



# FATS AND PROTEINS RESEARCH FOUNDATION, INC.

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November 21, 1972  
No. 101

## PROTEIN-ENCAPSULATED FAT FOR RUMINANT FEEDING

The amount of fat that can be efficiently utilized by cattle and other ruminants is limited by a number of factors, including the type of ration, acceptability, and the effect of fat on rumen microorganism activity. Under most practical feeding conditions not more than four percent fat can be added to cattle rations without adverse effects on gains and feed efficiency.

It has been postulated that increased concentrations of fat in the ration could be efficiently utilized by cattle if the fat could be "protected" in the rumen and then released and digested in the "true" stomach and intestine. Professor William Hale and his associates at the University of Arizona, with grant support from FPRF, are investigating this possibility.

In the first year's research safflower oil was added at the 6% level to cattle rations. For one lot of cattle the safflower oil was "unprotected." A second lot was fed the same amount of safflower oil "protected" by emulsifying it with an equal amount of casein then reacting the emulsion with formaldehyde which caused the fat to be encapsulated in a cross-linked protein matrix that would not be digested by rumen microorganisms. Theoretically the protein matrix should be broken down in the acid conditions in the stomach, releasing the fat for digestion and utilization. Safflower oil was used in this preliminary study because it contains highly unsaturated fatty acids that could be used as "tracers" to follow the digestion and deposition in the blood and tissues.

Although the number of animals in each lot was small (3-5) and numerous analytical problems were encountered the results (Table 1) indicate clearly that the "protected" safflower oil was better utilized by the steers than the "unprotected" safflower oil. Steers receiving the "protected" safflower oil had higher levels of serum lipids than did steers receiving the other rations. Also analysis of various tissue fats at slaughter showed that the level of linoleic acid in the fat of steers fed "protected" safflower oil was about six times the level of linoleic acid in the fat from steers fed the other rations. This indicates that the "protected" safflower oil did move through the rumen essentially unchanged.

In current trials Professor Hale is studying the response of steers fed tallow "protected" with collagen cross-linked with formaldehyde. If these trials yield the expected results, it should be possible to at least double the level of animal fat added to cattle rations. Also a significant new market for collagen will result.

Table 1. Digestibility of Rations and Performance of Steers Fed the Rations

|                             | Control | Control +<br>6% Saf. Oil | Control +<br>6% Protected<br>Saf. Oil |
|-----------------------------|---------|--------------------------|---------------------------------------|
| Dry Matter Digestibility, % | 72.7    | 68.1                     | 75.2                                  |
| Energy intake daily, Kcal   | 31,138  | 28,639                   | 27,024                                |
| Digestible energy, %        | 71.8    | 64.3                     | 74.2                                  |
| True lipid digestibility    | -       | 41.8                     | 88.8                                  |
| Av. daily gain, lb.         | 2.70    | 1.72                     | 1.94                                  |
| Feed/100 lb. gain, lb.      | 726     | 942                      | 784                                   |