

The background of the book cover is a traditional Japanese painting, likely a woodblock print or a reproduction of one. It depicts a rural scene where a person is plowing a field. The person is dressed in traditional attire, including a wide-brimmed hat and a patterned kimono. They are using a long pole to guide a large water buffalo, which is harnessed to a wooden plow. The field is a mix of brown and green, suggesting different stages of cultivation or different types of soil. In the foreground, there are some dark, rocky or uneven patches of land. The overall style is characteristic of Edo-period Japanese art, with a focus on everyday life and labor.

# Rice, Agriculture, and the Food Supply in Premodern Japan

Charlotte von Verschuer

Translated and edited by Wendy Cobcroft

# Rice, Agriculture, and the Food Supply in Premodern Japan

A large number of studies on the agricultural history of Japan have focused on the public administration of land and production, and rice, the principal source of revenue, has received much attention. However, while this cereal has clearly played a decisive role in the public economy of the Japanese State, it can be argued that it has not had a predominant place in agricultural production. Far from confining its scope to a study of rice growing for tax purposes, this volume looks at the subsistence economy in the plant kingdom as a whole.

This book examines the history of agriculture in premodern Japan from the 8th to the 17th century, dealing with the agricultural techniques and food supply of rice, wheat, millet and other grains. Drawing extensively on material from history, literature, archaeology, ethnography and botany, it analyses each of the farming operations from sowing to harvesting, and the customs pertaining to consumption. It also challenges the widespread theory that rice cultivation has been the basis of “Japaneseness” for two millennia and the foundation of Japanese civilization by focusing on the dietary diversity of Japan that is still the basis of Japanese nutrition today. Furthermore, the book will play a role in the current dialogue on the future of sustainable agricultural production from the viewpoints of ecology, biodiversity, environment, dietary culture and food security throughout the world as traditional techniques such as crop rotation are explored in connection with the safeguarding of the minerals in the soil.

Surveying agricultural techniques across the centuries and highlighting the biodiversity and polycultural traditions of Japan, this book will appeal to students and scholars of Japanese history, the history of science and technology, medieval history, cultural anthropology and agriculture.

**Charlotte von Verschuer** is a Professor at the École Pratique des Hautes Études (EPHE), Paris, France. Her research interests focus on agriculture, economics, foreign relations and material culture. Her books include *Across the Perilous Sea: Japanese Trade with China and Korea from the Seventh to the Sixteenth Centuries* (2006).

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# **Rice, Agriculture, and the Food Supply in Premodern Japan**

五穀文化

**Charlotte von Verschuer**

**Translated and edited by  
Wendy Cobcroft**

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# Preface

The Japanese learn from their earliest years that irrigated rice cultivation has played a dominant role in their history. Having been born outside this context, I wanted to find out when this “culture based on rice” appeared and how this cereal came to be a fundamental element of Japanese civilization. This book therefore grew out of a desire to go back to the sources of Japan’s rice-growing culture, and to examine the existence of a very widespread theory according to which rice cultivation has constituted the basis of what it means to be Japanese for two millennia. If one is to believe the supporters of this theory, who are as numerous among the Japanese as they are in non-Japanese scholarly circles, rice growing is the foundation of Japanese civilization, the rice field symbolizing the land and the society of this country.

For several years I worked my way through the historical and archaeological documents of early medieval Japan, looking for elements that would show the dominant place of rice in Japanese culture. But I found nothing that led in this direction. If many present-day scholars speak of a cultural primacy of rice, this is perhaps because of the wealth of information on rice found everywhere in the historical sources. However, these are concerned mainly with government and the life of the élites, so much so that the assessments of historians tend to focus on public accounting at the expense of the subsistence economy that is far less in evidence in the texts. The public administration is the subject of many publications. I will here focus my investigations on the origins of Japanese rice cultivation in the historical sources. To do this, I had to change my standpoint and approach. I tried to put myself in the place, no longer of the government, but of the farmers, namely the majority of the population. It became clear that rice was neither a staple food nor a fundamental element of the culture of early medieval Japan. In my view, the subsistence economy and the traditions of that time are characterized rather by a cereal polyculture (including rice and millets). The early medieval written sources speak of the “five grains”, a notion that symbolizes the Japanese idea of polyculture. Rather than rice alone, these diverse “five grains” played an essential role in the annual rituals and celebrations of early medieval Japan. My first aim, which was to go back to the origins of the rice-growing culture, led me to re-examine the role of rice in Japanese society. My research has led, in short, to a deconstruction of the myth of rice in early medieval Japan. On the other hand, it has revealed the full array of the country’s biodiversity and the rich variety of its agricultural practices.

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In the course of this work I have drawn on viewpoints from history, literature, archaeology, ethnology and botany. I have thus benefited from the judicious advice of many colleagues and friends. Francine Hérail, Marie Maurin and François Sigaut kindly read various chapters of the original French text and made many helpful suggestions. Jacqueline Pigeot and Michel Vieillard-Baron checked the French translations of many poems. The seminars of François Sigaut on agricultural techniques and of Jean-Marie Pesez on medieval archaeology gave me a much better understanding of the specificity of the Japanese context. Perrine Mane helped me to analyse the implements using the Japanese agricultural iconography that I showed her. Bruno Smolarz and Yoshio Abe were kind enough to contribute useful comments at my seminar on rice cultivation. Takeshi Watabe introduced me to the iconography of Chinese agriculture and – with Yin Shaoting – to the techniques of swidden farming (shifting cultivation) in the province of Yunnan. Sam Quoc Chan helped me to conduct a survey with the farmers of Dali, in Yunnan. Noriko Maeyama accompanied me around Japan during my research into modern swidden fields and early medieval toponyms and made a number of valuable comments. Wilhem Grootaers drew my attention to the importance of toponyms and dialects. Ishii Susumu gave me useful advice about the value of toponyms. Georges Métailié was kind enough to share his knowledge of traditional Chinese botany. Abe Gihei kept me regularly informed about the latest archaeological discoveries. Kōno Michiaki generously shared his knowledge of the agricultural techniques of early medieval Japan and provided me with a great deal of information on the subject. Kimura Shigemitsu told me a lot about the non-irrigated crops of late medieval Japan and acquainted me with the farming traditions of the village Akiyama-gō in Nagano. Toshio Araki supported me in some of my hypotheses that depart from the views of certain Japanese historians. Ishigami Eiichi often gave me advice and helped me to question his colleagues, thereby enabling me to refine my thinking on specific points. Suzuki Yasutami helped me with the philological interpretation of some early medieval texts. Jane Cobbi and Ernst Lokowandt drew my attention to the material and economic aspects, when I first went into this new field of research

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# Abbreviations

BZ	Dainihon bukkyō zensho
DNK	Dainihon komonjo
ES	Engishiki
F	Fudoki
GR	Gunsho ruiju
Hi	Heian ibun
IJ	Iroha jiruishō
K	Kojiki
Kjg	Kōtaijingū gishikichō
M	Man'yōshū
MJ	Nihon Montoku tennō jitsuroku
N	Nihon shoki
Ni	Nara ibun
NK	Nihon kōki
NKBT	Nihon koten bungaku taikai
NR	Nihon kiryaku
RGi	Ryō no gige
RK	Ruiju kokushi
RMS	Ruiju myōgishō
RR	Ritsuryō
RSh	Ryō no shūge
RSK	Ruiju sandai kyaku
ShJ	Shinsen jikyō
SJ	Nihon sandai jitsuroku
SKT	Shinpen kokka taikan
SN	Shoku Nihongi
SNK	Shoku Nihon kōki
SNKBZ	Shinpen Nihon koten bungaku zenshū
SNKS	Shinchō Nihon koten shūsei
SY	Seiji yōryaku
SZKT	Shintei zōho kokushi taikai
TM	Tōdaiji monjo
WR	Wamyō ruijushō
WSZ	Wakansansaizue
ZGR	Zoku gunsho ruiju

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# Introduction

Up to the 20th century, Japan's economy was based on agriculture, which provided for the needs of its inhabitants. The open countryside that has inspired poets over the centuries was characterized by rice fields, but rice was reserved for upper-class tables. For centuries, work in the irrigated and dry fields regulated the lives of a predominantly farming population. The agricultural history of Japan has been the subject of numerous studies, most of them focusing on the public administration of land and production. Rice, the principal source of revenue, has received most attention. However, while this cereal has clearly played a decisive role in the public economy of the Japanese State, it has not had a predominant place in agricultural production. Agriculture is no more synonymous with rice growing in Japan than in other Asian countries. The present work proposes an approach to agriculture that encompasses not only irrigated and dry cultivation, but also the fruits of plant gathering in uncultivated areas. Far from confining its scope to a study of rice growing for tax purposes, it looks at the subsistence economy in the plant kingdom as a whole. Leaving aside for the moment the public economy and its administration, we will attempt to paint a picture of the private (household) economy of Japan from the 8th to the 17th century.

Chapter 1 focuses on rice cultivation, especially the annual cycle of farm work from sowing in the seedbed to harvesting and storage. It also deals with the other permanent crops – cereals, vegetables and tree fruits – these too being part of a regular cycle of farming tasks. It shows the production processes and techniques mainly from the farmers' point of view as they can be observed through the administrative texts and early medieval poetry. The chapter ends with a summary of the technical innovations of the Edo period (1603–1867).

Chapter 2 describes the methods of itinerant forest agriculture, namely swidden farming or shifting cultivation and agri-silviculture. Given the dearth of historical sources, we have borrowed the conceptual framework from ethnology and have based our documentation on early medieval Japanese lexicography, poetry and toponymy. The practice of swidden farming,



## 2 Introduction

which has now been largely abandoned, appears to have been very widespread both in premodern Japan and in other civilizations.

Chapter 3 gives a catalogue of the wild plants harvested by the Japanese of the medieval period, with a great diversity of fruits, nuts, vegetables, herbaceous plants and tubers, as well as wild gramineae. The information drawn from the regulations relating to taxes and the kitchens of the imperial court has been supplemented by archaeological and ethnographical data.

Chapter 4 is an attempt to evaluate the production of the various agricultural sectors in the plant kingdom. We have carried out estimates of the proportion of rice and other foods in order to get some idea of the diet of the premodern Japanese. We have therefore looked at the data from the point of view of consumption and, in order to do this, we have compared the administrative texts with data from the prehistoric and late medieval periods.

Chapter 5 deals with cultural factors. It analyses the notion of grains held by the Japanese of the early medieval period and shows that rice did not occupy a dominant place in the mythology, the historiography, or the rituals and celebrations of the imperial court.

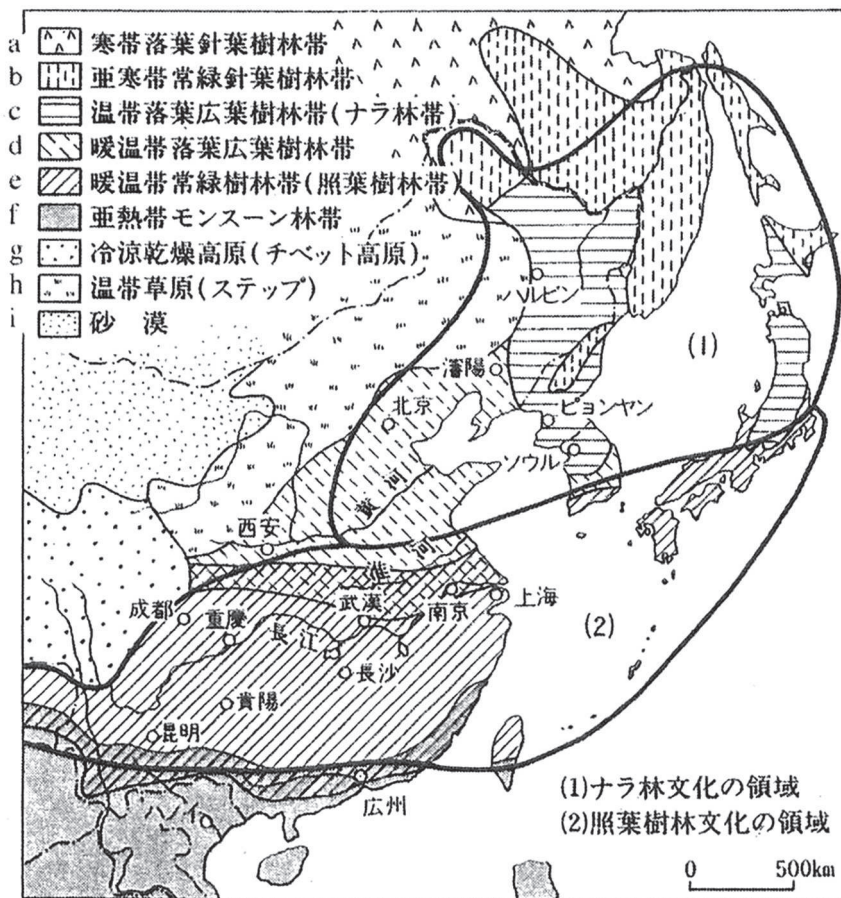
Each chapter includes a historical review of the debate on a specific problem. The questions raised relate to various topics: the Neolithic origin of swidden farming in Japan; the coexistence of the gathering of wild plants and agriculture; the role of rice in the dietary history; the theory of a so-called “rice-growing culture” that is specifically Japanese.

The book ends with a catalogue of the edible and industrial plants known from early medieval Japan (see the Appendix). To draw it up, we consulted the most reliable authors as regards the identification and names of plants, but the reconstruction of the ancient Japanese flora remains a subject for future research.

In order to situate our study in the natural setting of the Japanese archipelago, we have included an overview of the geographical environment and historical evolution of the agrarian space in Japan (see Map I.1).

### The natural environment

The Japanese archipelago has several climates and two major vegetation zones. The far north-east of the country consists of a subarctic zone with a conifer forest. The north-eastern half of Honshū is characterized by a cool-temperate climate and a forest of broad-leaved deciduous trees that includes fagaceae of the species beech *buna* and oak *konara*. The north-eastern region is called by the Japanese “Beech/Fagus zone *buna-tai*” or “oak forest *nara-bayashi*”. The south-west, taking in Honshū, Shikoku and most of Kyūshū, corresponds to a warm-temperate zone with a forest of shiny leaved trees, i.e. a laurel-forest *shōyō jurin*, thickly wooded with oaks of the species cyclobalanopsis *kashi* and castanopsis *shii*. However, the primary forest has receded owing to reafforestation with useful conifers. A process begun at the end of the Neolithic, reafforestation, especially with pines *matsu*, would have been



Map I.1 Vegetation zones of East Asia

Notes: (1) Beech/Fagus zone; (2) laurel-forest zone (a) Arctic zone, forest of conifers and deciduous trees; (b) subarctic zone, conifer forest; (c) cool-temperate zone, forests of broad-leaved deciduous trees, Fagus zone; (d) warm-temperate zone, forest of broad-leaved deciduous trees; (e) warm-temperate zone, forest of evergreen trees, laurel-forest zone; (f) subtropical zone, monsoon zone; (g) Tibetan plateau; (h) steppe; (i) desert.

Sources: Sasaki Kōmei, *Nihon bunka no kiso o saguru*, NHK Books, 1994, based on Zhongguo zhipi bianji weiyuanhui, ed., *Zhongguo zhipi*, Beijing Kexue Chubanshe, 1983, p. 53.

#### 4 Introduction

accelerated with the progress of civilization from the 5th century AD. In the 1970s, the planting of resinous trees, such as the cryptomeria *sugi* and cypress *hinoki*, was once again encouraged by the government, so much so that the forest landscape changed markedly up to very recent times. From an agricultural point of view, Japan has benefited from a dual influence from the continent. Dry crops arrived from the northern *Fagus* zone, while irrigated rice growing made its appearance from the southern laurel-forest zone.

#### The introduction of irrigated rice cultivation

Traditionally (from the mid-20th century), the introduction of irrigated rice growing into the Japanese archipelago was dated to the beginning of the Yayoi period, which in its turn was dated from 300 BC–300 AD. It was thought that rice growing spread very rapidly, in a few centuries, up to the far north-east of the island of Honshū. Since the distribution and management of irrigation systems required a social organization, the Yayoi period would have witnessed the birth of an agricultural society based on rice cultivation. This notion formed part of everyone's general knowledge and was included in Japanese primary school textbooks up to the beginning of the 21st century. However, this notion has recently been re-examined and redefined, as it is no longer supported by material evidence.

It is known today that the beginnings of irrigated rice cultivation in Japan date from the early 1st millennium BC, that this agricultural technique first arrived in the north of the island of Kyūshū and that it followed a long journey of several centuries before being adopted in other regions. Moreover, the discoveries relating to rice growing have led scholars to question the dating of the Yayoi period itself. Depending on whose work one consults, it begins around 400, 500, 780 or 950 BC. In the early 2000s, scholars tended to date the Yayoi period from the early 1st millennium BC to the late 3rd century AD as regards the introduction of irrigated rice. As of 2014, however, the dating for the beginning of Yayoi has been reassessed, so that it now coincides with the start of agriculture in general (beginning with dry crops before irrigated rice), namely between the mid-2nd and the mid-1st millennium BC (see Table A.3 in the Appendix).

Four archaeological sites have prompted theoretical speculations by those in favour of a very rapid expansion of irrigated rice cultivation in the archipelago:

- Itazuke in Fukuoka, discovered in 1978, dating from 1000–500 BC, or the end of the final Neolithic (according to the former dating);
- Nabatake in Fukuoka, discovered in 1979, dating from the middle of the final Neolithic (depending on the scholar consulted, between 800 and 400 BC);
- Tareyanagi in Aomori, dating from the middle phase of Yayoi (the first centuries around our era), discovered in 1981;
- Sunazawa in Aomori, dating from the end of the early phase of Yayoi (2nd century BC), discovered in 1987 (all according to the former dating).

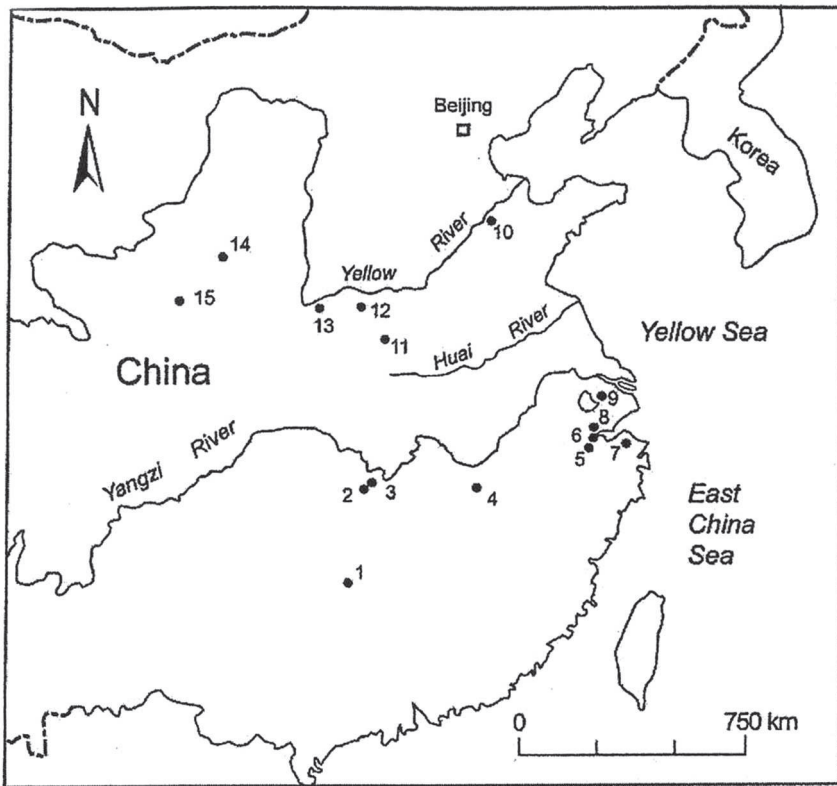
While the four sites mentioned do indeed prove that irrigated rice cultivation in the south (Kyūshū) began in the early 1st millennium, these sites that are supposed to document the spread of rice growing from Kyūshū (Fukuoka) towards the far north of Honshū (Aomori) in three or four centuries remain isolated. Moreover, the spread towards the north-east (Aomori) was not overland, but via the Sea of Japan. Subsequent archaeological discoveries have shown other geographical gaps between the regions of the Inland Sea and the Aomori sites and, what is more, these new discoveries attest to the presence of rice, though seldom of irrigation. The rice discovered in the form of marks on pottery, charred grains, pollens or phytoliths does not make it possible to distinguish between irrigated and dry crops; and, apart from the two sites in Aomori, archaeologists have found few traces of hydraulic systems (irrigation canals or dykes) in remains before the 1st century AD outside Kyūshū.

On the other hand, the biologist Satō Yōichirō has revealed the genetic DNA structure of two types of rice in samples taken from sites of the Yayoi period: temperate *Oryza sativa* L. var. *japonica* (*ontai japonica*) and the tropical *japonica* variety (*nettai japonica*). The former, irrigated, is originally from eastern China; the latter is still being widely grown on swidden fields in many parts of South-East Asia. Temperate rice, irrigated, gradually made its way into the Japanese archipelago, after tropical dry rice which, according to Satō Yōichirō, was still grown until the Heian period (784–1185).

There remains the problem of the origin of this rice. In the present state of knowledge, it is thought that the centre of rice domestication is likely to have been in the region of the Middle and Lower Yangzi in China. However, this process has been the subject of ongoing research since the discovery of the Hemudu site in Zhejiang in the 1970s. In fact, it took several thousand years from the beginning of wild rice harvesting in the late Pleistocene until the emergence of fully domesticated rice in the early–middle Holocene. Researchers also agree that, even at this time, the selection pressure was apparently not intensive and that rice played only a minor role in the subsistence economy (Li Liu and Xingcan Chen, 2012). The Chinese archaeological sites for domesticated rice include both *indica* and *japonica* varieties and provide evidence of irrigated as well as tropical dry rice (see Map I.2). It is therefore possible that not only irrigated rice, but also tropical rice reached Japan from the Lower Yangzi region.

Transmission may have been directly via the East China Sea, or via southern Korea, albeit with a significant time difference. Irrigated rice would only have reached Kyūshū in southern Japan several thousand years after its beginnings in China (see Map I.3), that is, between 1000 and 500 BC.

Irrigation techniques subsequently spread across the Japanese archipelago (except Hokkaidō) during the Yayoi period (500 BC–300 AD), but with regional differences. The process of adopting such techniques imported from the Chinese mainland was probably not as rapid and uniform as might have been thought until recently. Dry or wet (non-irrigated) rice cultivation is attested in



Map I.2 Archaeological sites associated with rice remains in China

Notes: Sites excavated between 1971 and 2009, including wild and domesticated rice remains, and dated to between 12000/11000 BP (or 10000/9000 BC) and 5000 BP (or 3000 BC). Numbered dots: 1. Yuchanyan; 2. Pengtoushan; 3. Bashidang; 4. Xianrendong-Diaotonghuan; 5. Shangshan; 6. Kuahuqiao; 7. Hemudu; 8. Luojiaojiao; 9. Caoxieshan; 10. Yuezhuan; 11. Jiahu; 12. Huizui; 13. Nanjiaokou; 14. Qingyang; 15. Xishanping.

Source: Li Liu and Xingcan Chen, *The Archaeology of China: From the Late Paleolithic to the Early Bronze Age*, Cambridge: Cambridge University Press, 2012, p. 77.

the archipelago long before the introduction of irrigation techniques. Some regions may have adopted the new irrigation method for a time, without changing their system of rice production in the long term. In any event, it seems that in the Yayoi period rice was not always irrigated and that the two types, temperate (irrigated) and tropical (which may be dry or wet, and in this case rain fed), coexisted.

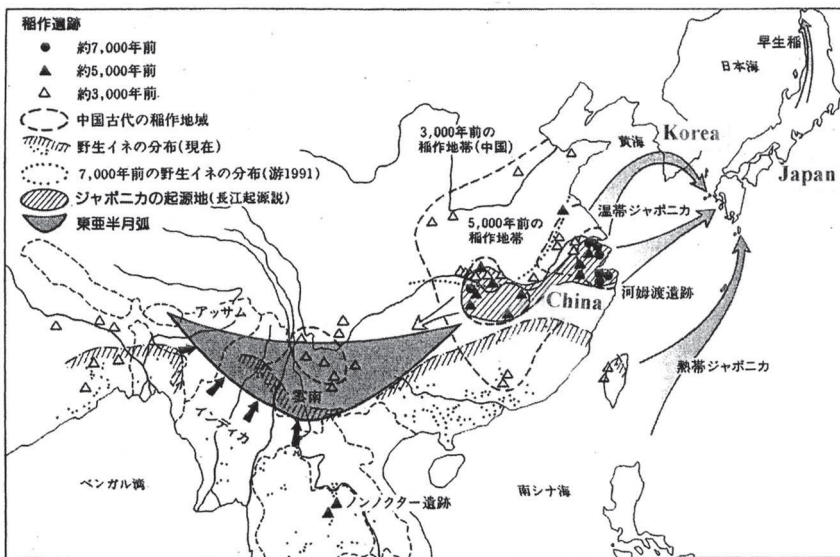
Several regions would have seen the emergence of agricultural societies based on rice cultivation. However, archaeological circles in Japan have in recent



times distanced themselves from the traditional view of a Japanese archipelago that converted *fully* and *all at once* to a rice-growing society at the dawn of Yayoi culture (Satō Yōichirō, 1996, 2001, 2002; Negita Yoshio, 2000; Hirose Kazuo, 1997; Tamada Yoshihide, 2009; Fujio Shin'ichirō, 2011; Shitara Hiromi, 2014).

The indigenous “Japanese” population in the south of the archipelago, notably in Kyūshū, was joined by groups from the continent, mainly from the Korean peninsula, during the Yayoi period. They were farmers who practised, among other things, irrigated rice growing. The repeated waves of immigration, which no doubt continued beyond Yayoi and up to the 5th–6th century, resulted in the intermixing of peoples and the spread of irrigation techniques side by side with other non-irrigated shifting and permanent crops from Kyūshū towards the central areas.

Local élites were formed; it is likely that they took on the management of the hydraulic systems and imposed rice growing in their respective regions. These



Map I.3 Transmission of irrigated rice cultivation to Japan

Notes: Rice-growing sites on the Asian continent: Black dot: site dating from 7000 BP or 5000 BC; Black triangle: site dating from 5000 BP or 3000 BC; White triangle: site dating from 3000 BP or 1000 BC; Dotted line: zone of irrigated rice cultivation in China; Striped line: zone of self-sown rice; Striped grill: probable centre of the emergence of rice cultivation in the Middle and Lower Yangzi; at the eastern extremity, the site of Hemudu at Yuyao, province of Zhejiang; Grey crescent: second centre of rice cultivation in Yunnan-Assam; Arrows: directions of the spread. The dating of Chinese sites is provided by Chinese archaeologists and has been reproduced by their Japanese counterparts.

Source: Sasaki Kōmei, *Nihon bunka no kiso o saguru*, NHK Books, 1994, p. 121; map based on data from Satō Yōichirō, *Ine no kita michi* (1992).

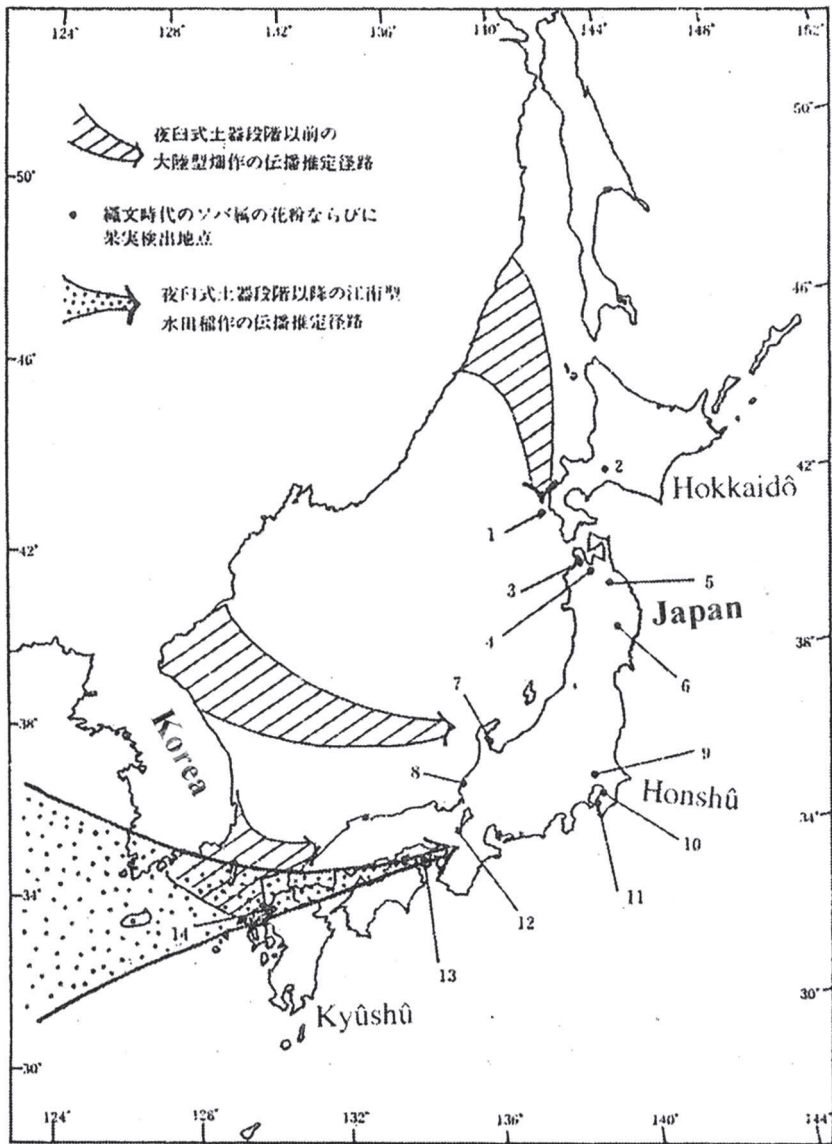
## 8 Introduction

élites founded on rice cultivation may have gradually increased in number towards the centre of the archipelago. Then in the 7th century AD, the Yamato clan gained power. Starting from the seat of its imperial court in central Honshū, this clan imposed rice growing on the population as an obligatory system of production and in the administrative code decreed rice to be the foundation of the fiscal and land system. Henceforth, irrigated rice was the basis of the public economy of the Japanese State and remained the value standard over the centuries and up to the modern period. It might be thought that the rice-growing phenomenon reached all the territory controlled by the Yamato clan, but in our opinion this is not so. Irrigated rice cultivation was widely practised on the plains and plateaux of the archipelago, which cover about one-quarter of the land surface. Moreover, rice was largely reserved for fiscal purposes, with most of its production used to feed the élites. In our view, rice was not the main staple food of the rural populations, either during Yayoi or during the following centuries and throughout the medieval period. Furthermore, irrigated rice arrived from the continent long after the other cereals and vegetables and has coexisted with these dry crops up to the present day (Miyamoto Kazuo, 2000; Terasawa Kaoru, 2000; Harada Nobuo, 2006; Fujio Shin'ichirō, 2011; Barnes, 2015).

### The introduction of dry grains

When irrigated rice cultivation reached northern Kyūshū between 1000 and 500 BC, dry rice and other graminæ had already been known there for one or two millennia. Archaeologists have discovered traces of buckwheat *soba* in fourteen Neolithic sites. Buckwheat appeared with barnyard millet *hie* in Hokkaidō from the early Neolithic (4000–3000 BC) and spread to northern Honshū during the mid-Neolithic (3000–2000 BC), together with common millet *kibi* and foxtail millet *awa*. These plants are of continental origin, though for barnyard millet archaeologists have also discovered a self-sown indigenous variety. It may be noted that all these cereals spread from the north-east to the south-west. They have in fact followed an opposite path from that of irrigated rice within the archipelago. Map I.1 shows the influence of the southern laurel-forest zone, the centre of irrigated rice; but there has also been an undeniable impact of the northern *Fagus* zone through which dry cereals reached Japan (Map I.4).

Other edible plants have been present across the country since the early Neolithic, such as beans *ryokutō* and tubers. Dry rice was known in western Honshū and Kyūshū long before irrigated rice, i.e. from the mid-Neolithic. Given the geographical location of the Neolithic dry-rice sites in southern Japan, and the fact that tropical dry rice is attested in China (Lower Yangzi) and South-East Asia, it might be thought to have come from the laurel-forest zone. However, the possibility of another transmission route via the southern islands cannot be ruled out. A rice transmission route via the Pacific has been under consideration for a long time based on the theories of Yanagita Kunio (1875–1962), but it is not supported by any evidence (Map I.3). The existence of this route may be confirmed in the future by the results of research into the



Map I.4 Transmission of cereals to Japan from the continent

Notes: Striped arrows: transmission of dry cereals from the Beech/Fagus zone; up to the late Neolithic (up to 1000 BC). Dotted arrow: transmission of irrigated rice cultivation from the laurel-forest zone; during the final Neolithic (1000-500 BC). Numbered dots: archaeological sites of the Japanese Neolithic where remains of buckwheat and/or nuts and seeds have been discovered.

Source: Yasuda Yoshinori, *Sekaishi no naka no Jōmon bunka*, Yūzankaku (1987: 214).



## 10 *Introduction*

origin of rice, taro and/or yams. All these spontaneous plants later gave rise to pre-domestic practices including systematic collecting and self-sowing, as well as to domestication, that is, the selection and manipulation of varieties. In any event, Japan had grain acquisition techniques long before the introduction of irrigated rice growing (Yasuda Yoshinori, 1987; Miyamoto Kazuo, 2000; Satō Yōichirō, 2000; Yamaguchi Hirofumi, 2011).

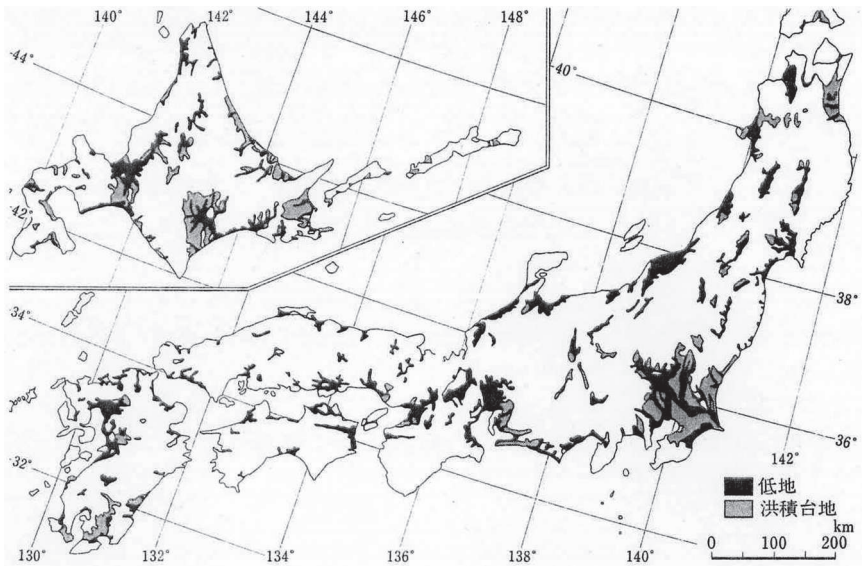
The earliest forms of dry cropping are dated to the late or final Neolithic or to the early Yayoi period. The dates are the subject of a debate that will be summarized at the end of Chapter 2. But we may assume that the early forms of farming, after pre-domestic acquisition and domestication, evolved into swidden and permanent farming of dry (non-irrigated) cereals and leguminous plants, and that irrigated rice growing, far from supplanting non-irrigated agriculture, coexisted with it from that time.

Since rice fields need level surfaces, rice was first grown on lowlands, as terracing is required to prepare slopes. This is why the coastal plains and intra-mountainous basins were ideally suited to and probably reserved for irrigated rice cultivation. Yet this space represents only a very small part of the land area of the archipelago (Map I.5). In fact, between two-thirds and three-quarters of the country is covered by forests and mountains, which are the preferred locations for dry swidden or permanent agriculture and the harvesting of wild plants. The topography of Japan is thus characterized by a duality of landscape: rice-growing plains and wooded mountains (Pelletier, 1994).

### **The forest environment**

With a forest cover of 66.5%, second only to that of Finland with 68.7%, Japan is characterized by a high rainfall (1,800 mm or twice the world average) favourable to the regrowth of forests, and these forests are situated almost entirely in the mountains. The wooded mountain is the defining element of the Japanese landscape. Mountains cover 61% of the nation's territory and hills (up to 300 m above sea level) cover 11%. Three-quarters of the country therefore consists of mountainous terrain. This proportion was perhaps close to 80% in early medieval Japan, if one excludes the areas of northern Honshū and Hokkaidō, which were not part of the country until modern times. Today, Japan has only 14% of lowland plains and 11% of moderately elevated flatlands (20–100 m above sea level).

Japan's terrain is characterized by its omnipresent slopes. Moderate or steep slopes (8–30° gradient) account for two-thirds of the total land area of the archipelago and very steep slopes (more than 30°) another one-tenth. One-quarter of the land area is on slopes of less than 8°, only half of which is actually flat (less than 3°). In other words, even the slightest reliefs stand out clearly and elevations of no more than 100 m take on the appearance of peaks, with deeply carved valleys and steep passes. This hilliness is explained by the violent action of the watercourses, which is far greater than atmospheric weathering. Aided by seasonal typhoons, with heavy and sometimes deluging rainfall, water erosion increases the number of V-shaped profiles (Berque, 1980).



Map I.5 Topography of the mountains, intramountainous basins and coastal plains

Notes: Reconstruction of Neolithic topography before the alluvial advance onto the littoral and modern polderization. White: wooded mountains; black: lowland plains; grey: intramountainous basins and alluvial terraces.

Sources: Sasaki Kōmei, *Hatasaku bunka no tanjō*, Nihon hōsō shuppankai (1988: 256); after Fujioka Kenjirō, *Nihon chishi*, Daimeidō, 1982.

With such a terrain, most of the Japanese landscape is thus an uncondusive environment for irrigated rice cultivation, as the gentlest slope requires terracing. In 1980, rice was grown wherever possible on the coastal plains and lowlands. Only 6% of rice fields were on slopes of more than 5°. In the early medieval period, however, some mountain populations were probably forced to farm unsuitable lands to fulfil their tax obligations to the imperial court. The mountainous zones, far from being unsuitable for dry crops, were on the contrary well suited to swidden-field crops, as these thrive on slopes of 30°.

Moreover, the wooded mountain areas had an abundance of plants available for gathering. In autumn, tree fruits and nuts were plentiful in the various environments. In the *Fagus* zone, there were acorns of *nara* oaks, beechnuts, walnuts, horse chestnuts and (sweet) chestnuts. The laurel-forest zone provided acorns of *kashi* and *shii* oaks, *kaya* (torreya) and other fruits such as the persimmon *kaki* and the akebia. Spring offered gatherers plants with edible parts, such as brackens and angelica. The mountain inhabitants extracted nutritious starches from the roots of lilies, yams, pueraria and bracken. Nuts and seeds have a calorific value similar to that of cultivated cereals (see Table A.5 in the Appendix). To sum up, while the lowlands were suitable for irrigated crops, the mountains also provided ample opportunities for obtaining plants.

# 1 Irrigated rice and dry crops

In early medieval Japan (8th–12th centuries), agricultural produce came, we think, from two types of cultivated areas: permanent fields and temporary (shifting) fields. The permanent areas consisted of irrigated rice fields, non-irrigated cereal fields (what we will call dry fields) and gardens with vegetables and fruit trees. Farming tasks followed one after the other throughout the year, at the times suited to each operation, and in parallel in the different areas. For example, the sowing of wheat took place at the same time as the irrigated rice harvest, in the 8th month (September) of the early medieval calendar. According to the calendar in use in premodern Japan, spring went from the 1st to 3rd month (February–April), summer from the 4th to 6th month (May–July), autumn from the 7th to 9th month (August–October) and winter from the 10th to 12th month (November–January). Farming tasks were divided equally from spring until autumn, at least in the central region (Kinai) around the two capitals of Nara and Heian (Kyōto), the area best documented by the archival texts.<sup>1</sup>

The public administration was tasked with overseeing the collection of taxes and, in order to achieve this, it encouraged farming activity. But contrary to Chinese practices, the Japanese government did not provide technical advice and did not distribute agricultural calendars or agronomy manuals before the 17th century. To stimulate agriculture, it repeatedly issued decrees to remind the local officials of all the provinces of their supervisory duty. Government encouragement consisted of rewarding zealous officials and having them undertake tours of inspection and write reports. The only technical recommendations that we know of, issued between the 8th and 12th centuries, deal with two points: the water-wheel and the rack for drying rice sheaves.<sup>2</sup>

The governmental decrees also urged the peasants “not to let the propitious time go by” for farming operations, without, however, making reference to an established calendar. In its admonitions, the administration seldom spelled out what tasks needed to be done, but once or twice it mentioned the sowing of wheat and buckwheat. Other than that, the almanacs distributed each year by the imperial court to all the provinces recorded the auspicious days for

certain operations, such as tillage, the cutting of vegetation on waste ground and the repair of the irrigation channels in the rice fields.<sup>3</sup>

It may seem strange that the Japanese did not consult the Chinese agronomy manuals for technical questions. There was an abundant Chinese literature on the subject. It produced seventy-eight agricultural treatises and calendars up to the late 10th century, some having been ordered by the Chinese court and distributed on its orders to all parts of the empire.<sup>4</sup> Japan imported from China many technical works in various fields, and the most detailed agricultural treatise *Qiming yaoshu* (6th century) was in its libraries in the 11th century. Even today there remains a copy made in 1166 in the Kudaradera temple. The Japanese administrative and legal texts dealing with agriculture do not mention the Chinese technical manuals and refer only to the early medieval encyclopedias and classical Chinese literature, as well as the chapters on public economy in the Chinese histories.<sup>5</sup>

Can this be seen as ignorance or a lack of interest on the part of the Japanese authorities in the matter of farming techniques? The absence of any reference to the Chinese treatises is all the more surprising as the Japanese learned from China in other scientific fields such as medicine, botany and calendrical science. In these fields, they edited their own compilations from the 9th century, whereas they began to write agricultural treatises only in the 17th century. Some scholars explain this phenomenon by the geographical and climatic differences between the two countries. Up to the 7th century, China was mainly concerned with non-irrigated cereal crops in the north of the country, whereas the Japanese court focused on irrigated rice cultivation. Moreover, northern China experiences long winters and less well-defined seasons than Japan. It follows that Chinese technical directives could not be adapted to fit the Japanese environment. In this country, the seasonal changes of the flora and fauna would serve as the guide that called farmers to their task.<sup>6</sup> In Japan, the phenological calendar was in fact quite distinct, as can be seen in the early poetry. This evokes, for instance, the sowing of the seedbeds in spring, when the wild geese return to the Nordic regions, the transplanting of the rice in summer beneath the cuckoo's song and the harvesting of the rice in autumn when the lespedeza comes into bloom. Work in the fields ended, according to the poets, when the wild geese returned to pass the winter in Japan. Thus, in what follows, our informants will be the Japanese poets, as well as the administrators and officials in charge of rural affairs, since we have no agricultural texts as such.

However, more than the geographical differences between China and Japan, the Japanese way of seeing the world seems to us to be the main reason for the court's lack of interest in technical questions. In our view, the Japanese mentality put zeal before technical ability. According to the authorities of the early medieval period, the farmer did not have to reason, but to work. A rational approach coupled with an economy of human energy and the notion of productivity was only to appear, in agriculture, in the 17th century.

**The ideal of the zealous farmer**

The *Shinsarugakuki*, written in the mid-11th century, conveys to us the image of the zealous farmer, as idealized by the Japanese authorities of the time. Here, by way of introduction, is the portrait of this “ideal farmer”. At the same time, the text surveys the agricultural vocabulary:

Tanaka no Tomoyasu, supernumerary assistant in the government of the province of Dewa (present-day prefectures of Yamagata and Akita), who is the husband of the third daughter of the officer of the palace gate guard, residing in the right section of the capital of Heian, devotes himself solely to agriculture, with no other occupation. He finds himself at the head of a household that owns several *chō* (1.3 ha) and is a manager *tato* of some repute. Year after year, in times of drought and in times of rain, he prepares the spades *suki* and hoes *kuwa*, inspects the soil quality and repairs the harrowing-combs (harrows) *maguwa* and ploughs *karasuki*. He skilfully shows the farmers how to maintain the dams, dykes, canals and ditches, and, in the fifth month, he employs men and women to transplant *hashoku* the rice, after sowing *tanemaki* in the seedbeds *nawashiro* and tillage *kōsaku*. He cultivates early rice *wase*, late rice *okute*, non-glutinous rice *urushine* and glutinous rice *mochi*. For the grain harvest *karikai*, he outdoes everyone else and the quantities of pounded rice increase each year. Moreover, the wheat or barley *mugi*, soybeans *mame*, cowpeas *sasage*, red beans *azuki*, foxtail millet *awa*, common millet *kimi*, barnyard millet *hie*, buckwheat *sobamugi*, perilla *e* and sesame *goma* that he has planted ripen in abundance in the gardens *sono* and dry fields *hatake*. Each seed he sows *chirasu* in the soil in spring multiplies by the thousands in autumn, and is then stored in the granaries *kura*. He does not make the slightest mistake from tillage *tsukuri* in spring until the harvest *osame* in autumn. He delights in seeing the five grains *gokoku* ripen and in reaping an abundant harvest of them and never to have known losses due to drought, flood, insect infestations or the failure of a crop to ripen. He has never shirked his duty to welcome with a feast the inspectors of the land register and the taxes levied on the holdings. Naturally, he has never forgotten a single sheaf or a single measure in the payment of taxes including: the farm rent, regular tribute, the land-tax in hulled and unhulled rice, the tax in kind, the tax that replaces corvée labour, the products that replace the rice taxes, the exceptional tax, the equipment and provisions for the government envoys, the local specialities, the price of saké; nor forgotten anything at all in the management of the lands under his control, namely the handing out of seed, the management costs, the purchase of products for exchange, the management of the labour corvées, credit and gifts for the provincial administrators. Though he has the misfortune to belong to a household that is subject to taxes, he is nothing like a member of these pathetic families who are always there weeping, flattering and begging.<sup>7</sup>

This extract lists the work in the fields that we now discuss in detail, more or less following the annual cycle from the 2nd month (March).

## Tillage

Every yearly agricultural cycle begins with the preparation of the soil, which involves breaking up the earth to enable it to bear the new crop. There are usually several tillings from the 1st month in the seedbeds, rice fields and dry fields. The number and depth of the dressings depend on the type of soil, type of crop, climatic conditions, etc.

Tillage is mentioned in a number of 8th-century poems, one of which says: “They have raked *aragaki* the rice field in front of my door and, under the bright sun, I wait for rain; I also wait for you.” Another poet expresses himself as follows: “In the dug rice field *utsu ta*, there remains plenty of barnyard millet, but not removed *erabu* [it is abandoned; I too am abandoned] and tonight will sleep alone.” From prehistoric times, the legendary emperor Nintoku (r. 313–399) and the empress reputedly composed poems about tilling *utsu* with the wooden hoe *koguwa*, carried out in a field of white radishes. Another legendary emperor mentions the iron hoe: Kensō (r. 485–487) addresses this poem to his brother on his arrival in the village of Shijimi in the province of Harima (Hyōgo): “Since you strike your fields *ta-utsu*, with hoes of Kibi iron, strike in your hands, all together, and I shall dance.”<sup>8</sup>

These poems mention the hoe and the spade, the two basic tillage implements used for both irrigated rice cultivation and dry crops. They are made of carved wood, and hundreds of remains have been found in archaeological sites. The hoe consisted of a blade and a handle into which it was inserted and with which it formed an acute angle. The spade was made either of a single piece of wood, or with a handle inserted into an eye of the blade, but forming an obtuse angle. From the 5th century, iron implements became more widespread: the wooden blade was embedded in an iron cutting edge shaped like a crescent, called a “hoe-iron” or “spade-iron”.

From the 7th or 8th century, tillage was part of the rituals of the Ise Shrine. In the 2nd month, a ritual hoe with an iron cutting edge was made and a priest tilled the sacred seedbed *mitoshirota o tagaesu*, accompanied by songs and dances. This ritual symbolized the start of agricultural work in the country. It was later taken up by the imperial court. The repositories of the Shōsōin in Nara have preserved two ritual spades, one dating from 758, used for the ceremonial tillage at the Nara court. This ceremony later took the form of an annual celebration at the palace. For example, in 864 and 866, all the members of the Heian court attended a ritual simulating the agricultural tasks *ta o tagaesu no rei*. This ritual is the origin of the agrarian festivals *dengaku* celebrated in the Japanese countryside from the medieval period to the present day.<sup>9</sup>

The examples mentioned refer only to the hoe *kuwa* and the spade *suki*, but on the occasion of the transplanting *taue* ceremonies and the rustic festivals



at the court in 1127, two oxen were brought along, which suggests draught tillage or harrowing in the irrigated rice field (Figure 1.9). Some large aristocratic and monastic holdings or estates did in fact have harrows and ploughs, but in our view draught agricultural implements were still not widespread at this time among the rural population.<sup>10</sup> Nonetheless, the plough appears in a poem by Emperor Tsuchimikado (r. 1198–1210) about quadrupeds: “Nowadays, one wonders whether the ox has the strength to pull the plough *karasuki* with which the peasants till *tagaesu* their rice field.” In poetry, the term *sukikaesu* probably meant “draught tillage”, and the terms *shirokaki* and *aragaki* “raking”;<sup>11</sup> the words *ta-utsu* and *uchikaesu* refer to digging with a hoe or a spade, and *tagaesu* to hand or draught tillage.<sup>12</sup>

It is not known whether the early medieval Japanese varied the depth of tillage, but we do know that they classified soils according to the expected yields into good, average, mediocre and poor quality. From the time of the minister Fujiwara no Muchimaro (680–737), people appreciated “the very black soil that characterizes a rice field of very good quality, where one can count on stable yields, even if there is drought or flooding”.<sup>13</sup>

When was tillage done? The celebrations at the Ise Shrine and the imperial court took place in the 2nd month (March), but the fields were tilled several times during the first three months of the year. The fragments of three almanacs for the years 746, 749 and 756 in fact show the auspicious days for tillage *tsuchi okoshi* in the 1st, 2nd and 3rd months, but no day in the 4th month.

Tillage was also depicted in the image of the 2nd month in the calendars painted on folding screens that decorated the aristocratic residences. Though none of these paintings survive, the descriptions remain. The composition of *byōbu uta* poems about the screen images *byōbu e* was in vogue from the 10th century. For example, the chief of police Fujiwara no Tadakimi (?–968) describes one of these images as follows: “Scene of tillage in the middle of spring (2nd month); several people are present, gathered under a willow tree; they are celebrating the god of the fields.” Other poems describe tillage in the 2nd or 3rd month.<sup>14</sup>

Apart from rice growing, our information on the other crops is restricted to the imperial vegetable gardens where wheat, barley and twenty-three vegetables were grown. Here tillage was done using a plough *kōchi*, hand tillage with hoes and spades *ryōri heiwa*, and raking *tsuchikai* possibly with a notched levelling board or a rake. Draught tillage was done once only for barley, wheat and beans, twice for fourteen vegetables, three times for Chinese chives, spring onions and radishes, five times for turnips and ginger *kurenohajikami* and seven times for wild chives. The first draught tillings were followed by a fairly intensive dressing with a hoe or spade, since one, two or three days’ work would be required for the same areas. After that, ridges were formed *une-age*, *wake-une* for two-thirds of the crops. Raking was done after the sowing of melons, egg-plant and taro, in order to cover the seed or to clean (i.e. to weed or break up the topsoil). There is no mention of any draught harrowing, whereas two ox-drawn harrows *maguwa* formed part of

the equipment for these gardens. According to Kōno Michiaki, harrowing was essential, particularly before transplanting water-celery and water-leeks.<sup>15</sup> In view of the interest of the regulation relating to the imperial vegetable gardens, the only document with technical information that we possess for the early medieval period, we will give a translation of it below.

### **The imperial vegetable gardens**

The “Regulations of the Engi Era” (*Engishiki*) issued in 927 deal with the vegetable gardens managed by the Bureau of the Imperial Table. They provide the only detailed account of the methods used for cereal and vegetable crops in the early medieval period.<sup>16</sup> We therefore present a complete translation of the chapter.

For the vegetable gardens, eleven oxen are to be provided by the Left and Right Offices of Horses. If an ox has died or is unfit for work, a request for its replacement is to be made to the Department [of Military Affairs]. The Department will give effect to the request after verification by the Ministry [of State Affairs]. Also to be provided are: 74 hoe and spade [blades], 40 hoe handles and 34 spade handles, to be replaced every two years (the old [blades] to be returned); 2 harrows (to be returned when they are damaged); 2 plough mould-boards and 4 ploughshares (to be asked for again if lost) [Figure 1.2] and 2 carts (replaced each year).

The gardens are cultivated by 14 workers (a head gardener and 13 subordinates). There is a boat for river transport (3 *jō* [9 m] long), moored at the port of Yodo-tsu [in Yamashiro]. This boat is used to transport the vegetables from the gardens of Nara and Naiki [to the Heian palace].

The gardens cover in total 39 *chō* 5 *tan* 200 *bu* [40 ha]. These are the vegetable gardens of Keihoku, 18 *chō* 3 *tan* [located north of Heian?], of Nara, 6 *chō* 8 *tan* 320 *bu* [at Kuse], of Yamashina, 9 *tan* [at Uji], of Naiki, 5 *chō* 5 *tan* 240 *bu* [at Kuse], of Hatsukashi, 4 *chō* 9 *tan* [at Otokuni], of Izumi, 1 *chō* [at Sōraku] and of Nara, 2 *chō* [at Nara?].<sup>17</sup>

There are 460 fruit trees: 100 pear, 100 peach, 40 mandarin *kan[shi]*, 40 dwarf mandarin, 100 persimmon, 20 orange *tachibana*, 30 large jujube *ōnatsume* and 30 *stauntonia mube*; and a garden of blackberries *ichigo* of 2 *tan*. All this is to be cultivated in accordance with the regulation. If the quantities are insufficient, this will be dealt with by the Discharge Investigation Bureau, when the officials responsible hand over to their successors.

There are irrigated fields of 6 *tan* 234 *bu* (to grow water-celery and water-leeks, located in the district of Otokuni).

Work in the vegetable gardens:



18 *Irrigated rice and dry crops*

- To grow 1 *tan* [0.3 acres] of barley *futomugi* requires 1 to 5 *shō* [12.75 litres] of seed and 14.5 days' work, namely:<sup>18</sup> 1 day for tillage with 1 ploughman, 1 ox driver and 1 ox; 1 day for hand tillage *ryōri* [with a hoe or spade]; 2 days to form the ridges; 1 half-day for sowing *tane-oroshi*, 2 days for harvesting, 5 days for selecting/threshing *erabu*,<sup>19</sup> 2 days for pounding *katsu*; (the same for wheat).
- To grow 1 *tan* [0.3 acres] of soybeans *mame* requires 8 *shō* [6.8 litres] of seed and 13 days' work, namely: 1 day for tillage with 1 ploughman, 1 ox driver and 1 ox; 1 day for hand tillage *ryōri heiwa*; 2 days to form the ridges; 2 days for sowing *uu* (in the 3rd month); 2 days for weeding *kusagiru*; 2 days for harvesting; 2 days for shelling.
- To grow 1 *tan* [0.3 acres] of red beans *azuki* requires 5 *shō* 5 *gō* [4.7 litres] of seed and 13.5 days' work, namely: 1 day for tillage with 1 ploughman, 1 ox driver and 1 ox; 1 day for hand tillage; 2 days to form the ridges (in the 5th month); 1 half-day for sowing *tane-oroshi*; 4 days for two weedings; 2 days for harvesting; 2 days for shelling.
- To grow 1 *tan* [0.3 acres] of cowpeas *sasage* requires 8 *shō* [6.8 litres] of seed and 13 days' work, namely: 1 day for tillage with 1 ploughman, 1 ox driver and 1 ox; 1 day for hand tillage; 2 days to form the ridges; 2 days for sowing *uu*; 3 days for weeding; 3 days for harvesting.
- To grow 1 *tan* [0.3 acres] of turnips *aona* requires 8 *gō* [0.7 litres] of seed and 32.5 days' work, namely: 2.5 days for five tillings with 1 ploughman, 1 ox driver and 1 ox; 1 day for hand tillage; 20 days to transport 120 loads of manure (6 *kin* [4 kg] per load), (that is, 6 return trips [error for 6 loads?] per day per person from the Left and Right Offices of Horses to the vegetable garden at [Kei]hoku; the same below for the other crops); 1 half-day for sowing (in the 7th or 8th month); 6 days for harvesting.
- To grow 1 *tan* [0.3 acres] of 'wild chives' *hiru* requires 3 *koku* [255 litres] of seed and 93 days' work, namely: 3.5 days for 7 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 3 days to form the ridges; 35 days to transport 210 loads of manure; 6 days for sowing (in the 8th month); 10, 8 and 7 days respectively for 3 weedings; 15 days for harvesting.
- To grow 1 *tan* [0.3 acres] of Chinese chives *mira* requires 5 *koku* [425 litres] of seed and 75 days' work, namely: 1 day and a half for three tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 2 days to form the ridges; 35 days to transport 210 loads of manure; 6 days to select *erabu* the seedlings; 6 days to transplant them (in the 9th month); 21 days for three weedings (7 days each time).
- To grow 1 *tan* [0.3 acres] of spring onions *ki* requires 4 *shō* [3.4 litres] of seed, 1,200 seedlings and 87.5 days' work, namely: 1 day and a half for three tillings with 1 ploughman, 1 ox driver and 1 ox; 1 day for hand tillage; 2 days to form the ridges; 35 days to transport 210

loads of manure; 1 half-day for sowing (in the 8th month); 20 days for transplanting (in the 2nd month); 10, 9 and 7 days for three weeding.

- To grow 1 *tan* [0.3 acres] of ginger *kurenohajikami* requires 4 *koku* [340 litres] of seed and 78 days' work, namely: 2.5 days for 5 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 35 days to transport 210 loads of manure; 4 days to form the ridges; 4 days for sowing (in the 4th month); 9, 7 and 6 days for three weeding; 6 days to pull up *torimushiru* the ginger.
- To grow 1 *tan* [0.3 acres] of butterbur *fufuki* requires 2 *koku* [170 litres] of seed and 34 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 20 days to transport 120 loads of manure; 2 days for sowing (in the 9th month); 2 days for the first weeding (in the 3rd month), 2 days for the second weeding (in the 6th month); 4 days for harvesting *karu*; replanting is done every three years.
- To grow 1 *tan* [0.3 acres] of thistles *azami* requires 3 *koku* 5 *to* [298 litres] of seed and 44 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 20 days to transport 120 loads of manure; 2 days for sowing; twice 3 days for two weeding (in the 2nd and 7th months), 4 days for harvesting *karu*; 8 days to select/remove *erabu* the heads; the heads are transplanted every three years.
- To grow 1 *tan* [0.3 acres] of early melons *wasauri* requires 4 *gō* 5 *shaku* [0.4 litres] of seed and 46 days' work, namely: 1 day for two tillings with 1 ploughman, 1 ox driver and 1 ox; 3 days for hand tillage; 3 days to dig the furrows [for the manure?] between the ridges; 12.5 days to transport 75 loads of manure; 1 day to [dig and] tread 360 seed-holes *kura-i*; 1 half-day for sowing (in the 2nd month); 12 days to drive away insects; 3 rakings *tsuchikai* and 3 weeding, done in 5 days (in the first half of the 3rd month), in 4 days (in the second half of the 3rd month) and in 3 days (in the 4th month).
- To grow 1 *tan* [0.3 acres] of late melons *okuteuri* requires 4 *gō* 5 *shaku* [0.4 litres] of seed and 35.5 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 3 days for hand tillage; 3 days to dig the furrows between the ridges, 1 day to [dig and] tread 360 seed-holes; 1 half-day for sowing; 1 day for 3 rakings; 3 weeding in 10 days (in the 3rd month), in 8 days (in the 4th month) and in 7 days (in the 5th month).
- To grow 1 *tan* [0.3 acres] of egg-plant *nasubi* requires 2 *shō* [1.7 litres] of seed and 41 days' work, namely: 1 day for two tillings with 1 ploughman, 1 ox driver and 1 ox; 3 days for hand tillage; 1 half-day for sowing (in the 3rd month); 1 day and a half to select *toru* the seedlings; 10 days to transplant them (in the 4th month); 3 days for 1

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- raking (in the 5th month) and 3 days for the second raking (in the 6th month); 18 days for 3 weedings (6 days for each).
- To grow 1 *tan* [0.3 acres] of radishes *ōne* requires 3 *to* [25.5 litres] of seed and 18.5 days' work, namely: 1 day and a half for 3 tillings with 1 ploughman, 1 ox driver ox and 1 ox; 1 day for hand tillage; 1 half-day for sowing (in the 6th month), 14 days for harvesting.
  - To grow 1 *tan* [0.3 acres] of lettuce *chisa* requires 3 *shō* [2.6 litres] of seed, 1,500 seedlings and 39.5 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 2 days to form the ridges; 22 days to transport 132 loads of manure; 1 half-day for sowing (in the 8th month); 2 days to select the seedlings; 6 days to transplant them (in the 9th month); 3 days for weeding.
  - To grow 1 *tan* [0.3 acres] of mallow *aoi* requires 2 *shō* [1.7 litres] of seed and 31.5 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 2 days to form the ridges; 22 days to transport 132 loads of manure; 1 half-day for sowing (in the 8th month); 3 days for weeding.
  - To grow 1 *tan* [0.3 acres] of coriander *konishi* requires 2 *to* 5 *shō* [21.3 litres] of seed and 28 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 2 days to form the ridges; 22 days to transport 132 loads of manure; 1 half-day for sowing (in the 3rd or 8th month).
  - To grow 1 *tan* [0.3 acres] of colza *ochi* requires 1 *shō* [0.85 litres] of seed and 28 days' work, namely: 1 day for two tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 2 men to form the ridges; 22 days to transport 132 loads of manure; 1 half-day for sowing (in the 3rd or 8th month).
  - To grow 1 *tan* [0.3 acres] of nothosmyrnum *soraji* requires 3 *koku* 5 *to* [298 litres] of seed and 35 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 2 days to form the ridges; 22 days to transport 132 loads of manure; 3 days for sowing (in the 9th month); 2 days for weeding; 2 days for harvesting.
  - To grow 1 *tan* [0.3 acres] of ginger *mega* requires 3 *koku* [255 litres] of seed and 35 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 2 days for hand tillage; 2 days to form the ridges (in the 9th month); 22 days to transport 132 loads of manure; 3 days for sowing; 2 days for weeding; 2 days for harvesting.
  - To grow 1 *tan* [0.3 acres] of taro *imo* requires 2 *koku* [170 litres] of seed and 35 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 4 days to form the ridges and till with a hoe or spade; 3 days for sowing (in the 3rd month); 6 days for raking; 6 days for 3 weedings (2 days respectively in the 5th, 6th and 7th months); 4 days to dig up the taro; 10 days to select it? *erabu*.

- To grow 1 *tan* [0.3 acres] of water-leeks *nagi* requires 20 bundles of seedlings and 53 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 1 day for hand tillage; 20 days to transport 120 loads of manure; 15 days to plant the seedlings (in the 5th month); 15 days for 3 transplantings *hashoku* (5 days each time); 15 days to collect and harvest them (each of the three times).<sup>20</sup>
- To grow 1 *tan* [0.3 acres] of water-celery *seri* requires 5 *koku* [error for 5 bundles?] of seedlings and 44 days' work, namely: 1 day for 2 tillings with 1 ploughman, 1 ox driver and 1 ox; 1 day for hand tillage; 20 days to transport 120 loads of manure; 6 days for transplanting (in the 2nd month); 10 days to select the seedlings; 5 days to drive [error for harvest?].<sup>21</sup>

It may be noted that the terms used in this regulation differ from the vocabulary of the poets. This is a terminology specific to the compilers of the *Engishiki*, none of whom were agronomists. This regulation is found in the article on the Bureau of the Imperial Table that determined the deliveries of foods and the management costs. The description of the imperial vegetable gardens was therefore not intended to serve as a directive for the farmers, but it sets out the agricultural operations with the aim of quantifying the work. In order to designate these operations, the compilers, it would seem, have coined their own terms and have not consulted either the Chinese works or the Japanese dictionaries. Yet their description of the procedures seems reliable. Aoba Takashi points out that certain indications relating to the quantity of seed and to the planting calendar correspond exactly to traditional Japanese practices that were current up to the 1930s.<sup>22</sup> On the other hand, one may be surprised at the lack of manuring and weeding for wheat and barley. Similarly, harvesting is omitted for several crops. The text may contain a few errors by the compilers and some entries are less complete than others. However, apart from these few errors, this regulation does indeed appear to show the methods used for vegetable crops in the 10th century.

## Fertilization

The texts concerning the methods of soil improvement are brief and their interpretations differ markedly. Let us first consider a legend about the village of Kōchi in Harima (Hyōgo):

In this village, rice is grown by sowing seeds, without spreading grass in the seedbeds. The reason is that the great deity of Sumiyoshi stopped in this village on her way [to the province of Settsu?], in order to take refreshments. Her attendants mixed up the grass that had been cut and spread *kariokeru kusa* by a peasant in a seedbed and fashioned a seat for the deity. The peasant, indignant, arrived and complained to the great deity. She replied after due consideration: 'The seedlings in your seedbed

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will grow as if the grass had been spread on it *kusa shiku*.' Since that time they have grown rice in this village without needing to spread grass in the seedbeds.<sup>23</sup>

### *Green manure*

The above legend suggests that green manure was widely used, at least in the region of Hyōgo, in the first half of the 8th century. At Ise, the spreading of grass also seems to have been the norm, since the first deity prohibited it in the rice field that produced the morning and evening offering for certain rituals; and "since then, they do not spread grass *naegusa shikazu* and the rice field is no longer invaded by leeches".<sup>24</sup>

Spreading is also mentioned by Fujiwara no Tamenari (11th century): "After having spread the cut grass *nawakusa karishikite* in their small mountain rice field, they sowed the seeds kept in a reservoir in their small field of ten *shiro*." The writer uses the word *karishiku*, meaning "to cut and spread", which was to remain the technical term for green manure up to the modern period.<sup>25</sup>

A legend written down in the early 13th century relates that the peasants of a region south of the capital of Heian harvested *kariire* grass and leaves to improve their fields in such quantities that the hills around the village of Ide lost all their vegetation. It was therefore wilderness areas and probably also waste ground that provided green manure. It may be noted that the cutting of grass *kusakari* was done not only to obtain manure, but also to collect fodder.<sup>26</sup>

### *Ashes*

Another method of fertilization was to collect vegetation from virgin lands, burn them in a heap and spread the ashes in the fields. In a manuscript of the journal of Fujiwara no Tametaka (1070–1130), an anonymous writer relates that "people gather brushwood *shiba o toru* to produce ashes that they scatter in the rice fields to fertilize them *koyashimu*".<sup>27</sup> We know that medieval people were well aware of the fertilizing value of ashes, as they would also set fire to waste lands with a view to swidden-field crops or the regrowth of useful plants. But in this case the ashes were produced on-site, whereas the method mentioned in the above manuscript suggests the gathering of fuel, followed by burning, then taking the ashes onto the cultivated land. It is, however, the only piece of evidence that we have for the early medieval period. This method has no equivalent in Europe, but is known by the name *citimene* in South Africa.<sup>28</sup>

One way of producing ashes on-site is to burn the stubble after the harvest, in the case of high cutting under the head, which leaves the stubble standing. This practice seems to have been widespread in medieval China, where people

spoke of “ploughing with fire and fertilizing with water” *huogeng shuinou*.<sup>29</sup> It is possible that the Japanese also cleaned with running fire lands that remained uncultivated for several months before sowing or transplanting. Or they may simply have buried the stubble or vegetation during tillage, without setting fire to it. Could there be an allusion to the burying of vegetation in this poem by Minamoto no Moroyori (1068–1139)?: “After turning over the soil with the young cyperus shoots in my small mountain field, I leave the seedbed to destiny, after having brought water to it.”<sup>30</sup> Perhaps the two methods, those of running fire and burying, are not mentioned in the early medieval sources because they were too commonplace and did not interest the public administration.

### *Animal manure*

There are also a few scattered pieces of evidence relating to organic fertilizer. Animal manure was used in the imperial vegetable gardens, as can be seen in the regulations translated above. *Koe* or *kuso*, written like ‘excrement’ *fun* and provided by the court stables was used for sixteen vegetable crops. It is not mentioned for barley, wheat, beans, late melons, egg-plant, radishes or taro. But it is possible that the choice of crops to be fertilized was governed by the distance that separated the stables from the vegetable gardens. Perhaps the sixteen plants were grown in those closest to the court stables, namely the one at Keihoku north of the capital, which was the largest with an area of 18.3 *chō* (20.7 ha) and the irrigated fields of water-celery and water-leeks in the district of Otokuni. These vegetable gardens were in the province of Yamashiro in the vicinity of Heian-kyō, whereas the others were further south in Yamato. The quantity of animal manure seems quite large. Depending on the crop, 75, 120, 132 or 210 loads were estimated per plot of 1 *tan* (0.3 acres). With 6 *kin* (1 *kin* = 670 g) or 4 kg per load, this represented respectively 300, 480, 528 or 840 kg of manure per *tan*. For transport on the back of porters, the estimate was 6 loads (24 kg) per person per day’s walk. If these figures are correct, the transporting of manure accounted for more than half of the work for the entire year in the imperial vegetable gardens.<sup>31</sup>

Animal manure is mentioned later in the *Shasekishū*, a 13th-century collection of legends. In one episode, horse manure *koe* is associated with the voice *koe* to recite the sūtra *Ninnōe kyō*, which attests to the reading *koe*, but up to the 12th century the dictionaries gave the reading *kuso* or *akuta*.<sup>32</sup>

In view of all these different references, historians give priority to green manure, as this method remained the most widespread up to the modern period. It is also attested for the medieval period by the disputes relating to the right of the peasantry to collect vegetation on waste lands, and it occurs in the agricultural treatises of the 17th–19th centuries. The archaeologist Kinoshita Tadashi thinks that large plank shoes *ōashi* were used from the medieval period to tread green manure into the fields, but that the *ōashi* discovered in sites dating