Pelleted rations for fattening steers with or without additional straw, dynafac, and diethylstilbestrol implants
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Abstract:
This experiment was conducted to study the effect of self-feeding a completely pelleted ration with or without straw, dynafac, and diethyl-stilbestrol (stilbestrol) implants on the gaining ability, feed efficiency, carcass grades, and net returns of fattened steers.

The experimental animals consisted of forty Hereford yearling steers divided into five treatments oh the basis of weight and previous experimental use. The trial was initiated by preventing the steers from having any feed or water for about sixteen hours previous to weighing each steer individually and feeding each group their ration on May 22, 1958. The rations were group hand-fed for about eleven days and then self-fed to the termination of the trial.

The trial consisted of group 1 steers receiving a mixed grain ration and alfalfa hay ad libitum. The pelleted ration fed to steers in groups 2 and 3 consisted of 70 percent grain, a mixture equivalent to that fed to group 1, and 30 percent sun-cured alfalfa. In addition, steers in group 3 received straw ad libitum. The steers in groups 4 and 5 received straw ad libitum and a pellet of the same percent composition as that fed to steers in groups 2 and 3, but which included 200 grams of dynafac per ton. Group 5 steers were implanted with 36 mg of stilbestrol at the outset of the trial.

The trial terminated on October 16, 1958, after a total of 147 days.

The steers were restricted to no feed or water for about sixteen hours previous to weighing them off the trial. They were bought by Armour and Company on a grade-in-yield basis and slaughtered in Spokane.

The steers that received the mixed grain and alfalfa hay had superior gains, carcass grades, and net returns compared to the steers fed the pelleted ration. The pelleted ration intensified rumenal hyperparakeratosis. The steers that received the same pellet as group 2 plus straw ad libitum had improved daily gains, carcass grades, and net returns. The feeding of straw tended to modify rumenal hyperparakeratosis.

The steers which were fed dynafac and straw ad libitum had superior gains, carcass grades, net returns, and minimized rumenal hyperparakeratosis when compared to the steers that were not fed dynafac. The steers implanted with stilbestrol had superior gains and net returns but inferior carcass grades when compared to those steers not implanted with stilbestrol.

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ABSTRACT

This experiment was conducted to study the effect of self-feeding a completely pelleted ration with or without straw, dynafac, and diethylstilbestrol (stilbestrol) implants on the gaining ability, feed efficiency, carcass grades, and net returns of fattened steers.

The experimental animals consisted of forty Hereford yearling steers divided into five treatments on the basis of weight and previous experimental use. The trial was initiated by preventing the steers from having any feed or water for about sixteen hours previous to weighing each steer individually and feeding each group their ration on May 22, 1958. The rations were group hand-fed for about eleven days and then self-fed to the termination of the trial.

The trial consisted of group 1 steers receiving a mixed grain ration and alfalfa hay ad libitum. The pelleted ration fed to steers in groups 2 and 3 consisted of 70 percent grain, a mixture equivalent to that fed to group 1, and 30 percent sun-cured alfalfa. In addition, steers in group 3 received straw ad libitum. The steers in groups 4 and 5 received straw ad libitum and a pellet of the same percent composition as that fed to steers in groups 2 and 3, but which included 200 grams of dynafac per ton. Group 5 steers were implanted with 36 mg of stilbestrol at the outset of the trial.

The trial terminated on October 16, 1958, after a total of 147 days. The steers were restricted to no feed or water for about sixteen hours previous to weighing them off the trial. They were bought by Armour and Company on a grade-in-yield basis and slaughtered in Spokane.

The steers that received the mixed grain and alfalfa hay had superior gains, carcass grades, and net returns compared to the steers fed the pelleted ration. The pelleted ration intensified rumenal hyperparakeratosis. The steers that received the same pellet as group 2 plus straw ad libitum had improved daily gains, carcass grades, and net returns. The feeding of straw tended to modify rumenal hyperparakeratosis.

The steers which were fed dynafac and straw ad libitum had superior gains, carcass grades, net returns, and minimized rumenal hyperparakeratosis when compared to the steers that were not fed dynafac. The steers implanted with stilbestrol had superior gains and net returns but inferior carcass grades when compared to those steers not implanted with stilbestrol.

INTRODUCTION

Producers of meat must be ever on the lookout for ways in which to improve the efficiency of and reduce the cost of production. The use of pelleted rations offers the feeder a chance to mechanize a large part of his feed-lot operation. The economical feasibility of feeding completely pelleted rations is dependent upon the cumulative effect of decreasing waste, reducing the labor cost, and improving the efficiency of converting feeds to meat, and increasing net returns in comparison with the increased cost of pelleting.

Most pellet mills require ingredients to be finely ground before being compressed into a pellet. Therefore, it is impractical to contemplate the effect that pelleting may have without first considering the effect that grinding the ingredients has. Thus, pelleting and associated processes may be adverse to one of the purposes of the ruminant digestive system, i.e. break down and utilization of bulky feeds. Both previous to and since the interest in pelleting, researchers have been trying to determine the relationship between bulk in the diet and rumination, rumination and retention of nutrients, and rumination and gaining ability of the animal.

The project reported herein was initiated to study some of the problems related to pelleted rations that are presently plaguing the feeding industry. The primary objectives of this trial were to study the effect of feeding, to yearling steers, a completely pelleted ration, with or without straw ad libitum, dynafac, and diethylstilbestrol (stilbestrol) implants. The characteristics considered important to study were: daily gain, appetite, feed-lot performance, carcass grade, incidence of rumenal hyperparakeratosis, and net returns.

REVIEW OF LITERATURE

CONCENTRATE-ROUGHAGE RATIO

Fattening rations for cattle generally have a wide ratio of concentrates to roughage. Beeson et al. (1957) observed that when steers were self-fed the components of a ration, they selected more concentrates and less hay than was provided for steers hand-fed a mixed ration. The self-fed steers had .22 lb. better daily gain and had substantially better feed efficiency. Webb and Cmarik (1957) found that steers getting a pelleted ration of 65 percent corn and 25 percent timothy-alfalfa hay mixture and 10 percent soybean oil meal had .18 lb. better daily gain and averaged $2.00 more per steer in net returns than similar steers fed a pellet containing equal parts of corn and timothy-alfalfa hay mixture and 10 percent soybean oil meal. Larner (1959) states that he prefers a pellet with a ratio of 70 percent roughage to 30 percent concentrates for fattening steers.

Lamb fattening rations are frequently much lower in energy value than steer fattening rations. A frequently used ratio in lamb rations is 70 percent roughage and 30 percent concentrates. Thomas et al. (1959) found no real difference in daily gain between pelleted rations consisting of 70, 50, and 30 percent roughage with inverse percentages of concentrates.

Bell et al. (1955) using dehydrated alfalfa, observed that a pelleted ration of 65 precent roughage and 35 percent corn produced a daily gain in lambs of .352 lb. whereas a pellet of 55 percent roughage and 45 percent corn produced a daily gain of .228 lb. However, if chopped alfalfa was used in a non-pelleted ration, lambs gained better on the higher concentrate ration of 55 percent alfalfa and 45 percent corn. Botkin et al. (1956)

found that lambs gained as well on rations containing equal parts of barley and alfalfa or 60 percent alfalfa and 40 percent barley.

FACTORS ASSOCIATED WITH PELLET FEEDING

Ingredient Type and Quality

The type and quality of feeds used in formulating a ration are known to cause variation in the effect of pelleting. Cate et al. (1955) did not observe any advantage from pelleting a ration of high-quality alfalfa-meal and corn. However, when a ration of timothy-meal and corn was pelleted, the lambs consuming the pellet ate more, gained faster, and graded higher than lambs consuming the non-pelleted ration. Neal (1953) tested the effect of pelleting on low-quality roughage, and observed that lambs gained faster and more efficiently on a pellet made of low-quality alfalfa and sorghum grain than lambs being fed a non-pelleted ration of high-quality alfalfa and sorghum grain.

Dehydrated alfalfa was reported to be inferior in pelleted rations for lambs at the Colorado Experiment Station, (Anonymous, 1956, and Esplin and Story, 1958). A pellet of equal parts of corn and alfalfa produced superior gains and equal feed efficiency when compared to a pellet of equal parts of dehydrated alfalfa and corn. Menzies et al. (1958) found that lambs gained faster and more efficiently when alfalfa was used in a fattening pellet rather than dehydrated alfalfa.

Esplin and Hazle (1958) observed an improvement in the feeding value of alfalfa when it was dehydrated. Lambs fattened on dehydrated alfalfa pellets had superior gains, carcass grades, and net returns when compared to lambs fattened on sun-cured alfalfa pellets. The fact that no concentrates

were included in the pellet in this trial may be the reason that these results are contradictory to those of Esplin and Story (1958).

Coarseness of Grind

Ensminger et al. (1948) observed no change in daily gain in steers when the roughage component of a meal ration was finely ground. Webb and Cmarik (1957) found that fine grinding of the ingredients of a completely pelleted ration restricted the gaining ability of steers, but not significantly 1/. They noted, however, that steers consuming the coarse-ground pelleted ration returned an average of $16.90, whereas those consuming the fine-ground pelleted ration returned only $4.30.

Noble et al. (1958) observed that chopping and mixing a lamb ration of whole milo and alfalfa improved the daily gain and feed efficiency substantially. Esplin and Hazle (1958) observed that fine grinding ingredients of a completely pelleted ration of equal parts of corn and alfalfa restricted the gaining ability of lambs. Those lambs receiving a ration which had been ground through a 1/16 inch screen gained .433 lb. each day, whereas those receiving the ration that had been ground through a 1/4 inch screen gained .502 lb. each day.

Size of Pellet

Esplin and Hazle (1958) fed lambs a wafer of 1 inch by 1/2 inch and a larger wafer of 1 1/4 inch by 1 1/4 inch by 3/4 inch and a pellet of 1/4 inch by 1/4 inch. They reported that lambs which were fed the two sizes of wafers gained faster than those fed the pellet.

1/ In this manuscript, the term significant denotes statistical significance beyond the 5 percent level of proability and highly significant denotes statistical significance beyond the 1 percent level of probability.

Feeding Methods

Bell et al. (1955) compared group hand-feeding twice daily to individual self-feeding of lambs. They observed that in three of the four comparisons made, hand-fed lambs gained at the faster rate. Beeson et al. (1957) compared hand-feeding a complete mixed ration to self-feeding the components of a ration. They observed that self-fed steers gained significantly faster; and had improved feed efficiency when compared to hand-fed steers. They observed in another trial that self-fed steers had a highly significant improvement in daily gain but no improvement in feed efficiency.

McCroskey et al. (1958) found that feeding the roughage component of a fattening ration ad libitum increased the consumption of roughage and stimulated the gaining ability of calves.

Need for Additional Roughage

Gordon (1958) presented evidence which indicates that sheep need some roughage in the diet in order to support rumination. Sheep receiving one pound and two pounds of roughage daily ruminated about seven hours. However, when a diet of all concentrates was fed rumination time decreased to two and one-half hours.

Bush and Jordan (1956) found that lambs on a completely pelleted ration craved more bulk as manifested by their consuming the straw which was made available for bedding.

PELLETING PER SE

Thomas et al. (1954) found that lambs fed a pelleted ration had no real improvement in daily gain but net returns were reduced when compared to lambs that were fed whole grains and alfalfa. Thomas et al. (1959) and

Botkin et al. (1956) observed that, compared to a ground mixed ration, lambs fed pelleted rations gained at a somewhat faster rate; however, the work of Thomas et al. (1959) showed that lambs consuming the pelleted rations returned substantially less net returns. Esplin et al. (1956) showed only a non-significant difference in daily gain favoring pelleted rations in several trials but a highly significant difference in one trial.

Noble et al. (1954) found that lambs consuming a pelleted ration had insufficient improvement in daily gain and feed efficiency to compensate for the increased cost of pelleting. However, Noble et al. (1953) reported that lambs fed a pelleted ration gained equal to and had considerably more efficient feed conversion than similar lambs fed a ground mixed ration. The pellet-fed lambs sold for a higher price and had greater net returns.

Whiteman et al. (1955); Anonymous (1954); Menzies et al. (1958); and Botkin and Paules (1955) found a highly significant difference in daily gain in lambs favoring pelleted rations; however, carcass grades and net returns were adversely affected.

Ensminger et al. (1948) observed that steers, receiving pelleted ground grass hay with a limited amount of chopped grain, had superior gains and feed efficiency when compared to steers which received the grass hay in the ground form. Webb and Cmarik (1955) reported that a pelleted high concentrate ration produced greater gains, feed efficiency, and net returns when compared to the same ration fed to steers as meal.

DIGESTIBILITY, RUMINATION, AND PALATABILITY

Palatability in fattening rations is of fundamental importance. A dusty condition, which frequently exists when ground rations are fed, can

be eliminated by pelleting. Esplin et al. (1956) found when both pelleted and meal rations were available lambs consumed four times as much of the pelleted form over a two-week period. McCroskey et al. (1958) found that three steers and one heifer consumed 2.2 times more pellets when both a pelleted and a meal ration were made available.

A close correlation between coarseness of grind and rumination was found by Kick and Gerlaugh (1936). They reported that as hay was cut into finer pieces, less time was required by sheep in masticuation and rumination. Gordon (1958b) substantiates the above evidence by noting that sheep spent less time ruminating hay that was fed as a meal than hay which was fed as long or cut into two inch lengths. This difference in rumination time was highly significant.

Swanson and Herman (1952) prepared hay by chopping or grinding it into three states of fineness. Heifers ruminated normally when fed hay chopped to 1.5 to 3 inches in length, very infrequently when fed hay chopped to one inch in length, and never ruminated when fed hay ground through a 5/16 inch screen.

No difference in rumination time in sheep was reported by Gordon (1958) when hay was fed in three different ratios of roughage to concentrates; however, when no hay was fed, rumination time was reduced by one third. The value of this evidence is doubtful, however, because only one animal was involved.

Swanson and Herman (1952) presented evidence which indicates that the finer the hay is chopped for dairy heifers, the less digestible the crude fiber becomes. Long et al. (1955) observed that a ground mixed ration has

lower digestibility of the organic matter, crude fiber, crude protein, and nitrogen-free extract than when not ground; however, the digestibility of these nutrients in the pelleted ration was equal to the digestibility of the ration before it was ground.

Grinding and pelleting of dried grass as reported by Blaxter and MacGraham (1956) and alfalfa, Myer et al. (1959) resulted in no real difference in net energy value when fed to sheep. Myer et al. (1959) did find that the pelleted alfalfa was highest in nitrogen digestibility.

Murdock et al. (1951) reported from experiments with yearling sheep that, when compared to coarse ground dehydrated alfalfa, fine ground dehydrated alfalfa was lower in T.D.N. and digestibility of crude fiber. They also found that compared to ground dehydrated alfalfa, the pelleted dehydrated alfalfa was higher in digestibility of crude fiber and T.D.N. These differences were highly significant. Richardson et al. (1957) presented evidence from sheep digetion trials indicating nitrogen retention was greatest when the ration was pelleted.

Evidence given by Jensen et al. (1958) indicates that grinding and pelleting may be a predisposing cause of rumenal hyperparakeratosis in sheep. There was no difference in daily gain between the pellet-fed lambs and those fed the ground meal ration; however, the difference in the number of lambs affected with rumenal hyperparakeratosis was highly significant in one trial and significant in another. Within the pellet-fed lot of one trial, the daily gain of the unaffected lambs was significantly greater than the affected lambs.

Esplin and Story (1958) observed from lamb-fattening trials and

slaughter data that 10 percent of the lambs fattened on a pellet of equal parts of corn-cob-meal and alfalfa and 10 percent liquid protein supplement were affected with rumenal hyperparakeratosis. Also, 63.3 percent of the lambs fattened on a pellet of equal parts of milo and alfalfa were affected, 80 percent of those fattened on a pellet of equal parts of corn and alfalfa were affected, and 100 percent of those lambs fattened on a pellet of equal parts of corn and dehydrated alfalfa were affected with rumenal hyperparakeratosis.

DYNAFAC

Information on effects of dynafac in completely pelleted rations is almost nill; however, a limited amount of evidence in available indicating that dynafac has some merit in meal-fattening rations. Thomas (1957) observed that yearling steers fed a controlled amount of a high concentrate ration gained at a faster rate when they were implanted with 36 mg of stilbestrol at the outset of the trial and received dynafac in a 32 percent protein supplement. This group of steers gained 2.85 lbs. daily over a 112-day feeding period; this increase represented a 22 percent increase in gain over the control steers which received neither dynafac nor stilbestrol, 11 percent increase in gain over other steers which had stilbestrol only, and 17 percent increase in gain over steers which had dynafac only.

Zimmer and Embry (1958) self-fed a high concentrate, ground, meal ration and dynafac to steers implanted with 36 mg of stilbestrol and observed an increase in average daily gain of .31 lb. over steers which received no dynafac. Dynafac-fed steers also ate about four pounds more of the ration per day and had an average net return of $19.00 more per steer.

Thomas and Jordan (1957) observed only questionable value from feeding dynafac to steers in a dry-lot fattening trial. Feed efficiency was slightly improved in the dynafac lot; however, the daily gain was unaffected and the carcass grades and net returns were inferior to the controls.

STILBESTROL

The effectiveness of stilbestrol, either fed orally or subcutaneously implanted, in producing faster, cheaper gains in the feed lot is well accepted today. Clegg and Carroll (1957) reported that steers on feed for 193 days gained equally well when given stilbestrol in the form of 10 mg daily oral or a 15 mg implant at the outset of the trial. A highly significant difference existed, however, between either form of stilbestrol administration and no stilbestrol. The authors state that though USDA carcass grades were lowest in the untreated group; an inadequate number of steers were involved and probably a real difference did not exist.

Perry et al. (1958) gave evidence indicating that the 36 mg level of implantation was the most effective in producing rapid gains without sacrificing carcass grade over an extended feeding period. They observed that, at the end of the two-month period, the steers implanted with 24 mg were gaining as rapidly as any group; however, at the end of the third month, steers implanted with 36 mg or 48 mg were gaining more rapidly than those on any of the other treatments.

Clegg and Carrol (1957) summarized a large number of field trial involving a variety of fattening rations and lengths of feeding periods and concluded that cattle implanted with 15 mg of stilbestrol at the outset of the trial can be expected to gain 15 percent faster and have about 10 percent improve-

ment in feed efficiency. Implantation of from 30 to 60 mg of stilbestrol can be expected to increase the gain 25 percent and improve the feed efficiency 20 percent. However, the improvement in gain and feed efficiency above that expected from 15 mg implants can be expected at the expense of reduced carcass grade.

CUMULATIVE EFFECTS

Kercher and Hilston (1958) found that a ground, pelleted, high concentrate ration of 26 percent alfalfa and 74 percent concentrates improved the daily gain and feed efficiency, but reduced the net returns in steers when compared to a similar ration fed as loose grain and long alfalfa hay. Kercher and Hilston (1958b) observed that a ground, pelleted ration of equal parts of alfalfa and concentrates produced only a slight improvement in gain, but a substantial increase in net returns when compared to a similar ration fed as loose grain and long alfalfa hay to steers.

Foster et al. (1953) reported feeding a ground, pelleted, complete ration to heifers did not affect the daily gain, but improved the feed efficiency when compared to a non-pelleted ration. Baker et al. (1953) observed that heifers ate less and had improved feed efficiency when a ration of 25 percent alfalfa and 75 percent concentrates was ground and pelleted.

Pope et al. (1958) found that calves gained better and had higher feed efficiency and sale value when milo was ground and pelleted.

Noble et al. (1958) reported that feeding a finely ground and pelleted ration of 50 percent concentrates and 50 percent alfalfa increased the daily gain and feed consumption in lambs but decreased the feed efficiency when

compared to the non-pelleted ration.

Neale (1953) observed, over a three-year period, that lambs self-fed high roughage pelleted rations gained consistently faster on less feed than lambs hand-fed long alfalfa and whole sorghum grain. Compared to the long alfalfa used in the hand-fed ration, the alfalfa used in the pellet was described as coarse and of low quality.

Ittner et al. (1958) observed a significant improvement in daily gain in beef steers when the roughage component of a ration was ground through a 3/64 inch screen and compressed into a 13/64 inch pellet as compared to the feeding of whole roughage.

METHODS AND PROCEDURE

Forty yearling Hereford steers from a winter mineral feeding experiment were used for this fattening trial. Eight steers were assigned to each group on the basis of weight and previous experimental use and each group was assigned, at random, to one of five pens.

The percent composition of the pelleted and mixed grain rations fed in this trial is given in table I.

TABLE I. Percent composition of the rations fed in this trial.

Feed	Mixed grain and Hay	Pellet 1	Pellet 2
	%	%	%
Barley	58.25	40	40
Wheat mix	8.25	5	5
Beet pulp	27.25	20	20
Alfalfa	ad libitum	30	30
Sugar pulp	6.25	--	--
Molasses	------	5	5
Dynafac 1/	------	--	X

1/ Dynafac was added at a level of 200 grams per ton.

The pellets, made by First Feed Mills in Bozeman, were 3/8 of an inch in diameter and about 3/4 of an inch long. The mixed grain ration was formulated to equal, as closely as possible, the nutrient composition of the concentrate mixture used in the pellets. The five treatments are given

in table II.

TABLE II. Treatments used in this trial.

Group 1	Mixed grain and baled alfalfa hay
Group 2	Pellet number 1
Group 3	Pellet number 1 + straw
Group 4	Pellet number 2 + straw + dynafac
Group 5	Pellet number 2 + straw + dynafac + 36 mg stilbestrol implanted

Feeding was accomplished by large self-feeders which had an approximate capacity of two tons of pellets or one and one-half tons of mixed grain. These feeders, illustrated in figure 1, were 12 feet long, 3 1/2 feet wide, and 6 feet high. The height of the feeder at the throat of the calf was 22 inches and the feeder trough was about one foot square. They were recharged from the top where a door, hinged from the middle of the feeder, could be opened.

Only four of the self-feeders were completed at the beginning of the trial and these were placed in the four groups of steers which were to be fed the pelleted rations and the group 1 steers were fed in an open-type concentrate bunker for sixteen days or until the other self-feeder was completed.

Appetite of the steers and the physical appearance of the feces were used as a guide as to how rapidly the groups of steers could be advance to full feed. The steers were accustomed to eating five pounds of grain and a small amount of timothy hay daily when they were on the mineral trial.

Eleven days were taken to advance the steers in groups 2, 3, 4, and 5 to a full feed of pellets which was about sixteen pounds per day.

FIGURE 1. General view of self-feeders used in this trial.

Because of the inclement weather it was impractical to self-feed the steers in group 1 in an open-type concentrate bunker and, therefore, sixteen days were taken to advance these steers to full feed which was about sixteen pounds of grain and 2.5 lbs. of hay. It was assumed safe to fill the self-feeders when not all the feed was consumed, and the steers were contented and not scoured.

Recharging the self-feeders involved restricting each group of steers to their loafing sheds for one to several hours, thus taking them off feed.

This was considered an undesirable, but necessary practice, so each feeder was filled with about a two-weeks' supply each time.

Straw was fed to steers in group 2 while they were going on feed. As the full feed level was approached, straw was gradually left out of the diet until they were getting none at the end of the eleven day hand-fed period.

Open-type roughage bunkers with canvas tops were used to feed straw and hay. The pattern of feeding roughage was to weigh out a complete bale to each group of steers as needed. Each day a portion of the bale was fed to the respective groups of steers. The bunkers were frequently cleaned out and the rejected roughage weighed back after which it was used for bedding in the loafing shed.

Wheat straw was used for bedding in all loafing sheds except group 2. Because an objective of this experiment was to maintain the steers in group 2 on a roughage diet, limited to the amount received in the pellet, it was believed that wood shavings would be a more suitable bedding material. These shavings were obtained from Yellowstone Pine Lumber Mill in Belgrade, Montana, in bales which weighed about fifty pounds each.

Each pen of steers had access to a fresh water trough located in the lot. Double mineral boxes, which contained iodized salt in one part and a mixture of 50 percent dicalcium phosphate, 25 percent trace mineral salt, and 25 percent calcium carbonate, were constantly available in the loafing shed of each of the five lots.

The trial was initiated by restricting the groups of steers to their respective loafing sheds the night of May 21, 1958. They were individually

weighed onto the trial the morning of May 22, 1958, having been off feed and water for about sixteen hours, and started on their respective rations that evening. Thereafter, the steers were weighed individually every twenty-eight days. Feed consumption for each twenty-eight day period was calculated on the basis of the total amount of feed that had been added to each self-feeder minus the estimated amount which had not been eaten.

At the termination of the trial, the steers were restricted to their loafing sheds about 5 P.M. October 15, 1958, and were individually weighed at 7 A.M. October 16, 1958. The feed not eaten in each self-feeder was also weighed back at this time.

The steers were bought by Armour and Company and slaughtered in Spokane. They were loaded on trucks about 1 P.M. October 16, 1958, and transported to the Northern Pacific yards in Bozeman where they were loaded on rail cars at 6 P.M.

The steers left Bozeman at 1 A.M. October 17, 1958, and arrived in Spokane at 1 A.M. October 18, 1958. They were immediately switched down to Armour and Company's yards where they were unloaded and group-weighed by treatment. They were then assigned to pens and fed and watered.

Steers in groups 3, 4, and 5 were slaughtered on Monday, October 20, 1958, and steers in groups 1 and 2 were slaughtered on Tuesday, October 21, 1958. As the skinning of each animal was completed, the ear tags were removed and attached to each carcass. The identity was maintained for each set of viscera and a record made of condemned paunches and abscessed livers. After the digestive contents had been emptied from each paunch, the incidence of rumenal hyperparakeratosis was estimated.

The carcasses were weighed warm and twenty-four hours after slaughter and graded by a USDA grader forty-eight hours after slaughter.

The gains were analyzed by an analysis of variance by the Montana State College Statistics Laboratory.

RESULTS AND DISCUSSION

DAILY GAINS AND FEED LOT PERFORMANCE

The weights, feed consumption, and feed efficiency of the steers in this trial are summarized in table III.

TABLE III. Summary of weights, daily feed consumption, and feed efficiency by groups.

Group	1	2	3	4	5
Treatment	Mixed grain Alfalfa hay ad libitum	Ration pelleted	Straw ad libitum	Dynafac DES. 1/	
Number of steers	8	8	8	8	8
Average weight (lbs.)					
Initial	527	520	511	526	526
Final	899	875	905	934	969
Gain	372	355	394	408	443
Daily gain	2.53	2.41	2.68	2.78	3.01
Average daily ration					
Pelleted ration or Concentrate	17.6	18.6	19.6	21.4	22.2
Hay or Straw	2.36	---	.82	.82	.85
Feed/cwt. of gain (lbs.)					
Concentrate	693.9	769.9	733.5	770.0	737.6
Hay or Straw	93.1	----	30.5	29.5	28.3
Total	787.0	769.9	764.0	799.5	765.9

1/ Diethylstilbestrol 36 milligram implant.

Grinding and pelleting the ration of 70 percent concentrates and 30 percent alfalfa adversely affected the appetites of the steers in group 2 in comparison to the steers in group 1. These steers consumed 1.36 lbs. less total feed per day and gained .12 lb. less than the group 1 steers. Because

the pellet contained 30 percent alfalfa, the steers in group 2 were required to eat a ration of lower concentrate percentage than that selected by steers in group 1 (see table IV). Even though the group 2 steers consumed less total feed, the reduced gain and lowered carcass grades of the steers in this group may have been due to the cumulative effect of pelleting and reduced T.D.N. intake.

Considering the fact that steers fed the mixed grain and alfalfa hay, frequently consumed as much total feed and consistently more grain than steers fed the pelleted ration and straw, (see table IV), and had only equal daily gain, (see table III), indicates that the combined processes of grinding and pelleting had a tendency to elevate the feeding value of the ration.

The higher gains of the pellet and straw-fed steers, over those which were fed only the pellets were probably influenced by the enhanced physical state of the ration, and higher intake of pellets. Steers in groups 3 and 4 consumed about equal amounts of straw daily and received a pellet identical in nutrient composition. The substantial increase in pellet consumption, almost two pounds a day per steers, and the .10 lb. increase in daily gain of the steers in group 4 over those of group 3, was probably influenced by the presence of dynafac in the pellet.

Steers implanted with 36 mg of stilbestrol ate about one pound more of pellets each day and had .23 lb. better daily gain than their controls, steers in group 4. An analysis of variance of the gains showed only a comparison between steers in groups 2 and 5 to be significant.

Feed efficiency, summarized in table III, varied only a slight amount between the five lots. Groups 2, 3, and 5 were equal to each other and

TABLE IV. Average daily consumption of grain and hay be groups by twenty-eight day periods.

Group	1			2			3			4			5		
28-day weigh period	Grain	Hay	Total	Grain	Hay	Total	Grain	Hay	Total	Grain	Hay	Total	Grain	Hay	Total
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st period	12.5	3.5	16.0	10.1	4.3	14.4	9.2	4.0	13.2	11.1	4.8	15.9	9.9	4.3	14.2
2nd period	16.6	2.8	19.4	12.5	5.3	17.8	15.3	6.6	21.9	15.5	6.6	22.1	17.2	7.4	24.6
3rd period	18.7	1.9	20.6	14.0	6.0	20.0	13.7	5.9	19.6	15.2	6.5	21.7	15.5	6.7	22.2
4th period	23.0	1.8	24.8	15.6	6.7	22.3	15.3	6.6	21.9	17.4	7.5	24.9	18.3	7.9	26.2
5th period	18.5	2.0	20.5	13.7	5.9	19.6	16.0	6.8	22.8	17.3	7.4	24.7	18.8	7.8	26.1
Average	17.6	2.4	20.0	13.0	5.6	18.6	13.7	5.9	19.6	15.0	6.4	21.4	15.5	6.7	22.2

highest in feed efficiency followed by less efficient groups, 1 and 4.

HEALTH

A low incidence of scours was observed in all groups of steers while they were being advanced to full feed. However, when all the steers were on full feed, all signs of scours disappeared. Furthermore, there was very little sickness of any kind throughout the trial. About midway in the trial two steers in group 2 appeared to be bloated; however, neither of these steers were treated because they never showed signs of sickness or lack of appetite.

Shortly after straw was left out of the diet, the steers in group 2 showed an intense craving for more roughage by consuming wood shavings as they were freshly distributed for bedding about twice a week. Figure 2 is typical of the steers as they would eat shavings from a freshly broken bale.

The steers in group 2 manifested a strong desire to eat the wood shavings only during the first two months of the trial. It was believed that eating the shavings might affect the steers' appetites for pellets; therefore, as soon as a bale of wood shavings was broken it was immediately mixed with the rest of the litter.

No differences in rumination was observed among the five groups; however, only casual observations were made, and thus it is possible that differences did exist, but they were not detected.

SLAUGHTER DATA

The incidence of rumenal hyperparakeratosis by groups is summarized, as percent of area affected, in table V. Because there was so much

variability among rumens estimated equally affected, this classification should be taken as only an indication.

FIGURE 2. Steers in group 2 eating wood shavings.

In some rumens, a large area was affected but within this area comparatively few of the papillae showed signs of rumenal hyperparakeratosis. In other rumens of equal area affection, as indicated by table V, less of the total rumen area showed involvement, but a greater number of papillae within this area were affected.

It is apparent, from table V, that rumenal hyperparakeratosis was intensified by grinding and pelleting the ration.

TABLE V. The incidence of rumenal hyperparakeratosis by groups.

Group	1	2	3	4	5
Treatment	Mixed grain Alfalfa hay ad libitum	Ration pelleted	Straw ad libitum	Dynafac	DES. 1/
	Distribution of rumens				
Rumenal Hyperparakeratosis Percent of area affected					
0	7		1	5	4
0-25	1		1	2	2
25-50		2	3		1
50-75		2	1	1	1
75-100		4	2		

1/ Diethylstilbestrol 36 milligram implant.

In group 1, seven steers were normal and only one was mildly affected; however, in group 2 all steers were affected and four of them were affected at the 75-100 percent level. Making straw available to the group 3 steers apparently modified the condition because only two steers were affected at the 75-100 percent level. Also, two steers in this group were either zero or only 25 percent affected. Only three of those steers receiving dynafac in group 4 were affected with rumenal hyperparakeratosis and none of these at the level of 75-100 percent affection.

Figure 3 is a section of the rumen from a steer of group 1. This rumen was typical of the rumens classified as zero percent affected in table V.

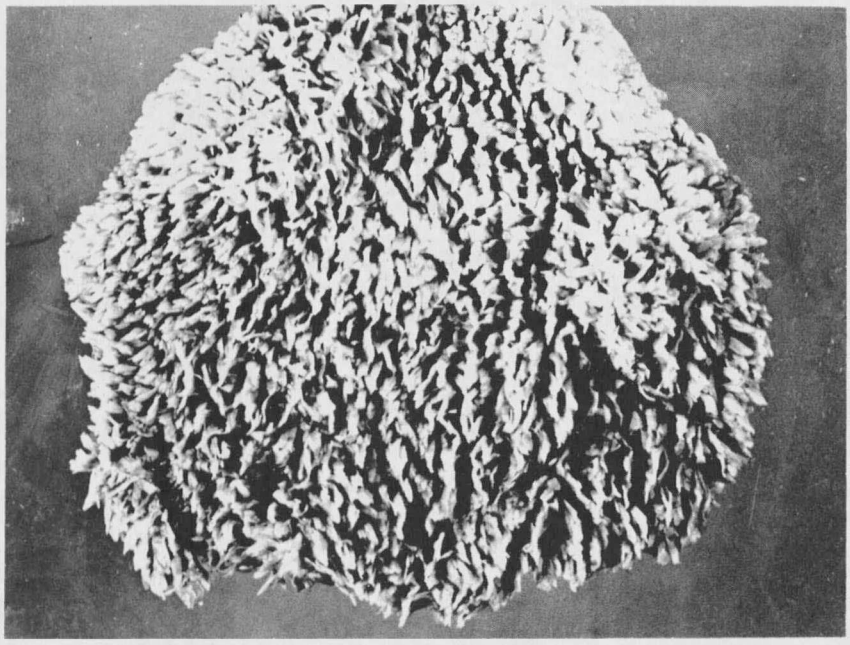

FIGURE 3. Section of a rumen from a steer of group 1.

In contrast to figure 3, figure 4 is a section of a rumen from a steer in group 3 which was estimated to be 100 percent affected. A large area of the rumen was affected and many of the papillae within the area were affected.

The relationship between the incidence of rumenal hyperparakeratosis and gain of the individual animals, by groups is summarized in table VI. It is apparent, from observing groups 2 and 3, that no correlation existed between rumenal hyperparakeratosis and daily gain in the individual animals within each group. Steer 45 in group 2 and 74 in group 3 were both estimated as 100 percent affected with rumenal hyperparakeratosis and they were also the fastest gaining steers within their respective groups. However, steer

47 in group 2 and steer 16 in group 3 were estimated as less than 50 percent affected with rumenal hyperparakeratosis, but were the second to best gainers within their respective groups.

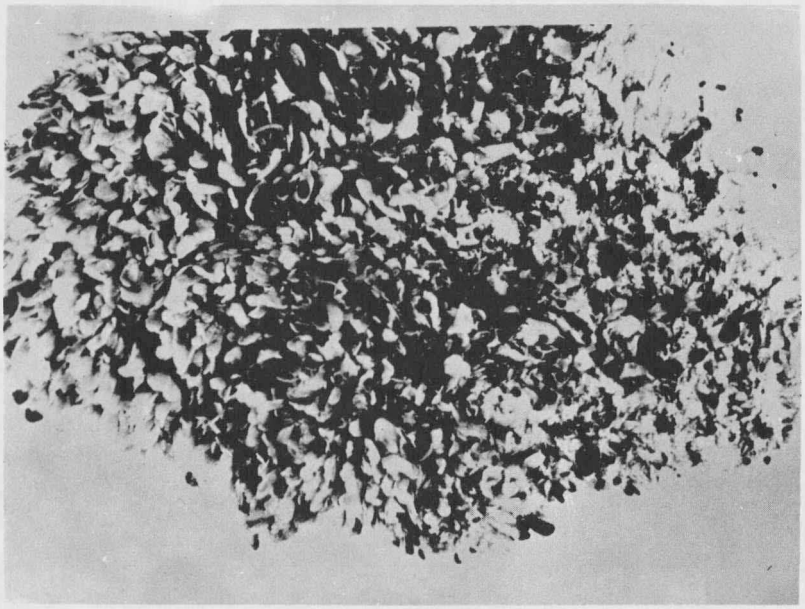

FIGURE 4. Section of a rumen from a steer of group 3.

The incidence of condemned livers and paunches was quite low. Steer 8 in group 1 and steer 41 in group 2 were the only steers in which the paunches were condemned. The reason for the condemnation in both cases was because of a growth adhering the paunch to the liver. The livers were condemned in both cases also. The liver of steer 73 in group 3 was condemned because of a small thumb-nail size abscess and the livers of steers 21 and 64 in group 5 were condemned for abscesses about one inch in diameter in the case of steer 21 and one involving about one-half of the liver in the case

TABLE VI. Relationship between total gain and the incidence of rumenal hyperparakeratosis by groups.

Group 1
Mixed grain and alfalfa hay

Steer No.	Total gain	% area affected
91	410	0
6	410	0-25
8	405	0
75	390	0
93	360	0
68	355	0
90	325	0
92	320	0

Group 2
Pelleted ration

Steer No.	Total gain	% area affected
45	420	75-100
47	415	25- 50
44	405	50- 75
42	308	75-100
48	345	25- 50
50	330	75-100
46	325	75-100
41	220	50- 75

Group 3
Pelleted ration + straw

Steer No.	Total gain	% area affected
74	475	75-100
16	440	25- 50
13	390	75-100
73	385	50- 75
2	385	0- 25
51	375	0
17	370	25- 50
11	330	25- 50

Group 4
Pelleted ration, straw, and dynafac

Steer No.	Total gain	% area affected
36	445	0
38	420	0
65	420	0-25
32	405	0
67	400	0-25
37	395	0
34	390	50-75
33	390	0

Group 5
Pelleted ration, straw, and dynafac, and stilbestrol

Steer No.	Total gain	% area affected
64	480	0
27	470	25-50
72	465	0-25
22	460	0-25
24	455	0
26	425	0
21	415	0
63	375	50-75

of steer 64.

It is interesting to note that in group 2 both steers 44 and 41 were recorded in the feed notes to appear bloated; however, steer 44 was very infrequently in a bloated appearance and steer 41 appeared bloated from the latter part of August to the termination of the trial. It seems quite possible that the growth adhering the paunch to the liver in steer 41 could have been the cause of his bloated appearance. It is also interesting to note that steer 41 was the poorest gainer in group 2, (see table VI).

In the stilbestrol implanted group, steer 64 was the fastest gainer, but he was also the steer with the abscess affecting over half of the liver. This is noted only in passing and is not meant to infer that large liver abscesses will not necessarily affect the gaining ability of animals.

The carcass grades of the five groups of steers are summarized in table VII. It seems of interest to note that when the sterrs were graded on foot for a field day, twenty-two days before slaughter, the stilbestrol treated steers graded the highest with three good and five choice. Steers in groups 1 and 3 were equal with five good and three choice and group 4 steers were all good and group 2 steers had seven good and one standard. Comparing this to the USDA carcass grades, the two systems of grading are quite consistent with respect to the steers of groups 1, 2, and 3, and possibly group 4.

In the stilbestrol-treated steers good muscle development may have been mistaken as fat when they were graded for the field day. The main reasons that the carcasses of these steers graded so low are that they generally lacked adequate feathering in the rib area and the high-good carcasses,

when ribbed down, had insufficient marbling in the eye muscle.

TABLE VII. USDA carcass grades by groups.

Group	1	2	3	4	5
Treatments	Mixed grain Alfalfa hay ad libitum	Ration pelleted	Straw ad libitum	Dynafac	DES. 1/
	Distribution of carcasses				
USDA grades					
Low good	---	3	1	1	1
Medium good	4	3	3	2	4
High good	1	1	1	---	2
Low choice	2	1	2	3	1
Medium choice	---	---	1	2	---
High choice	1	---	---	---	---

1/ Diethylstilbestrol 36 milligram implant.

The shrink while enroute to Spokane, cooler shrink, and carcass yield are summarized in table VIII. Little difference existed between the groups with respect to these characteristics. However, it is worthwhile to mention that the group 2 steers, which received the pelleted ration had 1.65 percent lower carcass yield than those steers fed the non-pelleted ration. Compared to their controls, the dynafac-fed steers had lower enroute and cooler shrink and increased carcass yield. The results of the steers in the stilbestrol group do not appear consistent with those of the other

treatments. The enroute and cooler shrink were both increased, but so was the carcass yield when compared to their controls.

TABLE VIII. Enroute shrink, cooler shrink, and yield by groups.

Group	1	2	3	4	5
Treatments	Mixed grain Alfalfa hay ad libitum	Ration pelleted			
		Straw ad libitum			
				Dynafac	
					DES. 1/
Enroute shrink, %2/	6.67	7.20	7.92	6.80	7.02
Cooler shrink, %3/	1.18	1.64	1.79	1.35	1.64
Yield, %4/	60.06	58.41	58.24	59.75	60.18

1/ Diethylstilbestrol 36 milligram implant.

2/ Calculated on the basis of the difference between the Bozeman weight and the off-car weights in Spokane divided by the Bozeman weight.

3/ Calculated on the basis of the difference between warm and twenty-four hour cold carcass weights divided by the warm carcass weight.

4/ Calculated by dividing the difference between the Bozeman weight and the twenty-four hour cold carcass weight divided by the Bozeman weight.

EXPENSES AND RETURNS

The expenses and returns of this trial are given in table IX. The mixed grain and long alfalfa hay ration was most economical with respect to converting feed to meat. Pelleting the ration tended to reduce the economy of feed utilization in the group 2 steers. The group 3 steers

TABLE IX. Summary of expenses and returns by groups.

Group	1	2	3	4	5
Treatments	Mixed grain Alfalfa hay ad libitum	Ration pelleted		Straw ad libitum	
				Dynafac	
					DES. 1/
Price of feed/cwt.($) 2/					
Pellet or Concentrate	2.08	2.26	2.26	2.29	2.29
Hay or Straw	.83	---	.50	.50	.50
Cost of feed/cwt. gain($)					
Pellet or Concentrate	14.43	17.40	16.58	17.63	16.89
Hay or Straw	.77	---	.15	.15	.14
Total	15.20	17.40	16.73	17.78	17.03
Feed cost/steer($)					
Pellet or Concentrate	53.68	61.77	65.27	71.97	74.85
Hay or Straw	2.86	---	.60	.61	.63
Mineral	.22	.29	.16	.15	.12
Total	56.76	62.06	66.03	72.73	75.60
Average financial cost/steer($) 3/					
Initial cost	163.37	161.20	158.41	163.06	163.06
Feed cost	56.76	62.06	66.03	72.73	75.60
Freight charge	7.89	7.64	7.84	8.19	8.48
Total	228.02	230.90	232.28	243.98	247.15
Gross return 4/	226.49	214.89	223.28	236.64	243.19
Net return	-1.53	-16.01	-9.00	-7.34	-3.96

1/ Diethylstilbestrol 36 milligram implant.

2/ Feed prices per cwt. used were as follows: Barley, $1.65; Wheat mixed feed, $1.85; Beet pulp, dried molasses, $2.05; and Sugarpulp, $3.50 plus 15¢/cwt. for grinding barley and 10¢/cwt. for mixing ration 1. Feed prices per ton were as follows: Alfalfa, $16.50; Straw, $10.00, Completely pelleted ration, $45.20, and Completely pelleted ration with dynafac, $45.84. No labor cost included.

3/ Steers were valued at $0.31/lb. at the start of trial.

4/ Steers were purchased by Armour and Company of Spokane on a grade-in-yield basis and slaughtered in Spokane. The following prices were paid for carcasses/cwt.: $43.50 for choice under 600 pounds, and $43.00 for choice over 600 pounds, $42.50 for good under 600 pounds and $41.50 for good over 600 pounds.

had somewhat improved economy of feed utilization when compared to the group 2 steers. Dynafac raised the cost of pellet 2 only $.03 per hundred pounds, but the dynafac-fed steers wer still less economical in feed conversion when compared to their controls.

A comparison of net returns showed it did not pay to pellet the ration with or without feeding additional roughage in this trial. Because of greater feed cost and lower sale price, steers in group 2 had considerably less net returns. Even though feeding straw did not make it economical to feed pellets in this trial, the value of straw was high as indicated by the increased net returns by the steers in group 3 compared to the group of steers not fed straw. On the average, the steers consumed less than a pound of straw per day but accounted for $5.00 more in net return. Feeding of dynafac with the pellet was observed to be an economically sound practice in this trial. The dynafac-fed steers returned, on the average, $1.66 more than their controls, the group 3 steers. Even though stilbestrol apparently had a depressing effect upon USDA carcass grades, the small price differential between good and choice carcasses was easily compensated for by improved gain and feed efficiency and, therefore, stilbestrol-treated steers returned $3.36 more than the steers not treated with stilbestrol.

Steers fed pelleted rations did not gain as well as those steers fed the non-pelleted ration. However, if both a pelleted ration and straw were fed, steers gained faster than when fed the non-pelleted ration. Straw and pellet-fed steers had greater net returns than pellet-fed steers; however, in both groups the net returns were less than those of the steers fed the non-pelleted ration.

These results are in partial agreement with other researchers. Webb and Cmarik (1955) observed improved gains and feed efficiency but decreased net returns when a high concentrate ration was pelleted and fed with additional roughage to steers. Baker et al. (1957) observed rate of gain, rumination, and general feed-lot performance to be normal when a high concentrate ration was pelleted and fed with additional roughage to heifers. Foster et al. (1953) found no significant difference in daily gain but the improvement in feed efficiency was highly significant in favor of a pelleted ration fed to heifers. Noble et al. (1954) and Whiteman et al. (1955) reported an improvement in feed efficiency and daily gain when a meal ration of equal parts of roughage and concentrates was pelleted and fed to lambs.

Improving the daily gain by feeding dynafac in this trial is similar to the results of Thomas (1957). However, Thomas and Jordan (1957) found no improvement in daily gain but a slight improvement in feed efficiency when dynafac was fed. In contrast to the increased net returns in this trial, Thomas and Jordan (1957) showed a considerable loss in net returns when dynafac was fed. Evidence advanced by Zimmer and Embry (1958) lends strong support to the results of this trial. They found .31 lb. increase in daily gain and $19.00 greater net return when dynafac was fed.

The stilbestrol implanted group had about 8 percent improvement in daily gain and 4 percent improvement in feed efficiency which is somewhat less than that observed by other research workers. Clegg and Carroll (1957) reported that improvement in gain and feed efficiency can be expected at the expense of reduced carcass grade when levels of stilbestrol from 30

to 60 mg are used which bears out the result of this trial.

The steers that received dynafac and stilbestrol, had a 12 percent improvement in daily gain over those steers that received neither dynafac nor stilbestrol which is somewhat less than the 22 percent observed by Thomas (1957).

SUMMARY

Forty yearling Hereford steers were used to conduct this 147-day fattening trial. One group of steers was fed a mixed grain ration and alfalfa hay ad libitum. A pelleted ration of 30 percent alfalfa hay and 70 percent concentrates was fed to the other four groups of steers. In addition to the pelleted ration three groups of steers were fed straw ad libitum and for two of those groups dynafac was included in the pellet. One of the groups of steers, which were fed the pelleted ration, straw ad libitum, and dynafac was also implanted with 36 mg of stilbestrol. The characteristics studied, relative to each group of steers, were: daily gains, appetite, feed-lot performance, carcass grades, incidence of rumenal hyperparakeratosis, and net returns.

The steers, with an average weight of 520 pounds, were lotted on the basis of weight and previous experimental use and started on feed May 22, 1958. The four groups of steers, which received the pelleted ration, were hand-fed to full feed in eleven days whereas the other group was hand-fed to full feed in sixteen days. Once on full feed all five groups had access to self-feeders at all times.

All five groups of steers went on feed equally well and with a minimum amount of scouring. Once on full feed a minimum amount of sickness was observed as indicated by the fact that none of the steers were ever treated for digestive disturbances.

The group of steers fed only the pelleted ration, 30 percent alfalfa and 70 percent concentrates, had poorer gains, lower carcass grades, and less net returns when compared to the steers fed the non-pelleted ration.

Feeding the ground, pelleted ration tended to intensify rumenal hyperparakeratosis. When straw was made available, in addition to the pellet, the daily gain and carcass grades were improved and the net returns were increased. Rumenal hyperparakeratosis was modified in the rumens of the steers that received straw.

Dynafac-fed steers had improved gains and carcass grades and higher net returns than steers which were not fed dynafac. Also, the incidence of rumenal hyperparakeratosis was minimized in the steers that were fed dynafac.

The steers supplemented with dynafac and implanted with stilbestrol had the highest daily gain in this trial. The comparatively low carcass grades of the steers in this group were easily compensated for by the heavier weights and, therefore, these steers were the most profitable of the pelleted lots.

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APPENDIX

TABLE I. Quantitative analyses data of the feeds used in this trial. 1/

	Moisture	Crude Protein	Ether Extract	Crude Fiber	Ash	Phosphorus	Calcium
	%	%	%	%	%	%	%
Pellet 1	8.9	12.7	1.8	15.3	5.0	.29	.65
Pellet 2	9.0	11.4	1.7	14.5	4.6	.28	.75
Grain	9.3	10.6	.8	9.1	3.9	.33	.21
Alfalfa	7.9	11.6	1.2	31.8	6.6	.12	1.37
Straw	5.6	2.0	.7	44.5	4.0	.03	.17

1/ Analyses were completed by the Montana State College Chemistry Department.