Seed Type Sold in the World Market

1. OP (open pollination) type
2. F₁ hybrid (crossing elite lines)
3. GM (genetically modified) seed (F₁)
Changes in World Seed Market Magnitude

World Seed Market

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>12.0</td>
<td>18.0</td>
<td>30.0</td>
<td>34.0</td>
<td>38.0</td>
<td>42.0</td>
<td>43.0</td>
<td>45.0</td>
<td><strong>48.2</strong></td>
<td>61.5</td>
</tr>
</tbody>
</table>

[ISF (International Seed Federation) 2013, NWB]

CAGR: 3-5%

World GM Seed Market

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>0.09</td>
<td>1.51</td>
<td>2.42</td>
<td>5.10</td>
<td>6.70</td>
<td>9.04</td>
<td>10.48</td>
<td>11.70</td>
<td>13.20</td>
<td>14.60</td>
<td>15.60</td>
<td><strong>15.70</strong></td>
</tr>
</tbody>
</table>

Global market value of biotech crops = biotech seed + technology fee (ISAAA, 2014)

GM seed of total seed market: 33%
Global Seed Market Distribution

- Corn: 32%
- Vegetables: 18%
- Soybean: 12%
- Rice: 10%
- Other: 6%
- Canola: 5%
- Wheat: 4%
- Potato: 4%
- Sugar Beet: 2%
- Sunflower: 2%
- Barley: 2%
- Cotton: 3%
- Sugar Beet: 2%
- Sunflower: 2%
- Canola: 5%
- Other: 6%
- Rice: 10%
- Soybean: 12%
- Corn: 32%
- Vegetables: 18%
Seed Market in Korea

- Seed from cereals, horticultural crops, medicinal plants & etc.
- Annual growth rate: 5%
- 1.2% of global seed market.
Seed Market Composition

Korean government controls the cereal market.

(RDA, 2013)
General Process of Seed Business

It takes 7-10 years to get one variety!
Vegetable Seed Market Growth in Korea

Annual growth rate: 7.5% (KSA, 2014)
- Vegetable seed market in 2014: $230M
- 1% = $2.3M
Production Value of Crops (average of 2007-2011)

A total vegetable produce market: ~9.5B$ (2013)

(Dr. MK Yoon, 2013)
Vegetable Seed Company

Employee: 430 (domestic)

Annual Sale 1st ranked in Korea

Nongwoo Bio Co.

KOSDAQ (since 2002)

Agbiotech R&D

An affiliate of NH

NWB was merged with NH on Sept. 1, 2014
Organization of NWB

President (CEO)

Auditor

Executive Director

B. Director

M. Director

S. Director

Finance

Domestic

Marketing

Oversea

Production

Affiliates

QA

R&D

FAC

BEIJING SHINONG CHINA

NONGWOO SEED AMERICA

PT. KOREANA SEED INDONESIA

NONGWOO SEED INDIA

NONGWOO SEED MYANMAR
Organization of R&D

Director

Biotechnology Institute (at Yeoju)
- Molecular Breeding
- Marker Development
- Marker Analysis
- Phytopathology Research
- Basic Research
- Tissue Culture Research

6 team

Breeding Institute (at Yeoju)
- Chinese cabbage, lettuce
- Radish
- Cabbage, broccoli, cauliflower
- Hot and sweet pepper
- Tomato
- Oriental melon, melon
- Maize

7 team

Breeding Institute at Beijing, Kwangdon, Hebei in China
Breeding Institute at California in U. S. A.
Kediri-Jatim Breeding Institute in Indonesia
Banglore Breeding Institute in India
Research Farm in Myanmar

Stock seed production center (3 team) at Yeoju

3 team

3 institutes & 1 center

Breeding Institute (at Miryang)
- Watermelon, squash, zucchini
- Onion, spring onion
- Cucumber

3 team

International Collaboration

Banglore Breeding Institute in India
Kediri-Jatim Breeding Institute in Indonesia
Research Farm in Myanmar
Human Resources for R&D (domestic)

- R. Scientist: 61
- Breeder: 29
- Biotech. S.: 30
- Engineer: 23
- Foreigner: 17
- Ad: 11
- etc.: 11
- Stock center: 2
- PhD: 17
- MS: 27
- BS: 17

Total: 184
Location of R&D Institute and Farm

Domestic
- Yeoju Breeding Institute
- Biotechnology Institute
- Yangkiri stock seed production farm
- Bonduri Pathology research farm
- Noen Research farm
- Miryang Breeding Institute

Foreign

“55ha”
Cultivation Area and No. of Research Scientist Abroad

- **India**: Total: 7, Area (ha): 2
- **China**: Total: 89, Breeder: 2
- **Indonesia**: Total: 18, Breeder: 1
- **Myanmar**: Total: 12, Area (ha): 3
- **USA**: Total: 83, Breeder: 8

Legend:
- **Area (ha)**
- **Breeder: 8**
Annual Turnover of NWB

65M$ in 2014 (net profit: 20%)
Global total: 85M$ in 2014
Sales Magnitude from Exporting

M$

20.0 M$

25M$ in 2014
### Vegetable Seed Sales of Seed Companies

<table>
<thead>
<tr>
<th>Company</th>
<th>2012 (M$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monsanto</td>
<td>851</td>
</tr>
<tr>
<td>Limagrain</td>
<td>756</td>
</tr>
<tr>
<td>Syngenta</td>
<td>682</td>
</tr>
<tr>
<td>Nunhems</td>
<td>410</td>
</tr>
<tr>
<td>Rijk Zwaan</td>
<td>340</td>
</tr>
<tr>
<td>Sakata</td>
<td>295</td>
</tr>
<tr>
<td>Takii</td>
<td>267</td>
</tr>
<tr>
<td>Enza Zaden</td>
<td>233</td>
</tr>
<tr>
<td>Bejo Zaden</td>
<td>178</td>
</tr>
<tr>
<td>East West</td>
<td>120</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>NWB</strong></td>
<td><strong>85 (global)</strong></td>
</tr>
<tr>
<td>Kaneko</td>
<td>75</td>
</tr>
</tbody>
</table>

Cf) World vegetable seed market: $5B (2012)
Breeding Institute (domestic)

Objective: development of elite seeds ($F_1$ hybrid)

<table>
<thead>
<tr>
<th>Yeoju Institute (7 team):</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Chinese cabbage, lettuce</td>
</tr>
<tr>
<td>□ Radish, carrot</td>
</tr>
<tr>
<td>□ Cabbage, broccoli, cauliflower</td>
</tr>
<tr>
<td>□ pepper</td>
</tr>
<tr>
<td>□ Tomato</td>
</tr>
<tr>
<td>□ Oriental melon, melon</td>
</tr>
<tr>
<td>□ Cucumber</td>
</tr>
<tr>
<td>□ Maize</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Miryang Institute (3 team):</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Watermelon, rootstock, squash, zucchini</td>
</tr>
<tr>
<td>□ Onion, spring onion</td>
</tr>
<tr>
<td>□ Cucumber</td>
</tr>
</tbody>
</table>

500 $F_1$ varieties are sold in the market every year

Since 1998, about 1000 varieties have been developed.
Objective:
- Provide breeding tools and new genetic sources

☐ Molecular Breeding
☐ Marker Development
☐ Marker Analysis
☐ Phytopathology Research
☐ Basic Research
☐ Tissue Culture Research
R&D Budget (domestic)

11M$ in 2014, 12M$ in 2015
(In addition, 2.5M$ from Government)
A Pipeline through Technology Combination

- Classical breeding technology
- DNA marker application
- New breeding tool
- Disease resistance screening
- Biochemical analysis
- New genetic sources
- Selection
- Production
- Assurance of quality
- Sale
### 1) PVPR

<table>
<thead>
<tr>
<th>Crop</th>
<th>Number of Varieties (PVPR issue)</th>
<th>Crop</th>
<th>Number of Varieties (PVPR issue)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radish</td>
<td>71 (31)</td>
<td>Watermelon</td>
<td>32 (18)</td>
</tr>
<tr>
<td>Chinese cabbage</td>
<td>42 (26)</td>
<td>Carrot</td>
<td>8</td>
</tr>
<tr>
<td>Cabbage</td>
<td>18 (1)</td>
<td>Onion</td>
<td>28</td>
</tr>
<tr>
<td>Pepper</td>
<td>109 (18)</td>
<td>Green onion</td>
<td>8</td>
</tr>
<tr>
<td>Tomato</td>
<td>19 (5)</td>
<td>Lettuce</td>
<td>15 (9)</td>
</tr>
<tr>
<td>Cucumber</td>
<td>20 (12)</td>
<td>Spinach</td>
<td>16</td>
</tr>
<tr>
<td>Oriental melon</td>
<td>11 (8)</td>
<td>Others</td>
<td>148 (6)</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>37 (6)</td>
<td>Total</td>
<td>582 (132)</td>
</tr>
</tbody>
</table>

For last 10 yrs (2003-12)
### 2) Patent

<table>
<thead>
<tr>
<th>Application</th>
<th>Registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>Domestic</td>
</tr>
<tr>
<td>Foreign</td>
<td>Foreign</td>
</tr>
<tr>
<td><strong>since 2003</strong></td>
<td><strong>10</strong></td>
</tr>
<tr>
<td><strong>1</strong></td>
<td><strong>11</strong></td>
</tr>
<tr>
<td><strong>5</strong></td>
<td></td>
</tr>
</tbody>
</table>
Vision 2020

“Global Top 10 in 2020”

Core value

Customer centered  Global  Change  R&D focused  Environmental friendly

Goal

One of the world’s leading companies in the vegetable seed industry  180M$ (2020)