STUDY ON THE SELECTION OF EFFECTIVE WATER-SAVING IRRITATION TECHNIQUES FOR XINJIANG AGRICULTURE

新疆农业

高效节水灌溉技术选择研究

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摘　要

新疆干旱缺水，农业是典型的灌溉农业，农业主要依靠水利灌溉，水是新疆干旱区最稀缺的资源。随着经济社会快速发展，水资源供求矛盾日益突出，节水势在必行，新疆农业用水占总用水量的96%，新疆节水关键在于农业。20世纪90年代中期以来，新疆在稀缺水资源诱导下大面积选择了高效节水灌溉技术，现已成为了国内及世界最大的农业高效节水灌溉技术示范区。本书针对新疆农业高效节水灌溉技术研究，不仅揭示和阐释了新疆成功选择高效节水灌溉技术的内在动因、选择方式、行为表现和选择绩效，而且可以为其他地区对高效节水灌溉技术选择提供理论和实践参考。

本书针对新疆高效节水灌溉技术选择行为，采用计量分析、比较分析、案例分析、调查分析的方法，规范研究和实证研究相结合，利用诱致性技术选择理论、交易费用理论、集体行动理论和农户行为理论等，构建了一个理论分析框架，分析了新疆农业节水灌溉技术选择的原因，并将节水灌溉技术选择的主体——政府、企业、科研部门、农业基层组织和合作组织及农户作为技术选择的一个整体，从技术供给和需求的视角运用理论和案例方法实证分析了新疆农业高效节水灌溉技术选择的主体行为、运行机制以及选择方式和路径，并利用计

量和模型的方法评价了新疆兵团和新疆地方农业节水灌溉技术选择的绩效。主要研究内容如下：

第一章导论部分提出了研究的背景、问题和思路等。阐述了本书的研究背景，指出水资源稀缺制约经济社会发展，特别是干旱半干旱地区，节水特别是农业节水势在必行。新疆成为我国高效节水灌溉技术推广的示范区，新疆农业高效节水灌溉技术选择的原因、过程和绩效值得探讨。此外，本章还陈述了研究的目标、内容、方法及可能的创新。

第二章概述了研究的相关理论基础，提出了理论分析框架，界定了相关概念和研究范围。概述了诱致性技术选择理论、新制度经济学相关理论、公共品理论等理论，提出理论分析框架，并对相关概念和研究范围作了界定。

第三章阐述了农业节水灌溉技术发展历程。阐述了现代农业、农业技术对农业节水灌溉技术发展的影响；概述了世界和我国节水灌溉技术发展历程，重点概述了新疆兵团和新疆地方节水灌溉技术发展历程，为后续研究做好了铺垫。

第四章对新疆兵团农业节水灌溉技术选择的原因作了分析，利用要素稀缺和市场需求诱致性技术选择理论，以兵团棉花膜下滴灌技术为例建立模型进行了计量分析。结果得出，要素稀缺和市场需求是兵团农业节水灌溉技术选择的动因。制度环境对新疆兵团农业节水灌溉技术选择具有影响。本章还从制度视角分析了新疆兵团对农业高效节水灌溉技术选择的优势，兵团特殊体制

下的土地经营制度、农业生产制度、农业技术保障制度等对兵团农业高效节水技术选择有很大影响。

第五章对新疆农业节水灌溉技术选择的供给主体行为进行了分析，并以案例方式对各主体行为作了深入剖析。本章分析了新疆兵团和新疆地方节水灌溉技术选择供给主体的行为反应，通过政府、企业、公共科研部门、基层农业组织的案例分析，验证了各主体对节水灌溉技术选择发挥的重要作用。①分析了政府参与节水灌溉技术选择的行为，以农八师石河子市和玛纳斯县政府对节水灌溉技术选择为案例分析了政府对节水灌溉技术选择的利益目标、行动反应和成效。通过分析得出，政府是节水灌溉技术选择的核心，是节水灌溉技术选择的有效推动者。②分析企业参与节水灌溉技术选择的行为，以新疆天业集团为案例，分析了节水灌溉技术产品供给企业的利益目标、行动反应和成效，指出企业是参与兵团高效节水灌溉技术大面积推广的关键主体。③分析科研部门参与节水灌溉技术选择的行为，以兵团组织所属科研部门联合攻关高效节水灌溉技术为案例，分析了公共科研部门的行为表现。公共科研部门是新疆兵团节水灌溉技术创新和推广的承担者，是节水灌溉技术供给的重要主体。④分析基层农业组织和合作组织参与节水灌溉技术选择的行为，以玛纳斯县塔西河村和农八师121团19连为案例，分析了基层农业组织对节水技术选择的利益目标、行动反应和成效。通过分析得出，不同体制下的基层组织对节水灌溉技术选择的采用方式和手段不同，因“制”和“地”而宜采用强制性、诱致性和

合作组织参与等技术选择方式可发挥出很好的效果。⑤对新疆农业高效节水灌溉技术的多主体参与的选择行为进行了评析。新疆农业高效节水灌溉技术选择是多主体参与下的动态反应，并形成了有效的节水灌溉技术选择机制，政府的强制性和诱致性技术选择及合作组织多方参与式选择等多种方式的运行和相互配合共同推动了节水灌溉技术选择，各种技术推广方式的作用下，农户基于自身利益和理性会主动选择节水灌溉技术。在农业节水灌溉技术选择多主体参与下和多种方式的有效配合下，对节水灌溉技术选择可以应对市场失灵、降低交易成本、克服集体行动的困境、弥补组织缺失等。

第六章对节水灌溉技术选择的需求主体——农户行为进行了实证分析。首先，对农户高效节水灌溉技术选择行为以问卷方式得到的调研数据进行了分析，对农户选择或没有选择滴灌技术的原因以及选择的意愿、方式和绩效进行了调查，结果得出，农户选择滴灌技术主要是由政府强制性技术推广方式决定的，诱致性技术选择也发挥重要作用，由最初的强制性选择到自愿选择，政府的政策、资金和技术支持对农户选择滴灌的决策有很大影响。其次，对农户节水灌溉技术选择行为影响因素进行了计量分析，结果得出，农户对节水灌溉技术选择受其个人特征、生产经营特征、节水技术特征和政府组织动员力度等多方面因素的影响。

第七章评价了新疆兵团和新疆地方农业节水灌溉技术选择的绩效。本章运用不同方法比较分析了不同制度下节水灌溉技术选择的绩效，首先，描述分析了新疆兵

团与新疆地方对节水灌溉技术选择的绩效；其次，通过对资源禀赋相似区域下制度环境不同的新疆兵团和新疆地方节水灌溉技术选择的绩效进行了分析，用计量和模型的方法从不同视角对它们的选择绩效进行了比较，对改进和完善农业节水灌溉技术选择的制度环境，提升节水灌溉技术选择的能力和绩效有重要意义。

第八章是研究结论和政策建议。新疆农业高效节水灌溉技术是要素稀缺和市场需求的诱致性选择，是政府、企业、公共科研部门、基层农业组织、合作组织和农户等多主体参与行为下的共同反应的结果；制度对节水灌溉技术选择有重要影响，基于新疆兵团特殊体制和土地经营制度等特殊性，新疆兵团对节水灌溉技术选择的绩效比新疆地方有明显优势。针对农业高效节水灌溉技术选择提出了合理配置利用农业水资源，发挥水资源稀缺对节水行为的诱导作用；构建多主体参与的节水灌溉技术选择体系和运行机制；提升节水灌溉技术选择各主体的选择能力，加强政府节水主导职能，提升企业技术创新能力，强化科研部门服务作用，加大基层部门组织能力，发挥合作组织动员能力，提高农户农业节水技能；优化农业节水灌溉技术选择的制度环境，改善节水灌溉技术选择的制度环境，创新土地承包经营方式，完善农业科技创新和推广服务体系等方面的政策建议。

关键词：节水灌溉技术；主体行为；政府；农户；强制性技术选择；诱致性技术选择

Abstract

As Xinjiang is characterized by drought and water shortage, so its agriculture depends heavily on irrigation and water is a scarce resource in arid Xinjiang. With the rapid development of economic and social the conflict between demand and supply of water is becoming increasingly evident, water-reservation is inevitable. Water for agriculture accounts for 96% of its total consumption, hence the key of water-saving lies in agriculture. Since mid-1990s, Xinjiang has adopted effective water-saving irrigation techniques as a result of scarce water and now Xinjiang has become the largest demo-zone of water-saving irrigation techniques nationwide and worldwide. The thesis not only interprets the internal cause for the choice of water-saving irrigation techniques, mode of choice, performance and results but also offers a theoretical and practical reference to other regions.

The thesis employs quantitative analysis, comparison, case analysis, observation, combination of theoretical and empirical study, using theory about induced technology selection, theory of the state, transaction cost theory, theory of collective action and theory of farmer action, in an attempt to establish a frame of theoretical analysis and analyze the

reasons for the selection of irritation techniques in Xinjiang. Taking the major body for selecting irrigation techniques-government, enterprises, research departments, farming basis units, cooperation organizations and farmers as a whole, it analyzes the behaviors of the major body selecting irrigation techniques, operating mechanism and mode and route of selection, and evaluates the performance of water-saving irrigation techniques in XPCC and local Xinjiang with the aid of quantitative and modeling methods. The main points are presented as follows:

Chapter One is the introduction, presenting the background of the study, problems and ideas. It points out that water shortage suppresses social and economic development, especially in arid and semiarid regions. Water-saving irrigation is a natural choice for Xinjiang to become a demonstration region. The reasons for Xinjiang to select water-saving irrigation techniques, the process and performance is a worthy topic of research. In addition, chapter one also deals with the objective of the thesis, contents, methods, and potential innovation.

Chapter Two summarizes the relevant theories (induced selection of techniques, new institutional economics, ideas about public goods), presenting the frame of theoretical analysis, defining relevant concepts and research range.

Chapter Three covers the development of agricultural

water-saving irrigation techniques, including the effects of modern agriculture and farming technologies on the development of irrigation techniques, the development of water-saving irrigation techniques at home and abroad. Emphasis is laid on the development of water-saving irrigation techniques in XPCC and local Xinjiang to pave the way for subsequent research.

Chapter Four analyses the reason for choosing between techniques of water-saving irrigation in XPCC with the help of theory of elements rarity and market demand-induced technique selection. It also builds a model on the basis of mulched drip irrigation to make quantitative analysis. The results suggest that elements rarity and market demand contribute to the selection of water-saving irrigation techniques. XPCC System plays a positive role in choosing between techniques of water-saving irrigation. XPCC is an advantage over local Xinjiang. Land management system, farming system and guarantee system of agricultural techniques in XPCC all affects the selection of water-saving irrigation techniques.

Chapter Five analyzes the participating subjects who are involved in the selection of water-saving irrigation techniques with means of case analysis. This chapter makes an analysis of the responses of participating subjects from XPCC and local Xinjiang, verifying the important role played by different subjects in the selection of water-saving

irrigation techniques. First of all, it examines the behaviors of governments participating in the selection of water-saving irrigation techniques, analyzing their goals, responses and efficiency in the selection of water-saving irrigation techniques by taking Shihezi of XPCC and Manasi county of local Xinjiang as examples. It concludes that government plays a vital role in selection of water-saving irrigation techniques and is the effective promoter for the selection of water-saving irrigation techniques. Secondly, it examines enterprises who get involved in the selection of water-saving irrigation techniques. Taking Tianye Group as a case, the chapter analyzes its goals, responses and efficiency in the selection of water-saving irrigation techniques, indicating that enterprise are the key subjects for popularizing water-saving irrigation techniques in XPCC. Thirdly, it examines research departments who get involved in the selection of water-saving irrigation techniques. The research departments at different levels under XPCC have made joint efforts to study water-saving irrigation techniques. Public research departments are the undertakers of tasks of studying and popularizing water-saving irrigation techniques and the important suppliers of water-saving irrigation techniques. Besides, the chapter looks at the behaviors of basic farming units getting involved in the selection of water-saving irrigation techniques. Taking Taxihe village in Manasi county of Xinjiang and Farming Company 19, Farming

Regiment 121, Agricultural Eighth Division of XPCC as examples, the chapter analyzes the goals, responses and efficiency of basic farming units in the selection of water-saving irrigation techniques, indicating. The analysis suggests that the basic farming units under different systems use different the ways and methods to select water-saving irrigation techniques. They can choose between compulsion, inducedness and cooperation on the basis of systems and field conditions to make the technique work better. Finally, it examines the selection of water-saving irrigation techniques by multi-subjects. Selection of water-saving irrigation techniques is the dynamic response by multi-subjects, and effective mechanism of selection of water-saving irrigation techniques has been developed. Governments'compulsory and induced selection of irrigation technique and selection made by various cooperative units work together to promote the selection of water-saving irrigation techniques. Under such circumstance of spreading different techniques, farmers will voluntarily and rationally select proper water-saving irrigation techniques based on their benefits. So when many subjects get involved the selection, the selection of water-saving irrigation techniques can handle market failure, cut down transaction costs, overcome the dilemma of collective action, and compensate for organization loss.

Chapter Seven makes empirical analysis of the behaviors of the demanding subjects-farmers. Firstly, it

analyzes the data obtained from the questionnaires about the selection of water-saving irrigation techniques by farmers, investigating the reasons for the selection, their willingness, ways and performance. It concludes that compulsory spreading of techniques by government contributes a lot to the selection of drip irrigation. Induced selection of techniques also plays an important role. Government policies, funds and technology support greatly affect their selection of drip irrigation in the change from initial compulsory selection to voluntary selection. Secondly, it analyses the factors that affect the selection of water-saving irrigation techniques. The results show that the selection are affected by many factors, including individual characteristics, farming management characteristics, water-saving characteristics and the intensity of government spreading.

Chapter Seven evaluates the performance of selection of water-saving irrigation techniques in XPCC and local Xinjiang. The chapter employs different methods to compare the performance of selection of water-saving irrigation techniques in different systems. Firstly, it describes the performance of selection of water-saving irrigation techniques in XPCC and local Xinjiang. Secondly, it analyses the performance of selection of water-saving irrigation techniques in regions with similar resource endowment in XPCC and local Xinjiang. It makes

further analysis of the selection performance from various perspectives using quantification and modeling. The results are important in improving the system environments, exalting the ability and performance of selection of water-saving irrigation techniques and presenting relevant policies and measures.

Chapter Eight copes with conclusions and suggestions of policies. The thesis comes to the conclusion that water-saving irrigation techniques in Xinjiang result from the induced selection due to element rarity and market demands. Government, enterprises, public research departments, basic farming units, cooperative units and individual farmers are all responsible for the result. Systems greatly affects the selection of water-saving irrigation techniques. The special administrative system and land managing system give XPCC an advantage over local Xinjiang in the selection of water-saving irrigation techniques. In the end, the thesis suggests the following proposals. Make good use of water resource and exert the inducing function of water shortage on water-conservation. Build a system and mechanism for the selection of water-saving irrigation techniques by multi-subjects. Improve the selection ability of individual subjects in selecting water-saving irrigation techniques. Strengthen the leading function by government, enhancing the innovative capacity of enterprises and intensifying the service by public research departments. Strengthen the organizing ability of

basic units, exerting the mobilizing ability of cooperative units and improving farmers'water-saving techniques. Refine the system environments for selection of water-saving irrigation techniques, improving the macro system environments, innovating the modes of land contract management and perfecting the system for agricultural technologies innovation and spread.

Key words: water-saving irrigation techniques; subject behavior; government; farmers; compulsory selection of techniques; induced selection of techniques

目　　录