AAA Experience with Incorporating Genomics into Genetic Evaluation

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American Angus Association
Angus Genetics Inc.
Utilizing Technology…

- 47.5% Natural Service
- 52.5% A.I.

29,135 Embryo Transfer (ET) Calves
10% of Registrations

FY 2013
AGI is one of four subsidiaries of the American Angus Association
AAA Weekly Genetic Evaluation

- 17.7 million pedigrees
- 23 million records
- 65 million EPDs
- 52,000 genotypes

Data have become currency of today
Samples Processed 2013: 105,000+
DNA Samples
How to Collect a DNA Sample

Blood Sample
Hair Sample
Angus Breeder
Submit genomic orders online
Send samples to AGI

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AGI
Check parentage
Generate genomic-enhanced EPDs
Store genotypes
Archive DNA samples

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Genomic Companies
Process DNA samples
Generate genotypes
Return genotype files to AGI

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AGI
Forward sample and barcode IDs to genomic companies

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Data Exchange 2013
Expected Progeny Differences
Harvest Data

100,575 carcasses

Ultrasound Measures

1.52 million scans

Genomic Results

~77,000 DNA results

Generate over 2.45 million weekly carcass EPDs

American Angus Association
Carcass Genomic-Enhanced EPDs
GE-EPDs are generated for Carcass Weight, Marbling, Ribeye, and Fat
### Genetic correlation between 50K prediction results and phenotypic AAA data by trait (December 2013)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Genetic Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving Ease Direct</td>
<td>0.63 ± 0.09</td>
</tr>
<tr>
<td>Birth Weight</td>
<td>0.66 ± 0.02</td>
</tr>
<tr>
<td>Weaning Weight</td>
<td>0.56 ± 0.02</td>
</tr>
<tr>
<td>Yearling Weight</td>
<td>0.67 ± 0.03</td>
</tr>
<tr>
<td>Milk</td>
<td>0.38 ± 0.03</td>
</tr>
<tr>
<td>Yearling Height</td>
<td>0.73 ± 0.02</td>
</tr>
<tr>
<td>Yearling Scrotal</td>
<td>0.77 ± 0.01</td>
</tr>
<tr>
<td>Dry Matter Intake</td>
<td>0.73 ± 0.02</td>
</tr>
<tr>
<td>Docility</td>
<td>0.65 ± 0.02</td>
</tr>
<tr>
<td>Heifer Pregnancy</td>
<td>0.49 ± 0.07</td>
</tr>
<tr>
<td>Mature Weight</td>
<td>0.71 ± 0.02</td>
</tr>
<tr>
<td>Carcass Weight</td>
<td>0.58 ± 0.02</td>
</tr>
<tr>
<td>Carcass Marbling</td>
<td>0.66 ± 0.03</td>
</tr>
<tr>
<td>Carcass Rib</td>
<td>0.68 ± 0.03</td>
</tr>
<tr>
<td>Carcass Fat</td>
<td>0.64 ± 0.03</td>
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</tbody>
</table>
### Weekly NCE EPDs

#### Production

<table>
<thead>
<tr>
<th>EPD</th>
<th>CED Acc</th>
<th>BW Acc</th>
<th>WW Acc</th>
<th>YW Acc</th>
<th>RADG Acc</th>
<th>YH Acc</th>
<th>SC Acc</th>
<th>Doc Acc</th>
<th>HP Acc</th>
<th>CEM Acc</th>
<th>Milk Acc</th>
<th>MkH MkD</th>
<th>MW Acc</th>
<th>MH Acc</th>
<th>$EN</th>
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<td>-.10</td>
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<td>+13.79</td>
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<td>4709</td>
<td>18366</td>
<td>+34.95</td>
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#### Maternal

<table>
<thead>
<tr>
<th>EPD</th>
<th>HP Acc</th>
<th>CEM Acc</th>
<th>Milk Acc</th>
<th>MkH MkD</th>
<th>MW Acc</th>
<th>MH Acc</th>
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</thead>
<tbody>
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<td></td>
<td>+8.1</td>
<td>+13.79</td>
<td>+18.98</td>
<td>4709</td>
<td>18366</td>
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#### Carcass

<table>
<thead>
<tr>
<th>EPD</th>
<th>CW Acc</th>
<th>Marb Acc</th>
<th>RE Acc</th>
<th>Fat Acc</th>
<th>Carc Grp</th>
<th>Usnd Grp</th>
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<tbody>
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</table>

#### $Values

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<tr>
<th>EPD</th>
<th>$W</th>
<th>$F</th>
<th>$G</th>
<th>$QG</th>
<th>$YG</th>
<th>$B</th>
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<tbody>
<tr>
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<td>+12.23</td>
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</tbody>
</table>
Genotypes

Algorithm to compute molecular breeding values

Algorithm = AGI / Zoetis R&D collaboration (SNP effects)
50K Calibrations

Calibration 1
2,400 animals
2011
SNP Effects

Calibration 2
12,000 animals
January 11, 2013
SNP Effects

Calibration 3
38,989 animals
New SNP Effects
December 6, 2013

51,044 genotypes represented
in December 6th release
Genomic Impact

Breeder
- Rapid weekly genetic predictions
- Genetic values for traits that are difficult to measure
- Calibration timing and acceptance

Association
- Sample handling considerations
- Personnel expansion or reassignment
- Programming infrastructure