Toshiyuki Monma · Itsuo Goto
Takahisa Hayashi · Hidekiyo Tachiya
Kanju Ohsawa *Editors*

Agricultural and Forestry Reconstruction After the Great East Japan Earthquake

Tsunami, Radioactive, and Reputational Damages

Springer Open

Toshiyuki Monma • Itsuo Goto
Takahisa Hayashi • Hidekiyo Tachiya
Kanju Ohsawa
Editors

Agricultural and Forestry Reconstruction After the Great East Japan Earthquake

Tsunami, Radioactive, and Reputational Damages

Springer Open

Editors
Toshiyuki Monma
Department of International Biobusiness Studies
Tokyo University of Agriculture
Tokyo, Japan

Takahisa Hayashi
Department of Bioscience
Tokyo University of Agriculture
Tokyo, Japan

Kanju Ohsawa
Tokyo University of Agriculture
Tokyo, Japan

Itsuo Goto
Department of Applied Biology and Chemistry
Tokyo University of Agriculture
Tokyo, Japan

Hidekiyo Tachiya
Soma City Office
Fukushima, Japan

ISBN 978-4-431-55557-5 ISBN 978-4-431-55558-2 (eBook)
DOI 10.1007/978-4-431-55558-2

Library of Congress Control Number: 2015947340

Springer Tokyo Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer Japan KK is part of Springer Science+Business Media (www.springer.com)

Agricultural and Forestry Reconstruction After the Great East Japan Earthquake

Tokyo University of Agriculture's Philosophy and the East Japan Assistance Project

Introduction

Two and a half years have now passed since the Great East Japan Earthquake, but a range of challenges still hamper the revival of the agriculture, forestry, and fishery industries in the area affected, and circumstances remain difficult. The revival of these industries is particularly delayed in Fukushima Prefecture, where tsunami damage and radioactive contamination resulting from the Fukushima nuclear accident were compounded by reputational damage as a result of the contamination.

On behalf of Tokyo University of Agriculture, I visited the city of Soma in Fukushima Prefecture immediately after the earthquake and ensuing disasters, and promised the mayor, Hidekiyo Tachiya, that the university would join forces with Soma to restore the city's devastated agricultural and forestry industries. Since then, the university as a whole has implemented a wide range of initiatives to help with the revival of Soma's community. Here at Tokyo University of Agriculture we consider it our duty to nurture talented individuals who can use practical science to contribute to the development of agriculture, forestry, and fisheries. It seemed only natural, therefore, that we should get involved in efforts to restore the disaster-stricken region.

Tokyo University of Agriculture was founded 122 years ago by Takeaki Enomoto, an influential figure in the government that ruled Japan after the Meiji Restoration in 1868. As Japan's largest agricultural university, the university has dedicated itself to developing skilled young people, producing a steady flow of high-caliber individuals for employment across the farming industry. The university's educational philosophy is rooted in the practical-science-based ethos espoused by its first president, Tokiyoshi Yokoi. Convinced that scientific principles are meaningful only when put into practice, he advocated the need to "Ask the rice plant about the rice plant; ask farmers about agriculture." Thus, Yokoi always maintained that the key to researching agricultural science was to understand that theory exists only through practical application, and that practical application occurs only in conjunction with theory.

The university's educational policy is above all founded on this all-pervasive ethos of practical science. Moreover, it is founded on a pragmatic education that equips our students to adopt roles of responsibility in agriculture and forestry, enabling them to contribute to the development of communities as local leaders both in Japan and overseas. We therefore regarded it as our calling to use the university's accumulated knowledge and technological know-how to help with recovery following these major disasters.

Outline of the Project

In light of our university's founding purpose and philosophy, we believed strongly that we should do all we could to contribute to rehabilitating agriculture and forestry in the wake of the Great East Japan Earthquake. We decided to act without delay, enlisting the help of all teaching staff to confirm that our students were safe immediately after the disasters. These efforts revealed that about 1,500 of our students came from the areas affected, and the family homes of 250 of these students had sustained major damage, including total or partial destruction. At the beginning of April, having decided on measures to assist the students whose homes had been damaged and obtained the approval of the university's board of trustees, we launched the Tokyo University of Agriculture East Japan Assistance Project with the aim of rehabilitating the agriculture devastated by the disasters.

First, we appointed a project leader: Toshiyuki Monma, an expert on agriculture in the Tohoku region, which was worst hit by the March 2011 disasters. On behalf of the university, he investigated from a range of perspectives what could be done where. Based on his investigations, we decided to start doing what we could in the city of Soma in Fukushima Prefecture as part of a project to assist the region. During the series of public holidays starting at the end of April, I visited the area with 14 teaching staff and researchers. When we arrived, local guides showed us fields covered in debris and sludge, and the sight left us speechless. In the face of such destruction, what we as a university needed above all was assistance from the local community, and we decided that it would be essential to conduct our activities in liaison with Soma's local authority, the Fukushima Agricultural Technology Centre and its Hama District Research Institute, and the local agricultural and forestry cooperatives.

With the assistance of local residents, the project's research teams started their investigations, each focusing on a separate area, such as farming, farmland reconstruction, soil and crops, forest reconstruction, community revitalization, or reputation-based damage. It soon became apparent that the recovery faced a number of challenges. Above all, farmers affected by the disaster felt differently about whether to resume agriculture depending on how much damage their farms had sustained and the size of their operations. Many small-scale farmers had lost much of their motivation to farm, while the desire to resume operations had also declined among large-scale farmers whose farms had sustained major damage. Given such

circumstances, it seemed a major challenge to rehabilitate farmland covered in debris, sea salt, and sand (although we were later able to demonstrate that application of slag from steelmaking converter furnaces effectively improved soil quality in paddy fields). We also suspected that radiocesium absorbed by trees would result in residual radiocesium in the forests for many years to come, because radiocesium absorbed by trees gradually works its way further inside the trees: that is an issue that continues to be of concern. In addition, we are still some way from fully understanding other issues that present a greater challenge still, such as economic damage from the negative reputation of Fukushima's agricultural and food products. Many radioactive "hot spots" have emerged from the effects of the cesium, and as a result farmers are beset by doubts about whether any agricultural products they produce will actually sell. What is needed, therefore, is an effective monitoring system to make absolutely certain no contaminated agricultural products are sold. We also need to decontaminate and restore the farmland that sustained major damage from the tsunami and identify effective methods of decontaminating the forests.

It is clear that it will take a very long time to rehabilitate the farmland and forests and to revive the community. On the most fundamental level, agricultural science is about creating the right environment for living organisms and cultivating a wide variety of plants and animals. In this case, we as a university still have a long battle ahead of us to find solutions to issues that have never before been experienced.

I sincerely hope that the knowledge and scientific technologies the university has cultivated since its founding will prove to be of use in restoring the agricultural and forestry industries in the disaster-stricken city of Soma in Fukushima Prefecture.

Chairman of the board of directors
Tokyo University of Agriculture
Tokyo, Japan

Kanju Ohsawa, Ph.D.

Foreword I

The earthquake off the Pacific coast of Japan's northeastern Tohoku region struck at 2:46 P.M. on Friday, March 11, 2011. It registered magnitude 9.0 with a maximum seismic intensity of 7 on the Japanese scale, and in Tokyo the seismic intensity reached upper 5. Here at the university, I was in a faculty meeting where we were just about to hear speeches from retiring teaching staff. We felt the ground shaking, and assumed that it would soon die down as it usually did, so nobody moved from their seats. But instead the shaking grew stronger, the windows began to rattle ominously, and as I wondered whether the display boards suspended from the ceiling might fall, the worst case scenario crossed my mind and a feeling of dread coursed through me.

When the shaking died down we were naturally very relieved, and all the teaching staff left the building, returning to their seminar rooms to lead the evacuation of their students to the sports ground. There were more than 1,000 students in seminar rooms or participating in club activities that day; teaching staff checked that they were all unharmed and led them to the sports arena to escape the cold. Then we were kept busy with a whole succession of demands such as distributing emergency food supplies and finding accommodation for students, teaching staff, and administrative staff who could not return home, as well as checking on the well-being of students who were visiting their families in the areas most affected by the earthquake.

Yet we never imagined that one hour after the earthquake a huge tsunami would strike the Pacific coast including the prefectures of Iwate, Miyagi, and Fukushima. We were lost for words when we saw the extent of the damage relayed to us on television, and thought of the sorrow and helplessness the people in the stricken areas must be experiencing. We were filled with a profound sense of loss at the formidable power of the tsunami as it stole so many precious lives, swept away houses, and deprived families of each other's company, destroying the region's farmland along with the very infrastructure of daily life. And there was more to come: the tsunami had caused a failure in the power supply at Fukushima Daiichi Nuclear Power Station, making it impossible to continue cooling the reactors. The resulting hydrogen buildup triggered explosions that caused partial collapse of the reactor buildings, releasing radionuclides that scattered and leaked across the

surrounding areas where people were going about their daily lives. Thus, this area that had already been devastated by the earthquake and tsunami suffered still more tragedy.

On behalf of the university I wish to express my condolences for every life that was so abruptly taken, and extend my deepest sympathies to all who lost family members or were otherwise affected by these disasters.

Here at the university we continued to check on the well-being of our students and their families. To ensure everybody's safety amidst the ongoing aftershocks, we canceled the graduation ceremony at which students are awarded their degrees, as well as the university entrance ceremony, both of which are usually very well attended by both students and their families.

As time went by, we wondered how Tokyo University of Agriculture could take advantage of its position as an established center for agricultural science to help recovery in the afflicted areas. The unimaginable scale of the devastation only aggravated the frustration we felt at having to sit by and watch. In May, my predecessor as president, Kanju Ohsawa, traveled to the region affected by the disasters, and after observing the situation there in great detail, went on to set up the Tokyo University of Agriculture East Japan Assistance Project. It was now that the university would be called to act upon the words of its first president, Tokiyoshi Yokoi, who warned students against excessive reliance on a theoretical approach to agriculture, cautioning that "where agricultural science flourishes, farming itself fails."

Hidekiyo Tachiya, the city of Soma's mayor, provided his full support for the project, and in 2012, the year after the disasters, we embarked on the first step in the process of restoring the paddy fields damaged by the tsunami. Prompted by local farmers' renewed enthusiasm for the idea of reviving the area's agriculture, we planted rice in 1.7 ha of paddy fields using the Soma (or Tokyo University of Agriculture) Method, and approximately 10 tons of rice was harvested. Promoted as "Soma Revival Rice," it became a beacon of hope for agricultural reconstruction in the Soma area. In 2013 we went on to plant an area of 50 ha, and 200 tons of rice was harvested; the plan is to extend the area to 200 ha in 2014.

In addition to the Soma Revival Rice project, many other initiatives to revitalize agriculture and the local community are now gradually producing results. This book is a record of the efforts by the city of Soma and Tokyo University of Agriculture to bring about such revitalization in the disaster zone during the past two and a half years. I hope that the publication of this book will be a catalyst for the reconstruction of agriculture in the Soma area, and that it will also be helpful for reviving agriculture in other areas.

I wish to express my heartfelt gratitude to Soma's mayor and all the city's residents for their understanding and support during the progress of this project. Finally, let us raise a cheer for the passionate commitment to reviving Soma's agriculture among the university's teaching staff and students as they continue to play an active part in the project.

President, Tokyo University of Agriculture Katsumi Takano, Ph.D.
Tokyo, Japan

Foreword II

The Great East Japan Earthquake hit on March 11, 2011, and left Soma's farmland in an appalling state.

The salt and sludge carried inland by the tsunami were accompanied by the wreckage of homes reduced to debris, huge fallen pine trees, and other waterborne objects that wreaked devastation as far as the eye could see across the once-beautiful paddy fields. The plastic greenhouses used for horticulture—particularly those used to grow strawberries—were all swept away and filled with sludge. The tractors, or in many cases, the homes, of Soma's farmers were washed away, and in the midst of such tragic circumstances, just when they were wondering how they could go on, the nuclear disaster delivered the final blow.

Then there was not only the tsunami damage with which to contend; there was also the cesium showering down onto the accumulated sludge. The situation was dire. In the district of Tamano, a mountainous area adjacent to the village of Iitate, a particularly large amount of cesium rained down onto the soil, contributing to a high ambient radiation dose compared with other areas. In addition to the damage wrought by the tsunami, therefore, we had a new problem: what to do about the damage caused by radionuclides.

What worried me most under these incredibly difficult circumstances was the thought that our farmers may lose the will to produce crops again. Nonetheless, I was able to find a ray of hope in the fact that the farmers still retained the strength of spirit to stand up to this catastrophe by farming as a community and forming agricultural corporations to work together.

It was around that time that the former president of Tokyo University of Agriculture, Kanju Ohsawa, visited us in Soma. I explained the situation to him at length, hoping that the university might perhaps be prepared to share its agricultural expertise to help us cope with the catastrophic circumstances we faced. He agreed to help, offering me the confidence-inspiring reassurance that the university would focus its assistance on Soma and work together with us to revive our agriculture. It was 2 months after the disasters when, buoyed by these kind words of support, we managed to rouse ourselves to collective action, determined to revive our agriculture one way or another. In addition to the assistance we received from the university,

we were to rely a great deal on our community's strengths, as well as the desire of our farmers to start producing again. Here at city hall we provided leadership, acting as the overall coordinator to bring together the strengths of the university, the community, and the farmers as we pursued our goal.

Two years and nine months have passed since then, and thanks to the assistance we received from Professors Toshiyuki Monma, Itsuo Goto, and Yukio Shibuya, and the many other professors and students the university sent to help us, we are now achieving significant results in our efforts to revive our agriculture following the disasters.

One such accomplishment is in our cultivation of paddy field rice, where we have been able to harvest "Soma Revival Rice" after successfully using slag from steelmaking to improve the quality of the soil impaired by the tsunami. In a separate initiative, our strawberry cultivation is benefiting from the efforts of strawberry farmers who joined forces to form an agricultural corporation and are working to deploy a new strategy to grow strawberries using hydroponics. Meanwhile, attempts to initiate measures to vertically integrate agricultural production, processing, and sales and distribution, are currently gaining momentum. In the district of Tamano, where the radiation dose was particularly high, a number of measures are proving effective, including farmland decontamination based on the results of soil surveys of individual parcels of land.

Now Tokyo University of Agriculture has compiled this book detailing all its initiatives in Soma to date. I very much hope that the book will serve to show as many people as possible that Soma is making steady progress with its recovery thanks to the university's agricultural expertise combined with our farmers' motivation and cooperative spirit and the strength of our community. We at city hall have also done all we can, but I think it is true to say that recovery can be achieved only when people involved in the various sectors affected receive substantial cooperation and assistance from members of their community and others. From that aspect, therefore, I am truly grateful for the assistance provided by everybody from Tokyo University of Agriculture. We still have much work ahead of us to revive our city, but I give my word that we will act together as a community to keep driving the recovery forward. As we do so, I sincerely hope that Tokyo University of Agriculture will continue to grant us the benefits of its agricultural expertise and the assistance of its teaching staff and students.

Mayor of Soma City
Fukushima, Japan

Hidekiyo Tachiya

Preface

The Tokyo University of Agriculture East Japan Assistance Project was launched in May 1, 2011, immediately after the occurrence of the Great East Japan Earthquake. By the time this book is published, the project will be in its fourth year of work. We still cannot forget the shock we felt on our first field survey, facing the paddy fields filled with rubble, the highly radioactive forests that no one was allowed to enter, the faces of people full of fear, and more. We stood, overwhelmed, with questions such as, "Can we really revive these disaster areas?", "Is there anything we can actually do to help?", and "Will the farmers be willing to resume farming?". However, we started the project with each project member determined to solve the problems one step at a time, to restore rich farmlands and bring back the farmers' smiling faces. This book is a record of our trial-and-error efforts and the fruit of our applied research, aimed at resolving the problems at hand.

Here, we summarize our latest results, in addition to those detailed in this book, to provide an overview of our achievements in this project. In our first challenge to recover paddy fields immensely damaged by the tsunami, we developed a convenient and low-cost farmland recovery technology called the Tokyo University of Agriculture Method, which has been adopted across Soma City. With this, rice has become producible on 267 ha of the damaged paddy fields in 2014, and an additional 200 ha will be recovered by the end of 2015. The first stage of recovery of paddy fields is almost complete. We also distributed the rice harvested in 2014 from the recovered paddy fields, named "Soma Revival Rice", to 4,000 elementary and junior high school students and teachers in Soma City. This activity has promoted local support for agricultural reconstruction, spreading attitudes such as "Let's eat these products together and support recovery!" and "Let's use them in school lunches!".

Regarding the second challenge of radioactive contamination problems, we have created a radioactivity monitoring system to cover each farm field in the Tamano area in Soma City, which is used to evaluate decontamination measures. In addition, we have performed experiments on radiation-contaminated grasslands of dairy farmers in Soma City to develop a decontamination method for steep-slope grazing lands. Once deemed too difficult to attempt and postponed by the Ministry of the

Environment, our research has attracted a great deal of attention. For the decontamination of trees with enormous amounts of radioactive contamination, we are developing together with local participants a new technology for the decontamination of persimmon trees and a technique for removal of cesium that has penetrated trees.

As can be seen, our efforts have produced results contributing to restoration, the first stage of reconstruction. However, there are still more severely damaged paddy fields that cannot be readily recovered from the effects of the tsunami. The development of methods to recover and farm on such paddy fields is an urgent issue we face. Other questions that remain in the agricultural reconstruction of tsunami-damaged areas include how to manage the finances and future business developments of agricultural cooperatives established after the earthquake.

Meanwhile, agricultural reconstruction of radiation-contaminated areas has just started, and we must study the means to support the future of farming here. Many of the contaminated areas are hilly and mountainous regions where agricultural production is difficult, providing little or no incentive for young people who left their home regions avoiding the radiation to return. In addition, damages caused by wild boar and monkeys have become more serious after the earthquake disaster, leading to more farmlands being abandoned and threatening the sustainability of rural agriculture. For the reconstruction of radiation-contaminated areas, we must create a new way of farming that will encourage young people to return to their home regions. It should be noted that overcoming reputational damage is crucial in the reconstruction of agriculture in Fukushima, and we must continue to address this issue. A lot of time is required for a complete recovery from the tsunami and radioactive damage of the Great East Japan Earthquake, and the Tokyo University of Agriculture will continue facing its challenges until this is achieved.

We would like to express our deepest gratitude to all the people who aided us in our project, especially the mayor, Mr. Hidekiyo Tachiya, and all other administrative staff of Soma City, the staff of the agricultural cooperative of Soma, the staff of Soso Norinjimusyo Fukushima Prefecture, and the farmers who supported our experiments. Also, we would like to extend our thanks to all students of the Tokyo University of Agriculture who volunteered to help in our field research and surveys. Our project would have failed halfway through without the support of all these people.

We close here with our heartfelt appreciation.

Tokyo, Japan — Toshiyuki Monma
Tokyo, Japan — Itsuo Goto
Tokyo, Japan — Takahisa Hayashi
Soma, Fukushima, Japan — Hidekiyo Tachiya
Tokyo, Japan — Kanju Ohsawa

Contents

Part I The Road to Reconstruction from the Tsunami and Radioactive Contamination: Two and a Half Years On

1 **Dealing with Disasters of Unprecedented Magnitude: The Local Government's Tribulations and the Road to Reconstruction** 3
Hidekiyo Tachiya

2 **Tokyo University of Agriculture East Japan Assistance Project Assisting with Reconstruction: Guiding Principles, Planning, and Propagation of Benefits** 19
Toshiyuki Monma

3 **Characteristics of the Agricultural and Forestry Industries in the Soma Area and Damage Sustained as a Result of the Great East Japan Earthquake** 43
Takahiro Yamada, Puangkaew Lurhathaiopath, and Toshiyuki Monma

Part II Reconstruction from Tsunami Damage

4 **Reconstruction Support for the Farmland Struck by Tsunami** 63
Itsuo Goto and Kaisei Inagaki

5 **Tsunami Damage to Farming Operations and the New Generation of Farmers and Farm Management** 85
Yukio Shibuya, Takahiro Yamada, Nyamkhuu Batdelger, Puangkaew Lurhathaiopath, Gentaro Suzumura, and Toshiyuki Monma

6 **Presenting a Model for the Revival of Rural Communities in Japan's Disaster Zones** 105
Shigeyuki Miyabayashi, Yasushi Takeuchi, Hiromu Okazawa, Tomonori Fujikawa, and Yutaka Sasaki

7 Contributing to Restoration of Tidal Flats in Miyagi Prefecture's Moune Bay Following the Great East Japan Earthquake and Tsunami 113
Susumu Chiba, Takeshi Sonoda, Makoto Hatakeyama, and Katsuhide Yokoyama

Part III Reconstruction from Radioactive Contamination

8 Initiatives by the Soil Fertilization Team to Develop Agricultural Technologies for Paddy Fields with Radioactive Contamination 123
Itsuo Goto and Kaisei Inagaki

9 The Potential for Producing Rice for Feed and Whole-Crop Rice Silage in Radiation-Contaminated Areas 139
Seiji Nobuoka

10 Developing and Trialing a System to Monitor Radionuclides in Individual Plots of Farmland to Help Reconstruction Farming in Contaminated Areas 149
Toshiyuki Monma, Puangkaew Lurhathaiopath, Youichi Kawano, Dambii Byambasuren, Yuta Ono, and Quar Evine

11 New Decontamination Methods for Parks and Other Areas in Which Radionuclides Have Accumulated 169
Mitsuo Kondo and Chizuko Mizuniwa

12 Forest Problems 179
Takahisa Hayashi

13 Nuclear Radiation Levels in the Forest at Minamisoma, Fukushima Prefecture 193
Iwao Uehara, Tomoko Seyama, Fumio Eguchi, Ryuichi Tachibana, Yukito Nakamura, and Hiroya Ohbayashi

14 Radioactive Contamination of Ostriches in a Potentially Permanent Evacuation Zone 203
Hiroshi Ogawa, Hidehiko Uchiyama, Koji Masuda, Takeshi Sasaki, Tadao Watanabe, Toshiaki Tomizawa, and Schu Kawashima

15 Radioactive Contamination in Some Arthropod Species in Fukushima 211
Tarô Adati and Sota Tanaka

16 A Consumer Survey Approach to Reputation-Based Damage Affecting Agricultural Products and How to Overcome It 221
Puangkaew Lurhathaiopath, Shizuka Matsumoto, Makoto Hoshi, Sayaka Yamaguchi, and Toshiyuki Monma

Part IV Activities and Impressions of Students and Farmers Who Supported the Project

17 Staking Recovery Hopes on Soma Revival Rice 235
Kaisei Inagaki, Tomoko Ninagi, Saburo Sasaki, and Akiko Sato

18 Impressions of the Students Who Participated in the Radioactivity Monitoring System of Farmland 247
Volodymyr Ganzha, Keiji Kanamori, Hana Fujimoto, and Ryo Itakura

19 Impressions of the Forestry Managers and Students Who Participated in the Radioactivity Damage Investigation of Forests 255
Eihachi Horiuchi, Kiyoaki Sasaki, Masaaki Itakura, Chisato Yasukawa, and Chihiro Kinoshita

Part I
The Road to Reconstruction from the Tsunami and Radioactive Contamination: Two and a Half Years On