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Summary and Implications
Carcass composition (n= 338) and meat quality (n=151) data were collected on pigs from the eighth generation of the Iowa State University Residual Feed Intake (ISU RFI) selection project fed either high or low energy diets. Both RFI line and diet were found to impact carcass composition, while having minimal effects on pork quality and sensory characteristics. RFI shows promise as a selection tool for improved efficiency without compromising pork quality, even if fed low energy diets.

Introduction
Feed costs account for the single largest cost of pork production. Recent increases in the cost of feedstuffs have led producers to look for ways to select for efficiency, as well as the use of alternative feedstuffs that are lower in RFI to demonstrate that, compared to selection for increased RFI, selection for decreased RFI resulted in low loin pH, greater loin lightness scores, and poorer loin water holding capacity after five generations of selection. Therefore, our objective was to examine the impact of divergent selection for RFI on pork quality and composition traits in the eighth generation of the ISU RFI selection project, which included 3 generations of selection for increased RFI in the previously randomly selected control line. Additionally, we wanted to examine if these pigs performed the same on diets low in energy and high in fiber.

Materials and Methods
Three hundred thirty-eight pigs (n=85 LRFI barrows, 83 LRFI gilts, 88 HRFI barrows, 82 HRFI gilts) from the eighth generation of the ISU RFI selection project were randomly assigned within each of two rooms to 20 pens (14-24 pigs per pen). Ten pens were placed on a low energy high fiber (LEHF; 2.91Mcal ME/kg; 24.6% NDF) diet and ten pens on a high energy low fiber diet (HELF; 3.31 Mcal ME/kg; 9.5% NDF). Pigs were harvested (92-140 kg BW) at a commercial abattoir in three groups. Data were collected on hot carcass weight (HCW), fat depth, loin depth, calculated percent lean using a Fat-O-Meater® probe at the 3rd to 4th last rib on the carcass 8 cm off the midline. Meat quality traits were measured on pigs from one room (n=151 [n=37 LRFI barrows, 35 LRFI gilts, 43 HRFI barrows, 36 HRFI gilts]). At two days post mortem, ultimate pH, drip loss ([(initial weight – final weight)/initial weight] x 100), subjective marbling (scale 1-10; NPPC, 1999), lean and fat color (CIE L* a* b*, D75 light source, 10º observer), and proximate analysis for fat, moisture and protein were collected. Sensory samples were aged for seven days at 0ºC, and then frozen for no longer than 90 days before use. Sensory samples were evaluated for juiciness, tenderness, pork flavor, off-flavor and tenderness by trained panelists (n=8). Instrumental tenderness was determined by star probe (crosshead speed of 3.3 mm/second; average of three punctures).

Data were analyzed using the PROC MIXED procedure of SAS (SAS Inst. Inc., Cary, NC), with fixed effects of line, diet, and sex, random effects of harvest group and room (in the case of composition data), and the covariate of live weight at harvest (in the case of carcass and proximate composition data and subjective marbling data).

Results and Discussion
Carcass Composition
Irrespective of line, the LEHF diet decreased HCW (P<0.01), fat depth (P<0.01), and loin depth (P<0.01) and increased percent lean (P<0.01; Table 1). Additionally, the LRFI carcasses had less fat depth and greater loin depth and percent lean than the HRFI carcasses (P<0.01 for all traits).
Gilts had less fat depth (P<0.01) and had greater loin depth (P<0.01) and percent lean than barrows (P<0.01). A line x sex interaction tendency was observed for fat depth, with LRFI gilts having less fat depth and the HRFI pigs on the HELF diet having the greatest fat depth compared to LRFI pigs fed a LEHF diet (P<0.06).

Carcass Quality

No line or diet differences were found in ultimate pH, lean a* and b*, adipose b*, and cook loss (Table 2). Carcasses from LRFI had lower marbling (P<0.01) and color (P<0.01) scores than those from the HRFI pigs. This agreed with the proximate composition data, which showed that LRFI carcasses had a significantly lower lipid percentage (P<0.05). HRFI barrows had greater marbling than all other line x sex combinations (P<0.05). Pigs fed the LEHF diet also had lower subjective marbling scores (P=0.01), less percent lipid (P=0.02), and tended to be more tender (P=0.08) than pigs on the HELF diet. The LEHF diet also affected adipose color, with HELF carcasses having lower L* values (P<0.05) and a tendency for lower a* values. A sex x diet interaction was found for drip loss (P=0.03), with barrows on the LEHF diet having the greatest drip loss and gilts on the LEHF diet the least drip loss.

These data suggest that, regardless of diet, pigs from the LRFI line are leaner, heavier muscled, and possess less marbling and percent lipid than the HRFI line. Although diet impacts carcass composition and adipose color, it appears that carcasses from HRFI and LRFI lines were generally not differentially impacted by diet. Thus, RFI shows promise as a selection criterion to produce animals that are leaner and more efficient with minimal impacts on pork quality.

Acknowledgments

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Figure 1. Effect of divergent RFI selection and diet on carcass composition traits.1

<table>
<thead>
<tr>
<th>Item</th>
<th>Line</th>
<th>Diet</th>
<th>Sig.2</th>
<th>Line</th>
<th>Diet</th>
<th>Sig.2</th>
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</thead>
<tbody>
<tr>
<td>HCW</td>
<td>HRFI</td>
<td>LRFI</td>
<td></td>
<td>HELF</td>
<td>LEHF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>94.43 (1.06)</td>
<td>94.86 (1.07)</td>
<td></td>
<td>97.03 (1.06)</td>
<td>92.26 (1.10)</td>
<td>**</td>
</tr>
<tr>
<td>Fat Depth, mm</td>
<td>20.58 (0.67)</td>
<td>18.51 (0.69)</td>
<td></td>
<td>21.67 (0.66)</td>
<td>17.43 (0.76)</td>
<td>**</td>
</tr>
<tr>
<td>Loin Depth, mm</td>
<td>57.63 (1.26)</td>
<td>60.76 (1.27)</td>
<td></td>
<td>60.50 (1.26)</td>
<td>57.88 (1.32)</td>
<td>**</td>
</tr>
<tr>
<td>Percent Lean</td>
<td>53.22 (0.50)</td>
<td>54.86 (0.53)</td>
<td></td>
<td>52.91 (0.51)</td>
<td>55.17 (0.56)</td>
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Figure 2. Effect of divergent RFI selection and diet on carcass quality traits.1

<table>
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<tr>
<th>Item</th>
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<th>Diet</th>
<th>Sig.2</th>
<th>Line</th>
<th>Diet</th>
<th>Sig.2</th>
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</thead>
<tbody>
<tr>
<td>pH</td>
<td>(5.65)</td>
<td>(5.65)</td>
<td></td>
<td>(5.63)</td>
<td>(5.67)</td>
<td></td>
</tr>
<tr>
<td>Drip Loss, %</td>
<td>(1.32)</td>
<td>(1.44)</td>
<td></td>
<td>(1.37)</td>
<td>(1.39)</td>
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<tr>
<td>Subjective</td>
<td>(0.16)</td>
<td>(0.17)</td>
<td></td>
<td>(0.16)</td>
<td>(0.17)</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>(0.21)</td>
<td>(0.22)</td>
<td>**</td>
<td>(0.22)</td>
<td>(0.23)</td>
<td></td>
</tr>
<tr>
<td>Marbling</td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>**</td>
<td>(0.12)</td>
<td>(0.13)</td>
<td>**</td>
</tr>
<tr>
<td>Lean L*</td>
<td>(48.48)</td>
<td>(50.44)</td>
<td>**</td>
<td>(50.23)</td>
<td>49.70</td>
<td></td>
</tr>
<tr>
<td>Lean a*</td>
<td>(0.27)</td>
<td>(0.28)</td>
<td></td>
<td>(0.26)</td>
<td>(0.28)</td>
<td></td>
</tr>
<tr>
<td>Lean b*</td>
<td>(3.51)</td>
<td>(4.09)</td>
<td></td>
<td>(3.42)</td>
<td>(3.17)</td>
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<tr>
<td>Adipose L*</td>
<td>(73.00)</td>
<td>(72.75)</td>
<td></td>
<td>73.65</td>
<td>72.10</td>
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<tr>
<td>Adipose a*</td>
<td>(0.38)</td>
<td>(0.39)</td>
<td></td>
<td>(0.38)</td>
<td>(0.40)</td>
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<tr>
<td>Adipose b*</td>
<td>(9.19)</td>
<td>(8.65)</td>
<td></td>
<td>9.21</td>
<td>8.63</td>
<td></td>
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<tr>
<td>Loss, %</td>
<td>(14.55)</td>
<td>14.52</td>
<td></td>
<td>14.31</td>
<td>14.76</td>
<td></td>
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<tr>
<td>Star Probe, kg</td>
<td>(0.48)</td>
<td>(0.52)</td>
<td></td>
<td>(0.48)</td>
<td>(0.64)</td>
<td></td>
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<tr>
<td>Protein, %</td>
<td>(5.01)</td>
<td>5.20</td>
<td></td>
<td>5.04</td>
<td>5.17</td>
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Proximate Analysis

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<th>Item</th>
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<th>Line</th>
<th>Diet</th>
<th>Sig.2</th>
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<tr>
<td>Moisture, %</td>
<td>(72.32)</td>
<td>73.67</td>
<td></td>
<td>72.20</td>
<td>73.80</td>
<td>*</td>
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<tr>
<td>Fat, %</td>
<td>(1.91)</td>
<td>1.38</td>
<td></td>
<td>1.95</td>
<td>1.34</td>
<td>**</td>
</tr>
<tr>
<td>Protein, %</td>
<td>(0.15)</td>
<td>(0.16)</td>
<td></td>
<td>(0.15)</td>
<td>(0.17)</td>
<td></td>
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</table>

Sensory Traits

<table>
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<tr>
<th>Item</th>
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<th>Sig.2</th>
<th>Line</th>
<th>Diet</th>
<th>Sig.2</th>
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<tbody>
<tr>
<td>Juiciness</td>
<td>(10.15)</td>
<td>10.44</td>
<td></td>
<td>10.47</td>
<td>10.12</td>
<td></td>
</tr>
<tr>
<td>Tenderness</td>
<td>(9.28)</td>
<td>8.97</td>
<td></td>
<td>9.09</td>
<td>9.16</td>
<td>*</td>
</tr>
<tr>
<td>Chewiness</td>
<td>(4.93)</td>
<td>5.49</td>
<td></td>
<td>5.26</td>
<td>5.16</td>
<td></td>
</tr>
<tr>
<td>Pork</td>
<td>(3.92)</td>
<td>3.81</td>
<td></td>
<td>3.89</td>
<td>3.84</td>
<td></td>
</tr>
<tr>
<td>Flavor</td>
<td>(0.15)</td>
<td>(0.16)</td>
<td></td>
<td>(0.15)</td>
<td>(0.19)</td>
<td></td>
</tr>
<tr>
<td>Off-Flavor</td>
<td>(0.43)</td>
<td>0.53</td>
<td></td>
<td>0.52</td>
<td>0.44</td>
<td></td>
</tr>
</tbody>
</table>

1 Least square means (SE) shown for each trait
2 Significance; **P-value <0.05, *0.05< P-value <0.10