PRODUCTION RESPONSES AND PROBLEMS RELATING TO THE USE OF MAIZE AND SORGHUM GRAIN IN FEEDLOTS

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Though there is very little New Zealand experience on the feeding to cattle of rations containing high levels of maize or sorghum grain, there has been wide experience overseas. For maize this is particularly so in the U.S.A. where some 90% of production is fed back to livestock. There has been reasonably wide experience with sorghum grain in Australia and the U.S.A., in the latter in fact Black **et al.** (1943) were reporting cattle performance on sorghum for preceding decades.

Certain general principles have been well established regarding grain feeding to beef cattle. With the higher energy grains at least, an increase in grain level in the diet will lead to an increase in growth rate and a lower feed conversion rate (Pryor, 1970). At such high levels, the nature of the roughage component does not have much effect on performance. Thus performance quoted here must be considered in the light of these principles.

There are numerous reports of cattle performance on high maize feeding although average daily gains obtained will be influenced by the percentage of grain in the ration. Preston and Willis (1974) reported data up to 1970 on maize feeding to cattle where no roughage was fed. Daily gains were within the range of 0.73-1.40 kg per day and feed conversions within the range of 5.00-7.44. A reasonable summary of U.S.A. experience is that gains of about 1 kg/day are obtained for British cattle breeds where maize is fed and some roughage provided.

There are very few data in the literature where direct comparisons have been made between maize and sorghum feeding at the same feeding level. Even if there were more, the interpretation could be rather imprecise since such factors as origin of grain and chemical composition will vary from location to location. In published tables Hewitt (1961) records maize as having a starch equivalent value of 77% and a gross digestible energy content of 79% whereas the values recorded for sorghum are 68% and 74% respectively. There seems little scientific basis for such low values for sorghum though at the time of publication, limited U.S.A. data may have influenced them. Morrison (1959) in the U.S.A. however quotes a TDN value in the range of 78.5-81.9% for most corn grains and a value of 79.9% for sorghum grain which is almost the mean of the corn value.

Overseas authorities, particularly the Arizona workers, have for some years inclined to the view that sorghum is inferior to maize in respect of feed conversion, though some have recognised that growth performance may be a little better with it. In the Arizona work it is distinctly possible that protein, processing or other limitations may have been occurring. Hale (1973) has recently stressed that there appears a close relationship between apparent protein disgestibility of grain and NFE utilisation of grain by cattle. Although few or no direct comparisons have been made, it is my view that in Australia sorghum has performed quite comparably to maize. For example, the Australian data on sorghum performance, e.g. Mossis (1966 a) reveals feed conversions of down to 4.8 on all grain sorghum feeding where urea was added. This is a lower figure than any quoted by Preston and Willis (1974) for maize. It is conceivable that some of the early workers with maize grain did not fully comprehend possible protein interactions.

It is quite clear that the productive performance of sorghum fed to cattle under Australian conditions has been nothing short of extremely good.

Sorghum grain has been fed with sorghum silage in several experiments, the latter ranging from 48-80% and though the higher the grain content the better was the performance, even at the 60% silage levels, liveweight gains of 1 kg/day in 18 month old Hereford steers have been obtained with sorghum grain provided adequate nitrogen intake was assured by the inclusion of urea (Morris and O'Bryan, 1965).

With prolonged sorghum grain feeding there is a possibility that nyctalopia (night blindness) might develop. However it is true that Morris and Pepper (1969) obtained no productive response to vitamin A supplementation even when the above disorder was present. One would expect that with maize use, avitaminosis and nyctalopia in cattle would be less likely to occur.

Diets containing either sorghum or maize grain at high levels can be deficient in protein, particularly if the roughage component is of low quality. I have analysed both grains in Australia and obtained crude protein values (N x 6.25) of less than 7%.

It may be worthy of consideration that beef can be produced from sorghum grain fed as a supplement to sorghum stubble. With intakes of supplements of approximately 5 kg grain per day, cattle liveweight gains of over 1 kg/day have been obtained from sorghum stubble.

There are very limited data available on the use of sorghum or maize in a cattle survivial situation. Morris and Gartner (1970) offered 3 or 4 kg of sorghum grain daily to mixed dairy cows through pregnancy and up to 70 days of lactation with high survival at the higher rate. Morris (1968) fed Hereford heifers 1.36 kg of sorghum grain daily, these animals lost only approximately 30 kg in weight after 26 weeks.

PROCESSING EFFECTS

Hale (1973) asserts that sorghum and maize appear to have their utilisation improved by processing more than other grains. There are a very large number of ways in which grains may be processed. Hale lists 18 such methods. There can be little doubt that processing can affect utilisation of grains by cattle and there is an extensive total literature but the equipment for many of these processes would not be available in New Zealand, nor practicable at the farm level. Grinding however is always a practicable possibility. Wilson **et al.** (1973) reported considerable animal variability to some processing of maize and high moisture maize though grinding generally increased degestibility. Morris (1966

b) showed that cracking sorghum grain increased its digestibility by 20% when fed as a drought ration. A latter study also showed the feeding of cracked sorghum was associated with significantly reduced rate of liveweight loss and improved survival of heifers fed a drought ration. Though fine grinding is not carried out normally in commercial feeding it does result in improved feed conversion rates but often is accompanied by lower intake and more animal health problems.

HEALTH FACTORS

A study of world literature would lead to the conclusion that health probelms associated with high level feeding can exist with any grain. These problems include D-lactic acidosis and associated digestive disturbances, bloat, rumenitis-liver abscess complex, laminitis and deaths may occur. However, there are few such reports for sorghum or maize. Morris **et al.** (1969) did report some incidence of laminitis in cattle fed sorghum grain **ad lib** with 0-2 kg roughage/day, though the incidence was higher in cattle fed barley or wheat on an otherwise similar diet. It is probable that cattle thus affected, have the further disadvantage that they consume less grain, probably because of walking difficulties. Persistance of lameness was also less in cattle fed sorghum grain.

There has been much concern about the presence of the rumenitis and liver abscess complex in beef cattle fed high grain levels. This disorder can lead to very heavy liver condemnations even in cattle appearing clinically normal. This problem however appears minor where sorghum and maize are the grains, though with barley it may be a significant problem (Rowland, 1970).

Bloat (gassy) occurrence can be very high on all ground maize diets. Preston (1963) reported 33% deaths from bloat on such a diet though other factors may have contributed. This is certainly an extreme result, and under commercial conditions ground maize rarely is very troublesome. The maize ill-affects may be possibly due to a lack of abrasive effects of this grain. It appears that bloat is less of a problem with sorghum and Preston and Willis (1974) have advanced some theoretical reasons why this may be so. There is another intriguing thought. In the 1960's sorghum grain was thought to be a cause of unsatisfactory poultry performance because of suspected high tannin content (Anon, 1965). It could be that tannins are indeed useful in cattle feeding in reducing bloat sensitivity, an aspect being investigated in frothy bloat (Reid **et al.**, 1974).

Morris, **et al.** (1969) concluded from their series of experiments that generally sorghum was a safer grain than either wheat or barley and it is certainly my view based on personal experience and the literature that sorghum is in fact the safest of the five common grains, with maize little behind it from the cattle safety point of view.

CONCLUSION

The evidence is overwhelming that maize and sorghum grains are very productive in cattle feeding situations, notwithstanding the fact that in the U.S.A., Arizona workers have recorded less satisfactory performance with sorghum than the Australian workers. Furthermore, sorghum and maize are almost certainly the safest of the grains for cattle feeding provided they are not fed in a finely ground condition. Both could have a vital role to play in any feedlot industry which may develop in the future if agronomic and economic considerations are favourable to their production.

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