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UA3/3/1 The Economical Approach to Raising Dairy Herd Replacements, with Emphasis on Source of Protein

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THE ECONOMICAL APPROACH TO RAISING DAIRY HERD REPLACEMENTS, WITH EMPHASIS ON SOURCE OF PROTEIN

BY Henry Amos
Larry Mutter

This project will be undertaken with the following three objectives as a guideline:

A. To arrive at the approximate dollar cost of raising dairy herd replacements.

B. To determine whether it is possible for the young ruminant animal to utilize non-protein nitrogen to meet part of the protein requirement for growth.

C. To attempt to reduce the cost of raising dairy herd replacements to the College Farm by breeding the heifers to calve at 21-24 months of age rather than the system employed in the past which placed heifers in production at 30-36 months of age.

PROCEDURE. Holstein heifer calves, as they become available from the college Holstein dairy herd, will be placed on one of the following four rations. These calves will be allowed to remain with the dam for the first seventy-two hours and then fed whole milk (at the standard rate of ten percent of birth weight) daily for eight weeks. At the end of eight weeks all calves will be weaned from milk. Starting at the fourth day from birth each calf will be offered a calf starter ration, recommended by the University of Kentucky Department of Dairy Science, until four weeks of age.

Four rations, given in Table 1, will be prepared by a local feed mill and fed to each group of heifers from one month to six months of age. Each ration will be balanced according to protein at sixteen percent crude protein. Alfalfa hay will be offered free choice to each calf individually until weaning.
At the end of the six month period all calves will be subdivided into two groups with one-half of the animals on each calf ration randomly distributed into two groups. Group 1 will receive liberal grain feeding; Group 2 will receive only a limited amount of grain. The heifers will remain on this trial until three weeks before calving. All heifers will be bred the first heat period after reaching eight hundred pounds. They will be pastured during grazing season and fed alfalfa hay and/or silage during the winter season.

The following records will be kept during the experiment:

1. Calves will be weighed at birth, every four weeks thereafter until six months of age, at one year, at eighteen months, at two years.
2. Weights at breeding and calving dates will be recorded.
3. Amount of grain consumed by each calf from birth until weaning will be determined and recorded and average animal grain consumption per animal will be used in computing grain costs from two to twenty-four months of age.
4. All costs incurred in rearing these calves.
5. Milk weights for the first lactation will be recorded monthly.
6. Age at breeding and age at calving.
7. Condition at calving.
8. Gross energy as B.T.U. per pound, percent crude protein, percent crude fiber, percent N.F.E., and percent ash in each of the four rations, silage, and hay used in this trial will be determined in the laboratory.
9. Digestibility and nitrogen balance will be determined in the laboratory if time and equipment are available to make these collections possible.

Duration of this experiment will be approximately three years, or until fifteen to twenty heifers are available to be placed on each ration.
The estimated annual costs for this project are:

Feed .................................. $2,000.00
Supplies ................................ 1,050.00

Scales $500
Waterers 200
Feed troughs and racks 200
Feed scales 150

Student labor ............................. 1,000.00

$4,050.00

TABLE 1
COMPOSITION OF EXPERIMENTAL Calf STARTERS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelled Corn</td>
<td>522</td>
<td>538</td>
<td>512</td>
<td>525</td>
</tr>
<tr>
<td>Cracked Corn</td>
<td>522</td>
<td>537</td>
<td>512</td>
<td>526</td>
</tr>
<tr>
<td>Crimped Oats</td>
<td>522</td>
<td>533</td>
<td>512</td>
<td>527</td>
</tr>
<tr>
<td>Molasses (liquid)</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Soybean oil meal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(44% C.P.)</td>
<td>405</td>
<td>356</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>0</td>
<td>0</td>
<td>436</td>
<td>386</td>
</tr>
<tr>
<td>Urea</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Trace mineralized salt</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Aureomycin</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>*Vit. A &amp; D Supplement</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

2168  2168  2168  2168

* Must provide 10,000 I.U. Vitamin A and 500 I.U. Vitamin D per pound.
During the past decade considerable interest has been shown in the area of nutrition of the dairy heifer. Research conducted at the various agriculture experiment stations has covered a wide variety of subjects, some of which are:

1. Level of feed intake and its effect on production in the first lactation (13,14),
2. Dietary effect on enzyme production in the calf (5),
3. Metabolism of different types of carbohydrates (6,15),
4. Animal vs. vegetable types of protein (10),
5. Utilization of non-protein nitrogen by the young calf (11,12),
6. Use of antibiotics in milk replacers, whole milk, and calf starters (12,1).

Swanson (14), using identical twin heifers of the Holstein breed, found the dairy heifer grown at a normal rate to have more secretory tissue in the udder and to produce more milk in the first lactation than her twin counterpart, which had received a high level of feed for the first two years of life. In another study (13), Swanson found that the ideal time to calve dairy heifers was somewhere near two years of age. In this study, using identical twins, he found that the two-year-old heifer produced more milk in the first lactation than her twin did at three years of age and was also more persistent in production during the first lactation; however, this difference in milk production during the first lactation did not carry over into succeeding lactations.

A study conducted at Iowa State University (9) has shown that heifers on low levels of nutrition for the first eight weeks of life tend to show the effects of this treatment up to one year of age, but that the slow rate of growth in the first few weeks of life has no effect on the first lactation, provided the animals receive proper care and food until calving.
Huber, et. al., (6) found sugar supplementation of whole milk to be impractical because of low digestion or low absorption of the added carbohydrate. The apparent digestion coefficient for lactose (milk sugar) was 94% but for sucrose (from sugar cane) was only 37%, indicating low digestion or low absorption. This work is supported by another study (5) which shows lack of enzyme adaptation to diet, but that heifers could utilize a diet of sucrose and starch after the rumen develops. Loosli, (11) has shown that the rumen mucosa and papillae begin to develop as soon as the young ruminant consumes a dry food material, thus making utilization of a wide variety of feed materials possible.

Other work (4) has shown there is no great advantage for complex calf starters over simple starters if fed on the same TDN basis; a simple starter in this study fed at 18% protein gave a significantly higher rate of gain than a complex starter fed at 20% crude protein.

Pasture (7) has been shown to be superior to dry lot feeding of hay for rate of gain for heifers six to twenty weeks of age. In this study each animal on either the hay or pasture diet received three pounds of dry calf starter daily.

Lassiter (3) has found the most satisfactory level of protein for the young calf to be between 18-20%. Brown, et. al. (1,11) have shown that a young calf six weeks of age, consuming a dry starter, is able to utilize the non-protein nitrogen compound, urea, as a protein substitute in the starter ration. In another study Lassiter and Brown (2) found no significant difference in gain on diets containing 14%, 16%, and 18% protein, but were able to show the optimum protein-caloric energy ratio to be 46 calories for each percent of protein in the diet.

Swanson (12) and Brown (1) have both shown beneficial results in heifer growth by the addition of chlortetracline, an antibiotic marketed as aureomycin, to both the whole milk, milk substitutes, and dry starter (grain) rations of the young ruminant.


13. Swanson, E. W. Milk Production and Growth of Identical Twin Heifers Calving for the First Time at Two Years and Three Years of Age. J. Dairy Sci. 44:2027. 1961
