Current Situation and Future Prospects for National Genetic Evaluation of Cattle in Thailand

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Current Situation
National Genetic Evaluations
DPO Genetic Evaluation
DPO Genetic Trends
Future Prospects
Final Thoughts

Current Situation - Thailand

Dairy Cattle Popn = 300,000
Recorded Cows = 30,000 (10%)
DPO = 2,000 (7%)
DLD = 24,000 (80%)?
Private Farms = 4,000 (13%)?

Published Genetic Evaluations

Public Sector
DPO
Since 1996
Kasetsart Univ
DLD
Since 2006?

Private Sector
Chokchai Farms
Since 2002?
Khon Khaen Univ

Observation

Tremendous Potential for Growth and Development of National Genetic Evaluations in Thailand

Why Are National Genetic Evaluations Needed?

Provide a Uniform Comparison Tool Within a Country
Selection and Mating Tool Uni & Multibreed
Maximize Accuracy of Prediction and Animal Rankings
Marketing Tool Increase Economic Value of Animals
Major Components

- Cattle Population
- Genetic Evaluation System
- Data Collection & Maintenance System
- Continuity & Dynamic Goals
- Flexible Organization & Resources

DPO Genetic Evaluation

- 1996
  Single Trait Sire (or Dam) Model (SAS)
  100d MY, kg; 100d FY, kg
- 1997-1999
  Single Trait Animal Model (MATVEC)
  100d MY, kg; 100d FY, kg
- 2002-2004
  Multiple Trait Animal Model (ASREML)
  100d MY & 100d FY, kg; 305d MY & 305d FY, kg
  Lact Length, d; Age at First Calving, mo

Mating Scheme - DPO

- Upgrading to Holstein
- Many Intermediate Crossbred Groups

Cattle Population - DPO

- Multibreed
  Population composed of purebred and crossbred animals that interbreed

Complete Multibr Popn
UF Angus-Brahman Herd

<table>
<thead>
<tr>
<th>Breed Group of Sire</th>
<th>BGDam</th>
<th>A</th>
<th>.75 A</th>
<th>.50 A</th>
<th>.25 A</th>
<th>B</th>
<th>Br</th>
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<tbody>
<tr>
<td>A</td>
<td>35</td>
<td>12</td>
<td>17</td>
<td>20</td>
<td>30</td>
<td>30</td>
<td>33</td>
</tr>
<tr>
<td>.75 A</td>
<td>25</td>
<td>16</td>
<td>19</td>
<td>18</td>
<td>32</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>.50 A</td>
<td>33</td>
<td>15</td>
<td>20</td>
<td>20</td>
<td>36</td>
<td>33</td>
<td></td>
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<tr>
<td>.25 A</td>
<td>23</td>
<td>13</td>
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<td>B</td>
<td>23</td>
<td>11</td>
<td>18</td>
<td>17</td>
<td>49</td>
<td>23</td>
<td></td>
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<tr>
<td>Br</td>
<td>23</td>
<td>9</td>
<td>18</td>
<td>18</td>
<td>27</td>
<td>36</td>
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Number of Parents

<table>
<thead>
<tr>
<th>Breed Group</th>
<th>Daughters with records</th>
</tr>
</thead>
<tbody>
<tr>
<td>(80-100)H</td>
<td>279 Sires 336 Dams</td>
</tr>
<tr>
<td>(60-79)H</td>
<td>11 Sires 317 Dams</td>
</tr>
<tr>
<td>(40-59)H</td>
<td>2 Sires 170 Dams</td>
</tr>
<tr>
<td>(20-39)H</td>
<td>0 Sires 31 Dams</td>
</tr>
<tr>
<td>(0-19)H</td>
<td>5 Sires 29 Dams</td>
</tr>
</tbody>
</table>
### Number of Daughters

<table>
<thead>
<tr>
<th>Year</th>
<th>Breed Group</th>
<th>Sire</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>BG Dam</td>
<td>Holstein</td>
<td>(0-99)H</td>
</tr>
<tr>
<td>(80-100)H</td>
<td>360</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>(60-79)H</td>
<td>310</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>(40-59)H</td>
<td>172</td>
<td>26</td>
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</tr>
<tr>
<td>(20-39)H</td>
<td>30</td>
<td>4</td>
<td></td>
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<tr>
<td>(0-19)H</td>
<td>29</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

### Type of Population - DPO

**Incomplete Multibreed Population**

- **Holstein, Native, Brahman, Red Sindhi, Sahiwal, Jersey**
- **Holstein – Other**
  
  (Other = Native, Brahman, Red Sindhi, Sahiwal, Jersey, Red Dane)

### Population Structure

<table>
<thead>
<tr>
<th>Year</th>
<th>Breed Group</th>
<th>DPO, %</th>
<th>Thailand, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>BG Dam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(80-100)H</td>
<td>39</td>
<td>47</td>
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<tr>
<td>(60-79)H</td>
<td>35</td>
<td>51</td>
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<tr>
<td>(40-59)H</td>
<td>19</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>(20-39)H</td>
<td>3</td>
<td>0</td>
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</tr>
<tr>
<td>(0-19)H</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

### Data Collection - DPO

- **Production, Reproduction**
  - Complete Pedigree (Animals, Sires, Dams)
- **Breed Identification and Breed Composition**
  - (Animals, Sires, Dams)

### Data Editing - KU

- **Original Dataset Edited for Incomplete or Incorrect Information**
- **Edited Dataset Checked for Connectedness**
- Sires and Maternal Granddams versus Herd-Year-Seasons

### Multibreed Contemporary Groups

- Herd x Year x Season
**Connectedness**

<table>
<thead>
<tr>
<th>Herd-Yr-Season</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Genetic Evaluation - KU**

**Multiple-Trait Linear Model**
- 100d MY & 100d FY, kg
- 305d MY & 305d FY, kg
- Lact Length, d
- Age at First Calving, mo

**Computed by Direct Procedures**
(Program ASREML)

**Multibreed Model**

- **Record**
  - Herd-Year-Season
  - Dam Calving Age (Regression on H)
  - Holstein Fraction (Regression)
  - Animal Additive Genetic Effect
  - Residual

**Multibreed Genetic Base**

**Multibreed Additive Genetic Base**
- Mean of alleles from all the Other breeds in the population

**Other**
- Native, Brahman, Red Sindhi, Sahiwal, Jersey, Red Dane

**Genetic Predictions**

**Animal EBV**

- Holstein Fraction of Animal x
- Estimate of Holstein Breed Group

**Prediction of Random Animal Genetic Effect**

**Genetic Evaluation System**

- **Dairy Producers**
- **Multibreed Dairy Population**
- **DPO**
- **Data Collection and Maintenance**
- **KU-UF**
- **Annual Genetic Evaluations**
DPO Genetic Trends

By Animals in the Pedigree

By Holstein Fraction of Animals

Chilean Genetic Trends

USA Genetic Trends

Genetic Trends MY 100d - DPO

Genetic Trends MY 305d - DPO

Genetic Trends FY 100d - DPO

Genetic Trends FY 305d - DPO
DPO Genetic Trends

By Holstein Fraction of Cow

80 to 100% H
60 to 79% H
40 to 59% H
20 to 39% H
Why Low Genetic Trends?

Small Population Size

How were sires chosen?

How were dams chosen?

Which traits were used to select parents?

How many traits were used for selection?

Popn Size vs Genetic Change

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Number Cows Evaluated</th>
<th>MY305 12-yr. Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPO</td>
<td>2,000</td>
<td>21 kg</td>
</tr>
<tr>
<td>Chile</td>
<td>60,000</td>
<td>1,138 kg</td>
</tr>
<tr>
<td>USA</td>
<td>7,000,000</td>
<td>1,118 kg</td>
</tr>
</tbody>
</table>

How were sires chosen?

EBV Within Population (USA, CAN, NZ, UNK)?

Pedigree?

Semen Price?

Traits Other than Production?

MY305 = 36.3 kg/12 yr

FY305 = 2.2 kg/12 yr

LL = -0.8 d/12 yr

AFC = -0.4 mo/12 yr

Emphasis on MY305

Were Foreign Sires Chosen Differently from DPO Sires?

NOT for the traits evaluated in the DPO population

Genetic Trends MY305H - DPO

Genetic Trends LLH - DPO
How were dams chosen?

<table>
<thead>
<tr>
<th>Phenotype?</th>
<th>Pedigree?</th>
<th>EBV?</th>
</tr>
</thead>
<tbody>
<tr>
<td>MY305 = 2.8 kg/12 yr</td>
<td>FY305 = -4.0 kg/12 yr</td>
<td>LL = 9.8 d/12 yr</td>
</tr>
<tr>
<td>AFC=0.0 mo/12 yr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Emphasis on Lactation Length

Which Traits Were Used For Selection?

- Primarily Production Traits (e.g., MY, FY)?
- Primarily Reproduction Traits (e.g., AFC)?
- Other Traits (e.g., health, adaptation, type)
- Likely a Combination of Reproduction, Production, and Health Traits (EBV? Phenotypes?)
- Low Selection Pressure on Traits Evaluated by DPO

How Many Traits Were Used for Selection?

- Single Trait (e.g., MY)?
- Multiple Traits (e.g., MY, LL)?
- Other Traits (e.g., health, adaptation, type)?
- Case 1: no selection, only Culling
- Case 2: Selection Using Several Traits (Reproduction, Health, Production; Phenotypes? EBV?)

DPO: Why the Low Genetic Trends?

- Small Population
- Few High BV Animals
- Low Accuracy EBV
- Low Usage of the Best Sires
- Unclear Dam Selection Strategy (EBV?)
- Traits Used for Selection? (Reprod, Prod, Health, Type)
- Low Genetic Trends

What needs to be done next?

- Improvements in Data Collection
- Improvements in Genetic Evaluation
- Establish Short and Long-Term Goals

Improvements in Data Collection

- Must Increase Number of Recorded Animals
- Factors Causing Slow Increase in Numbers
- Modify Data Collection Strategies?
- Increase Benefits to Producers?
- Establish Economic Incentives?
Improvements in Genetic Evaluation

Models of Higher Complexity and Precision
- Substantially Larger Dataset
- Simple Genetic-Economic Indexes
- Simple Cost-Benefit Analyses

Short-Term Goals
- Greatly Increase Recorded Population
- Identify Factors Slowing Growth
- Evaluate Additional Traits
- Develop Genetic-Economic Indexes

Long-Term Goals
- Broader Research & Development Goals
- Integrate Genetic-Economic-Management-Health
- Incorporate a Wider Range of Target Traits
- Create a Formal Feedback Mechanism

Future Prospects
- Phase 1: Finished. Basic Structure for National Genetic Evaluations is in Place
- Phase 2: National Genetic Improvement Plan with Clear Research and Development Objectives

Some Ideas for Phase 2
- Develop a National Consortium for Genetic Improvement of Dairy Cattle in Thailand
- Producers-Government Organizations-Universities-Private Companies
- Research and Development Workplan
- Broad Research and Development Goals [Genetic-Economic-Management-Health]

Some Ideas for Phase 2
- Good Integration and Communication Among Participating Organizations
- Effective Feedback Mechanism
- Effective System to Implement New Strategies
- Periodic Reevaluations
Iterative Reevaluation of Goals and Results

- Genetic-Economic-Management-Health Factors
- Current Decisions
- New Results
- Revised Decisions
- Current Results

Final Thoughts 1

- Free-Trade Agreements Will Force Producers to Lower Costs and Be Efficient
- National Genetic-Economic Information Will Help Producers to Remain Competitive
- Accuracy of Genetic Evaluations in Thailand Must Increase

Final Thoughts 2

- Dairy Producer Participation in National Genetic Evaluations Must Increase (Currently 10% Producers Collect Data)
- Combine Genetic and Economic Information
- Develop a National Consortium for Genetic Improvement of Dairy Cattle in Thailand

Number of Cows per Genetic Evaluation - DPO

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cows</th>
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<tbody>
<tr>
<td>1996</td>
<td>0</td>
</tr>
<tr>
<td>1997</td>
<td>0</td>
</tr>
<tr>
<td>1998</td>
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<td>2000</td>
<td>0</td>
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<tr>
<td>2001</td>
<td>0</td>
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<tr>
<td>2002</td>
<td>0</td>
</tr>
<tr>
<td>2003</td>
<td>5000</td>
</tr>
<tr>
<td>2004</td>
<td>3000</td>
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