H. Takahashi, K. Sato, D. Takata and K. Hayashi
"Damages of Fresh and Processed Fruit Industries Imposed by the 2011 Fukushima Dai-ichi Nuclear Accident and Counteractions Implemented by the Local Agricultural Co-operative. -- The Case of Peach and Ampogaki (Semi-dried Persimmon) in Date City."
Fukushima Mirai Agricultural Co-operative

Established in March 2016 by uniting Four former Agricultural Co-operatives.
United Co-operative Covers 12 municipalities, Four Districts:

- Fukushima District [ Fukushima City, Kawamata Town]
- Date District [ Date City, Kori Town, Kunimi Town]
- Soma District [ Soma City, Minami-soma City, Shinchi Town, Iitate Village]
- Adachi District [ Nihonmatsu City, Motomiya City, Otama Village]

<table>
<thead>
<tr>
<th>Farmer member</th>
<th>2015 Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Semi-Farmer)</td>
<td>94,645</td>
</tr>
<tr>
<td></td>
<td>(46,943)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount of Member Stock</th>
<th>14,230 Million JPY = 111 Million Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Board Member</td>
<td>Director 55, Auditor 8</td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Full time Staff</td>
<td>1,903</td>
</tr>
<tr>
<td>Part time Staff</td>
<td>512</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finance</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members Bank Saving</td>
<td>715 Billion JPY = 5,580 Million Euro</td>
</tr>
<tr>
<td>Total Loan Amount</td>
<td>147 Billion JPY = 1,150 Million Euro</td>
</tr>
<tr>
<td>Mutual Insurance</td>
<td>2,801 Billion JPY = 22 Billion Euro</td>
</tr>
<tr>
<td>Agricultural Sales Amount</td>
<td>27.3 Billion JPY = 213 Million Euro</td>
</tr>
<tr>
<td>Members Purchase Amount</td>
<td>17.6 Billion JPY = 137 Million Euro</td>
</tr>
</tbody>
</table>
The Area of Fukushima-Mirai Agricultural Co-operative
Agricultural Sales (total and by district)

Fukushima Mirai Co-operative
Total (Million JPY)

[By District]
yellow: Fukushima
red: Date
green: Adachi
purple: Soma

図説作業の緊急時環境放射線モニタリングフロー図

取種可否確認検査

○目的
取種の可否を判断
○検査時期
取種時期のおおむね10日～2週間前
○検査対象品目
避難指示解除後の適格区域及び固定制限区域/域の
指定解除からの1年以内の時期を含む。）で検出され
る全ての試料品目
ただし、前年度以降の緊急時モニタリング検査の
結果が5000μSv以下である品目は除く。
○採取方法
旧市町村において原則3点以上
作付面積1ha 基準値を10haを超えるごとに1点
以上追加。

緊急時モニタリング検査

○目的
出荷物の安全性の確認
○検査時期
出荷のおおむね3日前
○検査対象品目
＜市町村＞
主産品目 野菜指定地域、特定野菜、果樹栽培物及び種類（品目）10、農が別途指示する品目、
前年度に5000μSvを超えた品目
＜市町村＞
前年度に出荷制限等に該当した品目、野生のものが出荷制限となっている品目、農が別途指示する品目、
市町村において、事故後初めて出荷するとともに検査実施のない品目
○採取方法
市町村が出荷許可をした方3点以上、さらに、前年度の緊急時モニタリング検査において、放射性セシウム
を検出した市町村の当該品目については、市町村が指定以上の数を検査することができる。
また、前年度の緊急時モニタリング検査において500μSvを超えた品目があった市町村の当該
品目は、市町村が3点以上、市町村ごとに1点以上とし、市町村単位で作付面積が1ha 基準
値を20haを超えるごとに1点以上追加。

解除可否確認検査

○目的
出荷制限等品目の解除可否を判断
○検査時期
出荷前おおむね10日～2週間前
○検査対象品目
出荷制限等品目
○採取方法
解除可否に基づき3点

モニタリング検査へ移行

基準値超過

市町村出荷許可出

出荷

基準値以下

出荷許可

モニタリング検査

出荷制限等解除

解消に向けた緊急時
モニタリング検査

G値出荷

1008μSv以上

1点以上検出

1008μSv以下

全対象点数

G値出荷

G値出荷

※ 上記のほか、放射性物質の飛散の可能性が認められた場合に、検査密度を高めて行う「集中モニタリング」がある。

Monitoring and Inspection Flow
What was done under 2011 Nuclear Disaster:
Preserving Agricultural Heritage of Date District.
Our Policy "Co-operative Operation and Exhaustive Treatment"

Fruit farm (orchard): in winter of 2011, high pressured water cleaning was exhaustively done. 390 unit of operators, cumulative number of worker was 35,000.
Health check and care of operators were also implemented.
Date District made 500 mesh map.

Paddy field: 90 tractors operated operated to spray Zeolite (2t/ha) and Potassium Silicate (2t/ha). Health check and care of operators were also implemented.
Date District 100 mesh map soil and crop research was implemented.
Decontamination efforts aiming at “Non-Detection” (number as of Mar. 2012)

<table>
<thead>
<tr>
<th>Fruit</th>
<th>trees</th>
<th>sites</th>
<th>Fruit</th>
<th>trees</th>
<th>sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>peach</td>
<td>199,896</td>
<td>8,938</td>
<td>grape</td>
<td>8,736</td>
<td>846</td>
</tr>
<tr>
<td>persimmon</td>
<td>257,517</td>
<td>24,847</td>
<td>yuzu (citrus)</td>
<td>356</td>
<td>98</td>
</tr>
<tr>
<td>ume (plum)</td>
<td>11,839</td>
<td>2,563</td>
<td>chestnut</td>
<td>616</td>
<td>137</td>
</tr>
<tr>
<td>apple</td>
<td>30,197</td>
<td>1,620</td>
<td>prune</td>
<td>200</td>
<td>44</td>
</tr>
<tr>
<td>Japanese pear</td>
<td>794</td>
<td>230</td>
<td>loquat</td>
<td>36</td>
<td>19</td>
</tr>
<tr>
<td>fig</td>
<td>6,611</td>
<td>183</td>
<td>karin (quince)</td>
<td>51</td>
<td>29</td>
</tr>
<tr>
<td>plum</td>
<td>11,951</td>
<td>1,169</td>
<td>pomegranate</td>
<td>141</td>
<td>31</td>
</tr>
<tr>
<td>Ginkgo nuts</td>
<td>649</td>
<td>50</td>
<td>blueberry</td>
<td>243</td>
<td>4</td>
</tr>
<tr>
<td>pear</td>
<td>3,367</td>
<td>125</td>
<td>apricot</td>
<td>878</td>
<td>93</td>
</tr>
<tr>
<td>cherry</td>
<td>5,931</td>
<td>428</td>
<td>other</td>
<td>8,634</td>
<td>724</td>
</tr>
<tr>
<td>kiwi fruit</td>
<td>873</td>
<td>139</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total 22 kinds of trees

Total treatment 549,516 trees.

Total field sites 42,317
Effect of Water Cleaning Decontamination
(Comparison of before and after)

<table>
<thead>
<tr>
<th></th>
<th>persimmon</th>
<th>plum</th>
<th>cherry</th>
<th>peach</th>
<th>apple</th>
<th>ume</th>
<th>grape</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>before</strong></td>
<td>603</td>
<td>590</td>
<td>506</td>
<td>570</td>
<td>577</td>
<td>504</td>
<td>570</td>
</tr>
<tr>
<td><strong>after</strong></td>
<td>128</td>
<td>169</td>
<td>263</td>
<td>231</td>
<td>218</td>
<td>274</td>
<td>145</td>
</tr>
</tbody>
</table>

- カキ: persimmon
- スモモ: plum
- オウトウ: cherry
- モモ: peach
- リンゴ: apple
- ウメ: ume
- ブドウ: grape
Sample 21 Fruit Farm: Distribution of Contamination (2012 survey) the left 3 rows indicate the maximum, the right average
Pilot Examination: Toward the production recovery of *Ampogaki* (semi-dried persimmon)
Fresh persimmon detailed survey, sampling from every farm (Yanagawa area, Date City, 2012)
Structure of Association that aims to recover Ampogaki (National and Prefectural Government, Municipality, and Agricultural Co-operative)
Ampogaki and Nuclear Disaster

Under the effect of 2011 Disaster, in Date District, the Ampogaki production has been stopped.

From 2013 the Agricultural Co-operative started model area re-starting experiment and introduced non-destructive inspector, and production management method.

Finally we constructed the new Ampogaki production system that can ensure complete food safety.

Because fresh persimmon have much difference (deviation) of contamination, and because of drying process can increase density of contamination as well, such system must include:

1) Non contaminated fresh persimmon.
2) The product is subject to exhaustive inspection (covering every individual unit), utilizing non-destructive inspector.
3) Management system from farm to processing (drying and packaging) is introduced.
Careful cleaning of drying house was done in order to prevent secondary contamination (transfer).
Towards the Recovery of *Ampogaki* (chronicle viewpoint)

### 2011
- De-contamination
  1. Cleaning Surface of Trees
  2. Cutting of branches

### 2012
1) Examination of Fresh Persimmon
   1) Examination of All Farmers Farm
   2) Research of Intra-tree transfer
   3) Research of the Effect of Cutting Branch
   4) Consideration of Cleaning method of Drying house

2) Construction of Non Destructive inspector and preparation of Exhaustive inspection.

### 2013 and after
1. Production of Fresh Persimmon *non-contaminated.*
   (and start experimental drying)
2. Construction of Exhaustive inspection system
3. Construction of Management system from farm to processing
4. Promotion of Sales by communicating with retailers
5. Replacing old trees and cutting branches

1–3 are done by the support of prefecture! Ampogaki promotion association.

Baby persimmon research
2013 started experimental processing of persimmon

1. Using safe fresh persimmon [setting pilot area for restarting.]
   Baby persimmon research (July) and setting pilot area.
   Also before-harvest research was done.

2. Non-Destructive inspection system was constructed
   By this, every unit of dried persimmon inspected
   S.L. (screening level) is set to 50Bq/kg

3. Management system from farm to processing
4. Promotion
5. Replacing of trees

Ceremony of pilot restarting project (Dec 2013)  Non-Destructive Exhaustive Inspection
Every unit of Ampogaki is subject to inspection. When a unit exceeds screening level, that unit cannot be sold. Otherwise, ensure stamp is put on and then sold to the market.
Every unit of *Ampogaki* is subject to inspection system and after inspection ensure stamp is put on.

The stamp to ensure safety and quality.
Photos (water cleaning in 2011 winter; processing; ceremony of restarting)
Price (JPY per kg) and Sales amount (t)
あんぽ柿出荷形態

収穫期の蜂屋柿

2016年～ 個包装開始
800g平核無柿

収穫期の平核無柿

2014年～ トレー袋

1kg蜂屋柿平箱
Inspection Data (by types)  

<table>
<thead>
<tr>
<th>Year</th>
<th>蜂屋</th>
<th>平核無</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>659,008</td>
<td>(0.15)</td>
</tr>
<tr>
<td>2014</td>
<td>1,632,096</td>
<td>(0.19)</td>
</tr>
<tr>
<td>2015</td>
<td>3,179,024</td>
<td>(0.28)</td>
</tr>
<tr>
<td>2016</td>
<td>3,578,336</td>
<td>(0.09)</td>
</tr>
<tr>
<td>2017</td>
<td>4,094,840</td>
<td>(0.04)</td>
</tr>
</tbody>
</table>

( ) percentage excess S.L.
Data by Package (no excess of S.L.)

- **2016**
  - 蜂屋: 42,426
  - 平核無: 1,494

- **2017**
  - 蜂屋: 57,234
  - 平核無: 5,636
Opening of New Facility of Ampogaki Processing (June, 2016)
Sales of Fresh Peach (Fukushima Mirai Agr. Co-op)
Tokyo Central Wholesale Market Data:
Fresh Peach Amount by Prefecture (2002-2018)
Merci Beaucoup!
Introduction & Objectives

- Peaches are among the major commodities produced in Fukushima prefecture, where the annual peach production was valued at 10 billion JPY and accounted for approximately 1/5th of the total peach production in Japan in 2010. However, there have only been a few attempts to understand the migration of radionuclides in peach trees. Therefore, there is an urgent need to clarify the impact of radionuclides on peach trees.

Materials and Methods

- Determined radiocesium concentration in peach fruits since 2012 at Date city in North Fukushima.

  Date city is one of the places deposited high level radioactivity, farmer have been able to produce fruits including less than regulation value of radiocesium as commercial cultivation.

- Radiocesium concentration of peach fruits at 15 days after full-blooming (DAF15, DAF 0 = late April) was the highest through fruit growth stage.

Fig.1 Air dose rate in Fukushima prefecture
**Results**

**Fig. 2** Annual Changes in Peach Fruit Cs-137 (Left) and K-40 (right) Concentration

- **Cs-137 (Bq/kgDW)**: Decreased from 2011 to 2015, peaking around 2011.
- **K-40 (Bq/kgDW)**: Showed variability but no clear trend over the years.

Legend:
- Peach fruit growth period (full bloom – harvest, usually 103 days)
- 15 Days after full bloom
- Harvest
- Accident Timing

**Fig. 3** Rate of Changes in Peach Fruit Radionuclide Concentration

- Changes in Cs would approximate to a changes in K

**Conclusions**

The Cs-137 concentration of peach fruits decreased drastically during the young immature stage, from DAF15 to 60, and then the concentration kept the low level until harvest at DAF103.

The Cs-137 concentration of peach fruits decreased every year for three years after the accident. However, the decreasing manner of Cs-137 in mature fruits was saturable, and consequently the Cs-137 concentrations in mature fruits after 2014 were not low compared with the previous year.