All-Forage Rations for Feedlot Cattle

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"There is no doubt that cattle can be successfully finished on all-concentrate diets composed of the common cereal grains. Wise et al. (1968) reviewed the recent progress made in this area and reported that, although there are several problems yet to be solved, 'all-concentrate feeding of beef cattle will take its place along with other cattle feeding systems with economic factors determining the extent of its use.'

In the future, it is quite possible that the cereal grains will become too expensive to feed to ruminants in large quantities because of the direct competition with the rapidly expanding population. Therefore, other methods of finishing cattle are needed to insure a continued supply of animal protein. In a review article, Beardsley (1964) reported that the value of a forage to cattle and sheep is influenced by the physical form in which it is being fed. Grinding and then pelleting an ordinary quality forage may increase feed intake by as much as 25%, daily gain by 100% and feed efficiency by 35%

The following trials were conducted to determine if cattle could be successfully finished to an acceptable carcass grade on all-forage diets and to study the influence of feeding an all-forage diet on animal performance and carcass merit.

Trial 1. This trial was conducted to (1) determine if pelleted alfalfa hay could be used to satisfactorily finish cattle into an acceptable carcass grade, (2) determine if feeding pelleted forage at the first or last part of a feeding period results in superior feedlot performance and carcass merit and (3) compare these treatments to feeding an all-concentrate diet throughout the complete study.

Forty-eight Hereford steer calves, averaging 239 kg, were removed from summer pasture, implanted with 24 mg of diethylstibestrol (DES) and randomly divided into four groups of 12 steers each. Adjustment from grazing to the experimental diets was

accomplished in 21 days. Intially, two groups received the all-concentrate diet (A), and two groups received a pelleted forage diet (B). After 77 days one concentrate group was switched to forage and one forage group to concentrate during a 14-day transition period. The four groups were then fed for an addition 77 days. The four treatment diets for the first 77 and last 77 days were designated AA, BB, AB, and BA for continuous concentrate, continuous forage, concentrate followed by forage and forage followed by concentrate, respectively. The steers were fed ad libitum during the 168-day study and sawdust was used for bedding.

Steers fed only the all-concentrate diet gained faster ($P<.01$) than steers fed the two diet combinations or those fed only the all-forage diet during the 168-day study. There were no significant differences among the performance of steers fed the latter three diets for the total study. The steers gained faster ($P<.05$) during the first 77 days than during the last 77 days of the study (1.22 vs 1.11 kg daily). Steers which were switched gained the fastest ($P<.01$) while they were fed the all concentrate diet. Since the steers were group fed, a statistical analysis of the feed efficiency could not be conducted; but the steers fed the all-concentrate diet required about 40% less feed/kg of gain than did steers fed the all forage diet. Average daily gains (kg) and feed/grain ratio during the study for the four groups, respectively were: 1.27, 5.71; 1.05, 10.06; 1.09, 7.98; 1.11, 8.14.

The carcass grades were higher ($P<.05$) for groups AA and BA compared to BB and AB. The dressing percentage of groups BB and AB was less ($P<.01$) than AA and BA. The rib eye area of groups AA and AB ($P<.01$) and BB ($P<.05$) was less than that for group BA. The fat covering of the steers in group BB was less ($P<.01$) than that for all other groups while group AB was less ($P<.05$) than that for group AA. The percent of fat in the ribeye of the steers in group BB was less ($P<.01$) than that of steers in group BA. The flavor and tenderness of the meat from steers in groups AA and AB scored lower ($P<.01$) than that from meat of steers in groups BB and BA. The juiciness of the meat from steers in group AB was less than that from steers in group BA ($P<.01$) and AA ($P<.05$). The overall desirability of the meat from steers in group AB was less ($P<.01$)

than that for groups BB and BA and also group AA was less (P .05) than group BA.

In trial 1, it seemed to make little difference if forage or concentrate was fed first on later animal performance when the opposite diets were fed. The steers fed the all-concentrate diet seemed to 'tire' of their feed as evidenced by the 1.44 kg daily gain during the first period compared to 1.30 kg daily gain during the second period. The steers consumed 2.45% and 1.93% of their body weight of the all concentrate diet during periods 1 and 2, respectively. A similar reduction in the performance of steers fed an all-concentrate diet based on wheat was noted in a previous study. (Oltjen et al., 1966). The steers fed the all forage diet throughout the study made almost identical gains during both periods. It is rather surprising that steers fed the all-forage gained only slightly less than steers fed for half of the total study on the all-concentration diet. Bond et al. (1967) reported that steers fed a coarsely ground all-forage diet from 6 months of age to slaughter gained 0.6 kg daily compared to 0.8 kg daily for steers fed a high-concentrate diet.

The steers fed only the all-forage diet in trial 1 consumed 95% the amount of metabolizable energy (N.R.C., 1963) and were 86% as efficient in converting it to body weight as were steers fed the all-concentrate diet. The steers fed the all-forage diet had only 55% the amount of backfat but 80% of the ether extract in the rib eye as did steers fed only the all-concentrate diet. This would indicate a favorable feed to carcass protein ratio with steers fed the all-forage diet.

The steers receiving the all-concentrate diet throughout the study were slaughtered at the end of the 168-day feeding period; but since it was desirable to slaughter all the steers at a similar weight, the steers on the BA regime were continued on diet A and were slaughtered at 189 days, AB at 196 days and BB at 203 days.

Trial 2. The purpose of this trial was to (1) determine if the feedlot performance and carcass merit of steers fed the pelleted alfalfa hay diet in trial 1 could be replicated and (2) determine the effect of pelleted alfalfa: timothy hay combinations

and a pelleted timothy hay: molasses: urea diet on feedlot performance and carcass merit. The four pelleted rations were (1) alfalfa hay (2) 2/3 alfalfa: 1/3 timothy , (3) 1/3 alfalfa hay: 2/3 timothy hay and (4) timothy hay. Average daily gain (kg) and feed/grain ratio, respectively, were 0.97, 10.98; 0.94, 11.91; 0.91, 12.63; 0.84, 12.70. Steers in group 1 were slaughtered at the end of 203 days but steers in the other groups were kept on their respective diets until they reached an equivalent weight. Group 1 steers gained faster ($P<.05$) than steers in group 4. The carcasses from the steers in all groups graded medium to high good.

The results from both trials indicate that pelleted alfalfa hay can be successfully used as a finishing diet for beef cattle. The steers fed the all-forage diet just prior to slaughter had the lowest dressing percentage but quite possible this was due to a larger ruminal fill with these steers. The results in trial 2 indicate that the replacement of alfalfa hay with timothy hay results in lowered animal performance, but satisfactory animal performance and carcass merit were obtained as long as a part of the diet was alfalfa hay.

Meyer it al. (1959a,b) demonstrated that increased gains due to feeding finely ground, pelleted alfalfa hay compared to chopped alfalfa hay are due to an increased feed intake. A faster passage of ingesta from the reticulo-rumen seemed to be responsible for this increased feed intake. Futhermore, fine grinding is probably the major factor causing the increased feed consumption of pelleted hay. Johnson et al. (1964) reported that when hay (alfalfa and mixed hay) constituted the entire ration, steers gained significantly faster when fed pelleted and ground as compared to long hay. Usually, apparent digestibility is slightly lower when pelleted forages are fed (Beardsley, 1964) but increased intake more than compensates for this and the overall effect is an increased intake of digestible nutrients. The pelleting response is usually the most effective in increasing the performance of ruminants when hay constitutes most of the ration. In the present study the alfalfa hay comprised 98.5% of the total diet and the hay was finely ground prior to pelleting in an attempt to maximize

animal performance."[1]

"Oltjen et al. (1971) conducted two experiment utilizing 104 Hereford steers to study the influence of low levels of roughage and roughage substitues on performance, carcass characteristics, rumen environment, rumen parakeratosis and liver abscesses of steers fed high energy rations. The treatments were: basal all-concentrate ration; basal plus 1.36 kg. hay per head daily; basal containing 5% conttonseed hulls; or 5% ground corn cobs; or 2% oyster, or 4% oyster shells; or 2% sand or 5% ground polethylene.

The addition of low levels of roughage, and roughage substitutes to the basal ration did not significantly increase body weight gains, but the addition of cottonseed hulls to the basal ration significantly increased gains ($P<.05$) over the basal and basal plus 2% or 4% oyster shell rations. Steers on the basal, basal plus hay and basal plus corn cob treatments yielded carcasses with larger rib eyes, thinner rinds and improved cutting scores, while carcass grades and marbling scores were not significantly different from the other treatments."[2]

1. R.R. Oltjen, T.S. Rumsey and P.A. Putnam. "All-Forage Diet for Finishing Beef Cattle." Journal of Animal Science, Vol.32: 327-333. February 1971.

2. B.R. Haskins, M.B. Wise, H.B. Craig, T.N. Blumer and E.R. Barrick. "Effects of Adding Low Levels of Roughages or Roughage Substitutes to High Energy Rations for Fattening Steers." Journal of Animal Science, Vol. 29: 345-353, August 1969.

Bibliography

Beardsley, D.W. 1964. "Symposium on forage utilization: nutritive value of forage as affected by physical form. Par II. Beef cattle and sheep studies." Journal of Animal Science, Vol.23:239.

Bond, James, N.W. Hooven, G.V. Richardson and E.J. Warwick. 1967. "Plane of nutrition: dairy, dual-purpose, and beef steers." Journal of Animal Science, Vol. 26:218 (Abst.).

Haskins, B.R., M.B. Wise, H.B. Craig, T.N. Blumer and E.R. Barrick. "Effects of adding low levels of roughages or roughage substitutes to high energy rations for fattening steers." Journal of Animal Science, Vol. 29:345, August 1969.

Johnson,R.R., G.E. Ricketts, E.W. Klosterman and A.L. Moxon. 1964. "Studies on the utilization and digestion of long, ground and pelleted alfalfa and mixed hay." Journal of Animal Science, Vol.23:94.

Meyer, J.H., W.C.Weir, J.B. Dobie and J.L. Hull. 1959b. "Influence of the the method of preparation on the feeding value of alfalfa hay." Journal of Animal Science, Vol.18:976.

Meyer, J.H., R.L. Gaskill, G.S. Stoecusand and W.C. Weir. 1959a. "Influence of pelleting on the utilization of alfalfa." Journal of Animal Science, Vol.18: 336.

N.R.C. 1963. Nutrient Requirements of Domestic Animals, No. 4. Nutrient Requirements of Beef Cattle. National Research Council, Washington, D.C.

Oltjen, R.R., P.A. Putnam, E.E. Williams, Jr. and R.E. Davis. 1966. "Wheat versus corn in all-concentrate cattle rations." Journal of Animal Science, Vol.25:1000.

Oltjen, R.R., T.S. Rumsey and P.A. Putnam. "All-forage diet for finishing beef cattle." Journal of Animal Science, Vol.32:327.