Correlations Among Yield and Composition of Milk of Angus-Holstein Cows and Consumption and Growth Rate of Progeny

Abstract

Milk production of Angus-Holstein F1 cows was greater than most previous estimates for cows of beef breeding. Milk consumption from pre- versus post-suckling weights, was more highly correlated (0.63, P < .01) with calf gain than was either milk yield (0.49, P < .01) or solids-corrected yield (0.54, P < .01). A prediction equation of six milk characters accounted for 53% of the variance in calf gain. An equation of solids-not-fat percentage and 12-hour milk consumption accounted for 49% of the variance in calf gain.

Introduction

Weaning weight is one of the most important determinants of net profits from a beef cow operation. The importance of milk yield or consumption or both in determining weaning weight has been reported (5, 12, 18) in beef breeds. Within recent years, beef producers have become interested in beef-dairy crossbreds cows because of their potential for increased milk production. The objectives of this study were to determine the relation of various milk yield and composition measures with progeny growth rate in an Angus-Holstein F1 cow herd.

Materials and Methods

Twenty-four cows were randomly selected within each of two years from fall-calving Angus-Holstein F1 cows from the State Correctional Institution at Rockview, Bellefonte, Pennsylvania. The cows ranged in age from 4 to 7 years. Different cows were used within each year. In Years 1 and 2, initial calf ages averaged 76.3 and 19.3 days and trials were 123 and 184 days. In Year 1, cows were allotted to a 2 × 2 factorial of small versus large cow body size and 85 versus 115% NRC (10) digestible energy recommendations for mature lactating beef cows (16). In Year 2, cows were allotted to a 1.0 mg melengestrol acetate2 orally per head daily versus no melengestrol acetate and 100 versus 115% digestible energy recommendations (17). All rations were composed of grass-legume hay and silage, soybean oil meal, and ground shelled corn and were isonitrogenous. There were 4 groups of 6 cows and 6 calves each. In Years 1 and 2, calves were sired by Polled Hereford and Angus bulls, respectively.

Milk yield and composition were measured at
2-week intervals throughout the trials. The general procedure in Year 1 was to separate cows and calves for consecutive 6- and 12-hour periods. At the end of 6 hours, calves were allowed to nurse for approximately 20 minutes. The cows were then confined to individual stalls, injected in the coccygeal vein with 40 USP units (2cc) of oxytocic principle and handstripped. The weight of retained milk was recorded and represented the amount of milk that was available for consumption by the calf (but not consumed) and unavailable residual milk. At the end of the subsequent 12-hour separation period, cows were injected with oxytocic principle and milked with machines. The cows were then handstripped and amounts of milk obtained with machines and handstripping combined to represent 12-hour kilogram milk yield. Milk samples were collected for determination of per cent fat (2), per cent protein (1), and solids-not-fat per cent (6). Equations of Tyrrell and Reid (15) were used to calculate 12-hour solids-corrected milk yield (SCM). In Year 2, procedures were the same except there were three consecutive 12-hour separation periods. At the end of the second period, pre- and post-suckling calf weights were obtained to the nearest 45 g with specially-built scales. The difference between pre- and post-suckling weights represented 12-hour milk consumption. Calf daily gain was calculated for 123 and 184 days of the trial in Years 1 and 2, respectively.

All subsequent correlations were intra-group-sex with initial cow and calf weights and calf age included in the model as continuous independent variables (7). Preliminary analyses indicated linear relationships between the milk characters and calf growth rate. Multiple regression analyses were according to Steel and Torrie (13).

Results and Discussion

Means, standard deviations and correlations of the characters are in Table 1. The values were on 48 cow-calf pairs with the exception of milk consumption which included 24 animals from Year 2.

The mean amount of retained milk was 0.55 kg. Retained milk was correlated 0.28 (P < .05) and −.27 with calf gain and fat per cent.

Fat, protein, and solids-not-fat per cent were positively related (P < .01) from 0.40 to 0.56. Each of these three composition measures was also negatively (P < .01) correlated with 12-hour consumption.

3 Olson Bros. Scale Service, Scottsbluff, Nebraska.
hour yield. Nonsignificant negative correlations were also observed between each of the composition measures and 12-hour solids-corrected milk and consumption. Correlations of fat, protein, solids-not-fat per cent with either daily gain of calf or weight change of cow were nonsignificant.

The mean 12-hour yield was 4.72 kg, which was greater than averages reported by Montsma (9), Neville (11), Christian et al. (3), and Melton et al. (8) but similar to the amount reported by Dawson et al. (4) with Shorthorn cows. Average 12-hour milk consumption was 3.69 kg. Yield and consumption were correlated 0.67 (P < .01). Milk yield, solids-corrected milk and consumption accounted for 24, 29, and 40% of the variation in calf gain; however, the correlations were not significantly different. These correlations are similar to those reported by Gifford (5) and Wistrand and Riggs (18), but lower than 0.87 observed by Totusek and Arnett (14). The correlations suggest that variation in milk production within a herd of Angus-Holstein F1 cows is an important determinant of calf gain.

The mean 24-hour kilogram of milk per kilogram calf daily gain (9.44/.936) was 10.1. Previous estimates were 8.1, 5.0, and 5.2 (8, 9, 18, respectively). This suggests a less efficient utilization of available milk with the Angus-Holstein cows. However, two factors that may have contributed to the difference were drylot confinement of the animals and minimal cow feeding space.

Change in cow weight during the trial was significantly (P < .05) and negatively correlated with 12-hour yield, 12-hour consumption, and calf daily gain.

Multiple Prediction Equations

### Table 2. Multiple correlations, regression coefficients, and standard errors of estimate for the prediction of calf daily gain (g) from milk composition, yield and consumption.

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained milk (kg)</td>
<td>98.17</td>
<td>95.59</td>
<td>——</td>
<td>117.67</td>
<td>116.98</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>——</td>
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<tr>
<td>Protein (%)</td>
<td>14.57</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>——</td>
</tr>
<tr>
<td>Solids-not-fat (%)</td>
<td>126.13</td>
<td>130.81</td>
<td>133.20</td>
<td>119.86</td>
<td>——</td>
</tr>
<tr>
<td>12-hr SCM (kg)</td>
<td>42.43</td>
<td>41.76</td>
<td>——</td>
<td>115.02</td>
<td>——</td>
</tr>
<tr>
<td>12-hr consumption (kg)</td>
<td>44.46</td>
<td>44.25</td>
<td>58.72</td>
<td>——</td>
<td>50.13</td>
</tr>
<tr>
<td>Intercept</td>
<td>—611.0</td>
<td>—597.7</td>
<td>—435.5</td>
<td>686.7</td>
<td>—627.7</td>
</tr>
<tr>
<td>R</td>
<td>0.73</td>
<td>0.73</td>
<td>0.70</td>
<td>0.65</td>
<td>0.65</td>
</tr>
<tr>
<td>$S_{yx}$</td>
<td>83.7</td>
<td>83.8</td>
<td>85.3</td>
<td>88.5</td>
<td>90.6</td>
</tr>
</tbody>
</table>

*Calculated from partial correlations derived with initial cow and calf weights and calf age held constant; n = 48 for all characters except 12-hour consumption, n = 24.
References


