook for undergraduate and graduate programs and be the reference for managers, researchers, and extension specialists of agricultural mechanization.

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前言

农业机械化发展问题,其核心是技术经济问题。新中国成立 60 多年来,中国农业机械化事业取得了长足进步,发展环境显著优化、政策法规不断健全、发展速度明显加快、地位作用持续增强,走出了一条“农民自主、政府扶持,市场主导、社会服务,共同利用、提高效益”为主要特征的中国特色农业机械化发展道路,成功实现农业生产方式由人畜力为主向机械作业为主的历史性跨越。

2010 年,全国农机总动力达到 9.28 亿 kW,农机装备结构持续优化;农业机械化关键技术及装备研发力度不断加大,部分“瓶颈”环节技术与技术集成问题得到解决;全国农作物耕种收综合机械化水平达到 52.3%,主要粮食作物生产机械化快速推进。水稻机械种植和收获水平分别达到 20.9%和 64.5%;玉米机械收获水平达到 25.8%,进入提速发展阶段。马铃薯及油菜、棉花、花生、茶叶等主要经济作物生产机械化取得突破性进展。畜牧水产养殖业、林果业、设施农业及农产品初加工等机械化全面发展。农机社会化服务呈现出组织形式多样化、服务方式市场化、服务内容专业化、投资主体多元化的特征,服务能力和效益明显提升。农业机械化的快速发展,在很大程度上缓解了青壮年务农劳力短缺对粮食生产带来的不利影响,有效提高了土地产出率、资源利用率和劳动生产率,持续增强了农业综合生产能力、抗风险能力和市场竞争力,为我国粮食生产实现“七连增”以及农业农村经济保持良好发展势头提供了强有力的支撑。

随着工业化、城镇化的加快推进,农民更加渴望有尊严的生活和体面劳动,青壮年务农劳力短缺矛盾日益突出,农业机械化发展的需求更加旺盛而迫切。加快推进农业现代化,要求转变农业发展方式,优化农业生产力布局,农业机械化发展的空间更加广阔。但是,农业机械化发展整体水平依然不高,与在工业化、城镇化深入发展中同步推进农业现代化的重大要求相比还存在诸多差距,与建设社会主义新农村的新任务还不相适应,面临诸多矛盾和问题,如先进适用、技术成熟、节能环保的农机装备和技术有效供给整体依然不足;农机装备结构和布局不尽合理,区域发展不平衡,老旧农机报废更新慢,不能充分满足现代农业发展和节能减排的要求;农机农艺融合不够紧密,工程技术集成欠缺;农机作业服务的组织化程度有待进一步提升,作业质量和效益不高,等等。这些问题都与农业机械化技术选择及技术经济效果有关。因此,非常有必要针对农业机械化发展中出现的有关技术经济问题提供一套理论分析方法。

农业机械化技术经济学是一门横跨农业机械化工程和技术经济学的交叉边缘学科,涉及农业机械化工程、经济学、农学、数学、运筹学等方面知识。作者在大量实地调研和科学研究的基础上,吸纳了公益性行业(农业)科研专项“种养业生产装

备与设施工程—农业机械化工程”(200903009-2)课题的研究案例,编撰《农业机械化技术经济学》。全书分上、下两篇共10章内容,上篇为理论与方法篇,下篇为应用分析篇。力求综合运用技术经济学的有关方法,理论与实际相结合,定性研究与定量研究相结合,提出农业机械化技术经济效益与评价指标体系和农业机械化技术经济分析方法,科学、客观地分析农业机械化发展的有关技术经济问题,特别是对农业机械化技术进步的宏观经济效果、农业机械运用管理与更新、农机社会化服务、农业机械商品流通、节能降耗与农业机械化等方面进行技术经济分析,介绍了农业机械化技术创新与价值工程的基本概念与内涵。本书具有以下三个特点:一是系统性,教材编写尽量做到内容体系完善,简繁得当。书中附有大量实际案例与习题,便于学生深入理解和掌握教学内容,全面、系统掌握农业机械化技术经济学的相关理论知识和主要分析方法。二是科学性,将技术经济学有关理论与方法引入农业机械化发展有关问题的研究,理论研究与实际相结合,定性研究与定量研究相结合,分析问题科学、客观。三是实用性,针对农业机械化工程专业学生经济学基础不强的实际情况,在知识结构的安排上由浅入深、循序渐进,简明扼要地阐述了农业机械化技术经济学的基本理论、主要方法及其应用案例,以达到学以致用为目的,符合教学规律。教材可供高等院校农业机械化工程专业高年级本科生和硕士研究生使用,亦可供农业机械化管理、科研、推广等相关人员参考。

本书由中国农业大学中国农业机械化发展研究中心常务副主任杨敏丽教授担任主编,参与编撰工作的人员有师丽娟、黄凰、李世武、游凌、仵建涛、张文博、恽竹恬等。全书由杨敏丽统筹,黄凰协助组织,申天兵、高巍、贾敏参与部分章节的校对工作。

作者长期从事的研究工作和本书的撰写均得到农业机械化领域诸多专家的关心支持,特别是中国工程院罗锡文院士、汪懋华院士,中国农业大学白人朴教授,中国农业机械学会陈志名誉理事长,中国农业工程学会朱明理事长,华南农业大学区颖刚教授,吉林大学杨印生教授,东北农业大学王金武教授,山西农业大学郭玉明教授,南京农业大学丁为民教授、何瑞银教授,浙江大学何勇教授,山东农业大学张晓辉教授,湖南农业大学孙松林教授等,以及农业部农业机械化管理司、各省(市、区)农机管理部门的领导,在此一并表示诚挚的感谢!

付梓之际,心中未免忐忑,由于时间和水平所限,不足之处在所难免,敬请读者批评指正。



2011年6月

Preface

Agricultural mechanization has made considerable progress during over 60 years since the People's Republic of China was founded. The core of agricultural mechanization is technical economy. With the environment significantly optimizing, policies and regulations continuously improving, development speed obviously accelerating, status and function continually increasing, the agricultural mechanization development road has been formed with Chinese characteristics of "peasant-independence, government-support, market-driven, social-service, common-utilization, benefit-improving". The historic leap of transforming farming methods from labor and draft animal operation to mechanical operation has been successfully achieved.

The national total power of agricultural machinery reached 928 million kW and the fleet was continuously optimized in 2010. Support for key technology and equipment R&D continuously increased. Problems of "bottleneck" technology and technical integration were gradually solved. The national comprehensive agricultural mechanization level of tillage, planting and harvesting reached 52.3% and the production mechanization of main grain crops developed rapidly. Mechanical planting and harvesting level of paddy rice reached 20.9% and 64.5% respectively. Mechanical level of corn harvesting reached 25.8%, heading into an accelerating stage of development. The mechanization of potato and cash crops such as rape, cotton, peanut and tea production has made breakthrough. Mechanization of animal husbandry and aquaculture, forestry and fruit production, facility agriculture and agricultural products primary processing are developing in an all-round way. Agricultural machinery socialized service has the characteristics as organization form diversification, service way marketization, service content specialization, investment subjects diversification, and service ability and efficiency have improved significantly. The rapid development of agricultural mechanization has eased the adverse effects caused by the young labor shortage on grain production greatly, improved the land output, resource utilization and labor productivity effectively, and enhanced comprehensive agricultural production capacity, an-

ti-risk ability and market competitiveness persistently. It also provides strong support for the seventh continuous growth of grain production and the good momentum of agriculture and rural economy.

With the industrialization and urbanization accelerating, peasants are more eager to have dignity life and decent work, the shortage of young farming labor is getting worse and the requirement of agricultural mechanization development becomes more urgent. In order to promote agriculture modernization, agriculture development mode need to be transformed, and agricultural productivity layout need to be optimized. Even though the potential of development is great, the overall level of agricultural mechanization is still low. Compared with major requirements to promote agricultural modernization and construct new socialism countryside, there is still a long way to go. Some problems those can not meet the requirements of modern agriculture development, energy saving and emission reduction should be solved urgently. Such as the supply shortage of agricultural machinery and technology, which are advanced and applicable, technical mature, energy saving and environmental friendly, irrational fleet and layout of agricultural machinery, unbalanced regional development, slow replacement and upgrade of old agricultural machinery. In addition, the combination of agronomy and agricultural machinery is not tight enough, organization degree of agricultural machinery operation service needs to be further promoted, operating quality and efficiency are not high. All of these are related to technical choice and economic efficiency of agricultural mechanization. Therefore, it is necessary to provide a theoretical method for the analysis of technical economic issues appeared on the progress of agricultural mechanization development.

Technical Economics of Agricultural Mechanization is a cross subject of Agricultural Mechanization Engineering and Technical Economics, involving agricultural mechanization engineering, economics, agriculture, mathematics and operational research, etc. Based on lots of investigations and scientific research, and cases of the Special Fund for Agro-scientific Research in the Public Interest (200903009-2)-Study on Agricultural Mechanization Engineering Integration Technology and Patterns, the authors compiled the Technical Economics of Agricultural Mechanization. The book consists of two parts, ten chapters. Part I is Theory and Method, Part II is Application and Analysis. By using technical eco-

conomic methods comprehensively, combining theory and practical, qualitative and quantitative analysis, the book introduced the agricultural mechanization technical economic effect and evaluation index system, and the methods of technical economic analysis, to research the issues of agricultural mechanization development, especially macroeconomic effect of agricultural mechanization technical progress, agricultural machinery management and upgrade, agricultural machinery socialized service, agricultural machinery distribution, energy saving and consumption reducing of agricultural mechanization etc. , and agricultural mechanization technology innovation and value engineering concept and contents are analyzed scientifically and objectively in the book.

This book has the following three characteristics: the first one is systematic, it tried to be integral and brief as well. The rich cases and exercises enable students to understand deeply and master related theories and methods of analysis. The second one is scientific, theories and practical methods as well as qualitative and quantitative analysis are combined in the research. The third one is practical. The knowledge structure of this book is from simple to complex and from easiness to difficulty step by step to suit the situation for agricultural mechanization engineering students who have weak background in economics. The basic theories, main methods and application cases are briefly illustrated in the book to achieve the purpose of application, which is in accordance with the teaching and learning regulation. The book can be used as textbook for undergraduate and graduate programs and be the reference for manager, researcher, and extension specialists of agricultural mechanization.

The editor-in-chief of this book is Minli Yang, who is a professor of China Agricultural University and the executive deputy director of China Research Center for Agricultural Mechanization Development. Other editors are Lijuan Shi, Huang Huang, Shiwu Li, Ling You, Jiantao Wu, Wenbo Zhang and Zhutian Yun. Minli Yang made overall arrangements, Huang Huang provided assistance. Tianbing Shen, Wei Gao and Min Jia proofread some chapters. The long term research work and book writing obtained concern and support from many experts in the field of agricultural mechanization, especially Xiwen Luo and Maohua Wang who are academicians of Chinese Academy of Engineering, Renpu Bai who is a professor of China Agricultural University, Zhi Chen who is the honorary chair-

man of Chinese Society for Agricultural Machinery, Ming Zhu who is the chairman of Chinese Society of Agricultural Engineering, Yinggang Ou who is a professor of South China Agricultural University, Yinsheng Yang who is a professor of Jilin University, Jinwu Wang who is a professor of Northeast Agricultural University, Yuming Guo who is a professor of Shanxi Agricultural University, Weimin Ding and Ruiyin He who are both professors of Nanjing Agricultural University, Yong He who is a professor of Zhejiang University, Xiaohui Zhang who is a professor of Shandong Agricultural University, Songlin Sun who is a professor of Hunan Agricultural University etc. , and the directors of Department of Agriculture Mechanization Administration of Ministry of Agriculture and different provinces. The authors wish to express the sincere appreciation to them.

Comments or corrections are welcome if there are some deficiencies.



June 2011

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第一章

导 论

人类的生存与发展必须依靠物质资料的生产。通过人的劳动来生产具有使用价值的物质资料以满足人类自身需求的能力就是社会生产力。推动生产力发展的动力,首先来源于人类对物质资料生产的需求,但“归根结底总是来源于发挥着作用的劳动的社会性质,来源于社会内部的分工,来源于智力劳动特别是自然科学的发展”^①。生产力水平的高低成为衡量社会发展水平或者行业发展水平的重要标志,而生产力的发展水平取决于技术进步的程度以及技术的应用水平。

第一节 现代农业生产系统概述

生产力系统是生产力要素或成分,按一定比例和形式结合起来形成的具有一定功能的有机整体。构成生产力的诸要素各有自身的特点与作用,各要素在发挥作用时不是各自孤立地存在,而是相互密切联系、相互影响和相互制约的。科学技术是推动现代生产力发展中的重要因素和重要力量。马克思明确指出:机器生产的发展要求自觉地应用自然科学,“生产力中也包括科学”^②,“劳动生产力是随着科学和技术的不断进步而不断发展的”^③。马克思的这一论断已经为不断发展的社会实践所证实。生产力的基本要素是生产资料、劳动对象和劳动者。生产资料是与一定的科学技术相结合的,劳动者也同样是掌握了一定科学技术知识的劳动者。现代科学技术的飞速发展并向现实生产力迅速转化,改变了生产力中的劳动者、劳动工具、劳动对象和管理水平。科学技术为劳动者所掌握,极大地提高了人们认识自然、改造自然和保护自然的能力及生产劳动能力。在生产力系统中,科学

① 《马克思恩格斯全集》第25卷,北京:人民出版社,1974年版,第97页。

② 《马克思恩格斯全集》第46卷下册,北京:人民出版社,1979年版,第211页。

③ 《马克思恩格斯全集》第23卷,北京:人民出版社,1979年版,第664页。