# PROTEIN NEEDS OF YOUNG CALVES

By Robert W. Gardner

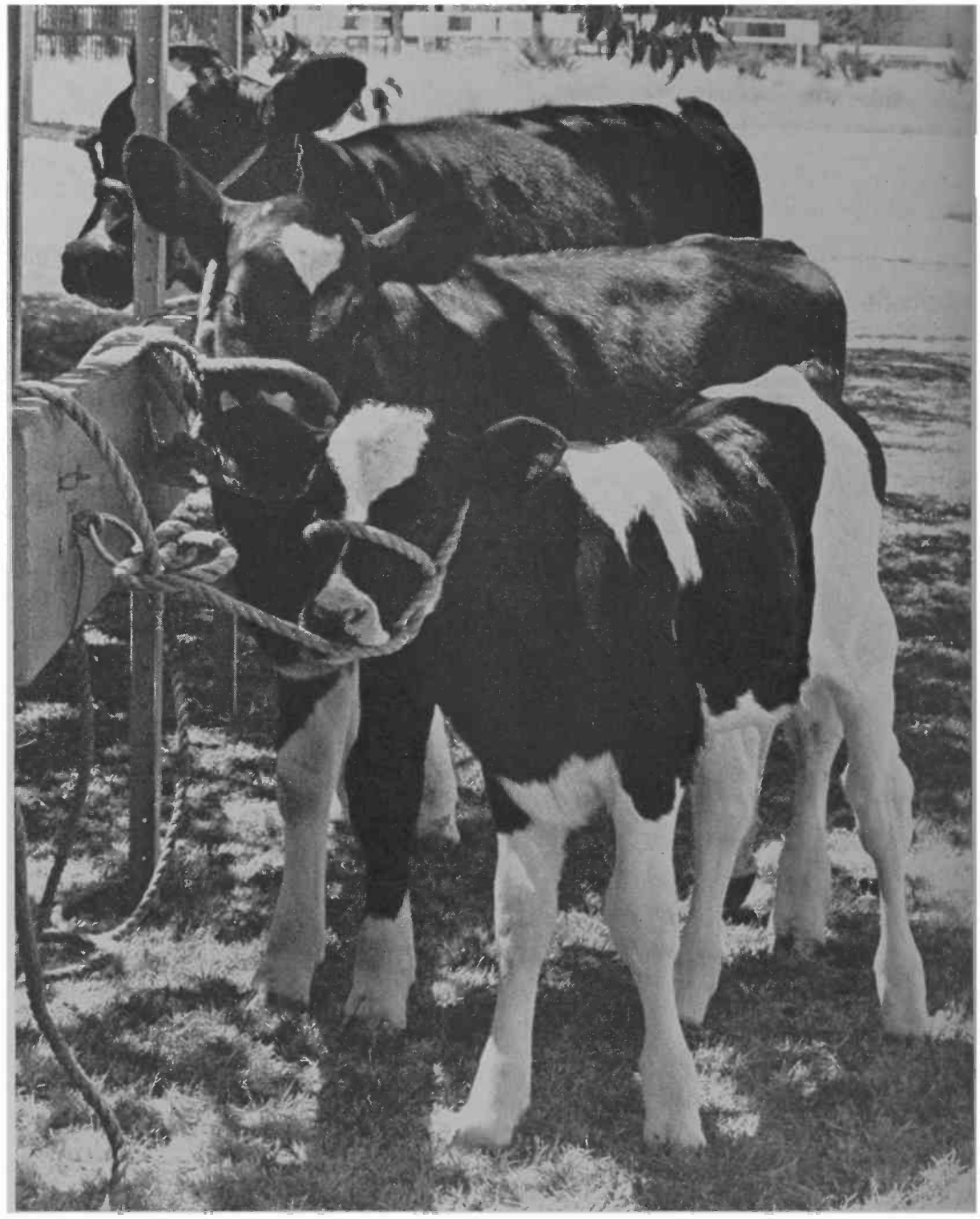
*Protein supplements can be deleted from calf starter rations provided the calf is given free access to concentrate mixes containing barley, and is supplied good quality alfalfa hay in unlimited amounts. This means substantial savings in feed costs without a detrimental effect on calf gains or health.*

This conclusion has been reached in the second phase of a study to find calf starters which provide proper nutrients, palatability and low-cost gains. Protein quality and ration palatability were investigated in an earlier experiment (*Progressive Agriculture in Arizona* Vol. XVIII, No. 1, 1966).

An observation common to both experiments was the dramatic effect of higher energy intake on rate of growth. Satisfying their appetites with palatable grain combinations and hay has allowed calves to approach more nearly their genetic potential in growth and yet the cost of the gains have been surprisingly low.

Thirty-six Holstein heifer calves were divided into three groups as they were taken from their dams at three days of age. Each group was offered starter rations containing equal amounts of digestible energy levels but different levels of protein, adjusted by substituting soybean oil meal for barley. All ration ingredients (Table 1) were ground and pelleted as a complete feed in order to avoid feed sorting.

Milk was limited to the amounts shown in Table 2. The calves were fed and housed individually. The rations were fed free choice. Feed consumption was recorded daily and calf weights were observed weekly. Gains



and feed utilization were calculated on the basis of growth from birth to 200 lb. body weight.

A second phase of the experiment was to consider the protein requirements of calves in the weight range of 200-400 lb. Accordingly, three different rations (Table 3) containing three graded levels of protein but equal energy content were fed to the heifers over this weight range. The calves were arranged in treatment groups such that an equal number of the calves on each of the three previous protein levels were included in

**Table 1 — Growth period 1 (birth to 91 kg)**

| *Ingredients* | *Ration* | | |
|---|---|---|---|
| | *1* | *2* | *3* |
| | | % | |
| Barley | 64.5 | 58.0 | 51.0 |
| Alfalfa hay | 20.0 | 20.0 | 20.0 |
| Soybean oil meal | 3.0 | 9.5 | 16.5 |
| Molasses | 10.0 | 10.0 | 10.0 |
| Salt | 1.0 | 1.0 | 1.0 |
| Dicalcium phosphate | 1.0 | 1.0 | 1.0 |
| Aurofac 10[a] | 0.5 | 0.5 | 0.5 |
| Vitamin A (30,000 I.U./g) | 0.022 | 0.022 | 0.022 |
| Crude protein | 11.9 | 14.7 | 16.9 |
| Digestible protein | 8.5 | 11.3 | 12.5 |

[a] Chlortetracycline (aureomycin) at 10.0 g/kg supplement.

**Table 2 — Milk Feeding Plan**

| *Calf Age* (*days*) | Daily Feed: *Whole Milk* (*lb./10 lb. body wt.*) | Daily Feed: *Skim Milk* (*lb./10 lb. body wt.*) |
|---|---|---|
| 0-3 | On cow | |
| 4-7 | 1 | ----- |
| 8-14 | 0.5 | 0.5 |
| 15-35 | ----------- | 1.0 |
| 36-42 | ----------- | 0.5 |
| Weaned by 42 days | | |

This is one of a series of reports, in *Progressive Agriculture in Arizona*, on research findings by Dr. Gardner when he was a member of the UA Dairy Science Department staff. He is now at Brigham Young University.

**HERE ARE THREE calves weighing 95 pounds (birth size); 200 pounds (end of Growth Period 1), and 400 pounds (end of Growth Period 2). The two larger calves consumed the rations containing the low-← est protein levels (Rations 1 and A). The picture portrays thrifty, healthy calves with no harmful effects from the low protein levels. Conformation and bone structure were not affected adversely by the rations.**

the groups fed the new levels. Grains and hay were offered separately, free choice, during this second phase.

The influence of protein levels on ration digestibility was observed in digestion trials. All rations were compared relative to efficiency of utilization of digestible protein and energy for growth.

Growth rate as measured by both daily gains and body measurements were not significantly affected by differences in protein levels used in the rations (Table 4.). This is rather surprising with a realization that a protein supplement comprised only 3% of Ration 1 during growth period one and no protein supplement was added to Ration A which was fed during the second growth period. Growth responses during the second growth period were not influenced by the protein levels consumed during the first period.

Most calf starter rations are currently formulated to contain 16 to 24% protein under the assumption that any less would reduce growth rate and subject calves to ill health. An important factor in the consideration of protein levels is the amount of feed a calf will consume each day, and the amount of energy in the feed. Too frequently calf feeders concern themselves with protein levels without any consideration of the amount of energy allowed the calves each day. *The results of this and previous studies indicate that energy requirements have been underestimated and protein levels overemphasized in attempting to obtain rapid and economical calf growth.*

Using different levels of protein did not change the total feed or digestible energy requirement for equal weight gains. Efficiency of feed utilization is summarized in Table 4.

The feed cost of raising each calf from birth to 200 lb. was about $1 less for calves fed Ration 1 (11.9% protein) than for those consuming Ration 3 (16.9% protein) because of the added costs of protein supplements in Ration 3. A difference in feed costs of $4.72 was noted in comparing Ration A (9.2% protein) with Ration C (14.0% protein) in the 200 lb. gain from 200 to 400 lb. body weight.

The lowest protein precentages used in the rations studied were not low enough to reduce the digestibility of the total ration. Calf health was excellent on all rations, with no death losses and limited scours only during the early milk feeding stage.

Approximately 18-19% of the weight gain of young Holstein calves is protein, the remainder being water, fat and minerals. The calves consuming Ration 1 converted 24 lb. of apparently digestible protein to an estimated 19 lb. of body protein, or a conversion value of 80%. The protein conversion value was 53% for the calves fed Ration 3. The animal industry has been criticized for the inefficient conversion of feed protein to animal protein for human consumption. Obviously this situation is the result of feeding excessive levels of protein needlessly.

The secret of a successful feeding program for replacement calves is unlimited access to palatable grains and alfalfa hay. Attempting to raise young calves on strictly roughage rations to reduce feed costs often proves to be more costly in both feed dollars and time than allowing calves to grow at their potential rate by free choice grain-hay selection. In the western area inclusion of barley as the main component of grain rations and alfalfa hay as the roughage seem to assure adequate protein levels when calves can satisfy their appetites with these feeds.

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**Table 3 — Growth period 2 (91 to 181 kg)**

| *Ingredients* | *Ration* | | |
|---|---|---|---|
| | *A* | *B* | *C* |
| | | % | |
| Steam rolled barley | 48.3 | 43.4 | 40.1 |
| Dry rolled milo | 45.2 | 43.4 | 40.1 |
| Soybean oil meal | ..... | 6.7 | 13.3 |
| Molasses | 5.0 | 5.0 | 5.0 |
| Ground limestone | 1.0 | 1.0 | 1.0 |
| Salt | 0.5 | 0.5 | 0.5 |
| Vitamin A (30,000 I.U/g) | 0.008 | 0.008 | 0.008 |
| Crude protein | 9.2 | 11.8 | 14.0 |
| Digestible protein | 5.1 | 8.5 | 9.1 |
| Alfalfa hay Crude protein 16.0 Digestible protein 11.9 | | | |

**Table 4 — Summary of average daily gains, total feed consumption, and daily feed consumption.**

| | *Rations* | | | | | |
|---|---|---|---|---|---|---|
| | *Period 1 (birth-200 lb.)* | | | *Period 2 (200-400 lb.)* | | |
| | *1* | *2* | *3* | *A* | *B* | *C* |
| | | (*lb.*) | | | (*lb.*) | |
| Av. Daily Gains (post weaning) | 1.6 | 1.6 | 1.6 | 2.5 | 2.4 | 2.4 |
| Av. total feed consumption (post weaning) | 185 | 201 | 188 | 716 | 668 | 792 |
| Alfalfa hay — fed separately | | | | 173 | 182 | 151 |
| Daily feed consumption (post weaning) | 4.4 | 4.4 | 4.2 | 8.8 | 8.1 | 9.7 |
| Alfalfa hay | | | | 2.2 | 2.2 | 1.8 |
| Feed/lb. gain | 2.8 | 2.7 | 2.8 | 4.4 | 4.3 | 4.7 |

**Table 5 — Average feed costs.**

| | *Rations* | | | | | |
|---|---|---|---|---|---|---|
| | *1* | *2* | *3* | | *A* | *B* | *C* |
| | | $ | | | | $ | |
| Ingredients and manufacturing costs/ton | 73.86 | 76.94 | 80.26 | | 65.68 | 68.95 | 72.23 |
| Alfalfa hay/ton | | | | $35.00 | | | |
| Av. Feed costs[1] | 8.39 | 8.86 | 9.41 | | 26.51 | 26.24 | 31.23 |

[1] Feed costs include all solid feeds from birth by growth periods. Milk costs are not included.

## Prof. Stanley...

(Continued from Page 3)

husbandryman, preached the gospel of better herd sires. Dr. Pistor talked animal health. Prof. Stanley himself "sold" ranchers on supplemental feeding. And among them and others there was born a new industry in Arizona agriculture — the drylot feeding or "finishing" of range cattle.

"I am proudest of the people I brought to our department — Bill Pistor the veterinarian, Lee Scott the animal scientist, "Bart" Cardon, the animal nutritionist, and W. G. "Bill" McGinnies the range scientist," says Prof. Stanley. Scott is deceased, but Pistor and McGinnies are still on the UA staff, although no longer in Animal Science. Dr. Cardon is a leading Arizona businessman catering to the needs of the livestock industry.

Those early workers are credited with devising and perfecting the salt-meal range supplement idea which is still in use. Hungry range cattle, if offered a grain or meal feed in a feeder out on the range, would consume it all in a hurry. Stanley added salt to the cottonseed meal, the salt a "governor" to restrict the animal's intake of the meal. Range cattle eat the mixture when hungry enough, but sparingly.

"One of the best things I ever did for the university was hiring Ernie Hussman," said Prof. Stanley. "Ernie was working as a cowboy on the Larimore ranch when we were running those early salt-meal experiments. I hired him as a UA herdsman, and today, as superintendent of the UA Tucson farms, he is one of the able and necessary cogs in the College of Agriculture operation," said Stanley.

Other important research accomplishments of Prof. Stanley and his associates in those early days included an economic study of range cattle and sheep production in Arizona, and the first and still most authentic study of salt and water consumption by range cattle. Also still valid is an early but complete analysis of range grasses, including the seasonal rise and fall of carotene content.

Another study involved carcass evaluation of Hereford cattle, forerunner by 22 years of today's Performance Registry International. The animal scientists in this university, with Prof. Stanley directing and participating in the work, made a classic study 15 years ago of dwarfism in beef cattle, proving that dwarfism is genetic and not caused by nutritional or other environmental factors.

Prof. Stanley himself obtained his master's degree at Iowa State, took advanced study at the University of Wisconsin, was set to get a Ph.D. later, but in the agreed year, 1938, all sabbaticals were cancelled.

Most important to this university, "Ernie" Stanley and "Bill" Pistor traveled the state and carried the gospel of better livestock management to the cattlemen and sheepmen. They became close friends with those in the industry, establishing a warm rapport which has not since been equalled. Out of those years came the Stanley-Pistor scholarship given to UA students in the livestock fields.

Ernie Stanley himself is a lifetime and honorary member of the cattlemen's, the sheepmen's and the Hereford breeders' state associations. Last year he retired from the department, and today he is still with his longtime colleague, Bill Pistor, working with the UA Brazilian and foreign student programs. He retired as department head emeritus. Prof. Stanley still has a keen interest in his old department and great pride in its continuing accomplishments.

"I guess I'm retired — but I'm still working," says Ernie Stanley with that warm smile which is his trademark. After nearly half a century of working for this university, serving the livestock people of the state, it's hard to quit.


**MARCH**

7 — Annual Bull Sale UA River Road Farm, Tucson.

12 — Maricopa County Nutrition Seminar, Phoenix.

12-14 — Artificial Insemination Workshop, Phoenix.

16 — FFA Field Day — U of A Campus.

**APRIL**

1- 4 — Conference on Control of Microbial and Chemical Contamination of Foods, Phoenix.

13 — Home Citrus Clinic, Ralt River Citrus Farm, Tempe.

20 — Home Citrus Clinic, Salt River Citrus Farm, Tempe.

**MAY**

2 — Cattle Feeders' Day at UA Farms, Tucson.

**JUNE**

3- 7 — Annual Town and Country Life Conference, UA Campus, Tucson.


KAWT, Douglas — Livestock Report — 6:20 a.m. and 12:10 p.m. Monday thru Saturday.

**Maricopa County**

KOOL, Phoenix — Garden Show Sat., 8:45 a.m.

KOY, Phoenix — Farm Report Mon. thru Fri., 6:50 a.m. Sat., 6:55 a.m.

KOOL, Phoenix — Mon. thru. Sat., 5:40 a.m.

KTAR, Phoenix — (radio & TV) Mon. thru Fri., 5:55 a.m.

KPHO, Phoenix — Mon. thru Sat., 5:45 a.m.

KUPD, Phoenix — Mon. thru Fri., 5:50 a.m. and 12:28 p.m.

## Protein Needs...

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Dairymen are tempted to use their regular dairy cow rations to feed to their calves because of ease of handling. There are some nutritional considerations which are counter to use of these rations. Firstly, antibiotics are not added to cows' rations and are useful in calf growth response during the first three months of growth; secondly, supplemental calcium should be included in a grain mix for calves when fed free-choice; thirdly, a supplementary source of Vitamins A and E are recommended when calves are on the grain rations. The author has found that the following amounts are satisfactory in a ton of feed and add but little to the total cost: (1) aureofac 10 (aureomycin, 10 g/lb. of mixture), 1.0 lb.; (2) calcium carbonate (ground limestone), 20 lb.; (3) vitamin A (30,000 I.U./g), ½ lb.; (4) vitamin E (tocopherol acetate at 20,000 I.U./lb.), 5 oz.