Controlling Aflatoxins in the Food Chain-
The Indonesian Experience

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Content of Presentation

• Introduction
  – Aflatoxins and their effect to health
  – Regulation related to aflatoxin
• Aflatoxins occurrence in food chain (corn and peanut)
• Networking related to aflatoxins and mycotoxins control
• Implementation (adoption) of good practices
• Conclusions
Introduction

• Indonesia as tropical countries – hot and humid – favorable for the growth of mold and mycotoxin production

• Important agricultural commodities
  – Corn, peanut – national consumption
  – Cacao, coffee – export commodities

• Impact of aflatoxins
  – Health – the national health
  – Economy : notification / detention of exported commodities
  – In 2010-2011, Indonesia received 14 notification from EU RASFF (Rapid Alert System on Food and Feed), due to the aflatoxin contamination on nutmeg; AFB1 = 6,4-120 µg/kg and AF(total) = 10,1-140 µg/kg; EU Regulation 165, 2010 AFB1 = 5 µg/kg and AF(total) 10 µg/kg
Regulation

• For feeds
  – SNI (Indonesian National Standard) for feed was established in 1995
    • Maximum level of total aflatoxins of feed-corn: 50 ppb (final product)

• For foods
  – 2004, Indonesian Food and Drug Control Agency:
    • Maximum level of aflatoxins in food: 35 ppb and AFB1 20 ppb
  – 2009 Indonesian National Standardization Agency launched SNI 7385-2009: standard for mycotoxin maximum level of some food products
SNI 7385:2009 - Aflatoxins maximum level in food products, by Indonesian National Standardization Agency

<table>
<thead>
<tr>
<th>No</th>
<th>Food products</th>
<th>Type</th>
<th>Max level (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milk and milk drink products</td>
<td>M1</td>
<td>0.5</td>
</tr>
<tr>
<td>2</td>
<td>Fermented milk and rennin hydrolyzed milk products</td>
<td>M1</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>Concentrated milk and its analog</td>
<td>M1</td>
<td>0.5</td>
</tr>
<tr>
<td>4</td>
<td>Cream and their related products</td>
<td>M1</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>Dried milk and related products</td>
<td>M1</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Cheese and analog products</td>
<td>M1</td>
<td>0.5</td>
</tr>
<tr>
<td>7</td>
<td>Dessert (pudding, yogurt)</td>
<td>M1</td>
<td>0.5</td>
</tr>
<tr>
<td>8</td>
<td>Whey and its products</td>
<td>M1</td>
<td>0.5</td>
</tr>
<tr>
<td>9</td>
<td>Peanut and their products</td>
<td>B1/Total</td>
<td>15/20</td>
</tr>
<tr>
<td>10</td>
<td>Corn and their products</td>
<td>B1/Total</td>
<td>15/20</td>
</tr>
</tbody>
</table>

EU Regulation 165, 2010; AFB1 = 5 µg/kg and AF(total) 10 µg/kg

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### SNI - 7385:2009: Other mycotoxins maximum level in food

<table>
<thead>
<tr>
<th>Mycotoxin</th>
<th>Products</th>
<th>Max ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deoxinivalenol</td>
<td>Corn and its products</td>
<td>1000</td>
</tr>
<tr>
<td>Fumonisin B1 and B2</td>
<td>Corn and corn as a raw material</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>Corn food products (flakes, popcorn, corn chips)</td>
<td>1000</td>
</tr>
<tr>
<td>Ochratoxin</td>
<td>Cereal (rice, corn, sorghum, wheat) and their products</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Spices</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Coffee</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Instant coffee</td>
<td>10</td>
</tr>
<tr>
<td>Patulin</td>
<td>Apple, extract apple, canned apple</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Puree apple</td>
<td>25</td>
</tr>
</tbody>
</table>
Overview of controlling Aflatoxins in the Food Chain: The Indonesian Experience (2003 – now)

Survey and Research
- Aflatoxin contamination in food chain (corn and peanut)
- Ochratoxins (coffee and cacao)
- Post harvest practices, Processors, Identified problems

Networking
- ABG: Academia, Business, Government
- AFI: Aflatoxin Forum Indonesia, since 2006
- MycoFI: Mycotoxins Forum Indonesia (since Oct, 2012)

Implementation good practices
- Training, Workshop, Field School
- Model for Good Agricultural Practices

Center of Excellence for Mycotoxin Studies (CEMycoS)
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Survey

- Aflatoxins occurrence in food chain (corn and peanut)
- Ochratoxins (coffee and cacao)
- Post harvest practices, Processors, Identified problems

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## Important Agricultural Commodities in Indonesia

<table>
<thead>
<tr>
<th>Year</th>
<th>Corn (Ton/Y)</th>
<th>Peanut (Ton/Y)</th>
<th>Un-hulled Rice (Ton/Y)</th>
<th>Soybean (Ton/Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>16,317,252</td>
<td>770,054</td>
<td>60,325,925</td>
<td>775,710</td>
</tr>
<tr>
<td>2009</td>
<td>17,629,748</td>
<td>777,888</td>
<td>64,398,890</td>
<td>974,512</td>
</tr>
<tr>
<td>2010</td>
<td>18,327,636</td>
<td>779,228</td>
<td>66,469,394</td>
<td>907,031</td>
</tr>
<tr>
<td>2011</td>
<td>17,643,250</td>
<td>691,289</td>
<td>65,756,904</td>
<td>851,286</td>
</tr>
<tr>
<td>2012</td>
<td>18,961,645</td>
<td>709,063</td>
<td>68,956,292</td>
<td>783,158</td>
</tr>
</tbody>
</table>

### Uses
- Feed
- Staple food (certain area)
- Snack
- Peanut sauce
- Snack
Total Number of Corn Sample =123

Aflatoxins occurrence in corn and corn based food

Level of aflatoxin contaminations increase at retailer

However corn based foods (flakes and marning) have low aflatoxin contamination

It is expected that ‘processing’ was able to reduce aflatoxin

Soaking and cooking in Ca(OH)₂ solution – step for the reduction aflatoxin
Sun-drying of corn at collector at Papar

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Samples were taken from farmer – retailer – traditional market – from 4 (five) production area.

Peanut at farmer level usually have low contamination of aflatoxin, however contamination level increase at retailer and market levels.

Peanut based products were also taken from the production area. Except sweetened peanut and peanut sauce, the contamination of aflatoxin were lower than the maximum level allowed.
Hybrid Dryer

Flipping peanut during drying by walking over
Identified Problem

- Low productivity
  - For corn about 3.5 ton/Ha, max.
  - For peanut about 1 ton/Ha, max. 3.5 ton/Ha
- Low quality of seed
- Less seed (50 kg/ha) which planted (normally 90-100kg/ha)
- Limitation of irrigation, fertilizer and pest control
- Improper agricultural, post harvest and material handling practices
- Low quality and safety (high aflatoxin level)
- Low prize and limited market opportunity

Business meeting with community, farmer groups, and local government at PATI
Aflatoxin Forum Indonesia (AFI) is a forum communication among government, research institute, university, industry, farmer, and community related to aflatoxin and their effect in health.

Objectives:
- To increase the awareness related to aflatoxin
- To establish integrated program
- To set up priority to control aflatoxin problem
- To organize concrete program and activities
- To support the government in socializing the regulation related to aflatoxin

Integrated Program by ABG networking

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Aflatoxin Forum Indonesia

- AFI-1 – 24 Feb 2006, UGM
- AFI-2 – 28 July 2006, at BKP Surabaya
- AFI-3 – 17 January 2008, UGM
- AFI-4 – 23 Oct 2008, UGM
- AFI-5 – 21 Dec 2010, UGM
- AFI-6 – 29 Sept 2011, BKP Semarang
- AFI-7 – 21 Nov 2011, UGM
- AFI-8 – MYCOFI (October 2012) UGM
The strategies and programs

- Establishing comprehensive program for training based on the existing problem – Training and assistance to the local farmer and traders – Field School
- Establishing guidelines for good agricultural practices (including the use of fungus and toxin resistant varieties of plants, proper irrigation techniques and fertilizer practices, pest control, and crop rotation)
- Establishing guidelines for good post harvest and material handling practices (including drying practices and storage condition)
- Research on applicable technology approaches in peanut and corn production
Cultivation

- Field preparation
- Fungal resistant seed
- Pest and disease control
- Plant maintenance (irrigation and fertilizer)
- Equipments for agriculture

Harvest

- Right schedule for harvest
- Harvest
- Drying, cleaning, sortation
- Equipment for harvest

Post harvest

- Drying (maintenance of water activity)
- Storage (temperature and relative humidity)
- Pest and disease control
- Packaging
- Equipments for post harvest

Added value

- Product development
- Decontamination of aflatoxin
- Packaging, storage, and marketing
- Equipments for processing
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Occurrence of OTA in COFFEE and CACAO Yogyakarta, 2012

<table>
<thead>
<tr>
<th>CACAO Samples</th>
<th>OTA (ppb)</th>
<th>COFFEE bean samples</th>
<th>OTA (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-1</td>
<td>7.85</td>
<td>F-1</td>
<td>11.21</td>
</tr>
<tr>
<td>F-2</td>
<td>13.19</td>
<td>F-2</td>
<td>3.37</td>
</tr>
<tr>
<td>F-3</td>
<td>29.49</td>
<td>F-3</td>
<td>8.58</td>
</tr>
<tr>
<td>F-4</td>
<td>10.61</td>
<td>F-4</td>
<td>2.34</td>
</tr>
<tr>
<td>F-5</td>
<td>6.68</td>
<td>F-5</td>
<td>5.26</td>
</tr>
<tr>
<td>F-6</td>
<td>19.83</td>
<td>F-6</td>
<td>3.49</td>
</tr>
<tr>
<td>F-7</td>
<td>17.29</td>
<td>F-7</td>
<td>8.38</td>
</tr>
<tr>
<td>F-8</td>
<td>8.50</td>
<td>F-8</td>
<td>2.55</td>
</tr>
<tr>
<td>F-9</td>
<td>17.09</td>
<td>F-9</td>
<td>2.64</td>
</tr>
<tr>
<td>F-10</td>
<td>12.31</td>
<td>F-10</td>
<td>2.77</td>
</tr>
<tr>
<td>C-11</td>
<td>17.95</td>
<td>C-11</td>
<td>4.16</td>
</tr>
<tr>
<td>C-12</td>
<td>10.67</td>
<td>C-12</td>
<td>3.48</td>
</tr>
</tbody>
</table>

Application of Fermentation and Drying for Cacao Production

Focus Group Discussion For Development System for Sustainable Cacao Production

VILLAGE MODEL for adoption good practices in Cacao Production at Yogyakarta, 2013
Implementation of Good Practices

• Training, Workshop, Field School
  – Field School at Pati

• Good Agricultural Practices
  – Model for peanut plantation - Jepara
Field School

- Field School has been designed and organized for peanut farmer at producer area.
- Content: Theory and Field Practices
  - Selection of peanut seed
  - Good agronomic practices
  - Good pre and post harvest practices
  - Identification and control plant diseases

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Opening Ceremony, 1 Feb 2008
“Low-Aflatoxins Peanut Planting”

Harvesting Ceremony, 8 May 2008
“Low-Aflatoxins Peanut”

Model – Area for ‘Good’ Peanut Plantation at Jepara, Java, in collaboration with the Local Government

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Model – Area for ‘Good’ Peanut Plantation at Jepara, Java, in collaboration with the Local Government
Integrated Farming System
Post Harvest Technology by Utilizing Biogas on Hybrid Drying Tool for Peanut and Gaplek in Jepara

Rapid drying - to improve the quality and safety
Good Practices
Silo di Kab. Sragen

<table>
<thead>
<tr>
<th>NO</th>
<th>Village</th>
<th>Aflaktoxin B₁ (ppb)</th>
<th>NO</th>
<th>Village</th>
<th>Aflaktoxin B₁ (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sono</td>
<td>6,4</td>
<td>9</td>
<td>Mojopuro</td>
<td>0,66</td>
</tr>
<tr>
<td>2</td>
<td>Sono</td>
<td>11,25</td>
<td>10</td>
<td>Mojopuro</td>
<td>18,35</td>
</tr>
<tr>
<td>3</td>
<td>Sono</td>
<td>0,85</td>
<td>11</td>
<td>Mojopuro</td>
<td>0,46</td>
</tr>
<tr>
<td>4</td>
<td>Sono</td>
<td>4,35</td>
<td>12</td>
<td>Mojopuro</td>
<td>0,30</td>
</tr>
<tr>
<td>5</td>
<td>Kedawung</td>
<td>0,05</td>
<td>13</td>
<td>Mojopuro</td>
<td>6,25</td>
</tr>
<tr>
<td>6</td>
<td>Kedawung</td>
<td>5,88</td>
<td>14</td>
<td>Mojopuro</td>
<td>6,05</td>
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<tr>
<td>7</td>
<td>Kedawung</td>
<td>0,38</td>
<td>15</td>
<td>Ngandul</td>
<td>0,46</td>
</tr>
<tr>
<td>8</td>
<td>Kedawung</td>
<td>0,53</td>
<td>16</td>
<td>Ngandul</td>
<td>0,41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td>Ngandul</td>
<td>0,80</td>
</tr>
</tbody>
</table>
Workshop Food borne Fungi and Mycotoxin Analysis for Industry
Workshop on Food Borne Fungi with the Industries, 21-22 Oct 08
Mycotoxin Forum Indonesia (MycoFI) – Workshop on Fusarium and Mycotoxin Analysis, 8-9 October 2012
International Conference on Mycological Aspects of Food and Feed Safety

Date: 27 - 28 June 2013
Venue / Organizer:
Faculty of Agricultural Technology
(Center of Excellence for Mycotoxin Studies / CEMycoS)
Gadjah Mada University,
Bulaksumur, Yogyakarta, INDONESIA

Website: cemycos.tp.ugm.ac.id
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Conclusions

• Aflatoxin Forum Indonesia is effective media in establishing of communication network.
• By good communication – integrated program in minimizing aflatoxin in food products can be set up by related parties (government, universities, industries, farmer groups, community)
• Several strategies for prevention and control aflatoxins have been promoted.
• Collaboration between universities, research institutes, government, farmer, traders, industries will be effective in implementation these strategies.

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Acknowledgment

Thank you for your attention