Oats in South-East Asia
Taiwan as a Springboard

Yung-Fen Huang and Chia-Shen Chen
Acknowledgement

International Oat Nursery

Breeders

Executive committee

Steve Harrison

Nicholas A. Tinker
Charlene P. Wight
Weikai Yan
Vern Burrows
World Production of Oats

Production quantities by country  Average 2010 - 2013

Regional Oat production (2010-2013)

- Europe: 62.5%
- Americas: 25.9%
- Asia: 4.7%
- Africa: 1.2%
- Oceania: 5.7%

Source: FAO
Asia Oat Production

2010 – 2013 Average Production (tonnes)

- China, mainland: 557,250.0
- Kazakhstan: 211,017.5
- Democratic People's Republic of Korea: 18,987.5
- Mongolia: 6,183.0
- Armenia: 3,497.5
- Cyprus: 774.0
- Japan, Lebanon: 217.3
- Georgia: 1,020.8
- Kyrgyzstan: 2,335.3
- Tajikistan: 2,593.8
- Azerbaijan: 3,175.5

Source: FAO
Pakistan (2004): oats were grown on 35% of total forage land. Record green forage 80-120 tonnes/ha.
- World oat production is generally concentrated between latitudes 35-65°N and 20-46°S.

- Oats require generally cool (15-25°C) and long-day condition.
Geography & Climate

- Total surface: 3,618,995 ha
  - 27% plain
  - 27% hill
  - 45% mountain

- Climate
  - Sub-tropical (North)
  - Tropical (South)
  - Temperate (Mountain)

Geography & Climate

Oats are not stranger in Taiwan

Oat planting record in Taiwan (1906): for forage use
Field experiment 1940 (Kuroki 1941)

Experiment site: Hengchun (tropical plain)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Sowing date</th>
<th>Heading date</th>
<th>Days to heading</th>
<th>Plant height (cm)</th>
<th>Tiller no.</th>
<th>Yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Sun-Oriented</td>
<td>Oct 10(^{th})</td>
<td>Dec 25(^{th})</td>
<td>76</td>
<td>90.2</td>
<td>35.0</td>
<td>4302.1</td>
</tr>
<tr>
<td>Indian oat (A)</td>
<td>Nov 1(^{st})</td>
<td>Feb 1(^{st})</td>
<td>92</td>
<td>142.0</td>
<td>9</td>
<td>2329.9</td>
</tr>
<tr>
<td>Indian oat (B)</td>
<td>Oct 30(^{th})</td>
<td>Jan 22(^{nd})</td>
<td>84</td>
<td>130.6</td>
<td>15.5</td>
<td>2680.4</td>
</tr>
<tr>
<td>Late Sun-Oriented</td>
<td>Oct 30(^{th})</td>
<td>Jan 23(^{rd})</td>
<td>85</td>
<td>130.6</td>
<td>16.2</td>
<td>3656.7</td>
</tr>
</tbody>
</table>

Adapted from Table 7, Kuroki (1941)
Present Context in Taiwan

- Forage occupies 30-50% of production cost in dairy cattle farms.
- Approximately half of the forage is imported.

Source data: Custom Administration, Ministry of Finance, Taiwan, R.O.C.
Context in Taiwan

- Winter forage is needed.
- Winter forage can be planted on fallow land and between two rice crops (Nov to Feb).

Taiwan Land Distribution

- Crop land (non-rice): 15.4% (166.6 kha)
- Rice field: 4.4% (51.0 kha)
- Fallow land: 1.3%
- Other (Mountain, hill, plain): 78.9%

Source data: Council of Agriculture, Taiwan, R.O.C.
An Integrative Project (2016-2019)

**Raw Material**
- Evaluation of forage varieties
- Growth condition & methods
- Machine development

**Processing**
- Hay
- Drier
- Energy-saver drying method
- Storage
- Silage
- Good strain for fermentation
- Anti-fungi protection
- Palatability

**Quality control**
- On-line QC tool
- Quality follow-up

**Animal raising**
- Forage recipe
- Animal experiment
Oat germplasm introduction

International Oat Nursery

2015 nursery:
- 71/71 pure lines
- 39/121 segregating populations
- 7/40 pure lines

Seed increase and preliminary phenotype observation at Taipei (sub-tropical plain) and Hengchun (tropical plain)
Taipei (subtropical plain)
Nov. 17th 2015
32 days after sowing
Kenting (tropical)
Nov. 16\textsuperscript{th} 2015
29 days after sowing
Breeding Oats for Taiwan: Past and Present

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Thank you for your attention!
Table 7, Kuroki (1941)

<table>
<thead>
<tr>
<th>品種</th>
<th>播種期 (月・日)</th>
<th>出穂期 (月・日)</th>
<th>草丈 (cm)</th>
<th>分収 (本)</th>
<th>園長 (cm)</th>
<th>小穂数</th>
<th>10 a 穀収量 (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>早生日向燕麦</td>
<td>10.10</td>
<td>12.25</td>
<td>90.2</td>
<td>35.9</td>
<td>31.0</td>
<td>77.0</td>
<td>417.3</td>
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<tr>
<td>印度燕麦 (A)</td>
<td>11.1</td>
<td>2.1</td>
<td>142.0</td>
<td>9.0</td>
<td>28.6</td>
<td>78.7</td>
<td>226.0</td>
</tr>
<tr>
<td>印度燕麦 (B)</td>
<td>10.30</td>
<td>1.22</td>
<td>130.6</td>
<td>15.5</td>
<td>26.0</td>
<td>69.7</td>
<td>269.0</td>
</tr>
<tr>
<td>早生日向燕麦</td>
<td>10.30</td>
<td>1.23</td>
<td>130.6</td>
<td>16.2</td>
<td>37.2</td>
<td>82.7</td>
<td>354.7</td>
</tr>
</tbody>
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