Recent Trends in Ruminant Nutrition

Ralph McCall
Recent Trends in

RUMINANT NUTRITION

Ralph McCall

IT IS FITTING that veterinarians should be concerned about the latest findings and ideas in animal nutrition. By the same token, it is important that the animal nutritionist know something of the latest ideas on disease and disease control. This is a day of specialization. It is practically impossible for one man to be an authority on both animal disease and animal nutrition. This does not mean, however, that an authority in one of these fields should not learn what he can of the other. The veterinarian and the feed man have essentially the same goal—to make the farmer more money by use of their services, their products or both.

EARLY NUTRITION RESEARCH

Protein

For many years, college experiments have indicated the need for supplemental protein to get increased returns from most cattle and sheep fattening rations, as well as to improve harvested dry roughage for breeding cattle and stocker cattle. Added protein feeding is now quite general.

Urea is now accepted as a suitable replacement of part of the protein in cattle rations. Urea seems to be somewhat less effective for sheep and dairy cattle than for beef cattle. Urea is not a means of making a ration better. It is a means of making a ration less costly so it will produce less costly gains and will give about the same performance. Urea has more value when high protein ingredients are scarce or expensive. It is a synthetic compound supplying nitrogen, the principal element in protein, but high protein ingredients contain energy and some minerals in addition to protein. When 1 pound of urea replaces the protein in about 7 pounds of soybean meal, it is necessary to include about 6 pounds of corn or energy feed, and some added phosphorus, to have the same feeding value as the soybean meal. Although Iowa State College in their Economy Supplement, supplied all the supplemental protein with urea, and got very good results when it was fed at the rate of 1 pound per day with a full feed of ground ear corn and legume hay, the author feels it is safest to limit the amount of urea to ½ (possibly as much as ½) of the protein of a supplement.

Some misconceptions have developed on protein feeding, one which is on protein poisoning. Many feel that protein poisoning is fairly common in cattle and sheep. To test this theory, one experiment was run in which some short yearling cattle were fed up to 14 pounds per head per day of a 24 per cent protein supplement, with hay as the only other feed. This supplement is usually fed at a 2 pound per day level. This
mixture furnished about 2½ times the recommended level of protein. The cattle did very well with no trouble at all. In another experiment, hogs were fed a much higher protein ration than is normally fed, with no ill effects. One of the best indications of the fallacy of protein poisoning is that green growing grass ranges from 15-25 per cent protein on a dry matter basis while the average ration of harvested feed contains 9 per cent to 12 per cent protein.

Trouble may result when large amounts of straight proteins are fed. This is not because of the excess of protein, but from a deficiency of other critical nutrients such as vitamin A, the presence of large amounts of gossypol in cottonseed meal or of the enzyme urease in improperly toasted soybean meal, for example. A ration containing more than the animal’s requirement for protein is not the most efficient ration, since excess protein is used as a rather inefficient source of energy after the nitrogen has been eliminated.

Minerals

Phosphorus has been recognized as a mineral that is often deficient in rations for feedlot as well as breeding cattle and sheep. Recent Iowa tests indicate the standard for phosphorus requirement is too low for maximum results with a Corn Belt fattening ration. A deficiency of this mineral probably does more than any other nutrient to limit reproductive performance as well as feedlot gain and feed efficiency. Phosphorus is the mineral most likely to be lacking in roughages. The poorer the quality of the roughage, the lower its phosphorus content. Drought increases phosphorus deficiency. Young growing grass is quite a good source of phosphorus, but by mid-season before the grass dries, the phosphorus content of most grasses is less than half the level in early season grass.

Calcium is a very important mineral. Fortunately there is less of a seasonal decline in the calcium content of grass and other forages than there is with phosphorus. Legumes are a particular-

ly good source of calcium. There is no need for added calcium beyond that furnished in steamed bone meal, dicalcium phosphate or deflorinated phosphate, with the possible exception of a ration composed primarily of non-legume roughages such as corn or sorghum silage.

The trace minerals most likely to limit performance of cattle and sheep include cobalt, copper, iron, manganese, iodine, and possibly zinc. Of these, cobalt is very important. It is necessary for the synthesis of vitamin Bl2. Copper and iron are of course involved in blood formation. They are often in short supply, or are unavailable to the animal because they are tied up by molybdenum or some other mineral. Some reason that since the trace mineral content of roughage and grain may be adequate, there is little need to offer a supplemental source of trace minerals. A deficiency of one of these trace minerals can seriously reduce gains and reproductive performance. The cost of supplying the necessary trace minerals is very small, so trace minerals should be included in fortified supplements. Where a supplemental feed is fed, it is a natural means to supply the necessary added minerals. By fortifying the supplement with minerals, it insures a more uniform mineral consumption.

It is often desirable to feed a high phosphorus mineral, free choice, in addition to the fortified supplement. Animals that have previously been on very mineral deficient feed, such as in a drouth area, or those having more than average gaining ability, and mineral requirement, will be more adequately supplied when mineral is also available free choice. Where a supplement is not fed, the free-choice mineral has added value. Free-choice mineral feeding does not usually give as uniform mineral consumption between animals in a group as is secured by hand feeding daily a definite amount of supplement.

**RECENT NUTRITION RESEARCH**

**Rumen Bacteria**

Probably one of the more important discoveries in animal nutrition was that
rumen bacteria are largely responsible for converting roughages to simple forms of energy that the animal can use. Their activity also includes the manufacture of certain B vitamins, and the conversion of non-protein nitrogen, or proteins of poor quality, to protein that meets the animals’ requirements. These bacteria have certain requirements. Some of these are known—others no doubt will be discovered. These micro-organisms require protein, phosphorus, sulfur, and cobalt. They need a source of quick energy, such as from molasses, to act as a “self starter”. They are also stimulated by the so-called “unidentified growth factor”, which occurs in dehydrated alfalfa meal, molasses, occasionally in soybean meal, and some other sources. The knowledge of feeding the rumen bacteria has made it possible to get considerable feeding value from certain poor quality roughages formerly considered worthless. It has also made it possible to get more out of conventional rations.

Vitamins

The need for added vitamin A in rations for fattening cattle, for growing cattle on dry feed, and for breeding cattle, is becoming recognized. This need is greatest for cattle in drouth areas or on feeds of low quality. Vitamin A deficiency has been particularly widespread the past few years. Cases of extreme vitamin A deficiency resulting in definite deficiency symptoms such as swollen legs and brisket, excessive lacrimation and keratitis are easily observed. These usually are corrected. The deficiencies of vitamin A, or of other critical nutrients that result in poor growth or reproduction, but which develop no recognizable deficiency symptom, are less likely to be corrected. Nutritional deficiencies are usually multiple. For example, there is seldom a deficiency only of vitamin A with all other nutrients being in optimum supply.

Stilbesterol

Stilbesterol feeding has been one of the most important advancements in animal feeding. The average results of college experiments throughout the country on feeding stilbesterol are summarized below:

<table>
<thead>
<tr>
<th>High Roughage</th>
<th>High Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per cent increase in gain</td>
<td>11</td>
</tr>
<tr>
<td>Per cent saving in feed per lb. gain</td>
<td>10</td>
</tr>
<tr>
<td>Carcass grade and yield</td>
<td>No difference</td>
</tr>
<tr>
<td>Increase in net return per head</td>
<td>$5 to $15</td>
</tr>
</tbody>
</table>

The largest response usually comes from stilbesterol in a high-grain ration. It has never yet failed to show a response even when fed on growing pasture where the response is naturally lower because of the estrogenic activity in the growing grass. Although the implantation of stilbesterol pellets at the base of the ear usually gives as much improvement in gain and feed efficiency as stilbesterol feeding, there are usually side effects in the implanted animals, including low backs and high tails. Prolapse of the vagina and udder development are common in implanted heifers. The implanted steers or heifers usually do not grade as high in carcass as stilbesterol fed cattle, although this is not always true.

Antibiotics

There has been a great deal of interest in so called “stress feeds” lately. These feeds usually carry a high level of chlorotetracycline or oxytetracycline. They are recommended for feeding to cattle or sheep shortly after arrival at the feedlot or at any time when animals are subjected to unusual stresses. Several years ago, research indicated that when chlorotetracycline or oxytetracycline was included in the ration of young calves, gains and feed conversion were usually improved, diarrhea of bacterial origin was reduced, the calves showed more bloom and were usually healthier. More recent work with antibiotics for weaned calves and older cattle has indicated less consistent response, but in many tests, the antibiotics have increased gains and feed conversion in both cattle and sheep rather substantially. Much needs to be learned about the
value of antibiotics in the growing ruminant ration, but the following conclusions are fairly well established. They are usually most effective early in a feeding period when fed with high roughage rations and where stress conditions are considerable, such as in commercial feed lots. Results of tests with the feeding level of chlorotetracycline have been variable. There is almost always a response in the first month or two, but sometimes it is lost by the end of the feeding period, or is not sufficient to pay for the cost of the antibiotic. Some research indicates the antibiotic improvement in gain and feed conversion is additive to that of stilbesterol. Other tests indicate there is little improvement from the antibiotic above that given by stilbesterol, when stress conditions are not excessive. If there is an antibiotic effect on carcass quality, it is usually an improvement. Lambs getting antibiotics in their ration are much less subject to overeating disease.

Rumen Culture

The addition of cultures of dried rumen organisms has given variable response in college tests. When dried rumen culture was fed throughout one test with yearling steers, daily gain was increased 0.17 pounds per day. This is identical to the response found in a Missouri test. Carcass grade was substantially improved in this test. In another test with a different culture, little response was obtained. It appears that the most important effect of the rumen culture, if any, is early in the feeding period.

Animal Fat

Animal fat seems to have less value in the ruminant ration than in poultry and hog feeding. Reduced palatability is more common when animal fat is added to the ration of both cattle and sheep, and improvement in gain and feed conversion is not as likely. However, considerable response to animal fat has been observed in some ruminant tests.

Fortified Supplement

Much improvement in the production of cattle and sheep has come about during the past 10 years, especially as the result of research by agricultural colleges and commercial feed companies. Research of this type has increased the value of the home-grown feed by supplying in fortified supplements the critical nutrients lacking in the home-grown feed. Gains on dry roughage have been substantially improved by supplying “green grass nutrition” in a fortified supplement that is fed with dry grass. Fertility and milk production of cows have also been substantially improved when fortified supplements have been fed in comparison to straight protein feeds or hay. This is certainly logical, since extra protein, for example, cannot make up for a deficiency of vitamin A or trace minerals.

In range tests comparing a protein fortified supplement fed pound for pound with “cake” and in an amount sufficient to supply the animal’s protein requirement, conception has been improved and calves have dropped over a shorter period. The fortified supplement will usually produce a larger calf crop and heavier, flesher calves because the milk flow of the cow is stimulated. Added protein helps in this direction but protein does only part of the job.

Feedlot cattle are returning a profit in recent years through use of supplements which are the result of modern research on margins that brought out the red ink not long ago. The factory type feedlot, a novelty 10 years ago, is now very common. Although feed conversions in the feedlot do not compare favorably with broiler or hog conversions, partly because lower energy feeds are used and the period of most efficient use of feed is behind the steer or heifer when it enters the feedlot, they have improved in the last few years. Pelleting of rations makes further improvement in conversion.

It is likely that progress in ruminant feeding is just beginning. Additional knowledge of the appetites of rumen bacteria, more information on the use of hormones and hormone combinations, more experience with antibiotics, chemobiotics, and with tranquilizers, could make our
Animal feeding has become a very dynamic business. The producer or feeder who doesn’t use the results of modern research will likely fall by the wayside. The same fate is in store for a commercial feed company that doesn’t put a good deal of effort on feed research and who doesn’t quickly put to work the thoroughly tested research achievements.

**SUMMARY**

For many years the emphasis of research on ruminant feeding was centered on protein supplements and later protein replacements, such as urea. Minerals soon came into the picture, and it was found that by balancing these items in the ration, a higher rate of gain and better feed conversion could be obtained. With the discovery of rumen microorganisms, an almost entirely new field was opened up. Interest was and still is centered on the requirements of these rumen microorganisms. Today, interest is shared in the ruminant flora, vitamins, hormones, and antibiotics. All of these seem to play an important part in proper ruminant nutrition, and research is necessary to utilize these factors to the best advantage.

**The Role of Hormones in the Relaxation of the Uterine Portion of the Cervix in Swine.**

Anatomically, the uterine cervix in swine was found to consist of two portions: the long, vaginal portion, which constricted and relaxed cyclically, and the short, uterine portion which remained tightly closed.

Daily measurements of the diameters of the cervices of nine normal sows showed that the vaginal portion was constricted during days 1 and 2 of estrus and then relaxed gradually until about day 9 of the estrous cycle with gradual constriction beginning again about day 14.

After oophorectomy, there was complete relaxation of the vaginal portion of the cervix, while the uterine portion was not noticeably affected. Injection of estrogen into castrated sows caused cervical constriction which continued as long as estrogen was injected. Estrogen injected into normal sows in mid-cycle somewhat hastened cervical constriction.

Even large doses of progesterone (20 mg. daily) were unable to cause relaxation of the cervix either in sows in heat or in castrated sows in which cervical constriction was caused by the injection of 1 mg. of estrogen daily. Relaxin (Relaxin) injected at the rate of 750 GPU per day did not cause cervical relaxation. Experiments on the effect of relaxin on the cervix are being continued.


**Susceptibility of Pleuropneumonia-Like Organisms to the Action of Antibiotics.**

In vitro, oxytetracycline, magnamycin and erythromycin inhibited the growth of four strains of pleuropneumonia-like organisms (PPLO) at different concentrations. Hygromycin, streptomycin and chlorotetracycline gave comparable results if used at high concentrations. The microbiocidal activity was maintained for a period of 10 days at a much lower concentration by the former three antibiotics than that of the latter three.

In embryonating eggs, the six antibiotics were examined for their chemotherapeutic action against an avian strain of PPLO isolated from a turkey sinus. All lowered the mortality rate and lengthened the survival time, but erythromycin was found to be the most active. Oxytetracycline and magnamycin showed comparable activity.

In vivo, 20 large white turkeys infected with PPLO and showing typical signs of infectious sinusitis became asymptomatic following erythromycin therapy. Eighteen of the 20 recovered completely.