RECENT DEVELOPMENTS IN SCHOLARSHIP ON THE *CH'IMIN YAOSHU* IN JAPAN AND CHINA*

YUKIO KUMASHIRO

I. RECENTLY PUBLISHED MODERN EDITIONS IN JAPANESE AND CHINESE

A. *The Background of the Chinese and Japanese Editions*

IN HIS INTRODUCTION prepared for the second edition of the Japanese translation of the *Ch'imin yaoshu* (hereafter cited simply as CMYS), Dr. Seiichi Tōbata has provided some useful information on this earliest known extant Chinese farming encyclopedia and its recent re-publication in modern Japanese translation [15].

The first edition of the Japanese translation, as he mentions, appeared in two volumes, issued respectively in November 1957, and June 1959. The second edition offers the same material as the first, but assembles the entire text within one volume, and includes, in addition, background extracts written by Dr. Tōbata, the late Prof. Mitsuji Koide,[1] Mr. Ch'i Hui-chih, and others. As in the case of the first edition, only the first nine *chüan* of the original text have been translated.

At virtually the same time as the first edition of the Japanese translation was coming off the presses, a new Chinese edition, with *paihua* commentary, was brought out in the Chinese People's Republic (the *Ch'imin yaoshu chinshih*, 4 Vols. [hereafter cited as CMYSCS]) by Professor Shih Shêng-han of the Northwestern Agricultural College. For the background of this Chinese version, and a brief history of the intercourse that developed between Chinese and Japanese scholars during its preparation, we turn to the remarks of Mr. Ch'i Hui-chih as set forth in his preface to the second edition of the Japanese translation.[2]

The publication of Prof. Shih's version occurred in four stages: Volume 1 (*chüan* 1–3), December 1957; Volume 2 (*chüan* 4–6), March 1958; Volume 3 (*chüan* 7–9), May 1958; and Volume 4 (*chüan* 10), June 1958. The project itself was first conceived during the course of a discussion on China's agricultural technology heritage at the Northwestern Agricultural College between Hsin Shu-chih, Chairman of the College, and Prof. Wang Yü-hu of the Agricultural Faculty

* I would like to thank Mr. James Polachek of the University of California (Berkeley) for his assistance in the following translation.

[1] Prof. Mitsuji Koide was the discoverer of the "Kanazawa" text (see infra, p. 447).

[2] See [2, pp. 60–61]. More on the exchanges between Japanese, Chinese, and German scholars during the course of preparation of the two recently published editions of the CMYS appears in Kumashiro [5, esp. pp. 487–500].

of Peking University. Further debate on this issue was conducted by a forum of specialists convened under the auspices of the Central Agricultural Ministry in April 1955, as a consequence of which it was determined provisionally to entrust the general responsibility for preparing a modern edition of the CMYS to Profs. Shih Shêng-han and the since deceased Wan Kuo-ting of the Nanking Agricultural College. The original scheme called for Profs. Shih and Wan to produce, separately, their own collated and annotated editions of the original text. From these was to be compiled, after mutual consultation, an authoritative annotated edition of the basic work. The edition eventually published (cited above as the work of Prof. Shih) represents, in fact, the first draft of a cooperative effort undertaken by Prof. Shih in collaboration with Prof. Wan, and issued by its authors in section only as a tentative manuscript. It was by no means intended as a printer's proof, far less as a definitive edition.[3]

The Japanese translation of the CMYS, as finally published, was likewise not originally intended by its authors as a definitive version; a collated Chinese text was not included, and the final *chüan* (*chüan* 10), dealing with products grown in the border regions, was omitted. The division of labor according to which the first edition of the Japanese translation was prepared was somewhat different from that employed by the editors of the CMYSCS. The text itself was divided, initially, into two sections. The first section (*chüan* 1–6, on crop production) was assigned to Prof. Buichi Nishiyama; the second (*chüan* 7–9, on processing and culinary techniques) to myself. The drafts thus prepared were subsequently collated to insure maximum uniformity in the rendering of technical terms. Differing interpretations were, however, noted when they could not be reconciled.

Both of the collaborators working on the Japanese translation prepared their initial manuscripts only after having assembled all of the texts and explanatory materials available in Japan. Variations in the original text and differing interpretations have been carefully noted. Previously published reference materials which were of particular usefulness in preparing the Japanese translation (including both Japanese and Chinese sources) have been noted in the bibliographical appendices to Volumes 1 and 2 of the translation. At this point, I feel obliged to mention that my own part of the translation relies rather heavily on the tentative draft translation of the CMYS ("*Seimin yōjutsu* zantei yaku-kō") prepared some years ago by the History of Technology Group at the Jimbun Kagaku Kenkyūsho of Kyoto University, at least for the portion of the text up to Section 71.[4] For the sections on brewing, I relied on a work written by the late Prof.

[3] The extract is from an introductory preface to the first volume of the CMYSCS, dated May 30, 1956. A popularized annotated and translated version of the CMYS (including both *paihua* translation and the original text) has since been published by Prof. Shih [13]. I should also like to note that Prof. Shih has subsequently published yet another volume concerning traditional agricultural encyclopedias [14].

[4] Members of the group were Profs. Motonosuke Amano, Kiyoshi Yabuuchi, Kōzō Watanabe, Toshikazu Ōshima, Suguru Shinoda, Shirō Kitamura, Mitsukuni Yoshida, Kenjirō Yoneda, Kōichi Kimura, and Yoshitaka Iriya.

Momoji Yamazaki [17]. For the remaining sections of my part of the manuscript, the reference work that I had at my disposal was the recently discovered hand copied Igai collated Sung text (part of the Seikadō Collection of the National Diet Library), which contained several helpful hints.

B. *Textual and Interpretive Problems Encountered by the Editors*

Differences in interpretation between my own draft and the studies undertaken by my Japanese predecessors (above noted) as well as the translation completed by my colleague, Prof. Nishiyama, have been noted in the published Japanese translation of the CMYS. But so many problems had to be dealt with in the process of preparing the final version of the Japanese translation that we were reluctant to issue an authoritative version.

Among the more serious problems we encountered was that of a divergence of opinion on many points of textual interpretation between ourselves and Prof. Shih. The discrepancies that came to the surface here were often of a fundamental variety. A further complication in this latter connection arose from the fact that the disagreements between our own translation and the *paihua* commentary of Prof. Shih were not necessarily coincident with the discrepancies observable between other Japanese translations and the recent Chinese effort. In some cases where Prof. Nishiyama and myself disagreed over an interpretation, one of our opinions might coincide with that offered by Prof. Shih on the same passage. In other cases, Prof. Nishiyama and myself found ourselves in disagreement both with other Japanese scholars and with Chinese commentators. And in still other cases, there appeared to be a basic division of opinion along the lines of nationality.

The first volume of our translation appeared before its Chinese counterpart, so that we were unable to note, in the text, those points over which we found ourselves in disagreement with our Chinese colleagues. However, a limited amount of comparison of our interpretations was possible as a result of Prof. Shih's gift (to Prof. Nishiyama) of a copy of an essay on the historical significance of the CMYS prepared during the course of his own editorial efforts, as well as of a new version (with *paihua* commentary) of a Han agricultural treatise which he had just completed.[5] Of special interest to us was the fact that, in the former work, Prof. Shih expressed his complete agreement with the suggestion of Prof. Nishiyama that the CMYS be treated as a philological entity in its own right,[6] and represented himself, furthermore, as in approving the line of argument maintained vis-à-vis this classic by Japanese scholars since their first encounter with it at the Rural Economic Research Institute of National Peking University in 1940 [11, p. 7].

In preparing the second volume of our translation, we were able to note our differences with Prof. Shih's version for more than half of the text covered (i.e.,

[5] The historical essay referred to was published in January 1957 [11]; the translation in November 1956 [10].

[6] Prof. Nishiyama has long maintained that the CMYS ought best be treated as the product of a particular academic-philosophical tradition, rather than as a merely technical manual.

Sections 62–76). Thanks to Prof. Shih's kindness in dispatching to us, by air mail, a copy of the third volume of his translation immediately after its May 1958 publication, we were able to note in some detail our divergences in interpretation up to the end of the text covered in this volume. However, since by the time we received this latter volume from Prof. Shih, we had already completed our draft translation, and were in the midst of composing an explanatory essay, with revision of the original manuscript to be concluded by the following autumn, we could do no more than leave a few spaces in the revised proofs for noting some of the more conspicuous discrepancies between our two editions.[7]

There remained, however, the problem of dealing with those points in the already published first volume of our translation (as well as those sections of Volume 2 already in proof before we were able to examine Prof. Shih's version) which a comparison with the Chinese version revealed to be susceptible to more than one interpretation. It was decided, accordingly, to note such points wherever possible in the explanatory essay appended to Volume 2, and to list the remaining passages over which we found ourselves in disagreement with Prof. Shih as supplementary notes at the end of the Index of Products-Utilization Citations also included in Volume 2.

This brings us to the problem of reconciling the differences in interpretation that divide the recent Chinese and Japanese editions of the CMYS—a problem which we dare say concerns Prof. Shih's group as much as it does our own Japanese scholars. Unfortunately, we have no word from Prof. Shih on how severely the problem of differing interpretations has affected our Chinese colleagues. But it would not be an exaggeration to say that Prof. Nishiyama and myself are still troubled by a distressing accumulation of difficult textual problems over which we find ourselves still unable to reach any accord. But before an attempt at reconciling our own version with that of Prof. Shih can be essayed, it will be necessary first for us to deal with our own internal disagreements.

II. SOME COMMENTS ON THE BACKGROUND OF THE CMYS AND THE PROBLEMS ENCOUNTERED IN PREPARING A MODERN COMMENTARY

A. *The Composition of the CMYS*

It is our opinion that the CMYS is best understood as an early attempt to standardize existing East Asian agricultural technology and its concomitant

[7] The portion of the text dealt with in this fashion falls between *chüan* 7, Section 77, and the end of *chüan* 9. I am sorry to say that the delay between the publication of the two volumes of the first edition of our translation was not so much the consequence of Prof. Nishiyama's desire to wait until we could obtain a copy of Prof. Shih's new version as much as the result of my own physical indisposition. The latter contingency was also responsible for our inability to alter any of the completed translation manuscript, in spite of Prof. Shih's kindness in dispatching by air mail a copy of Volume 3 of his work as soon as it appeared. We had, ultimately, to make do with recording some of our differences in the footnotes.

social organization and culture (*Pflugbaukultur*). Nearly half of the text appears to be a derivative from earlier works; according to Prof. Shih (whose collating efforts have been exhaustive), some 164 previous works including their interpretated editions are cited without mention in the text of the CMYS.[8] It would not, therefore, be incorrect to consider the CMYS as rather more a compendium or encyclopedia than an independent and discreet treatise. Two important earlier works[9] have indeed been quoted from so extensively that it has been possible, simply by piecing together the citations as they appear on the CMYS, to produce a tentative version of these long since disappeared texts. And the sections of the CMYS dealing with brewing and culinary technology preserve for us, in extenso, several no longer extant pre-Sui treatises on products-processing and cooking.[10]

In sum, it is possible to say that the CMYS represents China's first (and last) truly comprehensive encyclopedia of agricultural and agriculture-related technology in its *Pflugbaukultur* stage. In subsequent ages, consumption and production aspects of agricultural ecology tended to become increasingly separated as categories of practical technology, the former become the exclusive domain of "cooking manual" (*shihp'u*) literature, and the latter the prerogative of "farming treatises" (*nungshu*), if we may judge by the separation of these two genres common to all subsequent Chinese bibliographical compendia. At the same time, the CMYS contains what appears to be the earliest extant compilation, not merely in East Asia, but in human history, of techniques of fermentation (including brewing) and cooking. Included in the CMYS, moreover, we find not simply the standard recipes of the author's age, but "variant" formulas for processing and cooking that had already been outmoded by the time the CMYS was penned. We have in the CMYS, in other words, something very much like a museum of nutritional scientific history.

Let us briefly scan the contents of this remarkable work. The CMYS is divided into ten *chüan* (or "parts"), and further subdivided into ninety-two *pien* or "sectinos." The prose style is unusually tight and carefully organized. A resume of the major subdivisions follows.

Tsashuo ("preface"), the authorship of which is different from that of the text itself.

Chüan 1. On the plowing and sowing of various comestibles, including german millet. (Sections 1–3)

Chüan 2. On "field" crops: miscellaneous cereals, and "field"-crop vegetables. (Sections 4–16)

[8] Shih Shêng-han [11, p. 5]. According to the calculations of Prof. Hu Li-ch'u, the CMYS text quotes without citation thirty previous works in the "classics" (*ching*) category, sixty-five in the "histories" (*shih*) category, forty-one in the "philosophy" (*tzŭ*) category, and nineteen in the "collected works" (*chi*) category, totalling 155 [3].

[9] These are the *Nungshu* of Fan Sheng-chih and the *Ssŭmin yüehling* of T'sui Shih, both dating from the Han period. In this connection see Shih Shêng-han [10] [14].

[10] Especially noteworthy are extracts from several works of Liang dynasty (502–56) origin, viz. the *Shihching*, the *Shihtz'u*, and the *Chiachengfa*, which constitute the oldest known texts on culinary and related arts in Chinese.

Chüan 3. On "garden" crops:[11] vegetables, the farmer's calendar, etc. (Sections 17–30)

Chüan 4. On fruit-bearing trees. (Sections 31–44) Note that in this and the previous *chüan* are included descriptions of elementary processing operations connected with the vegetable and fruit crops therein catalogued.

Chüan 5. On trees bearing non-comestible crops, and the processing procedures for their harvests: mulberry-raising, dyestuff-bearing plants, and the processing of plant-materials for cosmetic use. (Sections 45–55)

Chüan 6. Livestock and livestock processing, fish-rearing, and aquatic crops. (Sections 56–61)

Chüna 7. Fermentation (I). On the manufacture of yeast-cakes (fungi), and brewing techniques. (Sections 62–67)

Chüan 8. Fermentation (II). On the preparation of fermented seasoning agents (soy-sauce, etc.) and meat dishes. (Sections 68–79)

Chüan 9. Other food preparation techniques: cereal staples, pickled meats and vegetables, sweets, etc. (Sections 80–91)

Chüan 10. On plants of the peripheral (border) regions (i.e., north of the Great Wall, and south of the Hwai River). (Section 92)

B. *On the Sequence of Topics in the CMYS*

Through *chüan* 6, the CMYS confines itself to discussing only aspects of productive activity, from the various basic land utilization techniques to the raising of livestock. By contrast, *chüan* 7–9 are concerned chiefly with processing and manufacturing technology, but the order in which the various crops are dealt with in this latter section does not coincide with the order of their appearance in the earlier *chüan.* In this latter section, the narrative proceeds from a discussion of the more sophisticated techniques of processing, etc., in common use at the time the CMYS was written to a discussion of more primitive techniques that were characteristic of an earlier period. A similar order of description seems generally to be pursued in dealing with the individual categories of processing and manufacturing techniques included in each of the sections (*pien*) of the text. Throughout the entire work, in other words, one has the impression that the sequence of presentation of the various items derives from the author's intention to bring together systematically a morass of pragmatic data never before so exclusively assembled. (For more on this point, see [8, Vol. 2, pp. 278–82].)

As an example of the kind of problem the complex organization of the material contained in the CMYS is capable of causing, let me point out one instance where my own opinion and that of Prof. Shih are diametrically opposed. In his

11 The distinction between "garden" and "field" crops made in this paper is my own. Although it is not possible to draw a clear line between these two types of land utilization, in general we may characterize "garden" crops as grown in irrigated, and sometimes manured, plots, the soil preparation of which is not ordinarily accomplished by animal-powered plowing; and "field" crops as those grown in animal-plowed, non-irrigated, yet non-manured soil.

discussion of the section on brewing techniques, Prof. Shih claims to have discovered five instances in which the text departs from the "normal" order of presentation of material. According to my Chinese colleague, these "interruptions" are most likely the result of some later editor's tampering with the original text. My own view, however, is that there is no departure whatsoever from the normal order of presentation. My reasons for so believing are detailed elsewhere, so I shall here render only a brief summary of my argument.[12]

Historically speaking, the development of brewing technology proceeded from the relatively primitive technique of brewing with an "unrefined yeast-cake (*rhizopus*) bred with a mash consisting only of parched wheat (the product so manufactured being known as *ch'unchiu*—"spring" wine—or *fachiu*—"standard" wine) to a more complicated method, using a mash consisting of a blend of parched, steamed, and raw wheat to breed a higher-potency "refined" *rhizopus* yeast-cake (the product of the latter technology being known as *tungchiu*, or "winter" wine). The CMYS section on brewing skills begins, however, with a rendition of the latter, more sophisticated recipe, and works backward to the former, more primitive one. Since I am persuaded that such an order of presentation conforms exactly to the normative order of discussion pursued by the author of the CMYS, I recognize in this particular situation no evidence of textual tampering. But the problem does not end here. Prof. Shih and myself disagree, in addition, over the specific breed of enzyme-producing *rhizopus* yeast-cake (fungus) are actually being referred to in the Chinese text of the CMYS. In particular, Prof. Shih interprets the term *fangch'ü* ("square yeast-cake") to refer to a specific variety of yeast-cake, while I understand this binome to be merely a generic term. I take the term *nüch'ü* ("feminine yeast") to mean a kind of grained yeast, and therefore not included in the pulverized yeast-cake (*ch'ü*, i.e., *pingch'ü*) category that appears ordinarily in the CMYS, while Prof. Shih insists that this same term refers to a "fine-yeast" fungus, conforming to the "refined yeast-cake" (*shench'ü*) category. It is my opinion that the CMYS brewing section describes in fact two different techniques for flavor preservation in the manufacture of wine, parallelling the basic distinction between the recipes for "summer" and "winter" brews,[13] whereas Prof. Shih is of the belief that the entire relevant passage is in reality dealing with only one basic recipe. A final disagreement between Prof. Shih and myself occurs in connection with the definition of what constitutes an "unrefined" of "crude" yeast-cake (*pench'ü*). I have defined this enzyme-producing agent as being bred in the manufacture of "standard" wine (*fachiu*), which in turn I define in terms of the proportions of the ingredients used in the preparation of the mash. Prof. Shih, on the other hand, defines "standard" wine as "official-recipe" wine (*kuanfa chiu*), reducing the issue to a

[12] Prof. Shih's opinion on this question is stated in the CMYSCS, Vol. 3, p. 508, commentary note no. 67.0. i. For my point of view, see [8, Vol. 2, pp. 298–99].

[13] The object of flavor preservation of "summer brew" is to prevent vinegar fermentation. For "winter brew" warmth is necessary to promote fermentation. The two different recipes are described in section 64 and section 67 in the CMYS.

matter of whether or not the brew is prepared in conformity with an officially-determined formula.

These are but a few of the problems over which Prof. Shih and myself disagree. But the ultimate source of our difficulties in achieving a unanimity of opinion over various points in the text is the very comprehensiveness of the enterprise undertaken by the author of the CMYS—an enterprise which goes well beyond the basics of agricultural technology, and seeks to catalogue the full range of practical sciences at the disposal of the East Asian *Pflugbaukultur* in which its author lived and wrote.

C. *On the Nature of the Technology Described in the CMYS*

The model agrarian technology set forth in the pages of the CMYS is based on the use of the "Chinese" or "square" plow.[14] Of particular noteworthiness is the precociousness of the development of dry-land-farming systems allowing the elimination of wasteful fallow, as well as the earliness with which Chinese agriculture appears to have developed techniques of manual cultivation (relying on the drill and hand-hoeing husbandry) permitting the rotation of crops on the same strip of farmland. Throughout the text of the CMYS, we find frequent mention of the term "yearly rotation" (*suii*), which I interpret as meaning crop-rotation (*Pflanzenwechsel*), as distinct from field-rotation (*Bodenwechsel*) characteristic of more primitive agriculture. Nor is the *suii* formula compromised by any short-cuts, such as the utilization of fallow land for grazing purposes (a feature of lactic agrarian cultures), or the substitution of fruit crops for more nutritive cereals (a habit of fruit- and wine-consuming agrarian cultures). The basic nutritive scheme presented in the CMYS relies completely on the protein and fats available from farinaceous comestibles. Alcoholic and seasoning agents are likewise manufactured from ingredients produced by normal "field"-cropping agriculture. What we see in the CMYS is nothing less than a pioneering effort to describe the earliest surviving picture of what we now characterize as a peculiarly East Asian model of agrarian civilization, based on an extraordinarily intensive land productivity and utilization pattern, and the widespread use of fermentation technology in the preparation of foodstuffs for consumption. These features of the "East Asian" model of agrarian civilization are, as I have previously suggested, made clear by the internal structure of the CMYS itself.

The agricultural technology described in the CMYS—based, as it was, on dry-field farming—was nevertheless to become, in subsequent centuries, the foundation of a Chinese wet-field (i.e., irrigated) agricultural technology. In brief, we find three areas in which agrarian technology was significantly transformed in the period after the CMYS was written. (1) The system of traditional dry-field plow farming technology was improved. (2) In "wet-field" (irrigated) agriculture,

[14] The "Chinese" or "square" plow (the so-called *Rahmenpflug*—E. Werth) is constructed in such a fashion that traction is not applied directly to the mouldboard beam. The mouldboard has a curved surface, the advantage of which is that, although plowing tends to be shallow, it is also quicker, and soil pulverization is more thorough.

the functions of irrigation technology came gradually to more substitute for deep-plowing technology. (3) Manual cultivation techniques (hoeing, weeding, etc.) came to be more fully developed, especially in connection with an increased use of fertilizer (both in pre-plowing soil preparation and during the vegetation cycle). We are in the habit nowadays of regarding the repeated sowing of cereal crops in the same field, accompanied by the intensive direct use of fertilizer, as a historical characteristic of East Asian agriculture. But it ought not to be forgotten that the origins of this system of field utilization are to be found in the model of crop rotation system first set forth in the CMYS [8, Vol. 2, pp. 265–77].

According to the crop rotation system noted in the CMYS (a system that I myself have labelled the "archaic sub-rotation formula"), the application of human and animal fertilizer to the soil is limited generally to the production of marketable "garden" crops. Common arable is not, as a rule, artificially fertilized. Consequently, the *suii* or crop-rotation plan described in the CMYS counsels the alternate cropping of a leaf-crop (*Blattfrucht*) in arable used for raising cereal crops (*Halmfrucht*); before reaching maturity, these leaf-crops are to be plowed back into the soil to provide natural fertilization. The principal leaf-crops mentioned are various species of cereal beans, sesame, and other cormophyte crops useful as fertilizing agents (so-called "green manure crops"). One of the more extraordinary features of the CMYS in this respect is that, in *chüan* 1, which catalogues all of the major "field" crops, the sequence of all of the possible preparatory crops (*Vorfrucht*) which can be alternated with each of these staples is provided; what is more, each preparatory crop is ranked in one of three groups according to their soil-restorative efficacy as preparatory crops (*Vorfruchtwert*). For instance, in the description of german millet cropping techniques, the CMYS notes that "the best german millet is grown in fields which have just produced a crop of *phaseolus aurens* or *phaseolus angularis* beans. The next best preparatory crops are hemp, common millet (*panicum miliaceum*), and sesame; the least efficacious preparatory crops are turnip and soy bean [8, Vol. 1, p. 44].

This latter aspect of the CMYS is absolutely unique among both Chinese and Japanese agricultural compendia. Most likely, the reason why such a catalogue of preparatory crops was not undertaken by any subsequent compilation is that, under the influence of an expanding use of irrigated-field farming techniques, the effect upon yields of the proper selection of a preliminary "preparatory" crop tended to diminish in comparison to what it had been in the predominantly arid farming current when the CMYS was written. For example, Japanese farmers using traditional dry-field growing techniques generally avoided the immediately consecutive cropping of tomatoes in the same plot. With modern, plastic-shielded, irrigated growing techniques at their disposal, however, regular alternation with irrigated rice in the same field for an interval of several years in succession has become possible in not a few instances. It would not, therefore, be inappropriate to trace the origins of the modern East Asian system of fertilized repeated cropping of cereals (albeit in irrigated fields) back to the

formula for alternating cereal and fertilizer crops that is recommended by the CMYS.

D. *Some Problems of Interpretation of the Introductory Remarks (Tsashuo) Section of the CMYS Text*

The "Introductory Remarks" (*tsashuo*) section that precedes the first *chüan* of the CMYS presents modern analysts of the CMYS text with some of their most difficult problems of interpretation. Both Chinese and Japanese students of the CMYS agree that, judging from the style and content of this essay, its author is different from the author of the rest of the text (Chia Ssŭ-hsieh) [8, Vol. 1, pp. 311, 341] [12, Vol. 1, p. 16, note 00.1]. Prof. Nishiyama regards the *tsashuo* as the work of an early T'ang author, writing not too much after the original text was compiled, and in geographical circumstances not too far removed from the site of Chia Ssŭ-hsieh's own activities. In this surmise, he has the consensus of Prof. Wan Kuo-ting as well [16]. Evidence for this Nishiyama-Wan theory derives from the fact that the *tsashuo* mentions a species of buckwheat (*ch'iaomai*) that is nowhere in evidence in the main body of the CMYS text itself. In addition, it has been observed that the terminology used in connection with harrowing operations, measures for use in the sowing of seeds, and recipes for the cultivation of lettuce and scallions that appears in the *tsashuo* is at variance with the parallelling terminology that appears elsewhere in the CMYS. Prof. Nishiyama, in arguing his case, has focused in particular on the discrepancies between the *tsashuo* and the text itself in the various descriptions of harrowing operations and of the techniques for measuring out seed during sowing. His principal evidence for the early T'ang dating of the *tsashuo* is that buckwheat did not become a common staple until the T'ang period, and that the measuring units which appear in the *tsashuo's* description of sowing techniques are T'ang units.

By contrast, Prof. Kenjirō Yoneda regards the *tsashuo* as of earlier origin than the main text, dating from before the implementation, in A.D. 458, of the "equal field" (*chünt'ien*) system of the Later Wei dynasty [19, pp. 126–42]. He argues that the crop referred to in the main text as *ch'ümai* corresponds to the "buckwheat" (*ch'iaomai*) mentioned in the *tsashuo*, and that the cause for this discrepancy in terminology is merely that, when the original text of the CMYS was recopied during the T'ang period, the copyists substituted the current T'ang term for buckwheat (i.e., *ch'iaomai*) to make the term more readily comprehensible to readers of the text. Prof. Yoneda derives further evidence for the pre-458 dating of the *tsashuo* from his belief that the system of surface and volumetric measure (*mu* and *tou*) employed by the author of the *tsashuo* is the Han system, and that the plowing-cultivating cycle described in the *tsashuo* is of a more primitive nature than that which appears in the main body of the CMYS. The procedure described in the *tsashuo*, Prof. Yoneda emphasizes, involves only a two-phase operation (plowing and levelling), whereas the soil preparation process mentioned in the main text of the CMYS includes the three stages of plowing, harrowing, and levelling.

As far as the latter argument is concerned, Prof. Nishiyama and myself disagree as to the correctness of Prof. Yoneda's dating of the measurement systems used in the *tsashuo*. According to Prof. Nishiyama, the surface measures used both in the *tsashuo* and in the main text are identical, in both cases being the "ancient small" *mu* (about one-eighth acre in modern measure) common in Chin and Wei dynasty texts. Only in the realm of capacity measures does Prof. Nishiyama see a discrepancy in the units of measure used.[15] The discrepancies in soil-preparation technology to which Prof. Yoneda points as evidence for his pre-458 dating of the authorship of the *tsashuo* are discounted by Prof. Nishiyama as being chiefly the result of variations in local practices and soil chemistry—the kind of regional technological variation, in other words, that is still to be found in countries with as much geographical diversity as China.

I myself cannot absolutely agree with Prof. Yoneda's unhesitating equation of *ch'ümai* with buckwheat. In both the Chinese and Japanese recent editions of the CMYS, the commentators have been unable to reach a final decision on just what variety of crop the mysterious *ch'ümai* that appears in the main text might actual refer to.[16] According to one passage in the main text of the CMYS, the basic method of preparing the harvested and husked *ch'ümai* product for human consumption involves steaming, drying, and then pound-husking in a mortar, crude pulverization, the resulting foodstuff being apparently a kind of porridge. But the main text mentions a supplementary method of preparing this product, according to which it is reduced to a finely-milled flour, and then baked. Prof. Yoneda believes that the mention of a porridge recipe in connection with *ch'ümai* confirms his equation of this latter species with a buckwheat-type cereal. I myself believe that the transition from porridge to firm-baked flour as the chief form of cereal consumption is supposed to have taken place between the Later Wei and T'ang dynasties. If Prof. Yoneda's equation is correct, the methods of cereal preparation catalogued in the CMYS would appear to be characteristic of an agrarian civilization en route from an older, porridge-consuming culture to the flour-consuming culture that we know to have spread eastward as the use of animal power in milling operations became more widespread. The question of the state of animal-powered technology at the time of authorship of the CMYS shall be postponed for discussion later on in this paper. At this point I should like to comment only that I personally find much evidence to contradict Prof. Yoneda's assumption that the *tsashuo* is of earlier origin than the main text of the CMYS; most of this evidence appears in the field-use formulas catalogued in the *tsashuo* itself. In the *tsashuo*, for instance, we find a good amount of dis-

[15] The *tsashuo's* author makes use of the T'ang volumetric measurement system, based on a "pint" (*sheng*) about three times as large as the "old" or "small" pint of pre-T'ang times, or about 1.6 gallons.

[16] See [8, Vol. 1, p. 98, note 14] and Shih [12, Vol. 1, p. 102, commentary note no. 10.8 i]. We suspected the reference was to a species of pearl barley, while Prof. Shih believed a kind of oats was intended. Recently, however, Professor Shinoda has suggested that the species in question resemble the gith plant of Western Siberia (*Agrostemma Githago*)—a suggestion with which I am inclined to agree.

cussion of the use of extraneous fertilization in connection with the contiguous raising of cereal staple crops, anticipating the development of a "three-crops-in-two-years"[17] rotation formula that is clearly based on intensive extraneous fertilization. As I see it, all of this suggests that the author of the *tsashuo* was describing the agricultural technology of a later, and not earlier, age than that in which the main text of the CMYS was written. The following material tends, I believe, to bear out my thesis.

In Volume 1, p. 12, of the Nishiyama-Kumashiro translation (covered in Volume 1, p. 22, item 0021 of the Shih Shêng-han text) we find the following formula:

> After harvesting a manured common millet crop, plow twice, harrow well, then sow with barley.

According to the "field"-crop rotation scheme recommended in the main text of the CMYS, extraneous fertilization (with manure, etc.) is replaced by alternating soil-enriching cormophyte crops ("green" or "natural" fertilizer) with cereal crops. If this formula were being followed in the above case, it would be natural to expect the CMYS text to recommend that a bean crop be sown soon after the harvest of the millet crop in question. The *tsashuo* recipe is thus very nearly a "three-crops-in-two-years" formula—a fact that suggests to me that the technology familiar to the author of the *tsashuo* is a more sophisticated one than that described by the author of the main text of the CMYS, and must therefore represent the agricultural science of a later era. The same evidence is, however, viewed by Prof. Yoneda as indicating that the "three-crops-in-two-years" rotation pattern was developed before the appearance of the CMYS, and was the product of Han dynasty agricultural technology [18, pp. 407–30].

What I have attempted in the preceding paragraph is no more than a resume of some of the more critical differences in interpretation that have arisen between several modern students of the CMYS and related texts. From these differences have been generated disagreements about some fundamental aspects of traditional farming technology and culture. Next we shall briefly survey the state of agricultural technology and the mode of farm management prevalent at the time the CMYS was written.

III. THE HISTORICAL BACKGROUND OF THE CMYS: PRE-T'ANG FARM MANAGEMENT

A. *Large-scale Farming and the Management of Processing Industries*

The text of the CMYS itself indicates no standard farm size, but a passage in the *tsashuo* suggests that a size of enterprise in excess of fifteen hectares (about thirty-seven acres) was common for the time. The passage in question appears

[17] The "three-crops-in-two-years" rotation pattern appearing in the *tsashuo* is a more advanced one than that of the main text; it features the use of manure in connection with the first crop in the cycle (common millet), and omits mention of the bean crop which appears as the final crop in the main text cycle.

in the midst of a discussion of the advisability of keeping the scale of farming at a modest level:

> A yoke of oxen [sufficient to pull a plow: i.e., three head] should make it possible to work a farm of three hundred "small" *mu* [a bit more than fifteen hectares].[18]

Compared with the scale of farm management we find common in later periods, the fifteen-hectare farm mentioned as "modest" in the above passage must nevertheless be considered extraordinarily large. Evidently North China agriculture during the fifth and sixth centuries was characterized by a rather unusually large scale of farming. The Six Dynasties period (A.D. 222–589) was one of the most chaotic in Chinese history. Some of the most disruptive wars in Chinese history flared during the century or so that followed the disintegration of the ternary arrangement of political power which had arisen from the ashes of the Eastern Han. A note for the year A.D. 386 recorded in a contemporary history (the *Chinshu* [Chronicle of the Chin], *chüan* 109) gives us a rather dismal picture of the condition of the Kingdom of Wei on the morrow of its conquest from the Eastern Chin by a force of nomadic *hsienpi* tribesmen.

> The local peasants have all fled their holdings. The plains lie bare, with not a fire to be seen for a thousand *li*.

Such, if we may credit the above source, was the discouraging lot of the "Han" farming population which the recently triumphant *hsienpi* conquerors were at the very moment attempting to bring under their control.

Among the policies adopted by the new rulers of the Kingdom of Wei to deal with this agrarian crisis were plans for expanding the area of cultivation, for settling soldiers in farming-garrison colonies, for distributing oxen and horses, for supervising the manufacture of iron for manufacturing farm implements, and for renovating and improving hydraulic facilities for flood control and irrigation. Nevertheless, in spite of the efforts of the *hsienpi* rulers, rural society continued to be afflicted by a myriad of problems brought on by the excessive concentration of land in the hands of rich farmers and ex-officials surviving from the previous dynasty, the steady flow of migrants into the ranks of the large serf population (over which the state had no cadastral surveillance authority), the unrestricted trade in slaves, and the centrifugal disposition of large self-sufficient clans provided with extensive holdings. It was in response to these problems, and particularly to the over-concentration of land ownership, that the Northern Wei dynasty introduced, in 485, the famous "equal field" reforms. Ignoring, for the moment, the question of how successful these reforms actually were in practice, we should note that it was most likely the institution of the "equal field" system that gave rise to the concept of a "standard" holding which we see figuring so prominently in the CMYS. According to the original formula of the "equal field" reforms, land was to be apportioned as follows:

[18] See [8, Vol. 1, p. 10] [12, Vol. 1, p. 22, commentary note no. 00.21]. Professor Shih unfortunately refrains from commenting on the problems of converting the surface and volumetric measures appearing in the CMYS and the *tsashuo* into their modern values.

(1) 40 *mu* for each free man or male serf,
(2) 20 *mu* for each free woman or female serf,
(3) 30 *mu* additional for every plow-beast owned (up to four head).

According to this scheme, an average family consisting of one free man and woman with three plow-beasts would rate a farm of 150 *mu*. If this couple had a son old enough to work in the fields and a *ménage* of serfs at their disposal, their holding would be 250 *mu*. Calculating with the *t'aiho timu* surface unit that was standard at the time (based on a five-*ch'ihpu*, equivalent to about 0.133 acres), the range of holding size for normal farming families should be from about 8 to 13.5 hectares (20 to 33.6 acres).

Before continuing, we should note that there is some disagreement among scholars about the actual size of the surface measure (the "small *mu*") used in the *tsashuo*. Prof. Yoneda follows the interpretation of Prof. Motonosuke Amano, who rates this ancient unit as the equivalent of only about 0.047 acres. If the Amano-Yoneda value is used, the 300-*mu* farm mentioned above turns out to consist of a mere 5.2 hectares (14.1 acres) [1] [18, p. 132]. The key passage which both Profs. Nishiyama and Amano use to calculate the size of the "small *mu*" unit appearing in the *tsashuo* reads, unpunctuated, as follows:

Hsiao mu san ch'ing chü ch'i ti ta mu ch'ing san shih wu mu yeh.

Prof. Amano takes the above passage to mean that 300 "small *mu*" (as used in the *tsashuo*) are the equivalent of 135 "large *mu*" in the obsolete measurement system of the Ch'i district. Prof. Nishiyama, on the other hand, believes the first four characters of this passage conclude a previous sentence. The remaining characters are thus to be read as meaning:

> According to the Ch'i measuring system (based on the "large" *mu*), 100 ("small") *mu* are the equivalent of 35 "large *mu*." [8, Vol. 1, p. 10]

Profs. Amano and Yoneda, we might further note, calculate the "small *mu*" as equivalent to 100 square Han paces (*pu*), and the "large *mu*" as the equivalent of 240 square Han paces. Applying this proportion, we will find that 300 "small *mu*" reduces to 125 "large *mu*"—a figure very close to the 135 "large *mu*" value that appears in the above-cited passage from the *tsashuo*. Prof. Nishiyama, on the other hand, believes the "large *mu*" to be about triple the size of the "small *mu*" (which if true, would mean the above figure of 35 *mu* would have to be corrected to 33.3 *mu*).

The fact that our different valuations of the size of the *mu* mentioned in the *tsashuo* text leads Profs. Amano and Yoneda and Nishiyama to arrive at estimates of the size of the normative "300-*mu* farm" no less than 290 per cent apart obviously constitutes a serious problem. Further consideration of the issue is therefore in order. Additional evidence supporting the fifteen-hectare estimate favored by Prof. Nishiyama and myself is to be found in a sixth century *Chiahsün* [Family precepts] attributed to Yen Chih-chui (531–91) of the Northern Ch'i dynasty, in which we find the following passage.

For a family of twenty, it is best not to own more than twenty serfs. A unit of this

size can be adequately supported on a holding of 1,000-*mu* fertile land. [6, p. 529]

By which is meant, it should be explained, that this land/manpower proportion, under contemporary conditions of agrarian technology, will afford sufficient income to maintain a house adequate only for shelter, horses and carriage minimally sufficient for transportation, and sufficient surplus to accumulate, each year, an emergency fund of several tens of thousands of cash (*ch'ien*).

If we can assume that the Northern Ch'i *mu* here mentioned corresponds to the "small *mu*" that Prof. Nishiyama believes to have been in use in the southern parts of China during the same period (i.e., the Wei-Chin *mu*, identical with the "small *mu*" appearing in the CMYS), this 1,000-*mu* farm would contain about fifty-one hectares (126 acres) of land—a figure only slightly in excess of the forty-five hectares that are posited by the Japanese translator of the *Yen-shih chiahsün*, Prof. Utsunomiya. Whatever the exact size of this ideal 1,000-*mu* husbandry, however, cadastral information surviving from the records of the Eastern Wei dynasty (which controlled adjacent territory several decades later) indicates that this size of holding would have qualified the proprietor for junior ("ordinary," as the *Yen-shih chiahsün* puts it) membership in the "gentry" (*shiht'aifu*) class at the time. From which it follows that a holding approximately one-third as large as this (i.e., fifteen hectares) by no means suggests a very large scale of farming by contemporary standards. Furthermore, the "emergency savings fund" income of "several tens of thousands of cash (*ch'ien*)" promised the proprietor of this 1,000-*mu* estate corresponds to no more than the income mentioned in the CMYS as average for a harvest of one or two *mu* of timber.[19]

Whatever the actual area of the 300-*mu* farm standardized in the "equal field" reforms, it is, however, indisputable that we are dealing here with a large-scale unit of enterprise, one which clearly requires the simultaneous employment of different management formulae. This being the case, it behooves us, before proceeding further, to make a brief survey of the variations in productivity and income-distribution pertaining to each of the various patterns of land and labor employment depicted in the CMYS.

B. *Disparities in Productivity and Income*

The "square-plow" agricultural technology standardized in the CMYS is supplemented by two additional work processes: (1) the use of the "Chinese wooden drill" (*lou*)[20] for furrowing and seeding; and (2) the multiple use of human labor power for subsequent cultivating and weeding. It is upon the foundations of the above agrarian technology that the crop rotation formula noted in the CMYS was developed, as I have frequently pointed out. The key aspect in the above formula is the extraordinarily intensive application of human labor power (using the hand hoe) in the latter stages of the above-outlined work cycle (i.e., cultivating and weeding); so basic is this pattern of labor application to the East Asian

[19] A passage in Section 50 of the CMYS tells us, for instance, that a *mu* of *Mallotus Japonicus*, maturing in ten years, brings a price of 60,000 *ch'ien*.

[20] A one-footed non-wheeled drill, fitted with a seed-dispenser.

agricultural method that Prof. Nishiyama has compared its universality to the ubiquitousness of bluish bottoms among children of Mongoloid stock. There does, of course, occur within the text of the CMYS occasional mention of a kind of primitive horse-hoeing (the so-called *chiang*) permitting the substitute use of a one-footed wooden drill in cultivating operations. But the atrophied condition of animal-powered cultivating in the traditional technology described by the CMYS is underscored by the author's comment to the effect that "five rounds of diligent hand-hoeing will make unnecessary any use of animal power in cultivating." It is my opinion that it was the hyperdevelopment of horse-hoeing (*chiang*) which was chiefly responsible for originating East Asian crop rotation patterns along lines quite different from those which were eventually pursued in Europe during the eighteenth century.[21]

Alongside of, and parallelling, the development of this labor-intensive mode of dry-land farming we observe the functioning of a system of familial (paternalistic) labor mobilization marked by conspicuous disparities in the distribution of income. The more conspicuous source of these disparities is the commonplaceness of servile (unfree) labor. But highly unequal patterns of income distribution (measured against labor output) are also to be glimpsed in the employer-employee relationships contracted between free farmers.

The exploitation of unfree labor is particularly conspicuous in the CMYS's descriptions of processing and manufacturing enterprises such as the processing of vegetables and other special crops, and the organization of fermentation-related work. Along with the growth of a market for "garden" and other specialized crops requiring post-harvest processing, we can observe the increasing commoditization of unfree labor resources. But before we can expand on this subject, it will be necessary first to discuss disparities in land productivity and the patterns of farm management that were created in response thereto.

Cereal (i.e., German Millet) Yields:

The following information on cereal (millet, etc.) yields appears in Prof. Nishiyama's translation notes. (Listing is by section [*pien*] number first, followed by the note number. The *mu* is taken as 0.125 acres, and the picul [*tan*] as 4.93 gallons.)

(a) Arable into which has been plowed back a "green manure" crop yields 10 *tan/mu*—or the equivalent of 1.2 *koku/tan* in modern Japanese measure. See [8, Vol. 1, p. 31] (1:32).

(b) The above yield is not affected by variant of seeding density. [8, Vol. 1, p. 61] (3:20).

(c) Arable suitable for growing "hollyhock" (*k'ui*, or *Malva Verticillata*) will yield 4 *tan/mu* (0.48 *koku/tan*) of "brown millet" (*hsüansu*). [8, Vol. 1, p. 132] (17:15).

[21] The use of horse-hoeing techniques in crop-rotation agriculture in Europe is known to have been commonplace at least by 1731, the date of publication of Jethro Tull's treatise on drill and horse-hoeing husbandry. More on this will be found in the explanatory essays in [8].

(d) Arable suitable for growing turnips will yield 1.2 *tan/mu* (0.14 *koku/tan*) of "brown millet." [8, Vol. 1, p. 136] (18:8).

The yield quoted in (a) applies to a millet crop grown on land which has been "naturally" fertilized (i.e., fertilized by plowing back into the soil a "green manure" crop). German millet being a staple "field" crop, no extraneous fertilizing (i.e., manuring) is performed. The maximum millet yield reported feasible for soil prepared in this fashion is 100 kg/*tan* (Japanese measure).

Case (b) is quoted in the course of noting a proverb about millet sowing. I therefore assume that the soil preparation method is the same as it was in (a).

In instances (c) and (d), the advertised cereal yields are noted in comparison with certain "garden" crop yields that might be expected from the same soil. The key to the spectacularly low millet yields therein posted is probably the nature of the terrain, the land in question being probably highland, impossible to irrigate, too marginal to merit extraneous fertilization, and deprived of an adequate supply of manual labor for weeding, cultivating, etc., by the more competitive labor demands of marketable "garden" crops (irrigated and extraneously fertilized) which are the principal subject of discussion. In case (d) the millet yield is accordingly a mere 12 kg/*tan* (Japanese measure) unmilled (or about 10 kg after milling)—about enough to maintain one adult for twelve days, assuming a minimum diet necessity of 240 kg/year of cereal staple. If the millet yield figure given in (d) above applied to a family's entire holding, that family (assuming five members) would have to plant about 150 "small" *mu* (about 7.5 hectares) of millet to meet its minimum nutritive needs, which corresponds almost exactly to the maximum amount of "personal land" (*p'eit'ien*) a family of this size would be allotted if the "equal field" system were operating as originally planned.

Another variable that might help account for the startling discrepancy in millet yields noted in the instances quoted above might be irregularities in the availability of plow animals and machinery permitting the use of animal labor power in harrowing operations. If the high yields reported in (a) and (b) above the postulated upon the availability of a team of three plow-beasts and harrowing implements that can be drawn by animal traction, we may well imagine a high frequency of farming households which were unable to attain such yields because they lacked one or both of the above. This latter hypothesis tends to be borne out by a passage in the *Weishu* [Chronicle of the Wei] that makes mention of an officially-sponsored program to encourage families of less than five members *owning no plow animals* to exchange their manual labor power (in cultivating, weeding, etc. operations) for the services of a plow animal.[22]

The Utilization of Marginally Productive Land—Timber-cropping:

In *chüan* 5 of the CMYS we find the author propounding the use of land of

[22] This was the so-called *jênniuli-hsiangmao-panfa* or "system for exchanging plowbeast and human labor." The exchange ratio was designated officially as twenty-two *mu* of plow-beast labor for seven *mu* of manual weeding and cultivating work. See "Kungtsung-chi," in *Weishu* [Chronicle of Wei], Vol. 4.

marginal productivity (as arable) for tree planting as a way of achieving maximum profitability in land utilization. In this connection, the farmer is urged to avoid planting a certain species of elm tree (the *Ulmus Campestris* or *U. Parvifolia*) on the periphery of fields, where the likelihood of sparrow infestation and crooked limb growth is greatest. Instead he is advised to make use of the poorest and most depleted soil (*terra alba*)—soil unsuitable for the planting of cereal crops—for the raising of trees [8, Vol. 1, p. 222]. In some cases, the CMYS provides highly schematic plans for timber cropping (especially where the land to be so allocated is flat and normal plowing techniques can be used in planting). For example, in cases where the proposed timber crop has a maturation period of ten years (viz. the *Ulmus Campestris* and *Parvifolia*, the *Populus Maximowiczii*, and the *Mallotus Japonicus*), the CMYS recommends a land allocation formula according to which a hundred-*mu* area is subdivided into ten-*mu* subsections, each of which is planted and harvested separately in a ten-year rotation cycle, thus guaranteeing a constant level of demand for seed and labor as well as a constant yield each year. Sample annual timber crop yields (rated in value per *mu* planted) appearing in the text of the CMYS are listed below [8, Vol. 1, pp. 223–24, 232, 229].

(a) *Ulmus Campestris* or *U. Parvifolia* (a kind of elm). About thirty thousand *wen* from the sale of branch trimmings for firewood. One "bundle" of twigs is valued at three *wen*, and one *mu* is reported as yielding ten thousand "bundles" a year. Exchanged for silk cloth, about one bolt (*p'i*). The CMYS notes, in passing, that the labor cost of branch-trimming and twig-collecting per *mu* is ten "bundles" (thirty *wen*) per diem. (Ten *wen* are the equivalent of one *ch'ien*.) The heavy lumber yield (gathered once every ten years) for this same tree crop is noted as exchangeable for ten bolts of silk cloth.

(b) *Populus Maximowiczii* (a kind of white ash). Harvested at three-year intervals for heavy lumber (commonly used for rafters), yields a minimum price of twenty thousand *wen/mu*.

(c) *Mallotus Japonicus* (a kind of oak). Harvested at ten-year intervals for heavy lumber, yields a market price of sixty thousand *ch'ien*.

(d) *Broussonetia Papyrifera* ("paper-mulberry"). Harvested every third year for its bark (usable in paper-making), the yield will exchange for ten bolts of silk cloth.

If the above figures are reliable, we may conclude that the most common Northern China tree crops produced a market value (per *mu*) in branch trimmings alone sufficient to pay for one thousand man-days per annum of labor (the equivalent of one bolt of silk cloth or thirty thousand *wen*), and about ten times this income from the sale of a ten-year harvest of heavy timber. Using this same land for growing millet, on the other hand, would produce a yield per *mu* of cereal sufficient only for twelve days' nutriment. Assuming ready access to markets via road, tree-cropping is thus clearly the more lucrative choice. Further evidence of the extreme profitability of timber-cropping on marginally productive land is the mention in the CMYS of such practices as plowing and extraneously fertilizing forestry seed-beds; in one extreme case (that of the *wut'ung* or

Firmiana Platanifolia) the text even recommends irrigation in addition to extraneous fertilization.

C. *Specialized "Garden" Crops: Their Processing and Labor Cost (with Unfree Labor)*

1. *Extraneous (manure) fertilization: the foundation of "garden" cropping*

The dried manure fertilizers (*fenshih* and *t'sanshih*) that appear in the pages of the CMYS are intended primarily for use in fertilizing irrigated "garden" crops. But this by no means implies that all irrigated "garden" plots are manure-fertilized. The basic plow-team of three oxen—by no means universally owned—will produce in a year only "thirty cartloads" of manure, according to the text. Following the fertilization recipe noted in the introductory *tsashuo*, each *mu* of "garden" crop requires a minimum of five "cartloads" of manure, meaning that no more than six *mu* of "garden" land can be so fertilized. For this reason, the CMYS recommends the use of "natural" fertilizer even in "garden" crop raising (i.e., plowing down a previously grown crop of "fertilizer"-bean or cereal-bean). That animal manure *was* used for fertilizer is suggested by the mention of stall-feeding for plow-beasts; but that the manure produced by stall-fed oxen was insufficient even for "garden" crop fertilizing is proven by the mention of widespread "natural" fertilization for "garden" crops. Reliance on "natural" (non-manure) fertilizer in "garden"-cropping in turn removed a major incentive for expanding animal-power resources, and probably also explains why traditional China failed to develop anything more than a primitive "garden"-plowing technology, based on the rarely-used *huotzŭ*.[23] Use of the *lou* (a wooden drill equipped with seed-dispenser) in "garden" soil preparation seems to have been infrequent, and never undertaken with the seed-box filled. Large-scale "garden" agriculture thus developed along peculiar lines, and with no reciprocating influence upon the state of animal-powered technology.[24] Intensivity of human labor input was thus characteristic of Chinese agriculture at least from the time the CMYS was written. The failure to utilize animal power in "garden" agriculture was but one symptom of this preference for labor-intensive farming. High degrees of labor input were also required by the techniques of work-management, harvest, processing, and foodstuff manufacture mentioned in the CMYS. And in subsequent centuries, as irrigated farming became more common, demands on human labor resources were

[23] The *huotzŭ* mentioned in the CMYS appears to be a type of wooden drill not equipped with a seed-dispenser, and drawn by only one animal. For more observations on the underdevelopment of the drill in traditional Chinese husbandry, vide supra, pp. 436–37.

[24] "Garden" crops are described as generally sown in lots of ten *mu*, while "field"-grown vegetable crops are commonly planted in a hundred *mu* lots. In the CMYS we may also observe the development of several highly popular secondary crops, such as hemp (for fibre), muskmelon (consumed as a pickled condiment), sesame (a source of seed-oil), and safflower (used in manufacturing lipstick), from "garden" to dry-field items. Dry-grown hemp was generally fertilized by manuring. The other crops here mentioned were generally rotated (in their dry-field variants) with "natural" fertilizer crops. It seems likely that it was during the course of this perfection of dry-field husbandry that the Chinese farmer developed the techniques of crop-rotation that were eventually to crystallize in the "three-crops-in-two-years" rotation formula.

increased logarithmically by the added chores of well-sweep and windlass operation.

2. *Turnips, etc.: yields and labor costs*

Turnip and *k'ui* (*Malva Verticillata*) cropping appear in the CMYS as highly lucrative forms of land use in areas within easy reach of urban markets. In terms of crude income the profitability of these two crops is rated as approximately triple that of cereal crops. For the turnip, the CMYS provides the following data on yields and labor costs:

(a) The normal compensation paid one unfree female laborer for harvesting ten *mu* of turnips is twenty "cartloads" (about seven tons) of turnip root.

(b) The unfree labor required to raise ten *mu* of turnips (consisting chiefly of hand-hoeing with a plow from which the mouldboard has been removed) is normally compensated with three "cartloads" of ferment-pickled whole young turnip heads [8, Vol. 1, p. 134]. Calculated in terms of milled millet, the labor of one unfree female exchanges for about sixty piculs of cereal (equivalent to the yield of a hundred *mu* of average arable). Taking the "picul" mentioned in the CMYS as about 16 kg, and the annual cereal consumption level of the average adult laborer to be in the vicinity of 240 kg per annum, this means that a hundred *mu* of turnips could pay for the pre-harvest labor services of one laborer for four years.

3. *Safflower (hunglanhua): yields and labor costs*

According to the CMYS, the safflower-seed yield of a hundred *mu* of high-grade arable (unirrigated) can produce two hundred piculs of oil for use as axle-grease or lamp-fuel. If an urban market is within easy reach, the income from this oil matches the income that might be anticipated from planting the same arable with hemp or millet. If, however, the market value of the flower of the safflower plant (used for the manufacture of lipstick) is added to the value realized from the seed oil, a gross profit equivalent to the market value of at least two hundred bolts of silk is promised. The same hundred *mu* of safflower requires, however, the morning labor of a hundred farm hands per diem until harvest—more than ten times the labor resources at the disposal of the ten-member family standardized in the "equal field" reform. The solution to this dilemma recommended by the CMYS is a kind of share-cropping arrangement, whereby village children are employed to tend the safflower crop in return for half of the harvest brought in with their labor. Using this system, the CMYS tells us, even an unmarried farmer or a widow proprietress can plant a large crop of safflower.[25]

[25] [8, Vol. 1, p. 239]. Prof. Shih Shêng-han has the following to say on the labor recruitment system whose outlines are suggested by the above abstracts.

> The children (both male and female) of unfree farm laborers were, like their parents, incorporated fully into the exploitative labor mobilization system that served the needs of the great landlord-farmers. This meant that the emergency labor-resources necessary for harvesting the safflower crop had to be sought from among the children of small or impoverished freeholders, many of whom were normally unemployed. . . . [11, p. 64]

D. *The Farm Management Pattern Depicted in the CMYS*

1. *Peculiarities and fundamentals of the system*

The pattern of farm enterprise as sketched in the pages of the CMYS is especially noteworthy for its reliance on a multitude of processing techniques—some of them highly specialized and performed with large quantities of raw material—to realize the value of the produce output of territorially extensive holdings. The model farm that we glimpse in the CMYS in many ways resembles a kind of rural factory. As we have had occasion to observe in the preceding sections, many specialized crops (including both vegetables and non-comestible crops) undergo rudimentary or occasionally even extensive processing (notably through fermentation techniques) before they leave the farm. The extensive labor power required for these manifold and often complex processing operations appears to have been supplied to a great degree by unfree laborers—as indeed seems often to have been the case in pre-processing operations. Numerous passages in the text imply a large scale of raw material input in connection with these processing procedures. Even in the processing of field produce for ordinary table consumption, enormous quantities of unprocessed material had often to be handled.

Perhaps the most dramatic instance of such large-scale labor-intensive processing work is that which we find described in connection with the brewing of wine. To begin with, the crude rice from which wine was commonly brewed had to be polished in cold water. In the manufacture of "winter brew" (*tungchiu*), begun late in the autumn after the cold had set in, hand- and foot-powered cold-water grinding had to be repeated several dozen times until the crude rice had been ground down to approximately 70 per cent of its original kernel size. In addition to the tedious milling operations themselves, large quantities of cold water had to be pumped into the milling vats, and equally large quantities of rice had to be shifted from the milling area into the fermentation tubs with painstaking care to insure that no disruption of the delicate fermentation produce might result. Manpower for this simultaneously exhausting and delicate work was provided, at least in the case of the larger farms, chiefly by family serfs.

In sum, it is impossible to overemphasize the importance of unfree labor resources for the development of that mode of highly intricate and labor-intensive agrarian culture that we now recognize as characteristic of East Asian rural society. The CMYS provides us with not a few examples of farming and processing operations requiring just this sort of backbreaking but highly skilled application of labor power. Several examples follow of the high level of expertise demanded of the laborer by the sixth century Northern Chinese farmer.

a) Determining when to begin various operations:

(1) Plowing is to be commenced "when the ridges of the soil turn white" (*paipei*).

(2) Seeding is to be undertaken "after the fields yellow" (*huangch'ang*) (i.e., after adequtae rainfall).

(3) Fermentation is completed when "bubbling subsides" (*futing*) and the "taste is appropriate" (*weitsu*).

(4) Boiling temperatures appropriate for culinary procedures are catalogued according to the size of the steam bubbles. "High boil" is described as "fish-eyed broth" (*yüyent'ang*); "medium boil" as "crab-eyed broth" (*hsiehyent'ang*); "low boil" as "hempseed broth" (*mafut'ang*).

b) Specifying in detail the techniques to be used in the manufacture of foodstuffs. For example, the variety of techniques mentioned for kneading water-noodles:

"Finger-kneading" (*na*). Probably means kneading with the fingers of both hands.[26]

"Press-kneading" (*an*). Apparently a technique of kneading with the palms of the hand used separately [8, Vol. 2, Section 80].

"Squeeze-kneading" (*na*). Presumably, kneading between the palms of both hands [8, Vol. 2, Section 82].

"Kneading" (*jou*). Apparently refers collectively to all of the techniques listed above [8, Vol. 2, Section 82].

c) Specifying in detail the form the finished product should take. For example, the variety of terms used to denote the manner in which cooked food is laded (*tien*) into the serving vessel.

"Half-laded" (*pantien*). The vessel is half filled.

"Full-laded" (*mantien*). The vessel is filled above the brim.

"Level full-laded" (*p'ingmantien*). The vessel is filled exactly to the brim.

"Complete-laded" (*ch'üantien*). All of the cooked product is served into the vessel.

"Messy-laded" (*huntien*). The cooked product is served as is (i.e., without parcing) into the vessel.

"Slice-laded" (*chiehtien*). The cooked product is cut into pieces before serving into the vessel.

"Separate-laded" (*piehtien*). The food is served into several discreet vessels.

"Mix-laded" (*chiehtien*). Several different foods are served together in one vessel.

"Mix-half-laded" (*fenpantien*). Each vessel is filled halfway with two different foods.

"Whole-laded" (*pingtien*). The prepared food is served into the vessel without removing its skin or wrapper.

"Set-laded" (*shuangtien*). Various foods are served in an arrangement consisting of one piece of each.

"Sundry-laded" (*kungtien*). Each vessel is served with several identical sets of different foodstuffs.

"Up-laded" (*yangtien*). Served face-upward.

"Heap-laded" (*leitien*). Served in a stack.

"Upright-laded" (*shutien*). Served upright in the vessel.

"Quick-laded" (*t'sutien*). Served at the table.

[26] For the techniques used to produce a thick water-noodle, see [8, Vol. 2, Section 82].

A similarly detailed list of varied operational procedures appears in connection with the first-mentioned and most important subject discussed in the CMYS: land utilization. Included are the following rubrics: arable, "garden"-land, orchard-land, forest-land, and "ponds-and-marshes." As we have so far omitted from our narrative examples of management formulas for "orchard-land" or "ponds-and-marshes," let us take this opportunity to touch briefly on these topics. "Orchard-land" (i.e., land planted with trees yielding a product other than firewood or timber) is discussed in the CMYS chiefly in connection with the production of mulberry-leaves for the silk industry. Other varieties of "orchard" tree mentioned in the text are as follows:

(1) The "wild mulberry" tree (*che*: *Cudrania Tricuspidata*), the leaves of which are fed to silk-worms for producing "wild cocoons" (*shanchien*).

(2) The "paper mulberry" (*ch'u*: *Broussonetia Papyrifera*), the bark of which is used in the manufacture of paper.

(3) A kind of willow (*ch'iliu*: *Salix Purpurea*).

(4) The bamboo tree, used for producing edible shoots.

There is, it should be noted, no description of spinning or weaving techniques in the CMYS, in spite of the prominence with which the mulberry tree is treated in the "orchardland" section.

In the category of fruit-bearing trees we will find a rather limited selection in the CMYS, most probably because of the failure of traditional Chinese agrarian civilization to develop the kind of taste for fruit-juices and fruit-wines that we find in early evidence in West Asian and European cultures. Juice-yielding fruits appear to have been consumed in the China of the CMYS only in a preserved form known as *kuoch'ao*—a kind of itinerant's tea prepared by mixing pulverized dried fruit with cereal flour. Wine and condiments were commonly manufactured not from fruits but rather from "field" crops, processed by controlled fermentation. We find malt is used only in the production of certain candies; a taste for beer never seems to have developed. The CMYS does, however, make mention of a handful of "orchard" trees cultivated for their nut product. These are the chestnut, the "Japanese pepper" (*Xanthoxylum Piperium*), and the *chuyü* (*Evoidia Rutacarpa*)—all of which bear coniferous fruit used in cooking.

Ponds and marshes make their appearance in the CMYS as sites for raising fish and aquatic vegetable crops, both consumed with condiments and seasoning agents.

Stock-breeding is discussed in the CMYS as a processing operation. We have already touched upon the early development of stall-feeding in the raising of large domestic animals (i.e., plow-beasts); this feeding technique seems to have developed in China, exactly as in early modern Western Europe, simultaneously with the appearance of crop-rotation agriculture. As consumers of rough fodder, the principal animals mentioned by the CMYS are the ox, horse, and sheep, the last-named evidently being the most important of the three. The sheep is described as being pastured for the entire length of the year. But pasturage is limited, and pasture areas must be rotated in fixed sequence to avoid total depletion. During the coldest part of the year, stall-feeding is normally resorted to.

As a source of meat, the pig is of higher status than the sheep, if we may judge from the greater diversity of uses to which it can be put. Indeed, the pig appears to be the most valuable of all of the common domestic farm animals. Capable of sustaining itself on forage or trough-feed, it can be turned loose during the autumn "busy" season, and trough-fed during the slack season; at the same time, it is able to provide for itself during the "famine" season between harvests if necessary.

From the above it should be evident that pasture-allocation is a significant aspect of land-use planning in the CMYS. Among the alternatives for pasturing domestic animals are: (1) the marsh-grass growing wild in undrained meadowland; (2) the acorn from the *li* (*Quercus Serrata*) tree; (3) feed-turnips grown in the underbrush of mulberry orchards; (4) feed-turnips raised as a catch-crop in hemp fields; or (5) the gleanings from harvested *taro*,[27] melon, or ground crops.

Domestic fowl are all trough-fed. Hens are described as the principal egg-producers among domestic fowl—exhibiting, according to the CMYS, a rather impressive egg-laying capacity of 120 eggs/bird per annum. The domestic duck and goose are the primary sources of meat among domestic fowl, though the eggs of both of these birds are mentioned as being consumed in processed form. Dog meat appears to have been consumed as well, while horsemeat is mentioned as comestible only after pickling in the lees of rice-wine.

From the evidence appearing in the CMYS, it seems hard to avoid the conclusion that the system of land utilization described in this text assumed an inadequate supply of pasturage and/or feed for the breeding of more than a few head of large domestic animals. "Natural fertilizer" crops (vide supra, pp. 440–41) had indeed become common by the time the CMYS was written. But the possibility of using such crops as a source of animal feed was only minimally appreciated. The only feed substances mentioned in the CMYS are green fodder and dried hay. There is, to be sure, some mention of the consumption of dairy products; but such consumption occurs only in connection with a porridge diet. The development of a dairy-based cuisine was clearly inhibited by a shortage of pasture, fodder, etc. But this is no more than what we might expect, given the atrophied condition of animal-powered cultivating technology characteristic of East Asian "square-plow" agriculture and the civilization that grew up with it. The reader desiring more information on the above points is referred to the "explanatory essay" (*ronkō*) appearing in Volume 2 of the first edition of the Nishiyama-Kumashiro Japanese translation of the CMYS.

CONCLUSION

I have noted in the preceding pages, albeit unevenly, most of the key issues which have attracted the attentions of Japanese and Chinese scholars engaged in recent studies of the CMYS text and its interpretation. Lest I create the mistaken

[27] The *taro* cited is the *paikuoyü*, so called because of the rapidity of its radical proliferation.

impression that our disagreements with Prof. Shih center on those points about which we have insufficient information to render an authoritative interpretation, I should like to emphasize that a good many of our differences with Prof. Shih's conclusions are the result of our entertaining two very distinct points of view about the integrity of the original text of the CMYS. While Prof. Nishiyama and myself have generally preferred to translate the Chinese text on the assumption that the narrative sequence is frequently disjointed, Prof. Shih tends to adhere to a less critical reading.

A conspicuous example of how different notions about the condition of the CMYS text has led to disagreements in its interpretation occurs in connection with the treatise on *chuming* [8, Vol. 2, Section 84], a culinary product which unfortunately has vanished entirely from both the verbal and practical traditions in China. It is of course hardly surprising that modern students of the CMYS should find their interpretive efforts impeded by the presence of numerous terms for which the material correlative no longer exists in China, or has at least become unclear as a result of changing usage.[28] The CMYS was written after all, over fourteen centuries ago, and in a style intended to make it as accessible as possible to the man in the field. Dialect and highly specialized vocabulary therefore abound. Furthermore, we must recall that the CMYS made its appearance well before the popularization of printing in China, while the earliest extant versions of the text date from the Northern Sung period (about five centuries later). During the intervening centuries, the CMYS was transmitted by hand-written copy, with the consequent introduction of numerous clerical errors and later commentary into the body of the text.[29] Furthermore, Chinese scholars, lacking until only recently a copy of the Northern Sung edition of the CMYS text, confined their attentions to the Southern Sung version which was available to them, introducing over the years a good amount of unsubstantiated textual adaptation, and sacrificing authenticity for comprehensibility. In handling these philological difficulties, I found myself much indebted to the pioneering research

[28] A plethora of farming encyclopedias (*nungshu*) made their appearance during the Sung, Yüan, Ming, and Ch'ing periods, however, it is difficult to trace the continued existence and use of most of the crops mentioned in the CMYS. The most conspicuous and important example is a crop referred to in the former text as *k'ui,* rendered above as "hollyhock"; this item does not appear in farming treatises after the Ming Period. There are, of course, other products of a more trivial nature whose identity is not clear. But we have found it generally feasible to venture a guess as to the actual identity of the item cited in the CMYS. That, at any rate, is the procedure we have adopted in preparing the manuscript of our translation.

Perhaps the most serious problem for contemporary students of the CMYS text results from the disappearance of virtually all of the culinary encyclopedias (*shihp'u*) current at the time the CMYS was written or during the subsequent Liang, Sui, and T'ang periods. If we had at our disposal even a small percentage of the texts for which the titles survive, we would be greatly aided in our attempts to establish correlations between various products and techniques as they exist in modern China and their fifth century counterparts described in the CMYS.

[29] The frequency of clerical errors and subsequent interpolations in the texts is commented upon in *chüan* 1 of the CMYS by the T'ang editor, Yen Shih-ku.

of my predecessors Profs. Koide and Nishiyama.[30]

In closing, I should like to observe that, however coincidental it might appear that both Japanese and Chinese researchers should happen to publish new editions of the CMYS practically simultaneously, far more than mere coincidence is responsible for this turn of events. The history of both projects begins with the discovery, in 1926, of what is so far still the most integral surviving version known to scholars of the CMYS: the Hōsa Bunko text of the Northern Sung edition (referred to below as the "Kanazawa text"; vide note 30). Chinese scholars were from the start most eager to obtain a copy of this Kanazawa text, but conditions did not allow their hopes to be realized until 1948, when, on the occasion of the first anniversary of the establishment of the Nōgyō Sōgō Kenkyūsho (National Research Institute of Agricultural Economics: Dr. S. Tōbata was then President) it was decided to bring out a collotype edition of this rare volume, a copy of which Prof. Nishiyama managed to put into the hands of our Chinese colleagues in spite of the postwar disorders on the mainland.[31] Prof. Shih Shêng-han has himself born witness to the importance of the Kanazawa text for the recently materialized modern Chinese version of the CMYS.

It is accordingly our most sincere hope that it shall be possible before long for us to collaborate with our Chinese colleagues in preparing a mutually acceptable collation of the CMYS text, from which might eventually be produced a definitive text and translation of this important work for use by future scholars. Toward this end, we look forward to the day when our work can be submitted to the appraisal and criticism of appropriate specialists in *both* Japan and China, and trust that we shall before too long enjoy the kind of direct contact with Chinese scholars necessary for this enterprise.

30 Three different Northern Sung printed editions of the CMYS have been discovered still extant in Japan. These are the Kōzanji, Kanazawa Bunko, and Igai-collated texts. More information on the various surviving texts of the CMYS appears in an article of Prof. Koide's authorship [4]. A study of the pedigree of the various extant texts of the CMYS made by Prof. Nishiyama [7] was originally appended to the 1948 collotype printing of the Kanazawa text.

31 See *Kanazawa-bunko-bon Seimin yōjutsu* [Kanazawa Bunko text of the CMYS], 9 Vols. (Tokyo: Nōgyō sōgō kenkyūsho, 1948). According to the philological researches of Mr. Mitsuo Tokoro, the history of the Kanazawa Bunko text goes back as far as the thirteenth century. Shortly after the first Mongol invasion attempt (1274), Hōjō Sanetoki ordered the recopying of a collated text of the CMYS based on two versions (one printed, the other hand-written) of the earliest Northern Sung printed edition (dating from the T'ienhsi reign period: 1017–21). This recopied "Hōjō" text subsequently became the property first of Toyotomi Hidetsugu, then of the Sōkokuji, and finally (in 1612) of Tokugawa Ieyasu, still with all ten *chüan* intact. In 1616, however, when the volume was transferred to the library of the Owari branch of the Tokugawa family, only nine *chüan* were listed. *Chüan* 3 (on "garden" crops) was apparently lost during this four-year hiatus. See [7, pp. 214–19], following which is appended an explanation of the pedigree of twenty-four extant manuscripts of the CMYS.

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