EFFICIENT FEED CONVERSION

WHY IS IT SO IMPORTANT

To create a sustainable future, the dairy industry must work to increase production with fewer inputs, while simultaneously working to reduce their environmental impact.

Feed represents the largest variable input cost of production, accounting for 51% of total production costs according to the USDA, and is related to enteric methane emissions. This means that the greatest potential to improve profitability and environmental sustainability is to improve the ability of dairy cattle to efficiently convert feed into consumer products.

Efficient feed conversion by dairy cattle has a direct impact on the animal’s carbon footprint. With the dairy industry being under intense scrutiny for its contribution to greenhouse gas emissions, the industry must recognize the urgency to develop and implement innovative technologies to prepare for potential regulations in the future.

STgenetics® has seen the huge opportunity to substantially reduce the carbon footprint of dairy production by increasing the feed conversion efficiency of dairy cattle. The EcoFeed® index by STgenetics® is an integrated approach to genetic selection based on progeny testing of females to identify sires that produce progeny who consume less feed while maintaining production compared to their herd mates to increase profitability and global sustainability.

HOW DO WE DEFINE FEED CONVERSION EFFICIENCY?

The EcoFeed® program utilizes a measure of feed conversion efficiency known as residual feed intake (RFI). RFI is a measure that quantifies the variation in feed intake beyond that needed to support maintenance and performance requirements. RFI can be used in multi trait selection indexes to simultaneously improve both feed conversion efficiency and other economically relevant traits, as it is independent of body size and production. This makes RFI an ideal trait for the EcoFeed® index as STgenetics® strives to create a future in which dairy cattle produce more outputs with fewer inputs, providing farmers with the economic and environmental sustainability necessary for long term success.

WHAT DOES THE FEED EFFICIENCY TRAIT FROM THE HOLSTEIN ASSOCIATION MEASURE?

The feed efficiency trait from the Holstein Association is a measure of potential net profit a farmer may receive from an increase in production. This trait is calculated from the following information:

\[
FE = (\text{Dollar Value of milk produced}) - (\text{Feed costs of extra milk}) - (\text{Extra maintenance costs})
\]

\[
= (\text{-0.187 x Milk}) + (\text{1.28 x Fat}) + (\text{1.95 x Protein}) - (\text{12.4 x BWC})
\]

* Updates to the Total Performance Index® (TPI®) and Type Composites August 2017

This trait is not based on actual measurement of feed consumption and it does not address the metabolic feed efficiency of animals as maintenance costs are driven by body size. The EcoFeed® index captures the metabolic efficiency of animals by capturing the variation in actual feed intake beyond that needed to support maintenance requirements, being independent of body size and performance; therefore, Feed Efficiency (FE) as calculated by the Holstein Association is uncorrelated with STgenetics® EcoFeed® index (r = 0.07).
SUSTAINABILITY WITH LESS DOLLARS AND MORE SENSE

Today’s technologies continue to provide dairy producers with new opportunities to improve production efficiency and therefore, profitability of their operations. One opportunity of immense interest today involves the exploration of animals who eat less feed while maintaining similar production to their herd mates.

Recognizing the prospect this brings to the future of the dairy industry, STgenetics® developed the EcoFeed® index to help producers create progeny with superior abilities to efficiently convert feed energy into production outputs.

WHAT IS EcoFeed®?

EcoFeed® is a feed conversion index based on information of over 4,000 female progeny from 550 sires. For heifers, feed conversion testing begins when animals are between 200 to 400 days old at the Ohio Heifer Center in South Charleston, Ohio. Upon entering the program, heifers are placed in pens where feed intake, performance, and feeding behavior traits are measured for a minimum of 70 days. Data collected during the testing period is used to compute an RFI value for each animal, which is calculated as the difference between actual and expected feed (based on body size and performance).

A bull’s EcoFeed® value is determined from the growing heifer RFI values of his daughters. Based on these values, a 100 base system is used to rank bulls based on their EcoFeed® value with every 10 points above 100 being one pound less feed (as-fed) the bull’s progeny can be expected to consume each day while maintaining production (based on a ration dry matter of 50%). For example, a bull whose progeny consume 1 pound less than expected based on their body size and performance will have an EcoFeed® value of 110, with 100 representing bulls whose progeny consume what is expected based on their body size and performance (Figure 1).

THE SCIENCE BEHIND IT

STgenetics® has evaluated feed conversion efficiencies on over 4,000 females making it the largest database of its kind. Utilizing this substantial database, STgenetics® is able to make genomic predictions of related animals with high accuracy. Of the females tested in the EcoFeed® program, high EcoFeed® heifers consume on average 24% less feed per day (or 10.4 lbs/d as fed) than low EcoFeed® heifers, with no differences in final body weight (BW) or average daily gain (ADG).

As a part of the Efficient Dairy Genome Project, Conner et. al, 2019 found a positive correlation between growing heifer RFI and RFI measured during the first 100 DIM (r = 0.37). It is apparent that economic benefits can be gained by selection for feed conversion efficiency during the growth phase and during lactation. While the EcoFeed® program has primarily focused on data collected in growing heifers, STgenetics® has heavily invested in evaluating EcoFeed® of animals across all stages of the cow’s productive life from birth, until she leaves the herd. This allows STgenetics® to drive genetic progress and capture the genetics of individuals who will help maximize economic and environmental sustainability.

CONCLUSION

Today's technologies continue to provide dairy producers with new opportunities to improve production efficiency and therefore, profitability of their operations. One opportunity of immense interest today involves the exploration of animals who eat less feed while maintaining similar production to their herd mates.

Recognizing the prospect this brings to the future of the dairy industry, STgenetics® developed the EcoFeed® index to help producers create progeny with superior abilities to efficiently convert feed energy into production outputs.
EcoFeed® is an excellent trait to include in your selection criteria for dairy bulls as well as females on your farm. A list of bulls with high EcoFeed® scores can be found at stgen.com and females can receive an EcoFeed® score when they are genomically tested through Genetic Visions-ST™. To incorporate EcoFeed® into your selection program, you can simply identify bulls and females with high EcoFeed® values who also exhibit desirable characteristics for other economically relevant traits as determined by your current production goals.

**CORRELATION OF GENOMIC BREEDING VALUES WITH PRODUCTION TRAITS**

<table>
<thead>
<tr>
<th>Trait</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Performance Index (TPI)</td>
<td>0.02</td>
</tr>
<tr>
<td>Net Merit (NMS)</td>
<td>-0.01</td>
</tr>
<tr>
<td>Cheese Merit</td>
<td>-0.01</td>
</tr>
<tr>
<td>Milk</td>
<td>0.06</td>
</tr>
<tr>
<td>Protein</td>
<td>0.06</td>
</tr>
<tr>
<td>Fat</td>
<td>-0.01</td>
</tr>
<tr>
<td>Productive Life</td>
<td>-0.05</td>
</tr>
<tr>
<td>Daughter pregnancy rate (DPR)</td>
<td>-0.08</td>
</tr>
<tr>
<td>Feed Efficiency (FE)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Producers can select for high EcoFeed® animals while maintaining or improving other economically important traits, as EcoFeed® is uncorrelated with traits currently utilized for selection purposes in Holstein cows as shown in Figure 2.

**RESULTS FOR YOUR FEMALES**

When you select for high EcoFeed® heifers along with other economically important traits at your dairy, you can expect to save on feed costs in growing heifers while maintaining body weight and average daily gain. EcoFeed® scores are breeding values. This means that a female with an EcoFeed® score of 110 will consume 2 pounds less feed per day (as fed) than her herdmates. To understand what she can transmit to her offspring, you can divide that number by 2.

**Figure 4.** shows an example of how to interpret the breeding values of female EcoFeed® scores for females genomically tested through Genetic Visions-ST™. Heifer A will consume, on average, one pound less feed per day (as fed) than her herdmates which translates to savings of $36.50 per year. Heifer B will consume two pounds less feed per day (as fed) than her herdmates for annual savings of $73.00 per year. If a 1,000 cow dairy has reduction in feed of as little as 2 pounds per day per animal, this could translate into savings of $73,000 (based on feed cost of $0.10/lb of feed as fed).

**Heifer A**

- EcoFeed® Index: 105
- Feed Intake: 1 lb less/per day than herdmates
- Feed cost: $0.10/lb
- Savings per year: $36.50

**Heifer B**

- EcoFeed® Index: 110
- Feed Intake: 2 lbs less/per day than herdmates
- Feed Cost: $0.10
- Savings per year: $73.00

Selection for high EcoFeed® animals can be done with the same confidence as selection for other economically important traits as the heritability of EcoFeed® (0.21) is similar to that of other production traits such as milk yield, fat yield, and protein yield as shown in Figure 3.

**HOW CAN YOU PROFIT FROM TESTING YOUR FEMALES FOR EcoFeed®?**

Females can receive an EcoFeed® score when they are genomically tested through Genetic Visions-ST™ as shown in Figure 4.