XI. POST-HARVEST MANAGEMENT TECHNOLOGY AND POLICY ON AGRICULTURAL PRODUCTS IN THE REPUBLIC OF KOREA

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Abstract

With the rapid changes of agricultural products market condition and consumers' choice for better quality and diversified food materials, the post-harvest management system moved from individual farm to large scale processing center in order to reduce management cost and get both high quality and safe agricultural products production. The number of Rice Processing Center (RPC), that can accomplish all rice related post-harvest operations, for example, drying, storage, processing, shipping, is 339 which can deal with 30% of total rice production in Korea. By the spreading of RPC, it could reduce the cost and labor needed in rice post-harvest operations by 31.8% and 63.9%, respectively, compared to those of individual farm. In addition, it also reduced various rice post-harvest operation loss by 1% from 6% of before RPC processing era. Till the year of 2007, more RPCs will be constructed that can process 70% of total rice production amount in Korea. For higher quality rice production, wet-type and dry-type processing system were developed for clean washed rice, and indent separator and color sorter were used for obtaining head rice.

For horticultural crops, 198 APPC (Agricultural Products Processing Center) were built at the major production sites that could reduce handling loss but increase produces values, providing a favorable condition for early standardization of produces. Produces grading and differentiating were enabled by not only establishing nondestructive quality inspection system using image processing, NIR technology or tapping sound application, which can measure inner qualities such as sugar content, acid degree and maturity as well, but also measuring outer qualities such as size and weight.

Government policies and financial supports for expanding facility and replacing old system are the important factors to increase international competitiveness of produces.

A. Introduction

Since 1980s, agricultural production environment is rapidly changing where rural population is decreasing and aging as well, and global agenda such as WTO's DDA and FTA between Korea and Chile is shaking agricultural production structure. Because of labor shortage, full time farmers with larger land and armed with more

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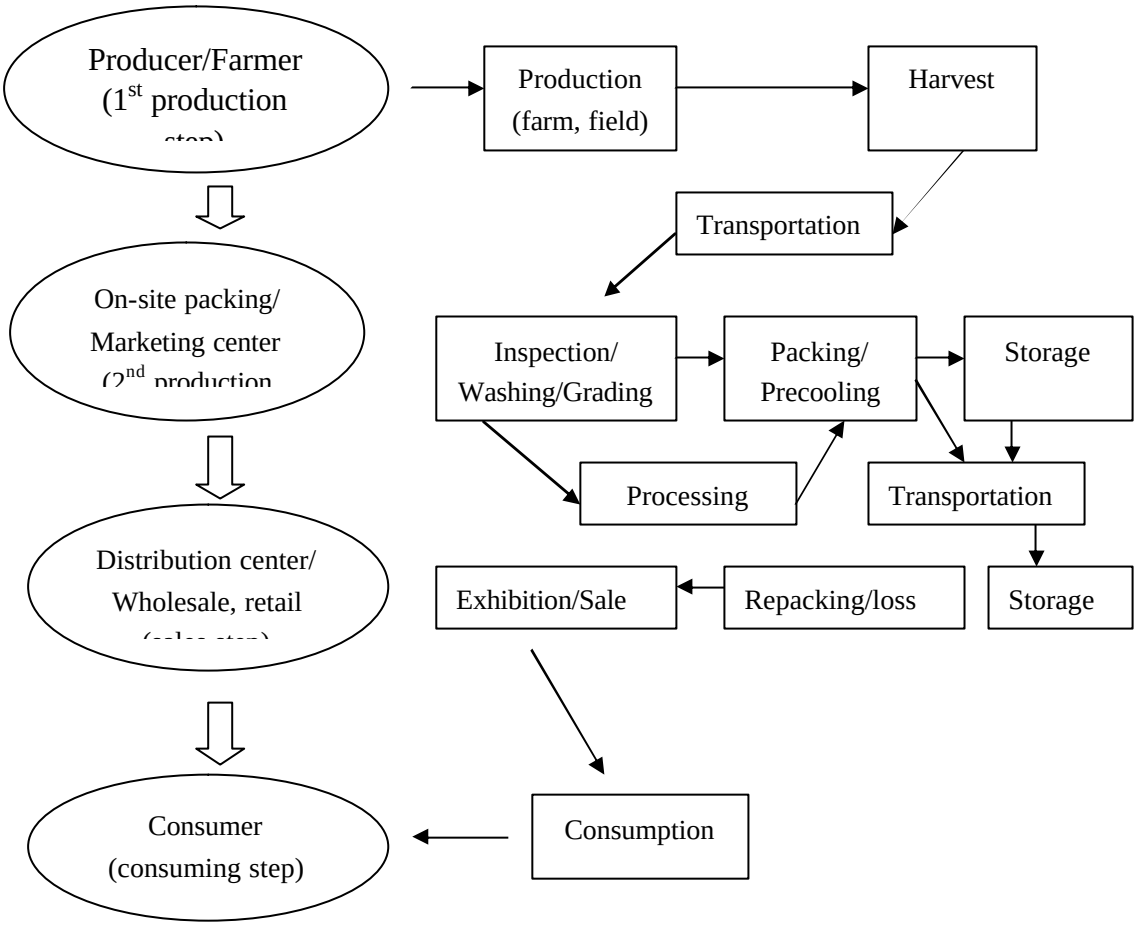
sophisticated farming technology produce more crops in quantity. In production aspect, RPC and produces processing center located near the production site provide better food materials in quality. In consumer position, with large discount stores, electronic commerce and TV home shopping corners consumers have more choices in purchasing food materials. Consumption trends are shifting towards high quality and safer products and their choices are far more diversified than before. More vegetables, fruits and meat are consumed but less rice is. However, current agricultural environment could not meet these market changes that the agricultural policy on the agricultural technology development focused on production amount increase and less care about post-harvest technology and its policy. Post-harvest losses are far larger than the developed countries; 6% for rice, 13~18% for fruits, 20~30% for vegetables. Therefore, now is the time to develop and propagate post-harvest technology and management skills for securing international competitiveness of Korean agricultural products and supplying safer and higher graded agricultural products to consumers.

In this paper, the present status and policy of the post-harvest technology toward rice and horticultural crops are introduced.

B. Status of post-harvest management system

Post-harvest management is the second production operation to add values to the products and the basic means for effective marketing. Figure 11.1 shows the post-harvest management system of agricultural crops in Korea, where various steps are required for the various crops that the operations be accomplished by the order and combined in organically. Before the early 1990s, one machine or one equipment worked in each operation, however, since the middle of 1990s with installing RPC and APPC, the system is able to collect this individual machine making one system at one place.

Figure 11. 1. Post-harvest management system



C. Post-harvest management technology

1. Rice

Before 1980s when staple crops were not enough to feed all people post-harvest management technology development was not the top priority in agricultural production policy but increasing crops production amount was. After that period, with the pretext of indirect crops production advanced crop storage cell and grain dryer were propagated. In 1990s, clean washed rice production technology and RPC were introduced and disseminated in the rice production sites, the important momentum to bring post-harvest management technology into agriculture. Figure 11.2 shows the basic processing steps in RPC. By the end of 2002, the number of RPC and DSC (Drying Storage Centre) was 339 and 524, respectively, so they can process 45. 1% of total Rice amount in drying, 24.2% in storage and 65.8% in processing, the three core operations in rice post-harvest management.

Figure 11.2. Basic processing steps in RPC

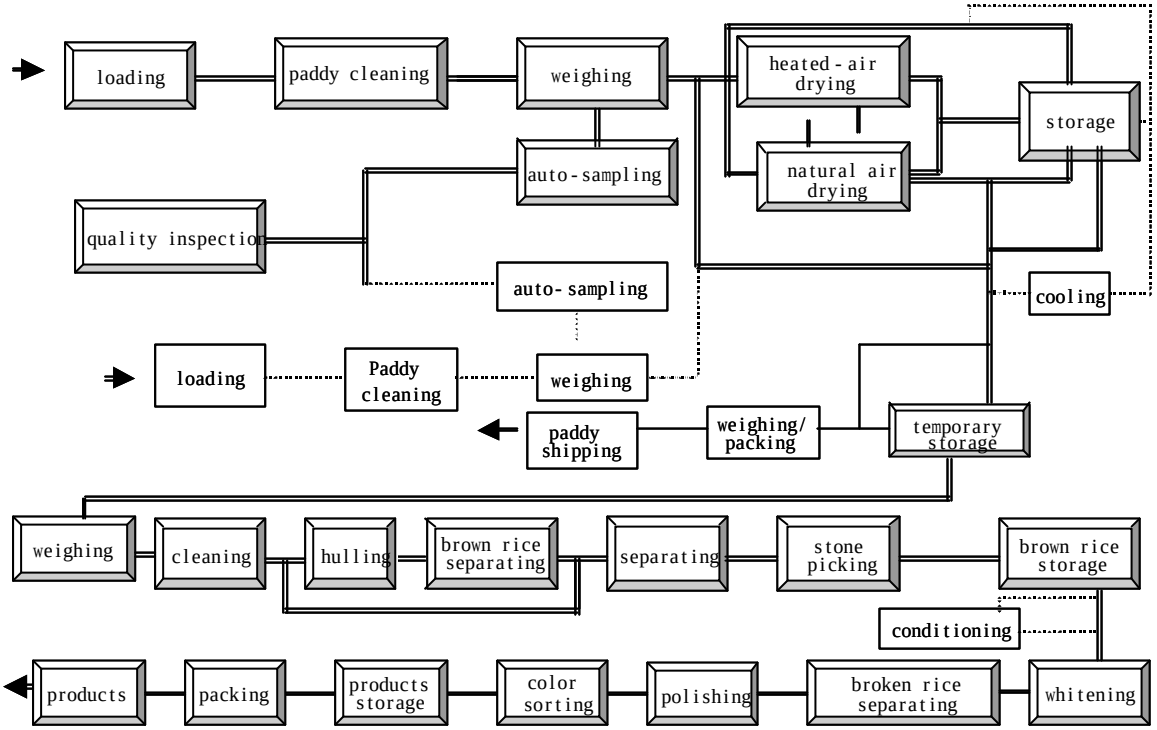


Table 11.1. Number of RPCs and DSCs per year

Year	'91~'94	'95	'96	'97	'98	'99	'00	'01	'02	Total
RPC	146	39	35	33	48	11	18	7	2	339
DSC	-	22	25	64	81	90	85	76	81	524

Machine units in each operation are as follows:

- Loading facility: Loading hopper, paddy cleaner, ash thresher, automatic balancer, moisture content measurer, etc.
- Drying facility: Circulation dryer, continuous dryer, natural air-drying bin, etc.
- Storage facility: Natural air-drying bin, storage bin, grain discharger, other attachments, etc.
- Conveying facility: Bucket elevator, chain conveyor, belt conveyor, screw conveyor, conveying shutter, gate devices, etc.
- Quality inspection facility: Sample grain divider, sample grain dryer, moisture content measurer, sample rice miller, sample grain grader, electronic balancer, rice whiteness meter, head rice meter.
- Milling facility: Polisher, huller, stone picker, grain grader, wet and dry processing system for clean washed rice, storage tanker, etc.

- Others: Dust collector, byproducts processor, etc.

Facility capacity of major operations based on processing of 15% M.C. rice is 2,000 tons/yr for drying and storage, 20 tons/day (white rice) for processing, 800 tons/yr for both drying and storage.

Using RPC, cost and labor time for rice processing was saved by 31.8% and 63.9 %, respectively, and processing loss too was reduced to 1% from 6%, compared to the individual farm processing (see Table 11.2).

Table 11.2. Comparisons of cost and labor time in rice processing between RPC and individual farm

Item	Individual farm (A)	RPC (B)	Difference (C=B-A)	Saving ratio (C/A)
Cost (Korean won/ton)	242,254.0	178,980.0	- 83,274.0	31.8
Labor time (hr/ton)	33.7	12.2	-21.5	63.9
Loss ratio (%)	6.0	1.0	-5.0	-

2. Horticultural crops

Post-harvest management operations are quite diversified consisting of collection, curing, pretreatment, grading, packaging, pre-cooling, low temperature storage, pallet loading, transporting, depending upon various crops. European countries and Japan have been doing these operations one line system in the produces packinghouse for a long time. Recently, Korea also began this kind of one line system in APPC managed by agricultural cooperative federation, farming cooperation or local farming group. APPC is classified into four different types; commercial distribution facility for fruits and vegetables, processing complex for fruits and vegetables, packaging center and local marketing center. By the end of 2001, 196 APPCs were installed by the initiation of the government. APPC has several functions in producing, collecting, grading, cleaning, packaging and shipping of agricultural produces. In addition, it provides distribution information collection and dissemination, joint accounting, brand development, direct sales and promoting export.

Table 11.3. APC installation status (2001)

Total	Commercial distribution facility for fruits and vegetables	Processing complex for fruits and vegetables	Packaging center	Local marketing center
196	25	3	106	62

Basic operations of APPC are; carrying ? pretreatment ? supply of raw materials ? grading? packaging. However, few differences exist depending on crop kinds.

(a) Carrying

Carrying operation is that produces in plastic box, container or net sack are taking into APPC and transferring to pre-cooler, low temperature storage house or grading conveyor belt, where unloading equipments, pallet transferring and loading and dumping device is using.

(b) Pretreatment

Pretreatment operation includes depriving un-sellable produces, envelope removing, wax applying, skin or root removing, in which un-sellable produces are sorted out manually; some devices are available for other jobs.

(c) Produces feeding

After the pretreatment operation, produces are transferred to conveying dish in order to be graded by weight, color, sugar content and maturity. Manual works sort out less hardness materials such as apple or pear and irregular-sized kinds such as cucumber or scallion.

(d) Grading

Before packaging, grading is performed by some criteria such as weight, size, color, etc. Several inner quality inspection graders are developed and available, Table 11.4 shows various graders and their applications.

Table 11.4. Various grader and their applications

Item	Type		Applicable produces
By size	Weight grader	Spring type	apple, pear, tomato, melon
		Weight balance type	apple, pear, tomato, melon
		Audio response type	apple, pear, peach
		Electronic type	apple, pear, kiwi fruit, melon, sweet persimmon
	Shape grader	Drum type	mini tomato, mandarin, potato
		Belt type	garlic, onion
		Roller type	garlic, onion, potato, mandarin orange
By grade	Image processing Grader	Black and white camera type	cucumber, apple
		Color camera type	apple, tomato, persimmon
	Sugar contents	NIR reflectance type	apple, pear, peach
		NIR transmittance type	mandarin orange
	Maturity	Tapping sound type	water melon

(e) Box filling and packaging

Most of box filling and packaging jobs are accomplishing by manually, but for some crops such as potatoes, onions, mandarin oranges the jobs are automated where sealing machine and binding machine are available.

(f) Pre-cooling and low temperature storage facility

Pressure difference method is the first choice in the pre-cooling, and temperature, humidity and gas concentration are controlled in the low temperature storage system. Horticultural crops handled in the APPC are listed in the Table 11.5.

Table 11.5. Major horticultural crops handled in the APC

Item	Total	Crops
Fruit horticultural crops	45	cucumber 17, tomato 15, mini tomato 6, strawberry 3, green pepper 3, melon 1
Condiment vegetables	96	onion 42, pepper 13, garlic 29, scallion 12
Root vegetables	48	potato 29, sweet potato 8, carrot 8, radish 3
Leaf vegetables	17	Chinese cabbage 13, cabbage 4
Fruits	129	apple 45, pear 36, persimmon 22, mandarin 10, peach 10, grape 6

D. Policy proposals for post-harvest management

1. Rice

For "systematic approaches for producing high quality rice" and rice post-harvest management, following post-harvest management policies are recommended:

- Expanding drying and storage facility in RPC.
- Providing subsidy to installing dryer, color grader, wet and dry processing. system for clean washed rice and dust collection facility.
- Reorganizing supporting program for drying and storage facility and high quality rice production facility.
- Providing subsidy for drying and storage facility in private sectors.
- Increasing subsidy for high quality rice production.
- Establishing drying and storage facility model by region and time.
- Establishing high quality rice production and distributing technology.

2. Horticultural crops

The Government projects on horticultural crops post-harvest management started in 1970s in order to manipulate shipping amounts, in which subsidy was allotted to the installing low temperature-cooling house. In 1994, the focus of the project was shifted to secure fresh and safe crops, for which expanding APPC and building distributing center were initiated; sustainable crops supply system, joint shipping system, standard produces shipping by standard packaging, pallet shipping and loading and unloading system were established. With constructing horticultural crops low temperature distribution system, it is possible to maintain freshness and suppress deterioration. Standardization of quality grading and packaging guaranteed the

transparency and credibility of the distribution process. Standard shipping procedure, strict safety inspection procedure, quality warranty system and production site certification of origin were introduced and practiced.

The following projects are planned and to be implemented:

- For effective distribution of agricultural products, standardization of facility and equipment shall be reorganized. Government subsidy is required for the installation of facility and equipment.
- As function adding of APC, financial support for marketing facility, machine, equipment, shipping, grading, packaging facility and pre-cooling, low temperature storage house are necessary.
- Facility related implementation, remodeling, function fortification, electronic auction system in whole and joint market shall be considered and supported.
- Direct transaction facility for agricultural products shall be installed and supported in financially.

E. Conclusions

With the rapid changes of agricultural products market condition and consumers' choice for better quality and diversified food materials, the post-harvest management system moved from individual farm to large scale processing center in order to reduce management cost and to promote both high quality and safe agricultural products production. The number of Rice Processing Center, that can accomplish all rice related post-harvest operations; for example, drying, storage, processing, shipping, is 339 which cover 30% of total rice production in Korea. By the spreading of RPC, it could reduce the cost and labor needed in rice post-harvest operations by 31.8% and 63.9%, respectively, compared to those of individual farms. In addition, it also reduced various rice post-harvest operation loss 1% from 6% of before RPC processing era. Until 2007, more RPCs will be constructed that can process up to 70% of total rice production in Korea. For higher quality rice production, wet-type and dry-type processing system were developed for clean washed rice, and indent separator and color sorter were used for obtaining head rice.

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