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# 13 Feasibility and issues in the application of HACCP at the farm level in Japan

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## ABSTRACT

HACCP criteria have been verified over the past three years on pilot farms in terms of producing safe fresh milk and improvements in animal health and milk production. Based on certification criteria, we conducted a hazard analysis of routine activities on the model farms according to the Codex General Principles of Food Hygiene, identified hazards, and specified control measures. Then, we established a HACCP plan for CCPs, and assessed the effectiveness of implementation of the plans with viable bacteria counts, somatic cell counts of fresh milk, contamination of antibiotics, or from the cows' condition and milk production. With comparison of pre- and post-implementation of the HACCP system for the pilot farms, the safety and productivity of raw milk have been improved.

Moreover, productivity improvement includes increased milk production, decreased ratio of cows with abnormal milk production, and increased survival ratio of cows at 12 months old.

## 1. APPLICATION OF FARM HACCP TO DAIRY FARMS

### 1.1. Establishment of hygiene control system

The certification criteria of farm HACCP (hazard analysis and critical control point) consist of (1) establishing an organizational structure that enables management systems to work properly, and (2) establishing pre-requisite programmes and HACCP plans (see Table 1).

- |  |  |
|--|--|
| <p>[I] Establishment of organization structure that allows its management system</p> <ul style="list-style-type: none"> <li>• Hygiene control and goal setting</li> <li>• Conduct of instruction and training</li> <li>• Analysis, evaluation, improvement, update of information</li> <li>• Internal verification, management review</li> </ul> |  |
| <p>[II] Preparation for hazard analysis</p> <ul style="list-style-type: none"> <li>• Establishment of prerequisite programs</li> <li>• Hazard analysis</li> <li>• Establishment of HACCP plans</li> <li>• Document control and recordkeeping</li> </ul>  |  |

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**Table 1:** Requirements for farm HACCP certification



Model farm owners assembled HACCP teams and established hygiene management systems according to their hygiene management policies and goals. The Japan Food Safety Verification Organization (JVO) supported the teams as an advisor.

Prior to hazard analysis, we documented the traffic patterns of employees, equipment and cows in flow diagrams, and the routine (regular and irregular) activities in order to exactly assess the existing condition of hygiene control. On that basis, we conducted a hazard analysis in accordance with the eight requirements of the general principles of animal hygiene, which are based on the Codex general principles of food hygiene.

Considering the aspects of hygiene management for feeding, milking, and raw milk, we completely

identified and listed hazards. We identified the hazards and developed written procedures like SOPs (standard operating procedures) and SSOPs (sanitation standard operating procedures) that define how and what to perform in order to prevent hazards. Following comprehension of all the hazards corresponding to the eight requirements of the Codex general principles, we determined critical control points (CCPs) and established HACCP systems in line with the HACCP system and the guidelines for its application.

Many of “the countries with advanced HACCP system” adopt good manufacturing practice (GMP) or good agricultural practice (GAP) as the prerequisite program (PRP); however, there are no such standards for dairy farms in Japan. Therefore, we adopted preventive control measures (procedures) for hazards, except for the above-mentioned CCPs as PRP (see Table 2).

Code of practices	Procedures	Recordkeeping
Facility maintenance / hygiene control	Tank cleaning	Inspection
	Excreta disposal/cleaning	
Pest control		Deratization and confirmation of efficacy
Waste management	Disposal of dead animals/bugs	
Hygiene control for employees/visitors		Disinfection of visitors (incl. vehicles)
Breeding management, etc.	SSOP, Artificial insemination, etc.	Work log Vaccination Observation checklist, etc.
Total: 13	Total: SSOP:1 Procedures: 23	Total: 16

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**Table 2:** Prerequisite program

## 1.2. Determination of CCPs in establishing HACCP systems

The CCPs used were (1) identification of cows to be milked to prevent contamination by drug residues and (2) raw milk temperature in bulk tanks.

### *Identify cows to be milked*

Critical limit: Milk is antibiotic/antimicrobial residue-free or of below detection limit.

Monitoring includes identifying cows treated with drugs for mastitis or other troubles by means of red duct tape on the tail and hind legs. These are checked against ear-tag numbers written on a white board, and number agreement is confirmed between red mats and red-taped cows. When discrepancy occurs, the cow is milked into a separate bucket and the milk is dumped (see Figure 1).

**Critical limits • Monitoring****Critical limits**

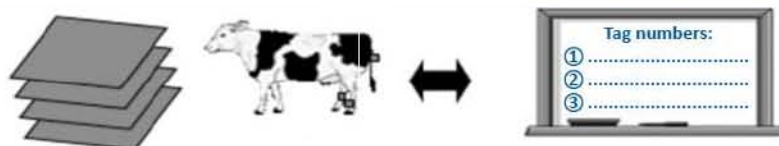
drug residues, e.g. antibiotics, antimicrobials zero or below measurable limits

**Monitoring**

- Match between the no. on a whiteboard and the ear tag no. of cows w/red tapes
- Match between the no. of cows w./no milk shipped and the no. of red mats

**Corrective action****Corrective action**

- The milk should be discarded after bucket milking



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**Figure 1:** HACCP plan 1. CCP: choose cows to be milked

**Bulk tank temperature**

Critical limit: Milk temperature is less than or equal to 8°C one hour after milking.

Monitoring includes visual checking and recording temperature of the tank by milkers at the completion of milking and checking that there is no deviation from critical limits by using a self-recording thermometer. In case of a deviation, the milk is dumped.

Even though a program may be good in content, inadequate training brings no change in the workplace. We drew up thorough programs that were even and moderate in volume, and offered training. Employee's comprehension was determined by multiple choice tests or skill tests; and if found incomplete, we repeated the training.

## 2. APPLICATION OF HYGIENE MANAGEMENT SYSTEM AND THE RESULTS

### 2.1. Training of employees

When applying farm hygiene management system, we provided training for employees using our own training programs. The program for less-experienced employees covered codes but not SSOP procedures; the program for mid-career and experienced employees covered every procedure including SSOPs contained in PRP, codes, and the HACCP plan.

### 2.2. Effectiveness of farm HACCP

To evaluate the effectiveness of farm HACCP, we compared the results for 2012 when the training was completed and the application started, with those for 2010. The year 2011 was a training period and was therefore excluded from the comparison.

Viable bacterial counts, somatic cells counts, and drug residues including antibiotics were measured as an index of safety. Average milk production per cow, cow numbers with abnormal milk production, and survival rate of 12-year-old cows were measured as an index of productivity (see Table 3).



## 1) Protect safety of raw milk

1. Prevent increases in viable bacterial counts, e.g. *Staphylococcus aureus*
2. Prevent drug residues, e.g. antibiotics, antimicrobials
3. Prevent increases in somatic cells counts

## 2) Improvement in productivity (1)

1. Increase in milk production (average per cow)
2. Decreasing ratio of cows w/abnormal milk production
3. Stability in survival rate of 12-month-old cows

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**Table 3:** Effectiveness of implementing HACCP at pilot farms

Viable bacterial counts, somatic cells counts, and drug residue levels showed slight improvement after implementation of HACCP, but no significant differences. This is because these parameters were already low in 2010. No drug residues were detected either before or after the implementation.

Average milk production, cow numbers with abnormal milk production, and survival rate of 12-year-old cows after application significantly improved compared to pre-application (see Table 4)

	Before instruction/training (2010)	After instruction/training (2012)	Statistical test
Average milk production/cow (kg)	31.4	34.0 (**)	0.0028
Ratio of cows w/abnormal milk production (%)	3.22	1.90 (**)	0.0045
Survival rate of 12-year-old cows (%)	94.0	96.6	—

$$t_o = \frac{|\bar{X} - \bar{Y}|}{\sqrt{U_e \left( \frac{1}{m} + \frac{1}{n} \right)}} \quad P < 0.01 **$$

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**Table 4:** Improvement in productivity

## 2.3. Qualitative assessment by owners

After application of farm HACCP, employees' attitudes to work changed: from the feeling of being forced to do work, to working under their own motivation. Employees understand the significance of hygiene management and what each task means, and proactively make suggestions for improvement.

## 3. DISCUSSION

On 4 January 2011, the Food Safety Modernization Act (FSMA) was signed into law in the USA and the FDA published a draft proposal on HACCP. In the near future the operation will start. Consequently, only those food products (including agricultural

and livestock products) produced or manufactured under the management of a HACCP system can be marketed in the USA. This will inevitably be applied to foreign-produced products, and Japan must export products produced under the hygiene management system in compliance with the FSMA.

HACCP will probably be required as a government mandate in "countries with advanced HACCP system" in the near future. Along with such worldwide trends, Japan needs to accelerate the nationwide implementation of HACCP.

Experts from around the world highly appreciate what we showed during the presentation, such as the usefulness of farm HACCP, adequate analysis,

bulk temperature and identification of cows to be milked as CCPs, development of unique means such as distinguishing cows by red tape and mats. They recognize that a world-class HACCP system has been developed and implemented appropriately.

## 4. ACKNOWLEDGMENTS

We have established a promotion committee so that the farm owners were able to conduct model business adequately and effectively. We would like to express appreciation to committee members for the worthwhile support and guidance from a comprehensive viewpoint. We would also like to thank co-researchers who actively participated in the model project and promoted it, and the people in Inoue Dairy Farm, Gumma, who understood the idea of the project and willingly worked with us. In addition, we thank officials of Animal Health, Ministry of Agriculture, Forestry, and Fisheries of Japan for offering us the opportunity to work on the project.

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