2020 Jersey Performance Index™ (JPI)

Updates to Jersey Performance Index™ authorized by the AJCA Board of Directors were implemented with the April 2020 official CDCB-AJCA genetic evaluations. JPI2020 predicts the efficiency of production by expressing lifetime production of fat and protein per unit of feed consumed. New traits included in JPI2020 are the six Jersey Health Traits (https://www.uscccb.com/wp-content/uploads/2020/01/CDCB-Jersey-Health-Traits.pdf) and two linear type traits—Rear Teat Placement Side View and Rear Teat Placement Rear View (https://www.usjersey.com/Portals/0/AJCA/2_Docs/Appraisal/19-A-Appraisal-Standards.pdf).


The three primary drivers of U.S. dairy cow sustainability are production, milk nutrient density, and body size. Specifically, Jerseys need to increase milk yield, maintain—or better improve—component levels, and maintain an optimum body size. The focus on Jersey sustainability was retained for JPI2020.

Traits and their percentage of JPI2020 are 27% PTA protein; 19% PTA fat; 3% Milk Density; 23% Production, milk nutrient density; 14.5% Fertility (includes 9% Daughter Pregnancy Rate, 3.5% Cow Conception Rate and 2% Heifer Conception Rate); 8% Survival (includes 5% Productive Life and 3% Livability); 4.5% Somatic Cell Score; and six new Jersey Health Traits at 4.6% (Milk Fever 1.0%; Displaced Abomasum 1.0%; Ketosis 0.4%; Mastitis 1.9%; Metritis 0.2% and Retained Placenta 0.1%). (Fig. 1)

Milk Density is calculated by subtracting the sum of PTA Protein and PTA Fat divided by .09 from PTA Milk.

Overall, 49% of the emphasis in JPI2020 is on production, 27% on fitness, 19.4% on functional type and 4.6% on disease resistance.

The goal behind the update to JPI formula was logical. It allows Jersey breed progress to continue, while ensuring tomorrow’s Jersey cattle are genetically predisposed to remain healthy, fertile and function while producing high levels of milk solids.

Dr. Kent Weigel, University of Wisconsin-Madison, led the research and development of JPI2020. The updated formula is derived from a prediction of efficiency for more than 300,000 Jersey females born since 2010 who have lactation and type information.

Lifetime production was tallied for each female. Individual type traits were used to predict body weight, which was then used to determine their lifetime feed intake. The ratio of lifetime production to lifetime feed intake was predicted using a model that included individual genetic evaluations for production traits, linear type traits, somatic cell score, productive life, livability and fertility measures. Contribution of the six health traits was determined by the amount of variation they explained in productive life and livability.

JPI is based on the ratio of lifetime combined fat and protein to lifetime dry matter intake, relative to other cows in the same herd born in the same year. Feed during the rearing period is considered, as are differences in maintenance intake for cows of different predicted body size. For cows that are still alive, we take how much they have produced and eaten to date.

Milk Density

Milk Density (3% of the index), formerly named CFP Milk, is a breed-specific adjustment to PTA Milk based on the target that every pound of PTA milk must include 0.09 pounds of combined fat.

Table 1. History of Traits and Weights (%) Used to Calculate Production Type Index (1998) and Jersey Performance Index™.

| Year | Protein | Fat | CFP Milk/Milk Density | FTI | PL | LIV | SCS | FUI | DPR | CCR | HCR | HTI |
|------|---------|-----|----------------------|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1998 | 55.5    | 22.2| 16.7                 | 5.6 |     |     |     |     |     |     |     |     |
| 2002 | 50.0    | 20.0| 15.0                 | 5.0 | 5.0| 3.75| 3.35| 7.0 | 2.0 | 2.0 |     |     |
| 2005 | 50.0    | 20.0| 15.0                 | 3.75| 3.75| 3.75|     |     |     |     |     |     |
| 2006 | 40.0    | 20.0| 15.0                 | 3.0 | 3.0| 7.0 |     |     |     |     |     |     |
| 2010 | 42.0    | 15.0| 15.0                 | 6.0 | 10.0|     |     |     |     |     |     |     |
| 2015 | 43.0    | 15.0| 15.0                 | 6.0 | 7.0 | 2.0 |     |     |     |     |     |     |
| 2017 | 30.0    | 15.0| 8.0                  | 6.0 | 7.0 | 2.0 |     |     |     |     |     |     |
| 2020 | 27.0    | 19.0| 3.0                  | 4.5 | 9.0 | 3.5 | 2.0 | 4.6 |     |     |     |     |
and protein. Milk Density is based on the idea it is preferable to have total yield of pounds fat and pounds protein come from more concentrated milk instead of a greater volume of watery milk.

For example, two bulls each have 75 pounds of combined fat and protein, but a large difference in their PTA Milk of 250 compared to 1,250 pounds. Relative to the target of 0.09 pounds of combined fat and protein in one-pound PTA of 250 exceeds that concentration and will gain approximately three JPI™ points. The other bull, at PTA Milk of 1,250 pounds, transmits more water relative to components. Therefore, he will lose approximately two JPI™ points.

The Milk Density attribution will result in a difference of five JPI™ points between the two example bulls.

Type Within Production

Of the components of JPI™, only one—the AJCA Functional Trait Index (FTI)—captures the effects of type traits within production on lifetime efficiency. It assesses how functional type traits are important to the Jersey cow’s economic survival. As such, it pinpoints where improvement will be the predicted daughter difference for milking, the bull with a PTA Milk of 250 exceeds that concentration and will gain approximately three JPI™ points. The other bull, at PTA Milk of 1,250 pounds, transmits more water relative to components. Therefore, he will lose approximately two JPI™ points.

The Milk Density attribution will result in a difference of five JPI™ points between the two example bulls.

### Table 2: Relative weights for specific traits and trait groups in Jersey Performance Index™

<table>
<thead>
<tr>
<th>Trait Group</th>
<th>Relative Weight (%)</th>
<th>Specific Trait (Direction)</th>
<th>Overall Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>49.0</td>
<td>Protein (+)</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fat (+)</td>
<td>19.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Milk Density (-)</td>
<td>3.0</td>
</tr>
<tr>
<td>Fertility</td>
<td>14.5</td>
<td>Daughter Pregnancy Rate (+)</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cow Conception Rate (+)</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heifer Conception Rate (+)</td>
<td>2.0</td>
</tr>
<tr>
<td>Survival</td>
<td>8.0</td>
<td>Productive Life (+)</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Livelivability (+)</td>
<td>3.0</td>
</tr>
<tr>
<td>Somatic Cell Score</td>
<td>4.5</td>
<td>Milk Fever (+)</td>
<td>1.0</td>
</tr>
<tr>
<td>Jersey Health Traits</td>
<td>4.6</td>
<td>Displaced Abomasum</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ketosis (+)</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mastitis (+)</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metritis (+)</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retained Placenta (+)</td>
<td>0.1</td>
</tr>
</tbody>
</table>

### Calculation of the Jersey Udder Index™

This index is the sum of PTAs for udder traits multiplied by their percentage contribution to the animal’s Jersey Performance Index™:

\[
\text{JUI}_{2020} = \left[ \left( 1.7 \times \text{FU} / \text{SD} \right) + \left( 2.5 \times \text{RH} / \text{SD} \right) + \left( 0.1 \times \text{RUW} / \text{SD} \right) \right]
\]

The traits and their weights in JPI™ are:

- Milk Fever or Hypocalcemia: (1.0%) Typically results after calving due to low total blood calcium levels.
- Displaced abomasum: (1.0%) Enlargement of the abomasum with fluid and/or gas that caused its movement to the left or right of the abdominal cavity; the twisting blocks the digestive process and usually requires veterinary intervention.
- Ketosis: (0.4%) Build-up of ketone bodies that typically occurs due to negative energy balance in early lactation.
- Mastitis: (1.9%) Infectious disease that causes inflammation of the mammary gland; one of the most common and costly diseases of dairy cattle.
- Metritis: (0.2%) Infection of the endometrium (lining of the uterus) after calving.
- Retained placenta: (0.1%) Retention of fetal membranes more than 24 hours after calving.

*Combined as the Health Trait Index (HTI), it is reported as JPI™ points like JUI™ and represents 4.6% of JPI™.

### Major Categories

- **Production** receives 49% of the emphasis in the new formula. There is 13.7% on udder health by combining direct selection for lower Somatic Cell Score (especially important to capture quality premiums) and JUI™. **Fertility** at 14.5% includes Daughter Pregnancy Rate, Cow Conception Rate and Heifer Conception Rate. **Survival** is weighted at 8.2% through PTAs for Productive Life and Livelivability plus the mobility traits (footangle, rear legs) in FTI. Lastly, the jersey-specific Body Weight Composite, at 10%, selects for **optimum body size**, which is directly related to feed intake directed to body maintenance versus production. Lastly, the Health Trait Index at 4.6% selects for **disease resistance**.

### Summary

Jersey Performance Index™ (JPI™) is a breed-specific selection tool that has been continually reviewed and updated based on sound science and relative to current economic conditions. “Jersey Performance Index™ focuses on the Lifetime Efficiency of the Jersey cow in a way no prior versions have done,” said Neal Smith, Executive Secretary and CEO of the American Jersey Cattle Association.

“The updated formula combines leading-edge methods which result in a healthier cow who can produce higher concentrations of components in her milk. While accomplishing all this, JPI2020 helps achieve optimum body size for greater feed and overall efficiency and sustainability, while improving on the Jersey cow’s long appreciated fertility.”
Jersey Performance Index
2020 vs 2017

**Jersey Performance Index 2020**

- **Production**
  - 27% - PTA Protein
  - 19% - PTA Fat
  - 3% - Milk Density
- **Udder Depth** +4.7
- **Fore Udder Attachment** +2.4
- **Udder Cleft** +1.9
- **Rear Udder Height** +1.8
- **Front Teat Placement** +0.9
- **Front Teat Length** -0.9
- **Rear Udder Width** +0.1
- **Rear Teat Position Side View** +0.8
- **Rear Teat Position Rear View** +0.6

**Jersey Performance Index 2017**

- **Production**
  - 30% - PTA Protein
  - 15% - PTA Fat
  - 8% - CFP Milk
- **Udder Depth** +2.5
- **Fore Udder Attachment** +1.7
- **Udder Cleft** +0.2
- **Rear Udder Height** +2.5
- **Front Teat Placement** +0.2
- **Front Teat Length** -0.6
- **Rear Udder Width** +0.1
- **Rear Teat Position Side View** +0.8
- **Rear Teat Position Rear View** +0.6

**Jersey Health Traits**

- **1.0%** - Milk Fever
- **1.0%** - Displaced Abomasum
- **0.4%** - Ketosis
- **1.9%** - Mastitis
- **0.2%** - Metritis
- **0.1%** - Retained Placenta

**Jersey Udder Index 2020**

- **Production**
- **Udder Depth** +4.7
- **Fore Udder Attachment** +2.4
- **Udder Cleft** +1.9
- **Rear Udder Height** +1.8
- **Front Teat Placement** +0.9
- **Front Teat Length** -0.9
- **Rear Udder Width** +0.1

**Jersey Udder Index 2017**

- **Production**
- **Udder Depth** +2.5
- **Fore Udder Attachment** +1.7
- **Udder Cleft** +0.2
- **Rear Udder Height** +2.5
- **Front Teat Placement** +0.2
- **Front Teat Length** -0.6
- **Rear Udder Width** +0.1

**Udder Depth (+)**

**Fore Udder Attachment (+)**

**Udder Cleft (+)**

**Rear Udder Height (+)**

**Front Teat Placement (+)**

**Front Teat Length (-)**

**Rear Udder Width (+)**

**Rear Teat Position Side View (+)**

**Rear Teat Position Rear View (+)**

*Milk Density is calculated by subtracting the sum of PTA Protein and PTA Fat divided by .09 from PTA Milk.*

**Functional Trait Index**

- **Udder**
- **Body**
- **Feet and Legs**
- **Jersey Udder Index**

- **Production**
  - 49% - PTA Protein
  - 27% - PTA Fat
  - 19% - Milk Density

- **Survival**
  - 8% - Productive Life
  - 3% - Livability

- **Somatic Cell Score**
  - 4.5%