Aspects of new GAP-based farm management systems for improving farming businesses

National Agriculture and Food Research Organization

Management Methods Project

Preface

The current agricultural production requires involving various efforts toward, for example, food safety and environmental conservation. Accordingly, farming has become more complicated because of farm expansion, high crop diversity, increased number of employees, and consequent increase in complications in the responsibilities of farm operators. Under such changing circumstances, the appropriate control of production processes and improvement of farm management have become important issues in farming.

The management methods project of the National Agriculture and Food Research Organization (NARO) focuses on Good Agricultural Practice (GAP), which aims at appropriate agricultural production, and has been involved in developing new GAP-based measures to improve farm management (new GAP-based farm management systems).

On the basis of the obtained research results, we created a pamphlet that describes the issues that should be considered when new GAP-based farm management systems are applied. We hope that this pamphlet can be used not only by farm operators but also by people who work for organizations supporting farming and that it contributes to highly efficient farming.

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NARO Management Methods Project

Contents

What are the new GAP-based farm management systems?

1. Future farm management

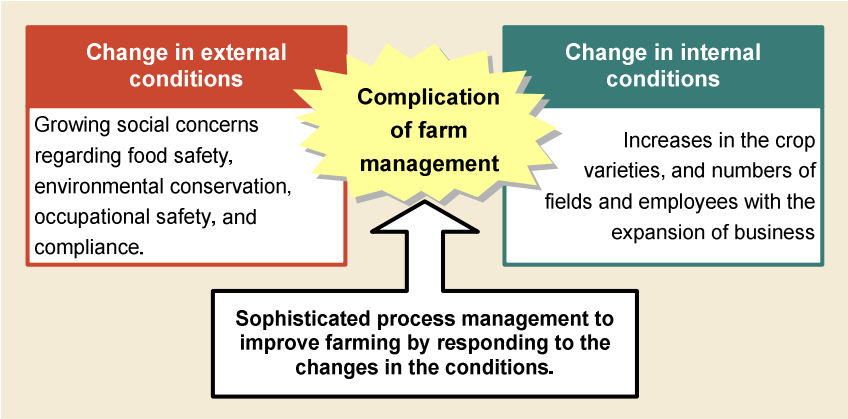
To achieve sustainable agricultural development, the following growing social concerns have to be addressed:

- Consumers' growing awareness regarding food safety in the context of food-related incidents (**ensuring food safety**),
- Growing environmental awareness, such as conservation of soil and water qualities and prevention of global warming (**environmental conservation**),
- Growing awareness concerning safe farm work, such as prevention of accidents involving self and others (**ensuring occupational safety**), and
- Compliance with laws, regulations, and guidelines pertaining to the above (**compliance**).

Currently, many farm operators have expanded the scale of their businesses or modified their businesses in accordance with the changing farm management systems. In addition, the following factors further complicate farm management and prevent improvements and increases in farming efficiency.

- Increased numbers of fields because of expansion of farming area
- Increase in the crop varieties to address the diverse consumer needs and risk diversification
- Increased numbers of employees with the expansions of farm and business.

To continue developing farms, the operators have to improve farm management by responding to the social concerns and changes in the farm management methods as described above. Moreover, fulfilling these goals requires sophisticated process management by using records that need to be checked constantly, instead of the conventional management method that is based on experiences and memories.



2. Interest in Good Agricultural Practice (GAP)

Good Agricultural Practices (GAP), which aim to attain food safety, environmental conservation, and occupational safety goals, has been promoted recently.

■ Guideline on common foundation of GAP

The Ministry of Agriculture, Forestry and Fisheries (MAFF) developed the guideline on common foundation of GAP in 2010. On the basis of scientific results and laws and regulations related to food safety, environmental conservation, and occupational safety, which are required for agricultural production, the guideline describes aspects that are particularly encouraged in the practice of process management (accurate implementation, records, checks, and assessment), such as the use of pesticides and fertilizers, soil management, and awareness of dangerous operations.

■ GLOBALGAP

GLOBALGAP (formerly EurepGAP) is a GAP certification system established by a gaoup of retailers belonging to the Euro-Retailer Produce Working Group (EUREP) and has laid down the criteria for food safety, environmental conservation, and worker and animal safety and welfare. Because retailers belonging to EUREP demand that the producers comply with GLOBALGAP certification, GLOBALGAP has spread not only in Europe but also to nations and regions exporting to Europe; GLOBALGAP is now a de facto international standard for GAP.

■ Japan Good Agricultural Practice (JGAP)

Japan Good Agricultural Practice (JGAP) is a GAP certification system that an incorporated nonprofit organization, JGAP office, has been disseminating and promoting in Japan. JGAP conforms to the guideline on common foundation of GAPs and also prescribes detailed directions concerning food safety, environmental conservation, and occupational safety.

In the JGAP certification system, third parties carry out audits and certify conformance to practices.

■ Prefectural GAPs, GAPs by the Japan Agricultural Co-operatives (JA) group

Some prefectures and regions have established their original GAPs corresponding to their purposes (e.g., branding of local specialties) and the actual situation.

3. Aim of the new GAP-based farm management systems

■ By using improved planning, recording, and checking activities, GAP aims to increase food safety, environmental conservation, and occupational safety. Farming businesses may benefit from performing these improvement activities not only for food safety, environmental conservation, and occupational safety but also for a wide range of farming management.

■ **With the improved use of GAP in the new GAP-based farm management systems, we aim to achieve further improvements in the increasingly complicated farm management.**

	Conventional management systems	Good Agricultural Practice (GAP)	**The new GAP-based farm management systems**
Background and purposes	Production and supply of food	Realization of food safety, environmental conservation, occupational safety, and compliance, which are growing social concerns	Realization of better and more efficient farming, which has become complicated with increases in the crop varieties and numbers of fields and employees
Management method	Management depending on experiences and memories	Accurate implementation, recording, checking, and assessment of farming processes (e.g., use of pesticides and fertilizers, soil management, and awareness of dangerous operations)	New improvement activities based on GAP

The new GAP-based farm management systems and improvements to farming

1. Improvements from the introduction of GAP in farming businesses

Introducing GAP to farm management yields various benefits to businesses.

■ A questionnaire survey of farms certified by JGAP, conducted in 2012, showed that various benefits were obtained by introducing GAP.

■ Awareness of employees, in particular, was improved in almost 70% of the farms.

■ In addition, improvements in "reductions of the dead stock of materials," "ease of arrangement of production and sales plans," and "quality" in approximately half of the farms and improvements in sales, yield, and cost reductions in approximately 30% of the farms were observed.

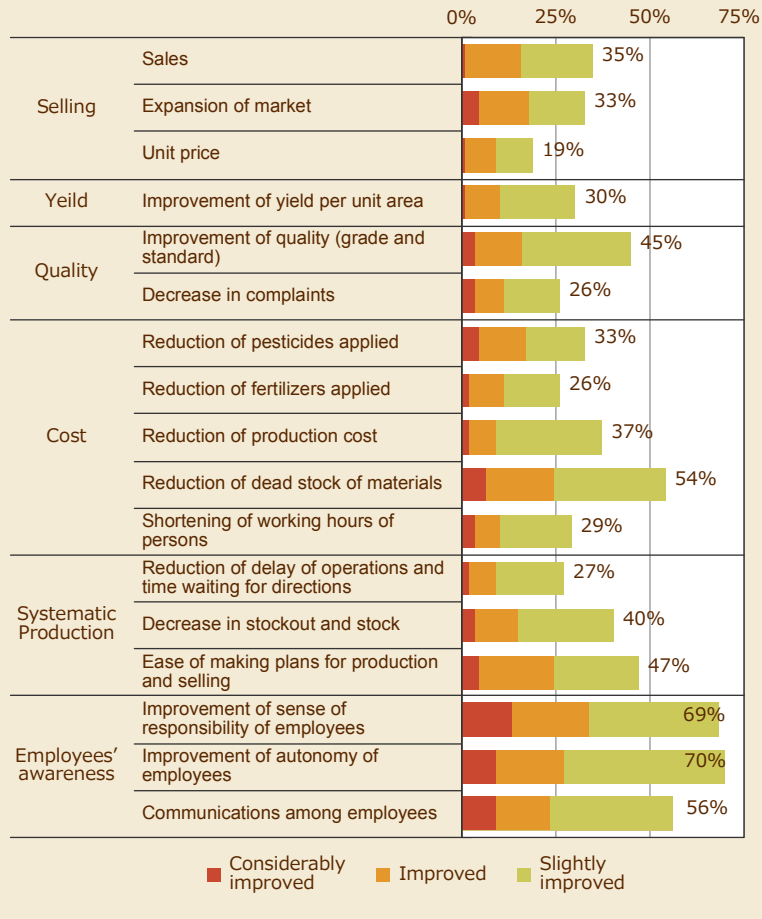


Figure 1: Benefits of the introduction of GAP for farming businesses
Reference: Analysis of the results of a questionnaire survey concerning the benefits of the introduction of GAP for farming business (Conducted in 2012: distributed to 164 JGAP-certified farms [individual certification] and responses received from 89 farms. Response rate: 54.2%)

2. Improvements in employees' awareness is important for producing benefits for businesses

Benefits of the introduction of GAP for farming businesses are obtained in sequence.

■ Introduction of GAP improves employees' awareness first. Then, improvements in employees' awareness boosts systematic production, which leads to improved quality and eventually improved sales.

■ In other words, improvements in employees' awareness, which forms the foundation of farming businesses, are crucial for improving businesses.

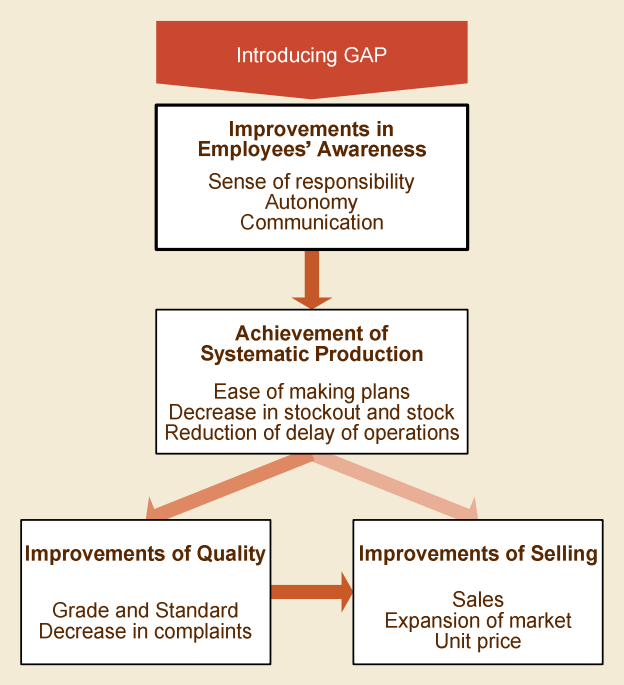


Figure 2: Mechanism of the appearance of benefits for businesses
Note: Arrows denote positive influences between the respective benefits. The dark color of the arrows indicates the strength of the relationship.

3. Importance of continuous effort

Some benefits will be manifested by continuous efforts at GAP.

■ Improvements in employees' awareness is observed regardless of the period since the implementation of GAP

■ On the other hand, quality improvements and cost reductions increases as GAP is implemented for a long period.

■ Accordingly, a continuous effort is important to achieve quality improvements and cost reductions.

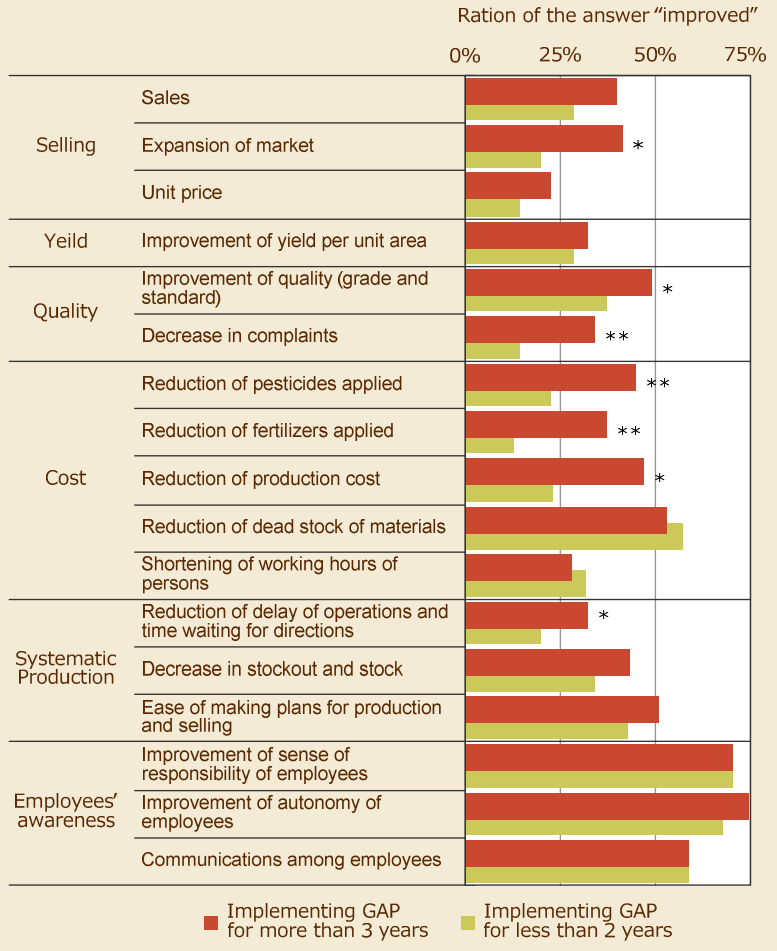


Figure 3: Difference in benefits to business according to GAP implementation period
Note: * and ** show the difference whether large according to the GAP implementation period.

4. Implementation of plan-do-check-act (PDCA) based on records

Some benefits are fully achieved by implementing improvement activities (plan –do–check–act) based on the records.

■ Concerning the plan–do–check–act system in production activities, the cases where farmers make better use of data on crop growth bring out greater improvements in crop yield per unit area, quality, and production cost reductions. Similarly, improvement activities based on the cultivation history result in quality improvements and further improvements of employees' awareness.

■ It is important not only to record data in each farming process but also to use the data positively for improvement activities.

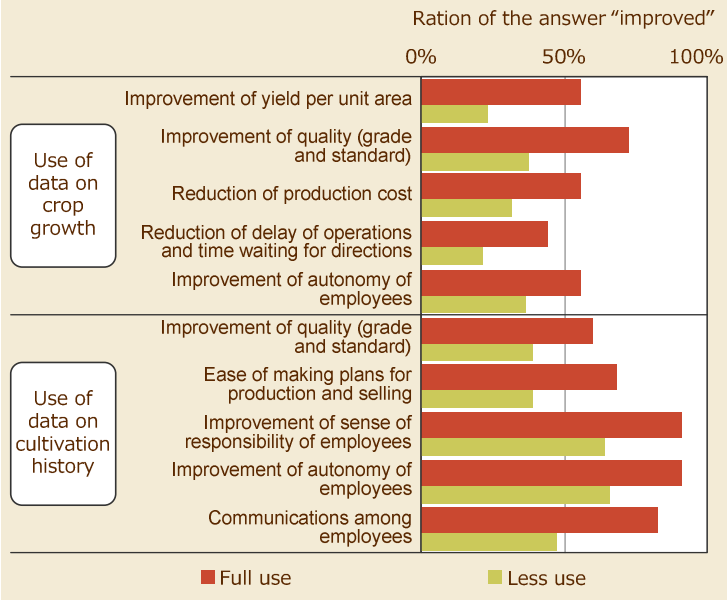


Figure 4: Differences in benefits to businesses according to use of the recorded data
Note: "Full use" is the case where records are positively used in 2 or more of the following 3 steps: "making monthly/weekly working plans (plan)," "checking on the progress of the plans and modifications to the plans (check)," and "reviewing to improve the efficiency of farm work (act)." "Less use" is the case where records are not used at all or only in 1 of the 3 steps described above. The figure shows only aspects in which distinct differences in benefits were observed.

Term What is the PDCA cycle?

PDCA is a management method to continuously improve business by repeating a 4-step cycle: Plan, Do, Check, and Act.

The concept of PDCA is widely used to improve the quality of businesses in general manufacturing industries and has been adopted in management systems such as the International Organization for Standardization (ISO).

5. Implementation of PDCA, including employees

Employees' participation in improvement activities (plan–do–check–act) is effective in improving employees' awareness and systematic production.

■ After the introduction of GAP, the cases in which employees newly participate in improvement activities (plan–do–check–act) in production resulted in major improvements in employees' awareness, achievement of systematic production, and cost reduction.

■ Particularly, the fact that improving employees' awareness affects various benefits means that the formation of an organization involving employees in improvement activities is important.

■ Actually, it is important to do improvements that reflect the opinions and ideas of employees engaging in farm work and to share the policies and problems of the farm among employees on such occasions.

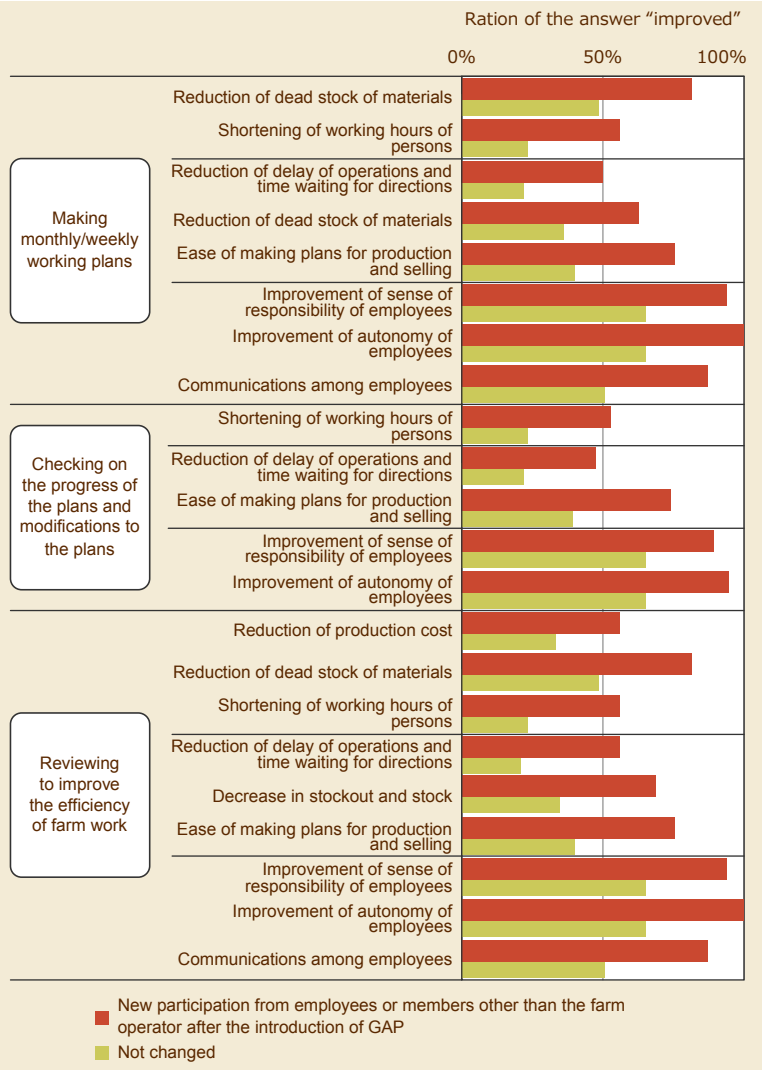


Figure 5: Differences in the benefits to businesses according to changes in the organization of improvement activities
Note: Only cases that show distinct differences in benefits from new participation from employees or members other than the farm operator after the introduction of GAP are shown here.

Examples of concrete efforts using the new GAP-based farm management systems

1. Yamanami Farm, Inc., with the aim to improve business by the introduction of GAP

■ The Yamanami Farm in Kashiwazaki City, Niigata Prefecture, is an incorporated farm that grows rice in hilly and mountainous areas on a large scale. The farm was incorporated in 1992 and obtained a JGAP certificate in 2009, and is currently involved in directly selling rice and making rice cakes.

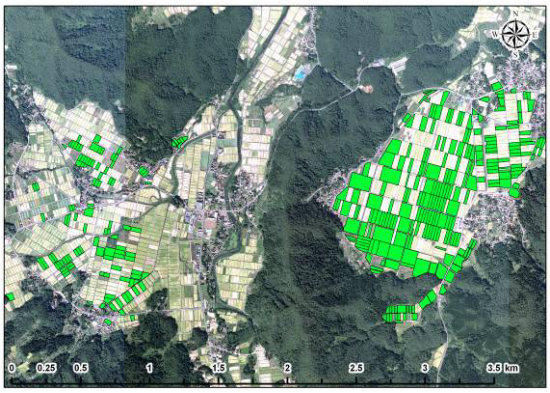


Figure 6: Distribution of the fields belonging to the Yamanami Farm (Partly shown)
Note: Fields colored green are part of the Yamanami Farm.

■ The total farmed area has expanded to 97 ha as of the financial year (FY) 2011 (72 ha for paddy-field rice) and the number of fields exceeds 400 (**Figure 6**). The Yamanami Farm manages the fields along with 2 members of the corporation, 8 full-time employees, and 600 temporary employees.

■ The reason for acquiring the JGAP certificate is that the farm operator wanted to review the farm operation and improve the operation of the farm and the employees rather than branding the products or expand the market.

■ After the introduction of JGAP, a reduction in the dead stock of materials, including pesticides was achieved by implementing the control of pesticides (control of use, storage, and stock of pesticides), which is one of the control points of JGAP.

■ The farm operator is also promoting original improvement activities based on the approach of GAP. As a result, improvements in the farm business and increased efficiency were achieved from various aspects.

2. Roles and responsibilities of employees at the Yamanami Farm

■ By using an idea from the designation of responsible persons for pesticides and fertilizer application, which is one of major points in JGAP, the Yamanami Farm delegates certain employees as responsible persons for each operation of farm work, such as puddling, rice planting, and water management.

■ Almost all employees are designated as responsible persons for some operations. In addition, to avoid losing interest in other operations, employees rotate annually according to their abilities.

■ Each person is responsible not only for the arrangements and direction of an operation but also for planning the operation and allocating people.

3. Improvement activities at the Yamanami Farm

The Yamanami Farm has continuously implemented the PDCA cycle (**Table 1**).

Establishment of the annual plan

■ In January and February, a planting plan and a fertilizer and pesticide application plan are decided through discussions.

■ Simultaneously, responsible persons for each operation and the roles of each employee are also decided to establish the organization for the year.

■ Each person responsible for an operation makes an annual working plan (schedule and allocation of persons) based on the results of the previous year.

Table 1: PDCA cycle of the Yamanami Farm

Annual PDCA cycle	Jan	- Make a fertilizer and pesticide application plan based on the results of the previous year.
	Feb	- Make a plan for planting. - The farm operator decides responsible persons for each operation. - Each responsible person for an operation makes an annual working plan (schedule and allocation of persons).
	Jun	- Check farm work done in spring and problems after planting. If necessary, revise the annual plan (From June onward, check the growth of rice regularly).
	Oct	- Account settlement. Review the year and consider points to be improved.
Weekly PDCA cycle	Daily	A responsible person for an operation (1) makes a record of the things done each day, (2) records working hours of the day in a farm diary, and (3) compares the things done that day with the working plan.
	At the start of a week	In a meeting on Monday, (1) the responsible person for the operation reports on lags between the initial work plan and the actual accomplishments and any other problems, and, (2) when necessary, all persons engaged in the operation discuss revisions to the work plan for the week. After the meeting, the responsible person for the operation makes an hourly work plan for the week.

Daily check on the progress of the plans and modifications on the plans

■ Once farm work begins, meetings are regularly held with the employees.

■ At daily meetings, employees review the work that was performed that day and the person responsible for the operation makes a record of the work that was accomplished.

■ In addition, another meeting is held every Monday to check the lag between the initial working plan and the realized accomplishments and to discuss methods to reduce the lag.

■ Moreover, all the people regularly complete a round of the fields to check the growth of paddy-field rice.

Discussion of issues that need to be improved in the next year

■ In October after rice is harvested, a meeting to review the performance during the year is held by including all the employees, to identify the points that need to be improved based on the records obtained during the year and to consider methods to improve those points. The results will be reflected in the plan for the next year.

4. Benefits to farming business in the Yamanami Farm

■ Before the implementation of the management system, the farm operator made all plans and gave all directions (that is, top-down governance). Accordingly, the employees had a strong "consciousness of being employed" and they strongly tended to seek detailed directions from the farm operator and do only those operations directed.

■ However, after the introduction of GAP, the well-considered organization and the improvement activities heightened workers' sense of responsibility and the autonomy of individual employees, and furthermore, raised common understanding of the circumstances of the whole farm.

■ As a result, effects that were not observed from top–down governance have been obtained, including the following benefits:

(1) Persons responsible for an operation became capable of making decisions in the field.

(2) Hence, the time to wait for directions in working operations was reduced.

(3) Because individual employees made a plan and all understood the whole working plan, imperfections in arrangements for operations (e.g., lack of materials or poor maintenance of machinery) were eliminated.

(4) Delays in working operation caused by imperfections in arrangements were eliminated and working operation progressed as planned.

Efforts made at the Yamanami Farm and benefits to the business

Efforts	Concrete procedure	Benefits
Determination of roles and responsibilities of employees	- Designation of responsible persons for operations - Planning and checking by the responsible persons for the operations - Regular rotation of roles	- Improvement of senses of responsibility and autonomy of individual employees - Building of common under-standing among employees - Reductions in time waiting for directions - Decreased delays in working operations caused by imperfections in arrangements
Continuous "plan, check, and act" with the employees	- Making a whole plan through discussion - Making a detailed partial plan by a responsible person for an operation - Regular comparison between the plan and the actual results - Identification of points to be improved and consideration of the points with employees	

5. Efforts made by other farms

■ Aiming at improving farm management, farms implementing GAP are making efforts suited to each business.

Farm B: enhancing its enterprise value by visualization of farm production

Farm B has approximately 50 ha of farmland and has 5 members of the corporation, 10 full-time employees, and 10 temporary employees. Farm B cultivates 8 types of vegetables, especially root crops, including carrots and burdocks.

Farm B, which has been dealing with mass merchandisers and food processors for the catering trade, has emphasized improvements of trust in and brand value of the farm itself rather than product differentiation such as "kodawari (special)" agricultural products. As methods of enhancing enterprise value, Farm B introduced a traceability system around 2000, was the first in Japan to obtain Japanese Agricultural Standard (JAS) for Agricultural Products with Production Information in 2006, and furthermore, obtained a GLOBALGAP certificate in 2007.

Flexible field management suited to the circumstances through designation of persons responsible for districts

With increases in farmer retirement as a backdrop, Farm B has greatly expanded its farm area in the past dozen years. Currently, Farm B has approximately 140 fields, which are located in 4 separate areas. In Farm B, the members of the corporation have taken partial charge of farm management. However, strict management of the fields and employees only by the members has become difficult under such scale expansion and such a situation could lead to increased inefficiency, such as deterioration of the quality of the products.

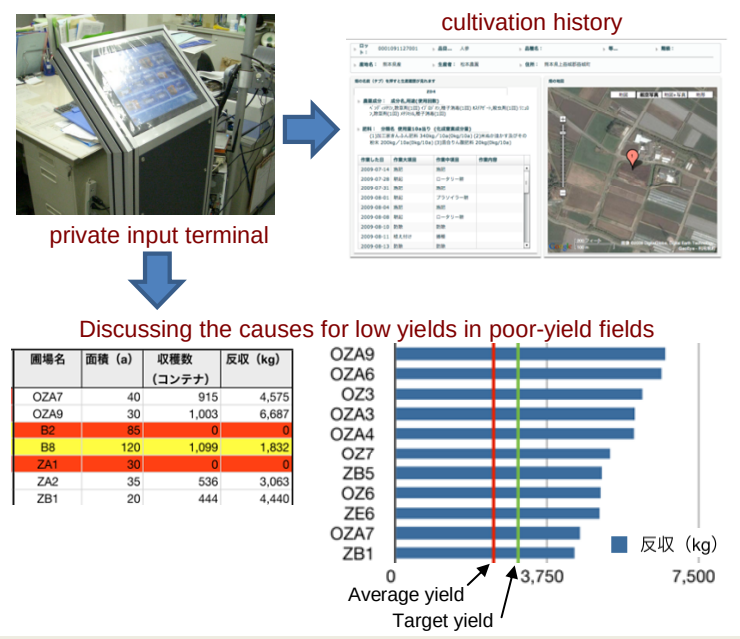
For this reason, Farm B adopts a management system in which 2 employees are designated as responsible for districts (sub-managers). The persons are given the responsibility for managing the fields and employees in the district and making arrangements and giving directions for operations suited to the circumstances. They also have a role to educate other employees.

Visualization of process management and rationalization of farm management

In addition, Farm B uses a traceability system not only for sales but also for the improvement of farm management to prevent its increasing inefficiency due to scale expansion and to promote rational farm management.

In Farm B, a private input terminal is installed in the office and employees input 5W1H (who, what, when, where, why, and how) of the daily operations into the terminal every evening when done. The input data are accumulated in a private database and a detailed cultivation history in each field can be referred to easily by searching the database.

In Farm B, ineffective operations are identified based on the data accumulated. Furthermore, information on yields from each field is shared with all full-time employees, and all employees discuss the causes for low yields in poor-yield fields and methods to improve these through plans of planting and operations in the next season. By the efforts described above, Farm B visualizes the production process and promotes rationalization of farm management.



Farm C: designating for sub-managers and crop responsible persons

Farm C has approximately 230 ha of farming area and 4 members of the corporation, 10 full-time employees, and approximately 100 temporary employees. Farm C cultivates vegetables and obtained JGAP certificate in 2009. Because Farm C plants almost 20 crops, Farm C adopts a management system in which employees are allocated to sub-managers in a production sector and to responsible persons for each crop under the sub-managers. The employees allocated to sub-managers and the responsible persons take responsibility for the implementation of operations concerning the crop.

The designation of such sub-managers and responsible persons improves the sense of responsibility of employees. In addition, the creation of rules concerning directions and reports has allowed issues that previously required directions from the farm operator to be resolved smoothly in the field. Furthermore, the autonomy of individual employees has grown and problems and ideas for improvement suggested by employees at the production site are brought to the farm operator through the sub-managers.

Farm D: sharing information among employees using information technology

Farm D has 160 ha of farmland and 1 member of the corporation, 3 full-time employees, and 3 temporary employees. Farm D has carried out dry field farming and obtained JGAP certificate in 2011 for changing the awareness of employees. At the time of introducing JGAP, Farm D introduced an original work management system for the centralized management of records required for GAP.

Using this system, the employees accumulate data including daily working plans, details of work done each day, and pictures taken in the fields (growth conditions) from portable terminals through the Internet. Before the introduction of the work management system, the farm operator had made all of the plans and checked all of the fields. After the introduction of GAP and the system, the employees made operation plans for each crop for which they were responsible and recorded and checked their operations.

In addition, the accumulated data can be accessed and shared easily through portable terminals and personal computers. This system allows for the effective use of the accumulated data in making farming plans and, at the same time, achieving better communications on the progress of working operations and growth conditions among the employees.

Aspects when addressing the new GAP-based farm management systems

The following aspects of the new GAP-based farm management systems for improving businesses are derived from the questionnaire survey and the efforts done in the farms.

I. Improvement of employees' awareness is important for improve farming business

■ Introduction of GAP first contributes to the improvement of employees' awareness. Then, this improvement leads to systematic production and quality improvement and eventually improved sales.

■ As described above, GAP not only contributes to securing "food safety," "environmental conservation," and "occupational safety" but also to "measures to improve farming business through improvement of employees' awareness."

■ In the instances described above, the introduction of GAP yielded improvements in the senses of responsibility and common understanding among the employees. As a result, the employees can make flexible judgments suited to the circumstances and therefore can reduce time waiting for directions and delays in working operations. In addition, the autonomy of individual employees has grown and problems and ideas for improvement from the employees are actively brought to the farm operator.

II. Participation of employees in improvement activities (plan-do-check-act) is effective for improving employees' awareness and systematic production.

■ The cases in which employees newly participate in improvement activities (plan–do–check–act) in production bring out large improvements in employees' awareness and achievement of systematic production.

■ In the farms described above, certain employees have been designated as responsible persons for aspects of each farm, such as "responsible persons for operations," "district responsible persons," and "crop responsible persons," and have made plans for operations and then checked the operations. Giving roles to the employees contributes to improve senses of responsibility and autonomy of individual employees.

■ In addition, the Yamanami Farm and Farm B have increased employees' common understanding of the problems, policies, and plans of the farms by discussing the problems in the production process and methods to resolve the problems.

III. It is important not only to record cultivation history and growth data but also to use the data positively for improvement activities.

■ As far as plan–do–check–act in production is concerned, the cases where farmers make better use of cultivation history and growth data brought out greater increases in the crop yield per unit area and quality.

■ In the Yamanami Farm, the actual result is recorded in the working plan sheet so that lags between the plan and the actual result can be checked easily. Furthermore, operations are adjusted and reviewed based on the records. In Farm B, all employees are involved in discussions on the causes of low yields based on a record of yields by field. Like these instances, records-based identification of lags between the plan and the actual result is an important first step to considering how to improve the problems.

■ It is also important to appropriately accumulate and store the data recorded and ensure easy access to the data. In Farm B and Farm D, centralized information management systems that make full use of IT and that manage data such as working plans, details of daily work done, and pictures taken in the fields (growth conditions) allow all employees to share information and to easily access past data.

IV. Continuous efforts at improvement activities are important to improve quality and reduce costs.

■ As the farmers implement GAP for a longer period, effects on quality improvement and cost reduction become greater. This fact suggests the importance of continuous efforts at improvement activities.

■ In the Yamanami Farm, lags between the plan and the actual results are checked in meetings on the first weekday and in meetings after rice planting. If there is a lag, all employees discuss how to adjust the lag. In October after rice is harvested, a yearly review meeting is held with all of the employees to identify points to be improved, to consider how to improve them, and to reflect them in farming in the next year. This shows how implementing both short-term and long-term improvement activities are important to improve the farming operation in the next year.

Appendix:
Results of questionnaire survey concerning the benefits to farming business after introducing GAP

Outline of the questionnaire survey

Target of the survey:	Individual certified farms (excluding foreign farms and farms only cultivating green tea) out of JGAP-certified farms (as of August 2012)
Survey method:	Mail survey
Survey period:	October 27 to November 7, 2012
Distributed to:	164 farms
Responded by:	89 farms (Response rate: 54.2%) (as of November 28, 2012)

Outline of survey result

■ Among farms responding to the questionnaire, the average farming area is 29.4 ha, the average number of fields is 82.9, the average number of kinds of crops is 7.5, and the average number of total members of the corporation and employees is 16.2. These figures imply that the farms are relatively large in scale and seem to involve complicated business.

■ Most of the farms have introduced JGAP to ensure food safety and security and expanded sales and marketing, which are the original purposes of GAP; however, some farms have introduced JGAP with the main aim of improving their farming business and efficiency.

■ In addition to the designation of responsible persons required by JGAP, many respondent farms assign responsibility to various persons for operations and production management and, in many cases, employees are designated as the responsible persons.

■ With the introduction of GAP, some farms implement plan–do–check–act (PDCA) in operation and production management and make rules based on PDCA. In some farms, members of the corporation or employees other than farm operators become newly engaged in PDCA in the farms after the introduction of JGAP.

■ The respondent farms have recorded and managed not only yield per unit area and cultivation history but also various data, including growth data and, furthermore, they have made full use of the recorded data for PDCA after the introduction of JGAP.

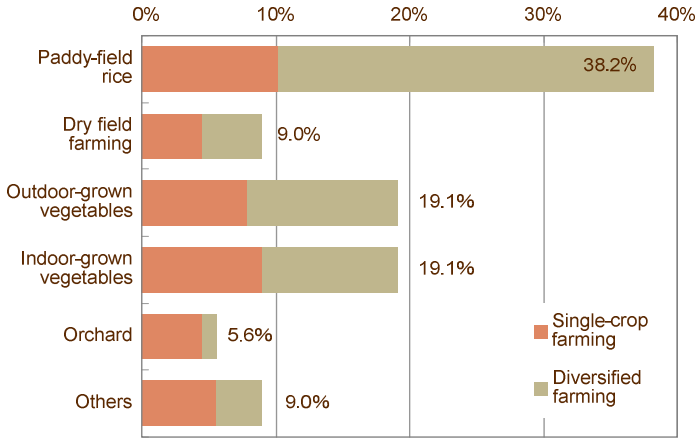
■ Thanks to the efforts described above, the respondent farms obtained various benefits to their business from introducing GAP.

General conditions of respondent farms

1. Farming type

■ Of the respondent farms, 38.2% were farms planting paddy-field rice, followed by farms growing vegetables outdoors and farms growing vegetables indoors, both of them accounting for 19.1%.

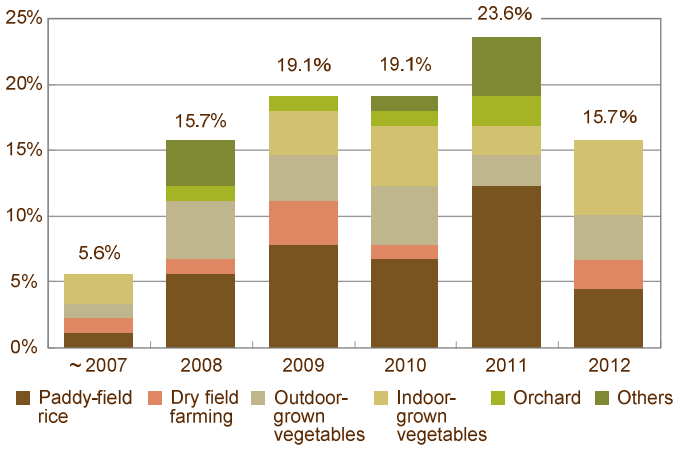
■ More than half of the farms have multiple sections, that is, diversified farming.



Note: Classified by the largest type of crop by sales. Others include mushrooms.

2. When JGAP was introduced

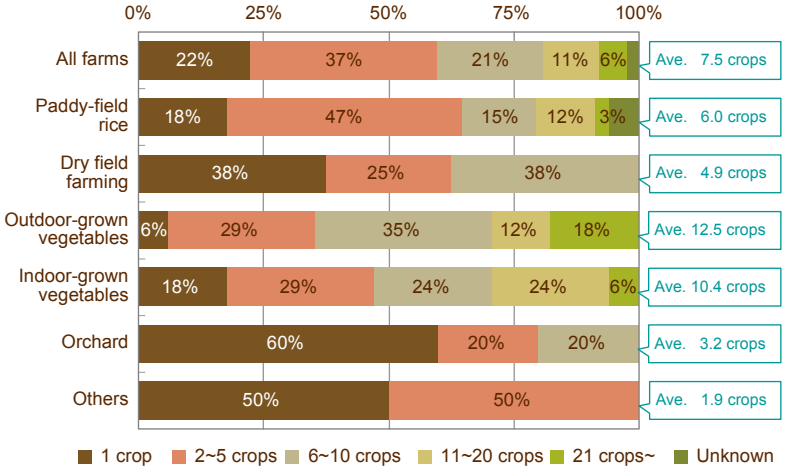
■ Approximately 60% of farms have been implementing JGAP for more than 3 years (that is, farms introduced JGAP before 2010).



3. The number of kinds of crops

■ The average number of kinds of crops in the respondent farms is 7.5.

■ When looking at the data based on the farming type, more than half of the farms growing vegetables outdoors or indoors cultivate 6 or more crops and the average number of crops of the farms growing vegetables exceeds 10.

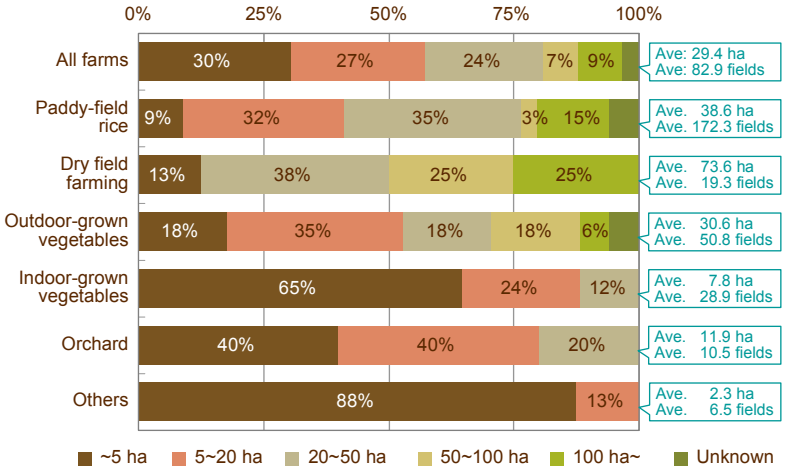


Note: The average number of crops was calculated except for the answer "Unknown.".

4. Farming area and the number of fields

■ Of the respondent farms, the average farming area is 29.4 ha and the average number of fields is 82.9.

■ When looking at the data based on the farming type, farms 20 ha or larger make up almost half of farms planting paddy-field rice and farms growing vegetables outdoors. The average number of fields of farms planting paddy-field rice is 172.3 and that of farms growing vegetables outdoors is 50.8.

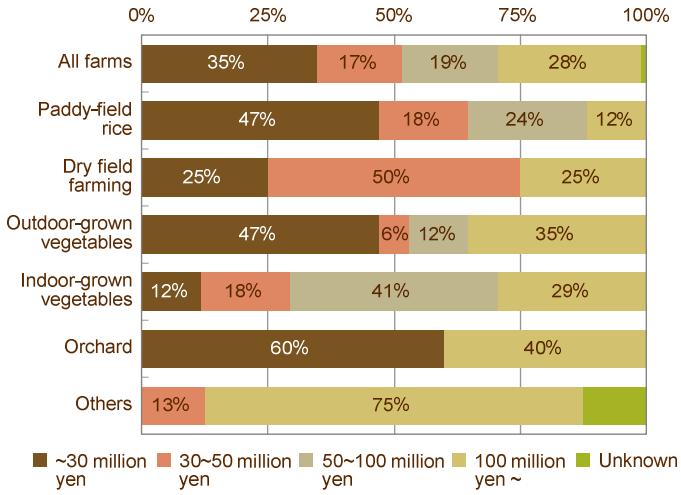


Note: The average farming area and the average number of fields were calculated except for the answer "Unknown."

5. Sales of agricultural products

■ Farms having more than 100,000,000 yen sales of agricultural products account for 28.1% of the respondent farms.

■ Farms producing and selling intensive crops (vegetables, orchards, and others) tend to achieve larger sales.

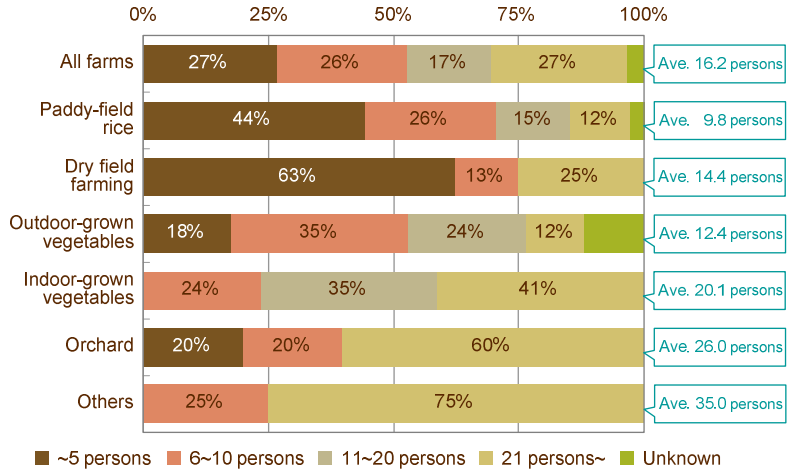


Note: Sales of agricultural products do not include sales by processing.

6. The numbers of members of the corporation and employees

■ The average total number of members of the corporation and employees is 16.2.

■ When looking at the data based on the farming type, grain farms (paddy-field rice and dry field farming) have 5 or fewer persons and farms producing and selling intensive crops have many employees.



Note: Employees only include full-time employees (not temporary employees).
Note: In some cases of community-based farm cooperatives and non-agricultural enterprises, the number of members of the corporation and employees is large.

Purpose of introduction of JGAP

■ The top answer is "to ensure safety and security of products"; 87% of the respondent farms responded with this.

■ Half of the responses from the farms were "to keep or expand sales and market."

■ Besides the purposes relating to safety and security and selling, there are other purposes as follows:

"to improve productivity" (27%)

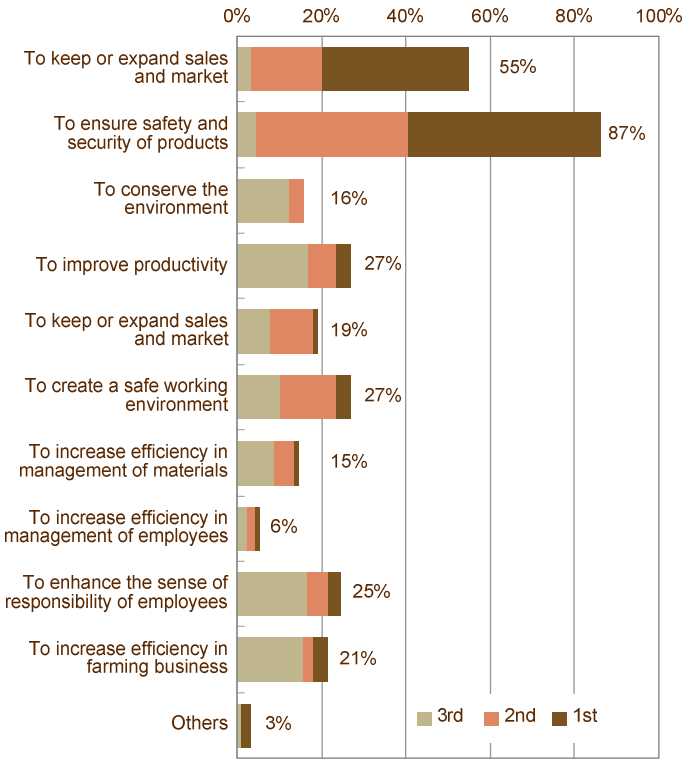
"to create a safe working environment" (27%)

"to enhance the sense of responsibility of employees" (25%)

"to increase efficiency of farming business" (21%)

"to increase efficiency of working operations" (19%).

Approximately 20% of farms have the purposes of improving business and increasing efficiency. Some farms mentioned such purposes in the first place (most important).

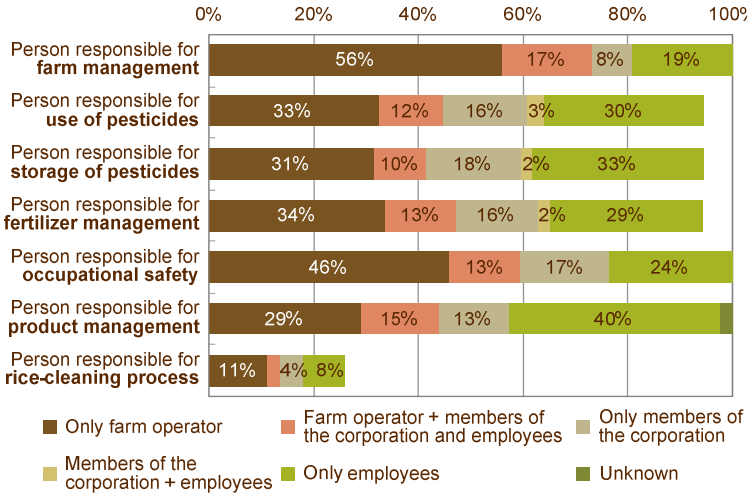


Note: Select 3 purposes for the introduction of JGAP in the order of importance.

Production management system

1. Allocation of responsible persons demanded by JGAP

■ To conformity with purposes such as food safety, JGAP requires the allocation of responsibilities to various persons. The cases in which farm operators serve as these responsible persons account for 30% to 50%; there are many cases in which members of the corporation or employees other than farm operators serve as these responsible persons.

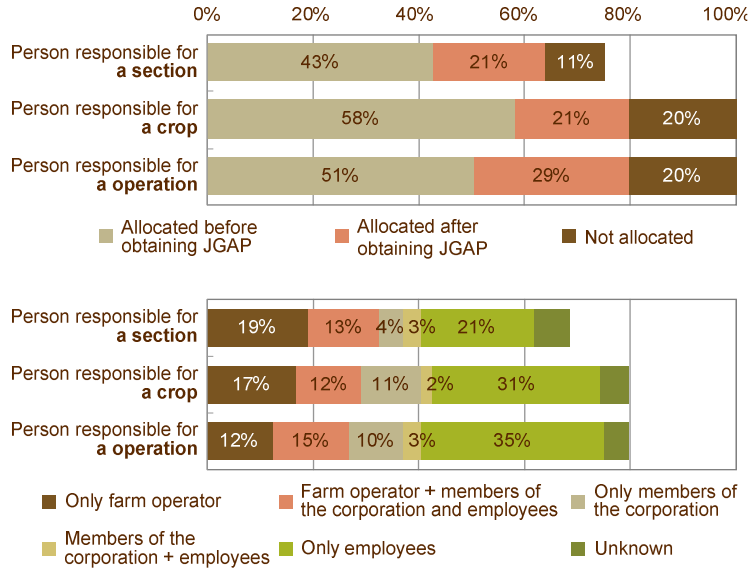


Note: Some farms of non-agricultural enterprises manage their fields only with full-time employees.
Note: The total may not equal 100% because fertilizer-free and pesticide-free farms do not allocate persons responsible for pesticide and fertilizer application.

2. Allocation of persons responsible for operations and production management

■ In addition to responsible persons demanded by JGAP, 60% to 80% of farms allocate responsible persons for each section, crop, or operation to manage operations and production in the farms. Farms that have allocated such responsible persons after the introduction of JGAP account for 20% to 30%.

■ Among them, the cases in which farm operators serve as such responsible persons account for about 20%; in most cases, members of the corporation or employees other than farm operators serve as such responsible persons.



Note: Total may not equal 100% because farms producing and selling only 1 crop do not require persons responsible for each section.

3. Implementation of PDCA in operation and production management before and after the introduction of JGAP

■ Considering the circumstances before the introduction of JGAP, there was a decrease in the number of responses from farms as "not implemented" or "not determined" for the establishment of responsible persons for making various plans, checking operations, and considering points for improvement after the introduction of JGAP. With the introduction of JGAP, the implementation of PDCA in operation and production management and the creation of rules based on PDCA seem to be promoted.

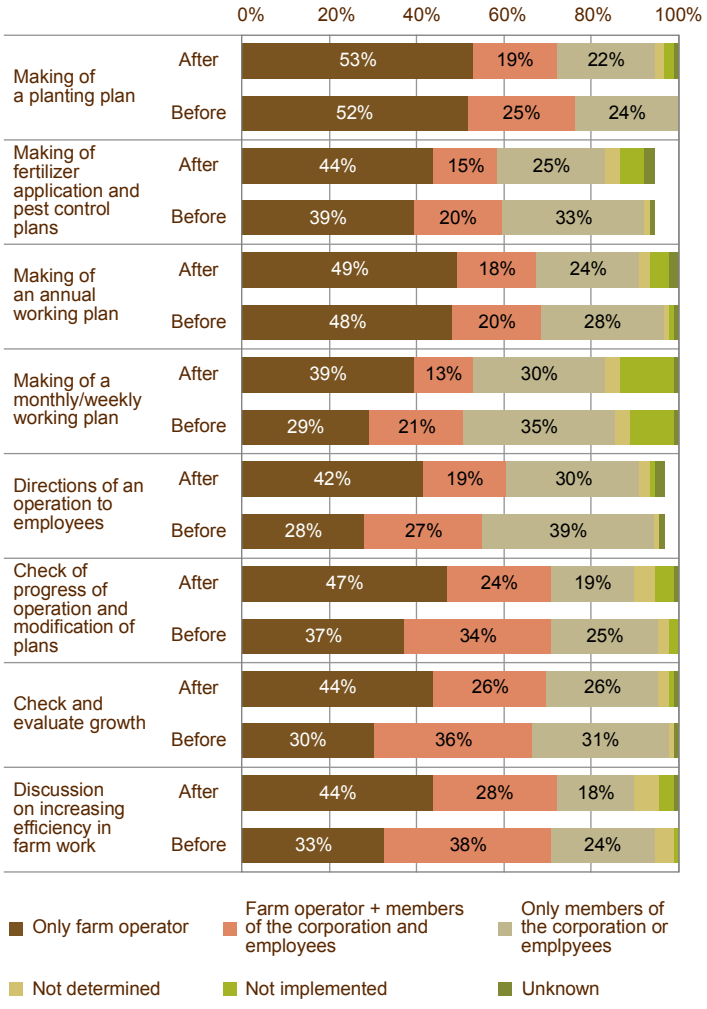
■ When assigning responsible persons, the number of farms carrying out PDCA with members of the corporation and employees other than farm operators increased after introduction of JGAP.

■ There are frequent cases in which members of the corporation and employees other than farm operators are involved in the following:

"Check and evaluate growth" (67%)

"Direction of an operation to employees" (66%)

"Discussions on increasing efficiency in farm work" (62%)



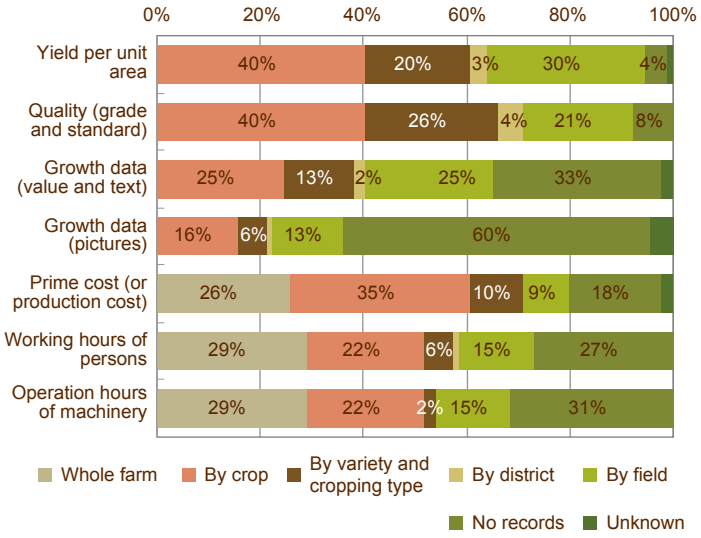
Note: The total for "Making of fertilizer application and pest control plan" does not equal 100% because fertilizer-free and pesticide-free farms are included in the survey.
Note: The total for "Directions of an operation to employees" does not equal 100% because farms involving only a farm operator are included in the survey.

Recording, storage, and use of data

1. Recording of various kinds of data

■ Yield per unit area and quality are recorded in almost all farms. Around 40% of the farms have recorded them by crop; 20% to 30% of the farms have recorded them by field.

■ Growth data is recorded in approximately 60% of the respondent farms; pictures, etc. are also recorded in nearly 40% of the respondent farms.



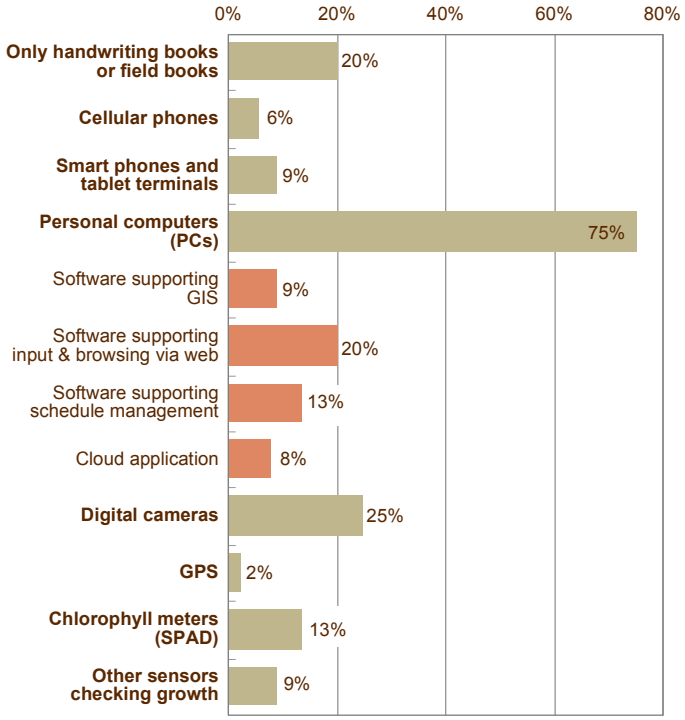
■ In addition, the working hours of persons and operation hours of machinery are also recorded in approximately 70% of the respondent farms.

2. Data collection and management

■ 75% of the respondent farms use personal computers (PCs) for the recording and management of data.

■ Among them, some farms use software supporting geographic information systems (GIS), input via web, and schedule management.

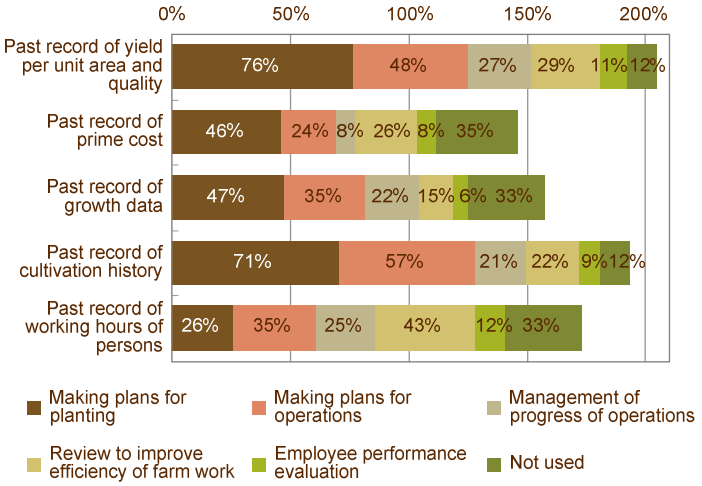
■ In addition, portable devices and sensors such as smart phones, digital cameras, global positioning systems (GPS), and chlorophyll meters are also used for data collection in some farms. Working hours of persons and operation hours of machinery are also recorded in approximately 70% of the respondent farms.



3. Good use of recorded data

■ Records of yield per unit area, quality, and cultivation history are often used for PDCA in the farms, especially for making plans for planting and operations.

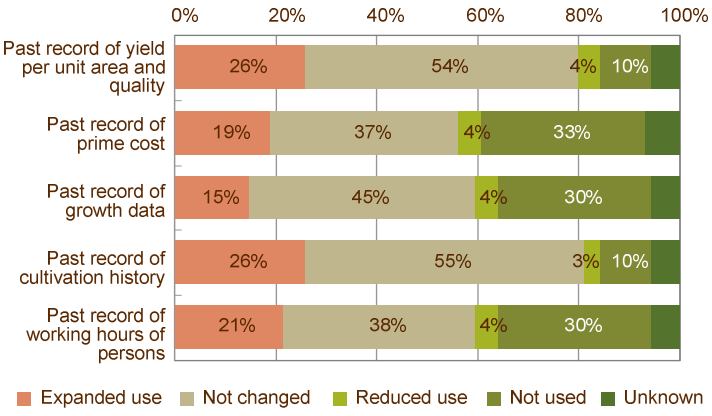
■ Approximately 40% of the respondent farms use records of working hours of persons for review to improve the efficiency of farm work. Records of yield per unit area, quality, prime cost, cultivation history, etc. are also used in 20% to 30% of the respondent farms.



Note: "Not used" includes farms having no records.
Note: Respondents answered all cases where the recorded data are used. (Multiple answers were allowed.)

4. Changes in the use of recorded data with the introduction of JGAP

■ With the introduction of JGAP, approximately 20% of the respondent farms expanded their use of the recorded data.



Note: Results show changes in the number of cases where each type of recorded data was used after the introduction of JGAP.
Note: "Not used" is a case in which the data were not recorded or used both before and after the introduction of JGAP.

Benefits of introduction of JGAP for businesses

■ In terms of selling, 56% of the respondent farms answer that "trust in customers" has improved.

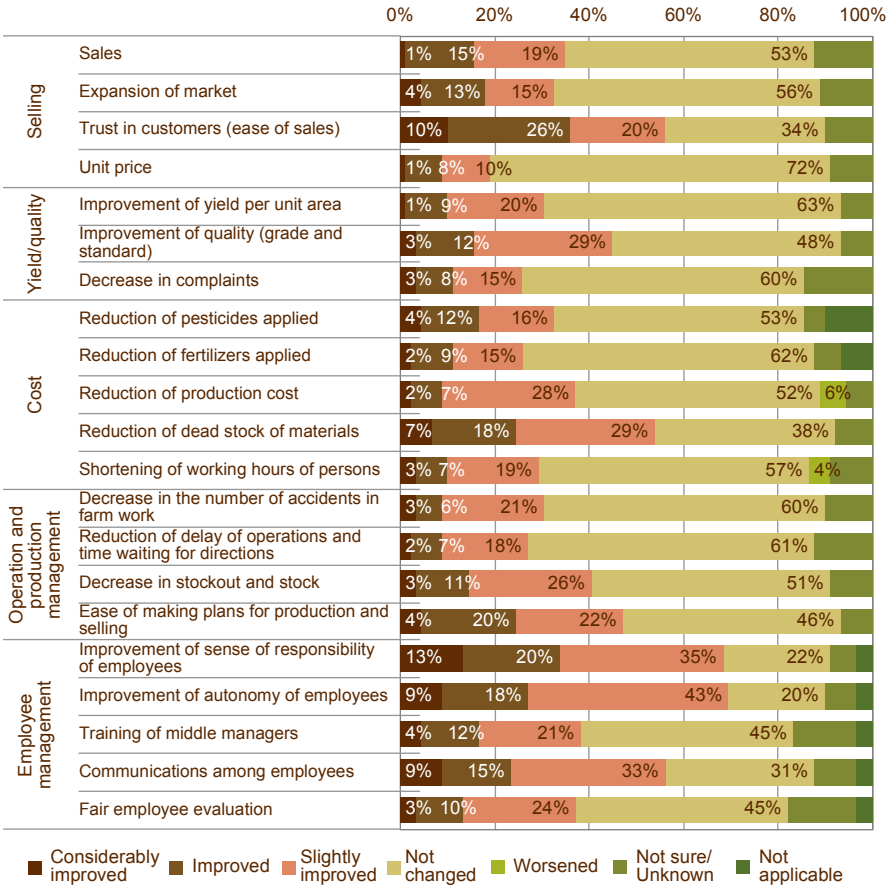
■ A little over 30% of the respondent farms answer that "sales" and "expansion of market" improved and nearly 20% of the respondent farms answer that "unit price" improved.

■ In terms of yield and quality, 45% of the farms achieved "improvement of quality."

■ In terms of cost, 54% of the farms reduced "dead stock of materials" and 37% of the farms reduced "production cost."

■ "Ease of planning" improved in 47% of the farms and "stockout and stock" improved in 40% of the farms. In addition, nearly 30% of farms improved "working hours of persons" and "the number of accidents in operation."

■ Approximately 70% of the farms answered that the "sense of responsibility of employees" and "autonomy" improved and 56% of the farms answered that "communications among employees" improved.



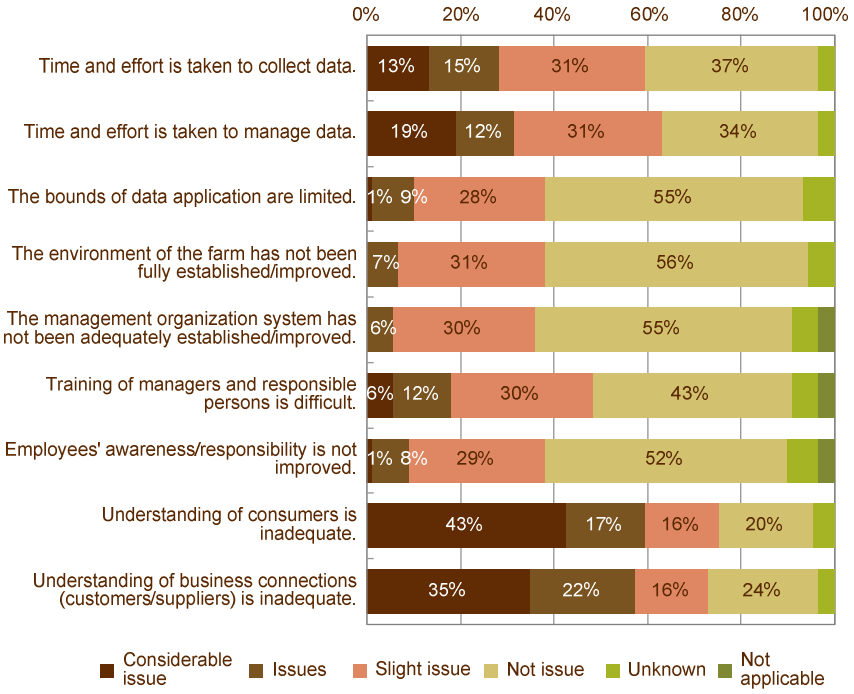
Note: "Not applicable" includes fertilizer-free and pesticide-free farms and also includes farms not employing anyone.

Issues to be addressed in the implementation of JGAP

■ More than 70% of the farms mentioned the understanding of consumers and business connections as issues to be addressed in the implementation of JGAP.

■ Approximately 60% of the farms mentioned time and effort taken for data collection and management as issues and approximately 40% mentioned good use of data as issues.

■ In addition, 49% of the farms regarded training of managers and responsible persons as issues and 39% regarded improvement of employees' awareness and responsibility as issues.



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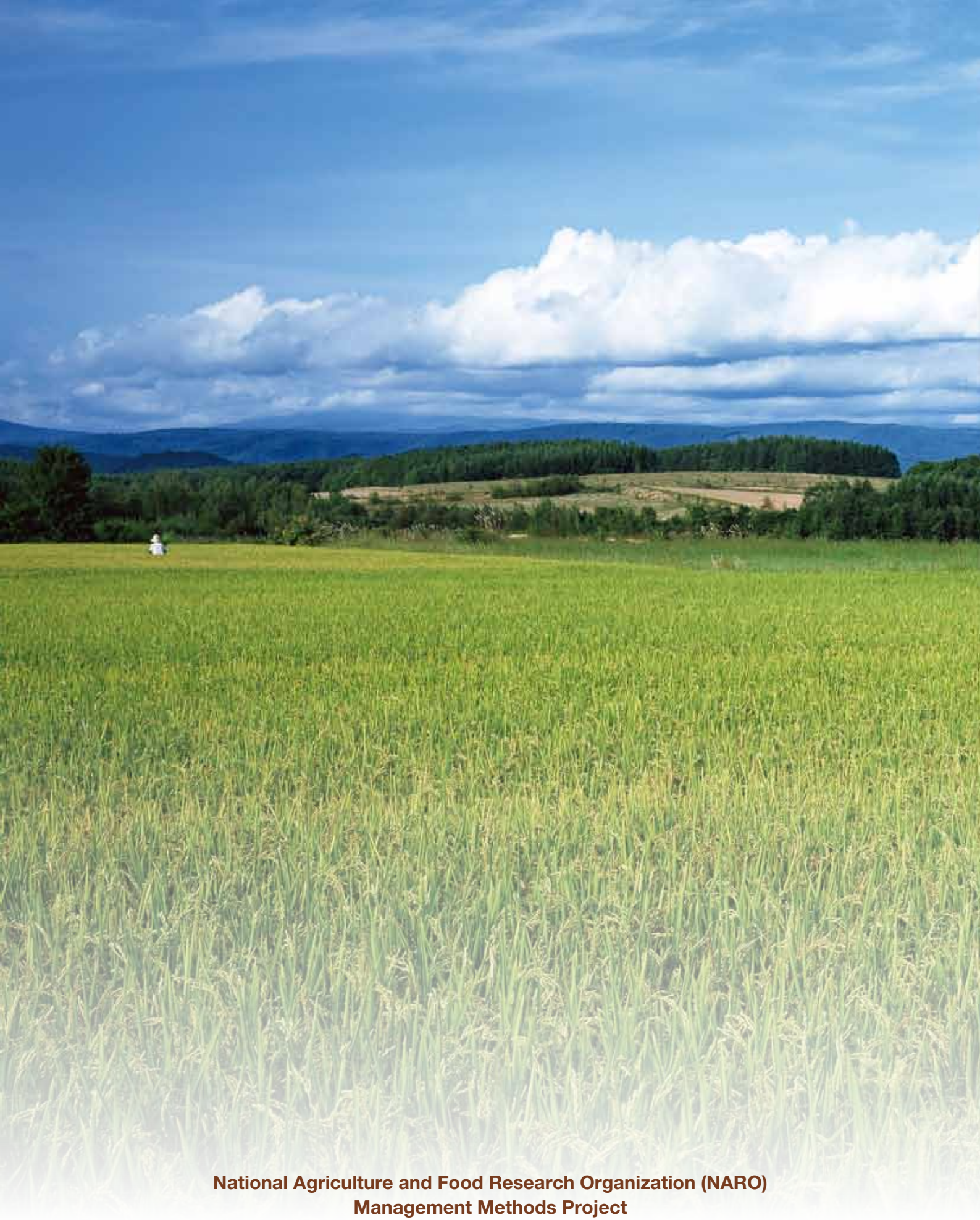

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