DAIRY SCIENCE -- 1966

Ohio Agricultural Research and Development Center

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ON THE COVER: Gerlaugh Hall, new $1.25 million
office and laboratory building for Departments
MAKING THE "SMALL" HERD MORE COMPETITIVE

J. A. Speicher
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The "small," well-managed dairy herd is economically competitive today and it will be economically competitive tomorrow! The "small," inefficiently-managed dairy herd never was, is not now, and never will be competitive!

Anytime a dairy herd is characterized by the word "small," the number of concepts of "small" nearly equals the number of readers—and authors. For these purposes, "small" is defined as a one-man dairy operation where the operator produces the feed crops, raises the replacements, and milks and feeds the cow herd. It is still "small" if his wife and children help him.

The type of dairying being referred to is basically a means of marketing the products of land and labor. Crops produced by the farmer are marketed through dairy cows. With such a system of farming, the dairymen must concern himself with attaining a profitable cropping program. He must then use his abilities to build a profitable dairy enterprise. The magnitude of the crop and dairy enterprises must be sufficient to return what he feels is an adequate income and all the parts need to fit together into a balanced and efficient operation.

For the dairy herd small in cow numbers to be in the strongest competitive position, efforts must be directed at making it big in output. The 30-cow herd producing 15,000 pounds of milk per cow is larger than the 45-cow herd producing 10,000 pounds of milk per cow and, other things being equal, a great deal more profitable. Crop yields need to be maximized and each acre must be used to its greatest advantage by growing crops which will furnish the greatest nutrient output per acre.

The operator of a small dairy herd needs to pay particular heed to the lessons of specialization. It is possible to increase efficiency considerably when one task is undertaken and continued for a reasonable length of time. Inefficiency is at its greatest when it becomes necessary to constantly change tasks and the accompanying equipment and methods. For this reason, the very small dairy herd which is accompanied by a "very small" number of sows and a "very small" number of ewes lends itself to inefficiency.

One of the greatest problems the small operation faces is related to investment. The fewer acres and cows in a smaller operation mean that each cow and each acre must carry a little larger load. For example, machinery investment (depreciated value) on a 400-acre farm could logically be expected to be held to $50 to $60 per tillable acre. It would be difficult to hold the machinery investment to this level on a 120-acre farm. Consequently, custom hiring of some jobs, joint ownership of machinery with the neighboring farmer, and the purchase of used machinery must play a larger role in the management of the smaller operation.
A sociological problem also faces the one-man dairy operation. Fewer and fewer members of society are willing to be tied down to the extent that a dairy herd holds the operator of a one-man dairy farm. In previous generations, this had little meaning but today it comes forward with ever greater force. To date, solutions have been individual in nature with many operators arranging some type of relief milking. Often the relief milker is the DHIA tester or a neighbor who has previously worked with dairy cattle. While this problem is not basically economic in nature, it is a real problem and is one of the causes for increased herd size. Many dairymen have increased their herd size to support two families so they might have more flexibility and freedom to leave the farm for extended periods.
PROFITABLE DAIRY FARMING TOMORROW

J. A. Speicher
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Dairy farming has been going through a period of adjustment. These adjustments are continuing to take place. While exact predictions of the future are not possible, it is possible to view what has and is happening in the dairy industry and to speculate from there.

Today's dairy farmer is faced with an investment which has been increasing as both size of operation and price levels have increased. The value of farm production has increased due to greater milk sales per farm and total costs are up. The pressure to increase dollar volume of business because of a smaller operating margin faces the dairyman at a time when he finds himself nudged ever faster toward complete mechanization due to the difficulties involved in finding reliable labor.

In viewing the existing situation, it also become obvious that the dairyman of today has the benefit of operating with the most advanced agricultural and dairy technology which ever existed. He finds himself milking cows with high productive ability and harvesting crop varieties with high yield potential. His job no longer demands the long hours of heavy physical exertion it once required. The dairyman himself is a well educated and highly capable member of society.

Based on what has been and is happening in the dairy industry, several factors are fairly certain to be necessary for profitable dairy farming tomorrow. The dairyman himself will need to be a skilled technician who keeps informed on new developments and price changes. He will need to be the kind of a man who spends time analyzing his farm enterprise. Sound management will be as necessary tomorrow as it is today.

In the future, it will be necessary to pay particular attention to the dollar volume of business. A desirable goal today is $18,000 gross income per man. Tomorrow it will be higher.

Output per cow and per acre will continue to play an important role in the profitable dairy farming operation. High milk production and crop yields serve as a step toward sufficient dollar volume and satisfactory labor income. The efficient use of labor will become one of the more important factors in profitable dairying tomorrow. As labor becomes more difficult to locate and consequently more expensive, it will be essential that it be used with wisdom. Presently, 350,000 pounds of milk per man serves as a working goal for the dairyman who also produces his feed crops and raises his replacements. Tomorrow this also will be higher.

Another factor conducive to profit for tomorrow's dairyman will be the selection of crops which furnish high nutrient output per acre.
At present the corn plant has a high priority but for most farms corn serves most profitably when alfalfa forms a part of the rotation.

The profitable dairyman of tomorrow will certainly need to manage investments and costs and not let them manage him. Investments wisely made will be those which get the greatest return per dollar invested. Purchases made in quantity and at the proper time will be more important in the future than they are now.

Adequate financing must necessarily be part of the profitable dairy operation. Repayment terms in the future, as now, must be in line with the ability of the business. Sufficient operating capital will need to be available to allow the manager to make full use of his knowledge.

Finally, the profitable dairy farm of tomorrow can be expected to be a planned operation. The dairyman will need to keep adequate financial, crop, and livestock records and routinely use these records to assist him in maximizing profits.
By June 30, 1966, the alfalfa weevil had been found in all of Ohio's 88 counties.

Alfalfa weevil damage to first and second cutting alfalfa was severe in 1966. The two main reasons for this were: (1) damaging populations were present in areas which previously experienced minor damage, and (2) rains in southern Ohio delayed the application of control sprays and permitted the alfalfa weevil to get a head start. Economic losses are expected to exceed the 1965 losses of $7 million by a substantial margin. A large part of this will be from loss of stand.

The future outlook concerning the alfalfa weevil is that economic damage may be expected throughout the state by 1970. Generally, after the weevil is found in an area or county, damaging populations may be expected 3 years later. Unlike other destructive insects, damaging populations of the alfalfa weevil may then be expected every year.

Like flies in the barn or weeds in corn, the alfalfa weevil is a pest the dairyman must learn to control. If control measures for the weevil are not applied, only dry alfalfa stems are left for the first cutting and subsequent regrowth may be seriously damaged.

The alfalfa weevil can be effectively controlled if the dairyman will take the following steps:

1. Become familiar with life history of the insect and its various stages, i.e., eggs, larvae, pupae, adults. This can be done by reading literature available from county extension agents and by attending meetings on the alfalfa weevil.

2. Obtain copies of current alfalfa weevil control recommendations and read them carefully.

3. Inspect alfalfa fields twice each week.

4. Select the pesticide to be used and carefully follow recommendations for its use and application. Pay particular attention to proper timing of applications.

5. Follow recommendations concerning retreatment or treatment of stubble.

Research is continuing at a rapid pace to find more convenient and economical means of controlling the alfalfa weevil. Until these are developed, spray applications of recommended insecticides are the best means of control.
In producing forage of the highest quality for dairy cows, three primary considerations must be taken into account. The first one is the problem of avoiding weather damage. Second, this type of forage should be processed in a physical form which will allow the cow to utilize the energy (cellulose and other fibrous substances) to the greatest extent. The third consideration is the cost of producing high quality forage, independent of the weather and in suitable physical form.

Two methods are available for avoiding weather damage: making the crop into silage or artificially drying the crop with or without prior wilting in the field.

Making silage is currently popular, especially high dry matter silage. High dry matter silage is palatable and avoids some of the problems of low dry matter silage. However, when the problems associated with uniform wilting, fermentation losses, feed intake, digestibility, storage costs, water handling, and odors are taken into account, the need for improved methods of processing high quality forage is apparent.

Making sun-cured baled hay is extremely hazardous in this area, especially from the first crop. Barn drying of baled hay offers a way of getting the crop out of the field and apparently saving the crop. However, often it is discovered at feeding time that barn-dried hay is musty, moldy, over-dried, harsh, or stemmy so cattle won't eat it in the needed amounts for high production.

The system of harvesting and drying forage which is most independent of weather and storage losses is that practiced by the commercial alfalfa dehydrators. Dehydrated alfalfa pellets have done an excellent job of meeting their objectives of the production of a high protein, high stabilized carotene, high xanthophil, high density product which fits well into the manufacture of commercial concentrate feeds. However, dehydrated alfalfa pellets have not proven to be a good source of energy for the ruminant, even though the original crop may have been an excellent source of energy.

The poor cellulose digestion of dehydrated alfalfa pellets is a result of changing the physical form by fine chopping and grinding through a hammermill prior to pelleting. This reduces the particle size to the point where the rate of passage through the rumen is too fast for complete bacterial fermentation of the cellulose. Thus much of the cellulose and related fibrous material passes undigested into the feces.

In Research Center experiments, it was not uncommon to find cellulose digestibilities of 40% or lower in ground and pelleted forage where the cellulose digestibility of long or coarsely chopped
hay from a similar crop was 67%. In most of the experiments, dry matter intake increased when the pelleted forage rations were fed. So digested dry matter was about the same and milk production was similar, despite the lowered efficiency of the pelleted forages.

Another problem associated with fine grinding and increased rate of passage is the effect on butterfat test. If rate of passage is too high, insufficient acetic acid is produced in the rumen and percent butterfat in the milk is reduced. Acetic acid is a precursor in butterfat synthesis and, if insufficient amounts are present, it interferes with normal butterfat synthesis. Ordinarily the feeding of a few pounds of coarse roughage will remedy this situation.

A recent effort, supported in part by the American Dehydrators Association, was made to try to improve the cellulose digestibility of dehydrated alfalfa pellets. Beet pulp, corn silage, and long alfalfa hay were fed with different proportions of alfalfa pellets. It was reasoned that perhaps these other coarser roughages would enmesh the fine alfalfa particles and delay their passage through the rumen.

The addition of either 10% beet pulp or corn silage showed a slight improvement in the observed percent cellulose digestion of the pellets compared to the expected. However, it was concluded that the associative effects of other roughages does not offer a practical method for overcoming the adverse effects of fine grinding on cellulose digestion. Therefore, if dehydrated alfalfa or grasses are to be produced in a form best suited for use by cattle and other ruminants, a way must be found to eliminate fine grinding.

Ohio dairy scientists have participated in several efforts in cooperation with the Department of Agricultural Engineering and various farm implement companies to develop a system for producing high quality forage which could be stored safely and handled easily. These efforts have involved wafering chopped dehydrated alfalfa, chopped dehydrated alfalfa baled in large high density bales using a paper baler, and flail harvester chopped alfalfa and immature orchard grass dried on a slatted floor with heated air and baled with a high density baler. These efforts are being continued.

A question often raised is: How much can we afford to pay for harvesting and processing forage crops as feed for dairy cows? A partial answer is given in the following table. It shows the value of forages harvested at different stages of maturity based on their energy and protein value when corn can be sold for $44 per ton and soybean oil meal can be purchased for $100 per ton.

Hay can ordinarily be purchased for $25-$35 per ton and can be produced on the farm at even lower cost. Thus the production of high quality forage, based on its actual feeding value in contrast to low quality forage and corn silage, allows a considerable margin. This can be applied to processing to avoid weather damage and to produce a product which can be stored, transported, and fed in suitable physical form for maximum utilization by dairy cattle and other ruminants.
Protein and Energy Value of Forages Based on Corn at $144 per Ton and Soybean Oil Meal at $100 per Ton.

<table>
<thead>
<tr>
<th>Forage Crop</th>
<th>Date Harvested</th>
<th>Dig. Prot.</th>
<th>Est. Net Energy</th>
<th>Feed Value /Ton *</th>
<th>**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(%)</td>
<td>(Therms)</td>
<td>($)</td>
<td></td>
</tr>
<tr>
<td>Orchard Grass</td>
<td>May 3</td>
<td>24.4 (est.)</td>
<td>62 (est.)</td>
<td>69.54 (est.)</td>
<td></td>
</tr>
<tr>
<td>Alfalfa</td>
<td>May 16</td>
<td>20.0</td>
<td>62</td>
<td>61.43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>June 3</td>
<td>16.9</td>
<td>49</td>
<td>50.56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>June 15</td>
<td>13.2</td>
<td>45</td>
<td>42.16</td>
<td></td>
</tr>
<tr>
<td>Alfalfa-Brome</td>
<td>May 17</td>
<td>16.9</td>
<td>62</td>
<td>55.71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May 24</td>
<td>14.1</td>
<td>56</td>
<td>48.18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May 31</td>
<td>11.3</td>
<td>52</td>
<td>41.43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>June 7</td>
<td>9.5</td>
<td>48</td>
<td>36.53</td>
<td></td>
</tr>
<tr>
<td></td>
<td>June 14</td>
<td>8.6</td>
<td>45</td>
<td>33.68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>June 21</td>
<td>5.8</td>
<td>38</td>
<td>25.75</td>
<td></td>
</tr>
<tr>
<td>Corn Silage</td>
<td>Early dent</td>
<td>4.1</td>
<td>65</td>
<td>33.30</td>
<td></td>
</tr>
<tr>
<td>Other feeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn and cob meal</td>
<td></td>
<td>3.9</td>
<td>72</td>
<td>35.70</td>
<td></td>
</tr>
<tr>
<td>Shelled corn</td>
<td></td>
<td>6.0</td>
<td>81</td>
<td>44.00</td>
<td></td>
</tr>
<tr>
<td>Soybean oil meal</td>
<td></td>
<td>37.0</td>
<td>80</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

* Calculations based on Petersen's formulas (J. Dairy Sci., 15: 293. 1932) dry matter basis.

** Does not include the value of carotene (vitamin A), vitamin D, calcium, phosphorus, other minerals, and perhaps unidentified nutritional factors present in these forages.
UREA-TREATED CORN SILAGE AND HIGH MOISTURE CORN FOR DAIRY CATTLE

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The practice of adding urea to chopped corn at the time of ensiling has been found to be a safe way to feed urea to dairy cattle. To increase the crude protein of corn silage, some dairymen are adding 10 lb. of urea per ton of forage as it goes into the silo. As a result, the crude protein of the corn silage is increased from approximately 6 to 13 percent. Presumably this reduces the protein needed in the grain ration. Other advantages are that a short time is required for adding urea, thorough mixing is nearly certain because of the relative small proportion used, and there is almost no chance of toxicity occurring, even if a twofold error is made in the urea addition.

On the other hand, it is highly questionable if urea-treated corn silage is the most efficient way to use urea in dairy cow feeding programs. Research Center results indicated nitrogen losses up to 18 percent. Feed intake also was suppressed when high-moisture corn silage was used. Efficiency of nitrogen utilization for protein synthesis was decreased unless at least half of the total nitrogen was furnished as unfermented crude protein from such sources as hay, pasture, or protein concentrates. The distribution of nitrogen between protein and non-protein nitrogen in some commonly used roughages is shown below.

<table>
<thead>
<tr>
<th>Roughage</th>
<th>% in Protein</th>
<th>% in NPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa hay</td>
<td>88</td>
<td>12</td>
</tr>
<tr>
<td>Alfalfa silage</td>
<td>56</td>
<td>6/4</td>
</tr>
<tr>
<td>Corn silage</td>
<td>51</td>
<td>49</td>
</tr>
<tr>
<td>Urea-treated corn silage</td>
<td>39</td>
<td>71</td>
</tr>
</tbody>
</table>

The limits of tolerance for non-protein nitrogen of individual cows may be reached if urea-treated corn silage (10 lb./ton) is the only roughage fed free choice and the amount eaten is above 6 lb. per 100 lb. of body weight.

The convenience of adding urea during ensiling results in some specific disadvantages in terms of nitrogen losses. When urea is added to corn at the time of ensiling, the optimum amount seems to be 7 to 10 lb. per ton of green material, depending on the moisture content. Urea may be used at this same level with ensiled high-moisture, ground shelled or ear corn.
Results of 5 years' research with ensiled high-moisture ground ear corn show that it was equivalent in feeding value to ground ear corn. The only exception was that when it was fed with a legume-grass silage ration of low dry matter, extra protein (soybean oil meal) was required to meet the protein needs of high-producing cows.
The pelleted combination of alfalfa meal and urea has provided a highly effective means of extending the quantity of urea which may be included in the rations of high-producing cows from approximately 20% of the total dietary nitrogen to 40%.

Urea has been used successfully in increasing quantities during the past 20 years as a partial protein substitute in concentrate rations for dairy cows. Current guidelines provide for including 1.5 to 2% urea in the usual grain concentrate mixtures for milking cows. This level of urea in the grain concentrate furnishes 18 to 24% of the total dietary nitrogen as urea and has resulted in satisfactory acceptability and milk yields.

When higher levels of urea, 2.75% of the grain concentrate or in excess of 25 to 32% of the total nitrogen, were fed in the usual grain mixtures, feed intake was depressed in high-producing cows. It was found that the depression in feed intake and unpalatability of high urea dairy rations can be eliminated by pelleting with alfalfa meal.

In current Ohio studies, supported in part by the American Dehydrators Association and the Alfalfa Producers Association of Ohio and Michigan, a pelleted combination of 66% dehydrated alfalfa, 31.6% urea, 2% monosodium phosphate, and 0.4% sodium metabisulfite is used as the protein concentrate in rations of high-producing cows. This protein supplement is tentatively called Dehy-100 because its total crude protein equivalent is approximately 100%. When added to corn meal at the 9% level, it results in a concentrate ration containing 18 to 19% protein. The resulting concentrate contains just under 3% urea, the legal limit.

It is assumed that the urea contained in the "dehy" pellet is released much more slowly in the rumen. This, along with the fact that the urea is in close proximity to the alfalfa particles, apparently increases the efficiency of nitrogen utilization considerably. Answers to these questions must await the results of experiments now being conducted or in the planning stages.

During the past 5 months, milk yields of cows fed Dehy-100 were equal to those receiving soybean oil meal as the protein supplement (Table 1). The highest producing cows have produced 70 to 74 lb. of 4% fat-corrected milk (FCM) per day for 140 days. They consumed 1 lb. of urea and 2 lb. of dehydrated alfalfa daily in the form of Dehy-100. It should be noted that 35 to 40% of the total nitrogen eaten by these cows was urea nitrogen.

The maintenance of high productivity in cows fed Dehy-100 demonstrates the probable usefulness of this product as a substitute for more costly forms of protein supplement.
TABLE 1.—Milk Yield of Cows Fed Either Dehy-100 or Soybean Oil Meal as the Protein Supplement in an 18% Crude Protein Concentrate.

<table>
<thead>
<tr>
<th>Cows</th>
<th>Milk Yield (lb. of 4% FCM)</th>
<th>Time, on Test (days)</th>
<th>4% FCM (lb./day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehy-100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H-1361</td>
<td>10,471</td>
<td>140</td>
<td>74.8</td>
</tr>
<tr>
<td>H-1580</td>
<td>8,328</td>
<td>142</td>
<td>58.5</td>
</tr>
<tr>
<td>H-1680</td>
<td>5,077</td>
<td>79</td>
<td>64.3</td>
</tr>
<tr>
<td>J-1632</td>
<td>6,871</td>
<td>148</td>
<td>46.4</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>127</td>
<td>61.0</td>
</tr>
<tr>
<td>Soybean Oil Meal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H-11439</td>
<td>7,807</td>
<td>110</td>
<td>71.0</td>
</tr>
<tr>
<td>H-1593</td>
<td>8,282</td>
<td>145</td>
<td>57.1</td>
</tr>
<tr>
<td>H-1637</td>
<td>7,762</td>
<td>123</td>
<td>63.1</td>
</tr>
<tr>
<td>J-1643</td>
<td>5,401</td>
<td>145</td>
<td>37.2</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>131</td>
<td>57.1</td>
</tr>
</tbody>
</table>
Ohio's new milk sanitation program is based on House Bill 420 passed by the Ohio General Assembly in 1965. This act provides for some fundamental changes in the administration of the state's milk sanitation program but few of these changes will be evident to the majority of milk producers.

The State Department of Health assumes the primary responsibility for administrating this new act. The regulations have general application in all health districts participating in this program in the state. They conform as far as practical to provisions of the most recent recommendations of the U. S. Public Health Service if they do not conflict with present state laws.

The Director of the State Department of Health has the responsibility for making a survey of each local health district to determine if it is qualified to administer and enforce the various provisions of the laws and regulations which apply to milk sanitation. Resurveys can be made if the Director believes they are required and approval may be given or withdrawn as conditions warrant.

Each producer must obtain a license ($5.00) from an approved local health district. The license remains valid for 1 year unless suspended, revoked, or the producer fails to renew it by January 15 each year. A denial, suspension, or revocation of a license is not effective until notice in writing has been delivered to the producer and a reasonable opportunity has been given for correction of the violation. Then each individual has an opportunity to appear at a hearing before the health district officials issuing his license.

Each dairy farm must be inspected once every 6 months. When approved by the State Director of Health or an approved health district, the milk can be sold anywhere in the state without further inspection.

Milk producers do not have to pay inspection fees as previously required in many parts of the state.

The bacteria count and temperature must be determined on at least four samples of each producer's milk every 6 months. The bacteria count limit is 100,000 and the temperature limit 50° F. Whenever two of the last four consecutive temperatures or bacteria counts taken on separate days exceed the above limits, the health district responsible must send the producer a written notice. This notice remains in effect as long as two of the last four consecutive samples exceed the limit. Whenever one of these limits is exceeded in three of the last five determinations, the law requires immediate suspension of the license.

Milk producers will find that other changes in requirements are minor. This is especially true for producers participating in the
Interstate Milk Shippers Program. This includes more than 14,000 of Ohio's 15,000 Grade A milk producers.

The new act creates a Milk Sanitation Board, with milk producers having a representative on this board. Other members are the Director of Health as Chairman, the Director of Agriculture, a representative of milk processors, and an employee of a health district. This board advises and consults with the Director of the State Health Department and Public Health Council regarding the administration and enforcement of various sections of the new law and revised code, develops new regulations and proposes revisions for consideration of the Public Health Council, and prescribes or adjusts fees as authorized in the revised code.
Ohio's major soil types and climatic conditions are represented at the Research Center's 11 locations. Thus, Center scientists can make field tests under conditions similar to those encountered by Ohio farmers.

Research is conducted by 14 departments on more than 5900 acres at Center headquarters in Wooster, nine branches, and The Ohio State University.

Center Headquarters, Wooster, Wayne County: 2017 acres
Eastern Ohio Resource Development Center, Caldwell, Noble County: 2039 acres
Mohoning County Experiment Farm, Canfield: 275 acres

Muck Crops Branch, Willard, Huron County: 15 acres
North Central Branch, Vickery, Erie County: 335 acres
Northwestern Branch, Hoytville, Wood County: 247 acres
Southeastern Branch, Carpenter, Meigs County: 330 acres
Southern Branch, Ripley, Brown County: 275 acres
Vegetable Crops Branch, Marietta, Washington County: 20 acres
Western Branch, South Charleston, Clark County: 428 acres