

Characteristics of Agricultural Techniques in 18th and 19th Century Joseon Dynasty

Yeom Jeong-Sup

Abstract

The agricultural technology of the Joseon period gradually evolved and finally achieved an appropriate level of sophistication during the late 18th century. The rice-transplantation technique was the dominant method used in rice cultivation in the latter half of the 18th century. Examples of agricultural management during the 18th century were cited to show the changes made in terms of the resultant agricultural productivity and especially yields per unit area. The most dominant method of dry field cultivation during the 18th and 19th centuries was double-cropping multiple crops. The systematic advances in the area of fertilization were the most distinct changes that appeared in the 16th century and are well documented in the agricultural manuals published during that time period. One can also see the characteristics of regional farming methods in the irrigation facilities. The Joseon government carried out traditional policies that strengthened the management of irrigation facilities. In the late 18th century, during Jeongjo's reign, there was a distribution of irrigation facilities in the eight provinces.

Keywords: rice-transplantation technique, fertilization technique, single-cropping system double-cropping system, cotton cultivation

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Introduction

Agricultural techniques are an important key to any evaluation of the levels of development in the preindustrial world. The same applies to the Joseon dynasty as well. Korean historians have long endeavored to elucidate the characteristics of Korean agricultural techniques during the period prior to the country's opening to the outside world in 1876. Since the 1960s, much research has been conducted with the aim of explaining how agricultural techniques evolved during the Joseon dynasty. Many scholars have inquired into the advancement of agricultural techniques from the fifteenth century to the eighteenth century during the Joseon dynasty. They have utilized the method of analyzing agricultural manuals (nongseo).

Many technical advances, such as paddy-field cultivation techniques and dry-field cultivation techniques (Kim Yong-seop 1971), fertilization techniques (Min Seong-gi 1988), irrigation systems (Yi Tae-jin 1986), and localized agricultural techniques (Yeom Jeong-Sup 2000), have been identified and explained thus far.¹ As a result, it has now been confirmed that paddy fields were continuously expanded over the years and rice-transplantation techniques (techniques related to the transplantation of rice seedlings) were developed in the process. It has also been confirmed that traditional agricultural techniques utilized locally were collected into local agricultural manuals from the late eighteenth century (Yeom Jeong-Sup 2000).

Research intended to elucidate agricultural productivity by analyzing detailed examples of farm management is scant and hard to come by. There has been, however, a significant number of studies on the scale and methods of agricultural management. Preliminary studies were made in the 1970s to estimate the rate of productivity per unit of area and since the 1990s there have been several studies

1. Yeom Jeong-Sup, *Joseon sidae nongseo pyeonchan-gwa nongbeop-ui baldal* (A Study on the Compilation of Agricultural Manuals and the Advancement of Farming Methods during the Joseon Dynasty) (Ph.D. diss., Seoul National University, 2000), pp. 1-13.

conducted with the purpose of making a rather long-term estimation of agricultural productivity utilizing real-life examples of agricultural management. Regions such as Gyeonggi-do Gwacheon area (An Byeong-tae 1982), Gyeongsang-do Chilgok area (Kim Geon-tae 1996), Chungcheong-do Seosan area (Choe Yun-o 2001), Jeolla-do Yeonggwang area (Jeong Seung-jin 1998) and Jeolla-do Yeongam area (Yi Yeong-hun 1999; Kim Geon-tae 1999) were examined in the process and yields per unit area were calculated by taking into account the taxes imposed by the landlord on the tenants.

The status of agriculture in the late Joseon period must be examined together with such elements as the evolution of agricultural techniques (cultivation methods) and the actual yields per unit area. According to previous studies, it seems pretty clear that there was a huge leap in agricultural technology from the sixteenth to eighteenth century, and there is no indication that there was any regression or stagnation in the process of technical advancement after the nineteenth century. It seems reasonable then to assume that the level of advancement of agricultural technology was maintained even during the nineteenth century.

This paper first reexamines the level of Joseon agricultural technology advancement up until the eighteenth century. The three parts of agricultural technology that were adapted in real agricultural production during the eighteenth century will be explained: the paddy-field agricultural techniques, the dry-field agricultural techniques, and the fertilization techniques. We can derive the unique characteristics of agricultural technology through this analysis. Then the unique characteristics of the paddy-field agricultural techniques in the Jeolla-do Neungju area will be examined along with the characteristics of the rice farming of that area in the nineteenth century. It can be argued that the peculiarity of rice farming of the Jeolla-do Neungju area derives from traditional practices of regional agricultural production.

The Characteristics of Paddy-Field Agricultural Techniques and Two Examples of Paddy-Field Yield during the Eighteenth Century

The Characteristics of Paddy-Field Agricultural Techniques

The agricultural technology of the Joseon period gradually evolved and finally achieved an appropriate level of sophistication during the late eighteenth century.² The cultivation of rice in paddy fields together with the cultivation of miscellaneous cereals in dry fields made up the dominant part of agriculture at the time. As cattle breeding was not yet very popular, the level of technology utilized in paddy and dry field cultivation were the most distinctive elements defining the stage of development attained by society at the time.³ We shall make an overall examination of the characteristics of agricultural technology in the eighteenth and nineteenth centuries, which would have undoubtedly determined the agricultural productivity of the time.

The technical status of Joseon agriculture can be examined through the various agricultural manuals that were published during the Joseon period (Yeom Jeong-Sup 2000, 17). In November 1798, King Jeongjo ordered the proclamation of the "king's command for the promotion of farming and the search for agricultural manuals" (gweon nongjeong gu nongseo yuneum) hoping to develop new agricultural techniques, while consolidating existing ones and maintaining agricultural productivity.⁴ This royal order was issued to proclaim the government's serious encouragement and promotion of agricultural operations throughout the nation, and eager collection of agricultural

2 Kim Yong-seop, *Joseon hugi nongeopsa yeongu* (A Study on the Agricultural History of the Late Joseon Dynasty), vol. 2 (Seoul: Ilchokak Publishing Co., 1971), p. 43.

3 Yi Ho-cheol, *Joseon jeon-gi nongeop gyeongjesa* (Agricultural History of the Early Joseon Dynasty) (Seoul: Hangilsa Publishing Co, 1986).

4 *Hongjae jeonseo* (Complete Works of King Jeongjo), vol. 29; *Ilseongnok* (Chronicles of Kings from King Jeongjo), *gichuk* (30th day of the 11th lunar month, 1798).

manuals, both those privately written and those published.⁵

As soon as the order was issued, several submissions were made to the government in response to the royal initiative, and the task of collecting data and related documents in preparation for the compilation of the Nongseo daejeon (Grand Collection of Agricultural Manuals) began.⁶ Several examples of submissions called eungji nongseo, agricultural manuals commissioned by King Jeongjo, are documented in the Ilseongnok (Chronicle of Kings from King Jeongjo), or various private anthologies (Kim Yong-seop 1970, 13). They contained methods and techniques that were actually being utilized in agricultural management in the latter half of eighteenth century.⁷

In the late eighteenth century, paddy fields were classified into three categories based on the ease with which they could be irrigated. Fields in the “first” class could be irrigated without difficulty or were naturally well watered by underground springs. The classification “second” meant the field was irrigable but did not have any natural watering source that would keep the field from drying out during even the briefest droughts. A field in the “third” category was one without any water source whatsoever. The renowned scholar Bak Ji-won in the eighteenth century suggested a somewhat different classification system, which was based on whether transplantation techniques were utilized in the field or not.⁸ He explained that there was no reason to restrict these techniques to only those paddy fields in the “first” class as defined in the manual Nongsa jikseol (Straight Talks on Farming). And he also insisted that the techniques must be

5. In May 1799, there were over 100 volumes of agricultural manuals from Seoul and eight provinces. Yeom Jeong-Sup, *op. cit.*, pp. 294-301.

6. Yeom Jeong-Sup, 18 segi mal jeongjo-ui nongseo daejeon pyeonchan chujin-gwa uiui (Jeongjo's Promotion of the Compilation of Nongseo daejeon and Its Meaning in the Late 18th Century), *Hanguksa yeongu* (The Journal of Korean History) 112 (2001).

7. In the late 18th century, there were many regional agricultural manuals, known as eungji nongseo (Agricultural Manuals Commissioned by Jeongjo). Kim Yong-seop, *op. cit.*, pp. 7-15.

8. Bak Ji-won, *Gwanong socho* (Brief Abstract of Assessment of Agriculture).

applied to the “third” class paddy fields because there was no sufficient water for the irrigation of paddy fields.⁹

The rice-transplantation technique was the dominant method used during rice cultivation in the latter half of the eighteenth century (Kim Yong-seop 1971, 43). This technique is a cultivation method closely related to the initial stage, the seeding stage and the early care stages for rice seedlings in the rice cultivation process. This technique has the advantage of allowing farmers to provide much more care to the rice plants, by coordinating concentrated effort after the plants are completely seeded and before they are transplanted (Yeom Jeong-Sup 2000, 151).¹⁰

This technique was made possible, as the transplanting nature of the method needed the space where the rice seedlings had been initially seeded to be maintained separately from the main field where the rice seedlings would later be transplanted. Because the transplantation technique allowed cultivators to concentrate their labor on a specific, restricted time frame, it represented a huge advance in agricultural technology.¹¹ The technique also spared the farmers the difficulty of having to irrigate the entire main field in the early stages of the young rice plants' growth, which would have been unavoidable if the rice seedlings had not been grown separately and then transplanted to the main field later. This technique allowed farmers to utilize the fertility of multiple sites of land in their cultivation efforts and ultimately contributed to a rise in agricultural productivity.¹²

In the early fifteenth century, several parts of the Korean peninsula adopted rice-transplantation techniques. From the late sixteenth century on, this transplantation technique gradually spread into cer-

9. *Nongsa jikseol* (Straight Talks on Farming), the first original agricultural manual in Korean history, was compiled in 1449 at the order of King Sejong.

10. Bak Ji-won, *op. cit.* The same opinion was initiated by Yun Hong-sim, one of the region's intellectuals who submitted eungji nongseo to Jeongjo.

11. Including *Nongsa jikseol*, most agricultural manuals agree on the ease of weeding as a condition of accepting rice transplantation.

12. Kim Yong-seop, *Joseon hugi nongseopsa yeongu* (A Study on the Agricultural History of the Late Joseon Dynasty), vol. 2, enlarged edition (Seoul: Ilchokak Publishing Co., 1990), p. 44.

tain areas of the southern region of the Korean peninsula where the climate enabled the adoption of the technique. It gradually gained in popularity so as to encompass the entire southern region of the Korean peninsula, and reached the position of being the most dominant trend in rice cultivation in that area from the early part of the seventeenth century (Yeom Jeong-Sup 2000, 139-145).

In King Sukjong's reign there were comments from government officials mentioning that the technique had become so popular that it had been impossible to ban it (found in an evaluation in the "Rules for the Promotion of Agriculture").¹³ In the beginning of the eighteenth century, the technique further expanded to Gyeonggi-do and the Gaeseong area (Kim Yong-seop 1971).

What enabled the expansion of this technique were the systematic enhancements made in technical areas. Caretaking procedures were necessary for the rice seedbed where the rice seedlings were initially placed. And fertilizing the rice seedbed was also emphasized.¹⁴ Supplemental measures to counteract drought problems included such methods as *geonangbeop* (placing rice seedlings in a dry rice seedbed and later transplanting them into a wet rice paddy) were also developed.¹⁵ The transplantation technique also technically diminished the amount of labor required by the traditional direct-seeding method. But the foremost reason for the popularization of the transplantation technique was the technical solution it provided to irrigation problems.

According to the famous nineteenth century scholar Seo Yu-gu, the transplantation technique had three major advantages: first, it reduced the amount of labor necessary for weeding;¹⁶ second, it

13. *Gwanmang jeolmok* (Provisions of Agricultural Promotion), in *Takji* (Records of the Ministry of Finance), *gwon* 3

14. Sin Sok, *Nongga jipseong* (Gross Summary of Farming Methods) (1653). Sin Sok had made wide supplements, especially on rice-transplantation techniques.

15. *Geonangbeop* was firstly introduced in *Nongga wollyeong* (Monthly Tasks for a Farming Household), compiled by Ko Sang-an in the early 17th century.

16. Seo Yu-gu, *Bolliji* (Records of Main Economy), in *Imwon gyeongje ji* (Sixteen Treatises on Managing a State), *gwon* 5

allowed farmers to use multiple sites and make full use of the fertility of those sites; third, it provided farmers with an opportunity to remove the inferior rice plants and concentrate their efforts on the superior ones. He also stated that he found the usual concerns about the technique's vulnerability to unexpected droughts to be unfounded. Since there would be no way to counteract severe droughts anyway, to not using the transplantation technique because of that already unavoidable predicament would certainly not be a wise move, especially considering the potential of the technique.

Developments made in the area of paddy-field agricultural technology led to the diversification of breeds as well as the appearance of locally-preferred breeds.¹⁷ New breeds were seeded and attempts were made to seed them, while certain local areas discovered and developed preferred breeds that were most compatible with their land. Breeds specifically designed for transplantation were also developed.¹⁸

The expansion of this transplantation technique was helped enormously by the expansion of the paddy fields as well. In the eighteenth century, dry fields were transformed into paddy fields throughout the country,¹⁹ meaning literally the converting of dry fields into paddy fields and increasing the size of paddy fields in general.²⁰ In the early part of the nineteenth century, Seo Yu-gu mentioned that almost 30% of the paddy fields available at the time had been newly developed as a result of the *bandap* efforts.²¹

The technical advances also led to the development of the double-cropping technique (known as the rice-barley double-cropping

17. Yeom Jeong-Sup, *Joseon sidae nongseo pyeonchan-gwa nongbeop-ui baldal*, pp. 153-154.

18. Seo Yu-gu, *Gongnyeonggo* (Analysis of Cereals Names), in *Haengpoji* (Records of a Farming Village), *gwon* 4

19. This transformation was called *bandap* or *banjeon*, which meant basically reversing or manipulating the original nature of a designated piece of land into a much more desirable one.

20. Kim Yong-seop, *Joseon hugi nongjopsa yeongu* (1990), pp. 91-92.

21. Seo Yu-gu, *Jeanje* (Land System), in *Haengpoji*, *gwon* 1

technique), where both miscellaneous cereals (usually cultivated in dry fields) and rice (usually cultivated in paddy fields) were cultivated on the same land at different times.²² This technique was called *yunjak*, which maintained a cycle of seeding and harvesting rice first and then barley next, providing the farmers with the opportunity to double the crops. For the successful implementation of this technique, a sufficient amount of manure was needed early on and the next series of seeds had to be planted as soon as the previous ones had ripened and been harvested. This technique was only possible on land where the transplantation technique had already been adopted.

Two Examples of Paddy-Field Yield during the Eighteenth Century

This section will examine changes made in terms of the resultant agricultural productivity and especially yields per unit area through examples of agricultural management during the eighteenth century. The first example is from the Gyeonggi-do Gwangju area through a yield report that was in the custody of the Gwangju An Family for generations.²³ The An Family of the Gwangju area was also that of the renowned scholar An Jeong-bok (1712–1791). It was honored throughout the nation and proud of its academic traditions. One of the most valuable documents in the custody of this family are the *Jonggye ilgi* (Diary of Lineage)—a documentation of various records related to *Jonggye* (an active community inside the family) activities including a list of tenant's names and yield reports accumulated during the time period 1738–1744.

The An Family of the Gwangju area tried to create a source of revenue, which would be used for various occasions, including the annual memorial services, by establishing some paddy fields as real estate shared by every member of the family. In 1737 An Taek-

22. Kim Yong-seop, *Joseon hugi nongeopsa yeongu* (1990), pp. 45–76.

23. The Academy of Korean Studies, ed., *Gomunseo jipseong* (Collection of Old Documents), vol. 8, *Gwangju anssi pyeon* (Gwangju An Family) (Seongnam: Academy of Korean Studies, 1990), pp. 130–148.

myeong, the leader of the family at the time, suggested that an annual memorial service for the Sagan-gong (one of the family's ancestors) be held. After a series of discussions, in October of the same year An Taek-myeong informed the members of the family that they were to gather at the mountain range where most of their ancestors were buried. Four months later, on the 30th day of the 2nd lunar month of 1838 (the 14th year of King Yeongjo's reign), a *Jonggye* community was finally organized, with the consent of the gathered members at the burial ground of the Sagan-gong in the Gigok area. After its organization, every member had to contribute a certain amount of money, which would be accumulated and be put to good use in matters related to the family in the future.

In 1740 (the 16th year of King Yeongjo's reign), some of the family members voiced their opinion and argued that the accumulated revenue be used in purchasing certain amounts of land so that the needed funds for occasions such as memorial services could be permanently secured. But opinions opposed to this idea were also very actively put forth. Opposing members believed that the amount of accumulated revenue was not large enough to realize the original plans of renovating the rituals and materials of the family, and should be left to accumulate and to continue to accrue interest. Members who supported the land purchase option responded by arguing that too many members of the family were already neglecting their duty of paying their share of the money on time and purchasing land would be much more efficient in securing the amount of money required.²⁴ Finally, they decided to purchase paddy fields with the money, and in the 12th lunar month of 1740, eight *durak*²⁵ of paddy field in the Jigok-dong area was purchased from a priest named Inho at the cost of 46 *nyang*.²⁶

24. *Ibid.*, p. 142.

25. *Durak* is a Korean traditional unit of area, literally means seeding of one *du*. *Du* also is a traditional Korean bulk unit, an equivalent sum of 6 liter. Therefore one *durak* equals size of land suitable for seeding one *du*.

26. *Nyang* is a unit of currency utilized in Joseon dynasty.

The An Family of Gwangju operated this paddy field by way of tenancy based on a fifty-fifty sharing of crops. Therefore the real yield can be estimated by doubling the amount of rent. The yield figures from this land from 1741 to 1743 are shown in Table 1.

Table 1. The Yield Report (1741-1743) from the Paddy Fields Owned by the Gwangju An Family, Who Lived for Generations in the Deokgok Area of the Gyeonggi-do Gwangju-gun Region²⁷

Year	Tenant	Number of durak-A	Rent (in du)	Yield (in du)-B	Yield per durak-B/A
1741	Eul-saeng	8	50	100	12.5
1742	Eul-saeng	8	93	186	23.25
1743	Eul-saeng Duman	8	81 (58, 23)	162 (116, 46)	20.25
	Namun	3	24	48	16
Total		27	248	496	18

*Eul-saeng=Kim Eul-saeng

According to these figures, the yields for the years 1742 and 1743 are almost identical, showing 20 or 23 du yield per durak. The average yield from 1741 to 1743 is roughly 18 du. But if we consider the 16 du yield secured from the land cultivated by the tenant Namun as an exceptional case (because the yield secured was exceptionally small), the overall average figure rises to 22 du. In 1742, the year in which all 8 durak of land were cultivated by Kim Eul-saeng, the average yield of the land is calculated to have been 23.25 du, and in 1743, the year in which the land was cultivated by both Kim Eul-saeng and Duman, the average yield of the land is calculated to have been 20.25 du. The overall average is calculated as 21.75 du, which is slightly

27. The Academy of Korean Studies, ed., *op. cit.*, pp. 144-148.

higher than the estimated average amount in the mid-seventeenth century.²⁸

The second example is a case from the Jeolla-do Yeongam area, a paddy field owned by the Nampyeong Mun Family located in the same area.²⁹ The Jokgye community of this family only purchased paddy fields as family property.³⁰ The yield report was not filed independently from other documents. There are, however, revenue and expenses documents from the Jokgye community. The Nampyeong Mun Family operated these paddy fields in a special way known as byeongnong. Incidentally, byeongnong was not a tenancy based on fifty-fifty sharing, but rather seems to have been direct management by the landowner through the use of subordinate manpower.³¹ The Nampyeong Mun Family received a certain amount of rice from the farmer who cultivated the Jokgye community's paddy field and were also members of the Jokgye community. The amount of rice received can be called joaek.

We can calculate the change of average figure of joaek from revenue and expenses documents from the Jokgye community, called Jokgye yongha gi. The year that marked the lowest joaek was 1762 when the average joaek per durak was 9.3 du, and the year that marked the highest joaek was 1764 when the average joaek per durak was 21.7 du. There were previously arranged joaek amounts, fixed even before the joaek was collected. In 1757 and 1758 the joaek was prearranged to be 22.3 du, but only 77.4 percent and 94.1 percent of

28. Generally a 15.9 du yield was the average amount expected per durak in the southern area of the Korean peninsula in the mid-seventeenth century. Jo Ik, *Pojeojip* (Collected Works of Jo Ik), vol. 2. *Ron seonhyecheong so* (A Memorial to the Throne about the Seonhyecheong Office).

29. The Academy of Korean Studies, ed., *Gomunseo jipseong* (Collection of Old Documents), vol. 22, *Yeongam nampyeong munssi pyeon* (Yeongam Nampyeong Mun Family) (Seongnam: Academy of Korean Studies, 1995).

30. *Jokgye* means a subcommunity in Nampyeong Mun Family for the purpose of holding a ceremony for the repose of their ancestors.

31. The general way of management during the late Joseon dynasty is fifty-fifty sharing by landowner and tenants. Kim Yong-seop, *Joseon hugi nongeopsa yeongu*, vol. 1 (1970).

the expected amount of the respective joaek were eventually collected (the average figure for the joaek was 17.2 du in 1757, and 21.1 du in 1758). After region-wide land surveys were conducted and some changes were made in the number of designated land units, a new tax known as sogyeong (which required the submission of 8 seung, namely 0.8 du).³² was imposed on the people and a certain amount of the yield was withheld and not incorporated into the amount submitted to the Jokgye community but was later submitted to the administrative office. That is why the "real" yield would be the sum of the recorded amount for the joaek (or the expected joaek) and the amount that would have been allotted elsewhere and submitted to the authorities. Seed was treated in the same way. The amount of seed was clearly fixed in every case, as it was not difficult to estimate the needed amount of seed due to age-old customs and agricultural practices.

The yields collected during the time period 1743–1765 are listed in Table 2. The yield per durak unit varied according to land units but the changing pattern due to weather conditions was almost identical. The overall scope of the agricultural productivity in the Jeolla-do Yeongam area in the eighteenth century are based on the figures in this table. The total average yield is calculated as 20.46 du per durak that was planted with one du of seed. The average yield figure jumps to 21.5 du if the D-a (2) and S-a (3) paddy fields (where the yields were the lowest) are considered to have been exceptional cases and omitted from the calculation. This appears to be the general yield ratio in the paddy fields located in the Jeolla-do Yeongam area owned by the members of the Nampyeong Mun Family Jokgye community. The highest ratio was 1 (planted amount of seed) to 30 (the yield), and the lowest was 1 to 10, showing a much more improved ratio compared to the general ratio of 1 to 18 from Table 1.

32. 1 du equals 10 seung.

Table 2. The Yield per Durak from Various Land Units Owned by the Nampyeong Mun Family: (1743–1765)³³

Land Unit (Size) Year	D-a	H-a	H-b	S-a	D-b	D-c	D-d	H-c	W-a
	(2)	(4)	(4)	(3)	(2)	(5)	(5)	(5)	(1.5)
1743	22.4								
1744	19.4								26.1
1745	19.9								26.1
1746									26.1
1747	18.4						25.5		26.1
1748	18.3					22.2	22.3	25.6	22.8
1749	18.4					24.6	22.9	29.0	22.8
1750	17.4	22.1				22.0	26.9	27.2	20.8
1751									
1752	16.9	24.9				25.8	27.3	24.0	22.8
1753	17.9	18.6			21.4	23.8	20.3	27.0	19.4
1754	17.4	22.4		22.4	21.4	21.8	18.3	23.0	19.4
1755	11.9	16.0	12.6	12.7		11.8		16.2	
1756	11.9	13.6	15.1	14.2	21.4	18.8	17.1	23.4	12.4
1757	15.4	22.4	22.6	21.2	22.4	21.8	21.3	20.0	16.1
1758	17.9	24.9	28.5	24.2	26.9	24.8	27.3	27.0	22.8
1759	16.9	20.1	22.8	19.2	25.55	21.8	25.4	20.8	22.8
1760	11.9	16.4	16.3	12.5	22.4	16.4	23.0	19.0	16.1
1761	14.4	20.1	20.3	18.2	22.4	20.8	20.3	19.2	18.1
1762		8.9			20.25		15.5	17.2	
1763	14.4	21.2	21.6	10.3	23.35	19.4	22.7	23.0	19.4
1764	18.4	19.9	18.8	18.5	26.4	21.8	23.3	21.0	19.4
1765	14.4	21.1	21.8	14.9	25.9	23.8	24.3	20.0	
Average	16.7	19.5	20.0	17.1	23.3	21.3	22.0	22.5	21.1

*D-a, D-b mean the name of land unit and parenthesized number means the size of durak.

**D, H, S, W indicate the initial letter of place names.

33. The Academy of Korean Studies, ed., *Gomunseo jipseong*, vol. 22, *Yeongam nampyeong munssi pyeon*, pp. 576–596.

Finally, it should be noted that the yield per durak varied significantly from year to year, and it seems to have been the result of variable weather conditions which were still basically uncontrollable in the mid-eighteenth century.

The Characteristics of Dry-Field Agricultural Techniques and Developments in Fertilization Techniques

The Characteristics of the Dry-Field Agricultural Techniques

The most dominant method of dry-field cultivation during the eighteenth and nineteenth centuries was double-cropping multiple crops in the same year.³⁴ This trend in agriculture had already been established since the mid-sixteenth century in Korea. Usually the land had to be prepared adequately before the plants were seeded and this task was known as jangmu (ridge-making). The method of jangmu in the seventeenth century was a lot more sophisticated than the fifteenth century version (Kim Yong-seop 1990). The sophistication can easily be seen from the initiation sequence of the plowing.³⁵

In the springtime, “spring plowing” (chun-gyeong) was not to be done so deeply as it would otherwise be difficult for the young plants to take root in the ground. On the other hand, during “autumn plowing” (chugyeong) the land had to be plowed deep so that the plants could survive the cold weather. The seedlings had to be planted shallow in the paddy fields, but the weeds in the deepest level had to be completely removed. Beans had to be planted deep, but barley had to be planted shallow.

It can be said that entering the later period of the Joseon dynasty, dry-field cultivation techniques had evolved from the traditional sin-

34. Min Seong-gi, *Joseon nongeopsa yeongu* (A Study on the Agricultural History during the Joseon Dynasty) (Seoul: Ilchokak Publishing Co, 1988).

35. U Ha-yeong, *Cheonillok, gwon 8, Nongga chongnam* (Comprehensive Bibliography on Agriculture).

gle-cropping method to that of double cropping.³⁶ The trend in cultivation during the early period of the dynasty, mostly in the fifteenth century, was basically single-cropping supplemented by a triple-cropping system in a two-year cycle.³⁷ Later this began to be replaced by the double-cropping technique as the geon-gyeongbeop which is used in plowing the first crop's roots and then sowing the next seed gained wide acceptance. The ganjongbeop (intercropping planting) was applied to most of the land, and governmental policy was established so as not to provide any help to dry-field cultivation even in cases of distress.³⁸ The establishment of the double-cropping system was basically a result of the improvements made in dry-field fertilization methods and the adoption of the deep-digging cultivation trend.

The development of the double-cropping system in dry fields was closely related to the system for the cultivation of barley. This was because the two major elements constituting the double-cropping system—the geon-gyeongbeop and ganjongbeop techniques—were a major part of the barley cultivation techniques of the time. The agricultural manual *Nongga wollyeong* (Monthly Tasks for a Farming Household),³⁹ which reveals the typical agricultural routine from the latter half of the sixteenth century, contains much more detailed references to the system for cultivating barley, including the geon-gyeongbeop and ganjongbeop techniques applied to barley cultivation with much more efficiency.

The fact that this manual only contains references to the double-cropping system in terms of barley cultivation without any reference to the traditional single-cropping system means that the former was already widely established in the latter half of the sixteenth century. And upon entering the seventeenth century, cultivation methods were even more enhanced and fertilization techniques were no

36. Kim Yong-seop, *Joseon hugi nongeopsa yeongu*, vol. 2 (1971).

37. *Nongga jikseol*.

38. Ko Sang-an, a scholar official who lived from 1553 to 1623, compiled *Nongga wollyeong*. He explained the monthly works of a farmhouse, especially by the 24 divisions of the year.

39. *Ibid.*

exception. The wide acceptance of the geon-gyeongbeop and gan-jeongbeop techniques led to the establishment of the double-cropping system of various breeds of plants as well.

This situation is clear from the government's own policy not to provide assistance to cultivation units affected by natural calamity. Because dry fields were operated under the double-cropping cultivation system (which would provide the farmers with some advantages), the government did not recognize any need to assist the victims (assistance was provided only when the scale of the disaster was too great to be overlooked).⁴⁰ This policy is well documented in *Takji jeonbu go* (A Study on Ministry of Finance and Land Taxes),⁴¹ and is later confirmed in *Yukjeon jorye* (Regulations of the Finances of Six Ministries), which was established in the late nineteenth century.⁴²

The diversification and development of planted breeds in dry fields were also under way as the double-cropping system was being consolidated. Progress in this area had already begun to be made long before this time. In the premodern era, the diversification and development of a preferred plant breed was usually a very long process differing considerably from the speedy development that is now taken for granted.⁴³

From the late seventeenth century, dry-field cultivation in the Joseon dynasty also saw the launch of the cultivation of crops specifically grown for commercial trade at the markets. The most representative of these was cotton, which began to be produced widely in the late fifteenth century. The cultivation methods for this material were first documented in manuals around the sixteenth century. Cotton cultivation was still limited to certain areas but became widely estab-

40. *Sukjong sillok* (The Annals of King Sukjong), *gwon* 24, *gyeongjin* (3rd) day of the 8th lunar month, 18th year of King Sukjong's reign.

41. *Takji jeonbugo yeonbun* (Decision of Rich or Poor Harvest). *Takji jeonbu go* was published in the late 18th century as a compilation of legal cases and judicial precedents.

42. Article of *Goheom punghyung* (Decision on Harvest), in *Yukjeon jorye*, *gwon* 3, *Hojeon*.

43. Seo Yu-gu, *Gongmyeonggo* in *Haengpoji*, *gwon* 4.

lished throughout the country in the late fifteenth century (with the exception of the Hamgyeong-do area). The expansion of its cultivation was partly in response to the government's demands for taxes but cotton mainly gained nationwide acceptance because of its suitability for making cloth to clothes.⁴⁴

The development of related techniques was also documented in manuals from the late sixteenth century. In *Sasi chanyo cho* (An Abstract on the Summary of Essential Work during Four Seasons), presumed to have been published in the late fifteenth century,⁴⁵ related cultivation techniques are described. And the fact that cotton-cultivation methods were continuously referred to in later manuals demonstrates the general acceptance of cotton cultivation by the public (Kim Yong-seop 1988, 103-113).

The cultivation of cotton almost completed its expansion throughout the southern area of the Korean peninsula in the late sixteenth century, and was expanding in the northern area due to government promotion (Min Seong-gi 1988, 264-313). Individual households especially cultivated cotton and markets for cotton products also emerged as its cultivation became more and more popular.⁴⁶ Cotton cultivation by nature required continuous suitable weather conditions and the local circulation of commercial cotton products had to be guaranteed in order for it to be able to continue.

It was the Bukhak-affiliated scholars who first suggested importing new techniques to produce cotton clothing from China (such as textile manufacturing). Various tools related to textile production remained basically the same to the last days of the dynasty. Cultivation techniques, however, continued to improve (Kwon Tae-eok 1983).

Other farm products intended for the market were tobacco and

44. Min Seong-gi, *Joseon nongeopsa yeongu*, pp. 264-293.

45. Article of Cultivation of Cotton, in *Sasi chanyo cho*. In the late 15th century Kang Hui-maeng, a scholar official, compiled *Sasi chanyo cho*.

46. From the late 16th century, *jangsi* (a five-day interval town market) emerged into an economic activity in rural communities. The main product sold at *jangsi* was cotton.

tea leaves.⁴⁷ The potential for the commercial cultivation of these plants was already recognized in the eighteenth century and was indeed causing some trouble as these plants had encroached onto other lands meant for cereal cultivation.⁴⁸ Trees on the sides of mountains were cut down so as to make room for tobacco cultivation but such actions also eliminated natural barriers that helped to prevent floods.⁴⁹

In the eighteenth century, the government had yet to come to a consensus on this new problem and both the options of placing a complete ban on tobacco cultivation and that of regulating it were all suggested in discussions. Both arguments had their merits as tobacco was in nature harmful to the health of the population but was very attractive, making it almost impossible to stop the entire population from enjoying the substance.

Developments in Fertilization Techniques

The method of fertilization in the early Joseon dynasty involved three elements: the material used for fertilization, the timing of the fertilization, and the crop being fertilized (Yeom Jeong-Sup 2000, 80-82). At that time, many different kinds of material were used as fertilizer: horse and cattle manure, trees and plants, ash and so forth. Fertilization was not included as an independent stage in the agricultural process, but was incorporated into the plowing and seeding stage.⁵⁰

The systematic advances in the area of fertilization were the most distinct changes that appeared in the sixteenth century and are well documented in the agricultural manuals published during that

47. Yi Yeong-hak, *Hanguk geundae yeonchoeop-e daehan yeongu* (A Study on Tobacco Industry in Modern Korea) (Ph.D. diss., Seoul National University, 1990).

48. Yi Jung-hwan, *Bokgeo chongnon* (Collection of Essays on Residence), in *Taeng-niji* (The Korean Classic for Choosing Settlements).

49. In the late 18th century, King Jeongjo was worried about the spread of tobacco and tea cultivation. We can see his concerns in *Jeongjo sillok* (The Annals of the King Jeongjo).

50. *Nongsajikseol*.

period. In the seventeenth century, the materials used as fertilizers were diversified and new techniques were developed (Min Seong-gi 1988, 225-263).

Firstly, human excrement was often used mixed with weeds or some other material. Human feces was no doubt gathered from the privies of civilian households. It was relatively easy for people cultivating land near a city to acquire the needed amount of excrement than for those living in more remote areas. The excrement was gathered in a large jar and mixed with ash. After this cycle was repeated several times, the amount of fertilizer needed was acquired.⁵¹

Secondly, the development of fertilization techniques played an important role in firmly establishing the rice-transplantation technique as well.⁵² Human excrement mixed with ash was traditionally used in dry-field cultivation, but as the transplantation technique was also establishing itself in paddy-field cultivation, human excrement also began to be utilized in paddy-field cultivation. Fertilizing not only the base portions of the transplanted area but also the young barley plants was also emphasized. According to U Ha-yeong, a member of the Practical Learning School of the late eighteenth century, barley cultivation required both sufficient sunlight and fertilizer, and both basal fertilization and additional fertilization.⁵³

Thirdly, additional fertilizing was established as part of the general fertilizing procedure. In other words, in addition to basal fertilization which was usually carried out after cultivation was initiated and before the seeds were planted, supplemental fertilizing was required and applied after the seeds had already been planted and the crops had started growing (Kim Yong-seop 1990, 190). It was previously believed that such additional fertilizing was established in the mid-eighteenth century, but according to a recently discovered text (a personal diary), presumed to have been written in the mid-seventeenth century, it seems that additional fertilizing was already in

51. Ko Sang-an, *op. cit.*

52. Sin Sok, *Nongga jipseong*.

53. U Ha-yeong, *op. cit.*

practice in the Chungcheong-do area at that time.⁵⁴

Therefore, after the end of the sixteenth century, fertilization acquired its own independent position in the agricultural process and in the agricultural manuals. In Ko Sang-an's *Nongga wollyeong* (Monthly Tasks for a Farming Household), written in the early seventeenth century, one finds the tendency towards treating fertilization as an independent category. In the early eighteenth century, agricultural manuals like Hong Man-seon's *Sallim gyeongje* (Guide to Everyday Life of Rural Korean Literati), and Yu Jung-rim's *Jeungbo sallim gyeongje* (Supplement to the *Sallim gyeongje*) accepted the fertilization method as an important factor. They then incorporated notes on the fertilization method into their agricultural manuals (Yeom Jeong-Seop 2000).

Characteristics of the Paddy-Field Agricultural Technology in the Jeolla-do Neungju Area in the Nineteenth Century

Let us now turn to some examples and then attempt to draw conclusions on the characteristics of Joseon agricultural technology. In order to examine the paddy-field agricultural techniques for the Jeolla-do Neungju area in the nineteenth century,⁵⁵ one can consult the "Chinongpyeon" (Section on Farming) of *Jukgyo pyeollam* (Handbook on *Jukgyo*), a regional agricultural manual authored by Han Seok-hyo.⁵⁶ The breeds planted and cultivated in this area were different from those preferred in other regions as preferable plants were selected for cultivation depending on weather conditions and the soil of the area. The breeds described in *Jukgyo pyeollam* were those mainly cultivated in the area.

The guidelines suggested for selecting healthy seeds were not

54. *Byeongja ilgi* (Diary of Byeongja Year), 3rd lunar month of 1638.

55. During the Joseon dynasty, Jeolla-do was famous for its abundant harvest of rice. They named Jeolla-do as the village of rice.

56. Kyujanggak Archives possess this book, the number of which is 奎 2442.

much different from the general guidelines dictated earlier in the *Nongsa jikseol* (Straight Talks on Farming). Every single seed had to be well shaped and juicy to grow without any setbacks.

Points to be kept in mind when plowing paddy fields were not specifically emphasized in this manual and were not given an independent chapter. But it should be noted that the author named the section, which contained references to the plowing processes for both paddy and dry fields, "Gahun chinongjang."⁵⁷ Several instructions were contained in this section such as those emphasizing the importance of timely plowing and selecting and utilizing the right kind of soil in order to grow a crop successfully. These instructions are all from the alleged "teachings of the ancestors," which must have been the embodiment of the typical and most preferable agricultural methods and techniques in that area during that time.

The characteristics of the cultivation practices adopted by the Han family and described in this manual are as follows: 1) the most preferable method according to the condition of the soil was to be used; 2) the amount of rainfall was also to be taken into consideration when determining the method of cultivation to be employed; 3) the seeding stage and the initiation stage of the cultivation process were to be considered together. This manual also emphasized the importance of relating the seeding and plowing methods to each other (which seems to have been necessary because of the environmental conditions of the region) instead of the number of plowing cycles.⁵⁸

Details of plowing methods are explained in various sections. The rice-transplantation technique seems to have been considered an established procedure. Cultivation using ox, a series of fertilizations and dry plowing three or four times were recommended. Dry plowing, in particular, was required in order to make adequate use of the

57. *Gahun chinongjang* is a secret agricultural manual handed down from Han Seok-hyo's ancestors.

58. *Chinongpyeon* section of *Jukgyo pyeollam* only described the rice-transplantation technique.

soil in cases where irrigation was not difficult and a large amount of manpower was available. Fertilizer made from human excrement mixed with ash was also recommended, while skin, seeds and the leaves of various crops were said to be worth mixing with the fertilizing materials. The unique ingredients used as fertilizing materials are another example of the agriculture characteristics of this area.

References to the dry-transplantation technique,⁵⁹ which was a factor in the nationwide acceptance of the rice-transplantation technique, also embody certain characteristics of this region's agricultural practices. Unique measures were taken when pulling out the seedlings. It was recommended that the base section be irrigated for one day (to soften the soil and make it more easy to pull the seedlings out) and the water drained and the seedlings pulled out. The prepared irrigation system or abilities are also notable.

Seeding methods are also referred to in the articles. It should be noted that the seeding process explained in this text is not the process of paddy seeding or dry seeding, but the seeding of the base section. It was recommended that the seeds be sown three or four times on a clear, sunny day in an orderly fashion. Guidelines related to the rice-transplantation process were more or less the same as those in other agricultural manuals.⁶⁰ There is, however, one notable difference. It seems that the people who took part in the cultivation were more interested in irrigation than in fertilization and initiation of the cultivation. This was because of the regional characteristic of the southern Jeolla-do area. It was more important for the farmers in this region to secure water with which to irrigate the soil than to secure material for manure. It is quite clear that irrigation was the most important element in the paddy-field agricultural technology of this region.

The other important aspect emphasized in the paddy-field cultivation in the Jeolla-do Neungju area was the elimination of weeds.

59. Ko Sang-an, *q. cit.*

60. Han Seok-hyo referred to Sin Sok's *Nongga jipseong* and Hong Man-seon's *Sallim gyeongje*, in compiling the *Chinongyeon* section of *Jukgyo pyeollam*.

One of the merits of the transplantation technique is that it significantly reduces the number of weeding (from 5 or 6 times to only 2 or 3 times) (Kim Yong-seop 1990, 36). According to cultivation guidelines suggested in *Jukgyo pyeollam*, it was recommended that weeding be carried out a total of three times: the first time 25-30 days after the plants were transplanted by hand or with hoes; the second roughly 15 days after the first time with only hoes, and the third, roughly one month after the second. The first round was considered the most important, in that it would ultimately determine the efficiency of the later weeding (Yeom Jeong-Sup 2002, 17-30).

Finally, in summarizing the characteristics of Joseon agricultural techniques in the nineteenth century, one first finds the characteristics of regional farming methods. In the late eighteenth century, there were many regional agricultural manuals, known as *eungji nongseo*, agricultural manuals commissioned by King Jeongjo.⁶¹ At that time there were also many intellectuals explaining the characteristics of regional farming methods (Yeom Jeong-Sup 2000, 243-256).

We can distinguish one regional farming method from another through two points. One was the technique of plowing with a plow pulled by an ox, the other was the shape of the weeding implement (called a *homi*). The regional plowing techniques all had characteristics that had been adapted to the regional agricultural environment.⁶² Between mountainous regions and plain fields there were differences in the skills needed for plowing in terms of the plow and the ox.⁶³ Furthermore, regional farming methods diverged into further subdivisions according to district. Distinctive features of soil and irrigation facilities comprised a subdivision of regional farming methods.⁶⁴

In irrigation facilities as well, there are different characteristics of regional farming methods. The Joseon government carried out tradi-

61. For more detail on *eungji nongseo*, see Kim Yong-seop (1970), pp. 7-15.

62. U Ha-yeong, *q. cit.*

63. Bak Ji-won, *q. cit.*

64. Kim Yang-jik's Memorial to the Throne, in *Seungjeongwon ilgi* (Diaries of the Royal Secretariat), *gwon* 1806, *byeongsul* day of the 3rd lunar month, the 23rd year of King Jeongjo's reign.

tional policies that strengthened the management of irrigation facilities. For example, they reestablished the Jeeonsa (Office of Irrigation Facilities) in the late seventeenth century in order to strengthen their management.⁶⁵ In the late eighteenth century, during Jeongjo's reign, there was a distribution of irrigation facilities in the eight provinces. As a result, each regional distribution had its own characteristics. For example in Gyeongsang-do there were many dams (known as jeeon), whereas Jeolla-do and Chungcheong-do had weirs (known as bo).⁶⁶

Conclusion

This paper has examined the level of Joseon agricultural techniques attained by the eighteenth century, in terms of paddy-field and dry-field agricultural techniques, fertilization techniques, and two examples of yield of paddy field during the eighteenth century. It has also explained the unique characteristics of agricultural techniques in the Jeolla-do Neungju area in the nineteenth century.

The agricultural technology of the Joseon period gradually evolved and finally achieved an appropriate level of sophistication during the late eighteenth century. The rice-transplantation technique was the dominant method used in rice cultivation in the latter half of the eighteenth century. What enabled the expansion of this technique were the systematic enhancements made in technical areas. The transplantation technique also reduced the amount of labor required by the traditional direct-seeding method.

Developments made in the area of paddy-field agricultural technology led to the diversification of breeds as well as the appearance of locally-preferred breeds. The expansion of this transplantation technique was helped enormously by the expansion of the paddy

65. In 1662, King Hyeonjong reestablished the Jeeonsa (Office of Irrigation Facilities). *Hyeonjong sillok* (The Annals of King Hyeonjong), *gwon* 5, *jeongyu* day (23rd) of the 1st lunar month, 3rd year of King Hyeonjong's reign.

66. Bok Tae-jin's Memorial to the Throne, in *Seunjeongwon ilgi*, *gwon* 1802, *giyu* day (20th) of the 12th lunar month, 22nd year of King Jeongjo's reign.

fields as well.

The most dominant method of dry-field cultivation during the eighteenth and nineteenth centuries was double-cropping multiple crops in the same year. This trend in agriculture had already been established since the mid-sixteenth century in Korea. The trend in cultivation during the early period of the dynasty, mostly in the fifteenth century, was basically single-cropping supplemented by a triple-cropping system in a two-year cycle.

Later, it began to be replaced with the double-cropping technique as the geon-gyeongbeop gained wide acceptance, the ganjongbeop was applied to most of the land, and governmental policy was established so as not to provide any help to dry-field cultivation even in cases of distress. The diversification and development of planted breeds in dry fields were also under way as the double-cropping system became consolidated. And the cultivation of cotton almost completed its expansion throughout the southern area of the Korean peninsula in the late sixteenth century, and was still expanding in the northern area, promoted by the government.

The method of fertilization in the early Joseon dynasty involved three elements: the material used for fertilization, the timing of the fertilization and the crop being fertilized. The systematic advances in the area of fertilization were the most distinct changes that appeared in the sixteenth century and are well documented in the agricultural manuals published during that time period. In the seventeenth century, the materials used as fertilizers were diversified and new techniques developed. Firstly, human excrement was often used mixed with weeds or some other material. Secondly, the development of fertilization techniques played an important role in firmly establishing the rice-transplantation technique as well. Thirdly, additional fertilizing was established as part of the general fertilizing procedure.

The paddy-field agricultural techniques for the Jeolla-do Neungju area in the nineteenth century were examined, consulting the "Chinongpyeon" section of *Jukgyo pyeollam*, a regional agricultural manual authored by Han Seok-hyo. The characteristics of the cultivation practices adopted by the Han family and described in their man-

ual are as follows. The most preferable method according to the status of the soil was to be used and the amount of rainfall was also to be taken into consideration when determining the method of cultivation to be employed. Lastly, the seeding stage and the initiation stage of the cultivation process were considered together.

In summarizing the characteristics of Joseon agricultural techniques in the nineteenth century, the different characteristics of regional farming methods are founded. In the late eighteenth century, there were many regional agricultural manuals, known as eungji nongseo. One can distinguish one regional farming method from another by two points. One was the technique of plowing with a plow pulled by an ox, the other was the shape of the weeding implement. Furthermore, regional farming methods diverged into further subdivisions according to district. Distinctive features of soil and irrigation facilities formed a subdivision of regional farming methods.

One can also see the characteristics of regional farming methods in the irrigation facilities. The Joseon government carried out traditional policies that strengthened the management of irrigation facilities. In the late eighteenth century, during Jeongjo's reign, there was a distribution of irrigation facilities in the eight provinces. As a result, each regional distribution had its own characteristics.

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GLOSSARY

An Jeong-bok	安鼎福	<i>jangmu</i>	作畝
Bak Ji-won	朴趾源	<i>jeon</i>	堤堰
<i>bandap</i>	反番	<i>Jeeonsa</i>	堤堰司
<i>bo</i>	泐	<i>Jeungbo sallim gyeongje</i>	增補山林經濟
Bukhak	北學	<i>jaek</i>	租額
<i>byeongnong</i>	竝農	<i>Jokgye</i>	族契
Chinongpyeon	治農篇	<i>Jokgye yangha gi</i>	族契用下記
<i>chugyeong</i>	秋耕	<i>Jonggye</i>	宗契
<i>chun-gyeong</i>	春耕	<i>Jukgyo pyeollam</i>	竹僑便覽
<i>du</i>	斗	<i>Nongga wollyeong</i>	農家月令
<i>durak</i>	斗落	<i>Nongsa jikseol</i>	農事直說
<i>eungji nongseo</i>	應指農書	<i>nongseo</i>	農書
Gahun chinongjang	家訓治農章	<i>Nongseo daejeon</i>	農書大全
<i>ganjongbeop</i>	間種法	<i>nyang</i>	兩
<i>geonangbeop</i>	乾秧法	<i>Sagan-gong</i>	思簡公
<i>geon-gyeongbeop</i>	乾耕法	<i>Sallim gyeongje</i>	山林經濟
Gigok	基谷	<i>Sasi charyo cho</i>	四時纂要抄
Goheom punghyung	考驗豐凶	<i>Seo Yu-gu</i>	徐有榘
<i>gweon nongjeong</i>	勸農政	<i>seung</i>	升
<i>gu nongseo yuneum</i>	求農書繪音	<i>sogyong</i>	所耕
Han Seok-hyo	韓錫敷	<i>Takji jeonbu go</i>	度支田賦考
<i>homi</i>	호미	<i>Yukjeon jarye</i>	六典條例
<i>Ilseangnok</i>	日省錄	<i>yunjak</i>	輪作

K C I