VALUE OF FAT IN LIQUID FEED

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Introduction

The supplement most fed to cattle grazing perennial grass pasture, rangeland, and other low to medium quality roughages is molasses-based liquid feed fortified with crude protein. A problem with molasses-based supplements is a moderate energy content of 55 to 65% TDN (as-fed basis). In some situations it would be useful if the energy level of molasses-based liquid supplements were higher. The best way to increase the energy level in liquid feed is to add fat. Adding 10% fat would increase the TDN of liquid feed by 20 percentage units to 75 to 85% TDN making it comparable in energy to many dry feed supplements on an as fed basis..

There are very few production studies with grazing beef cattle fed molasses-based liquid feeds containing added fat. Previous Florida studies conducted in the 1960's showed that a molasses supplement containing 10% vegetable fat and fed at a rate of 3 pounds per day to growing steers grazing pasture increased rate of gain 16%. No further research was on the value of fat in a liquid supplement in Florida, or elsewhere, until recently.

Past Florida research was conducted with vegetable oil which readily mixed with molasses and remained in suspension for reasonable periods of time without suspending agents. Products offering the greatest potential in terms of supply and costs are animal fats (tallow and catfish oil) and restaurant grease (reprocessed vegetable shortening). The limited research on suspending fats in molasses-based liquid feeds and the effectiveness of fat in liquid feed fed to yearling heifers or brood cows was conducted in Florida during the past 5 years. This paper will discuss these studies.

Suspending Fat In Liquid Feed

Procedure

A study was conducted to evaluate stability of various combinations of fat (tallow and restaurant grease) and suspending agents in a molasses-feather meal slurry (88.5% molasses, 10% hydrolyzed feather meal, and 1.5% urea). Animal fat and restaurant grease was mixed in a 5 liter, stainless steel, waring blender. Each fat was mixed at the 5 and 10% level into the molasses slurry in replace of molasses. Each fat and molasses slurry combination was mixed without a suspending agent and combined with .05, .15, and .25% gum powder; .5, 1.0, and 1.5% attapulgite clay; 1, 3, and 6% lecithin. The molasses slurry mixtures were stored in 14 x 25 cm cylinders and sampled at 14, 28 and 56 days.

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Results

Fat concentration was higher in samples removed from the top one-third of cylinders than in samples removed from the bottom one third in all situations. Overall, the treatment containing no suspension compound was the most homogenous. After 14, 28 and 56 days, fat content of samples removed from the bottom 1/3 of cylinders containing molasses slurry without suspending agents were 90, 91, and 94%, respectively, of samples removed from the top 1/3.

For the first 14 days, attapulgite clay held fat in a very uniform suspension, but at 28 and 56 days the fat content of molasses slurry containing clay tended to be considerably higher in the top of cylinders, especially with the higher clay levels (1.0 and 1.5%). Considering all time periods and suspension agent levels, gum appeared to be the poorer compound for holding fat in suspension, with lecithin being intermediate to gum and clay.

Both fats remained in suspension equally well without suspending agents, indicating that a molasses, feather meal, and fat mixture forms a good emulsion independent of suspending compounds, regardless of fat type. The limited amount of fat separation which occurred would not present problems in terms of beef cattle nutrition, but may present minor problems in the feed tag guarantee. Foregoing the need of a suspending agent in molasses slurry supplements would relate to a meaningful savings in liquid feed formulation. Low levels of attapulgite clay (0.5%), the only product that appears to hold fat in suspension in molasses slurry, cost about $125 per ton . It would cost about $0.70 to add 10 pounds of clay to a ton of molasses slurry.

In concurrent feeding trials, 10% animal fat and restaurant grease was mixed into a molasses-feather meal slurry in 500 gallon mixing tanks without suspending agents, and no separation was observed in the field. The supplement containing animal fat exhibited minor caking on mixing equipment and feed troughs, primarily during cool periods (less than 50° F), but there were no major problems encountered with slurry consistency or flow. One could visually detect fat in the liquid feed mixtures, especially animal fat which gave the molasses slurry mixture a lighter brown color.

Fat in Liquid Supplements Fed to Yearling Heifers

Procedure

Two trials were completed at the Range Cattle Research and Education Center which evaluated the addition of 5% fat, as catfish oil, in a molasses-feather meal slurry (13% feather meal) fed to yearling heifers. Heifers were fed supplement in open troughs twice weekly to provide 5 pounds per head daily from weaning in September at 8.5 months of age through a 60 day breeding season starting March 1. Heifers were grazed on bahiagrass pasture and fed stargrass hay from December through the breeding period. Heifers were weighed at the start of the trial, approximately every 60 days, and at the beginning and end of the breeding period. Heifers were bled at each weighing, and blood samples were analyzed for serum cholesterol content. Heifers were palpated for pregnancy in August.

Results

In comparison to heifers supplemented with molasses-urea, heifers fed molasses slurry containing feather meal or feather meal and catfish oil gained faster and had a higher pregnancy rate ($P < .05$). Also, heifers fed the molasses slurry containing feather meal and catfish oil has a faster rate of gain and a higher pregnancy rate ($P < .05$) than heifers supplemented with molasses containing only feather meal (Table 1).

Because of their greater need for energy, the addition of at least 5% fat to liquid supplements has a very positive effect on the performance of heifers to be bred as yearlings. The degree of response appears to be economical with current prices for fat (15 to 20 cents per pound). Other competitive fat sources are animal fat (tallow) and restaurant grease (yellow grease).

Fat in Liquid Supplements Fed to Brood Cows

Procedure

A two-year cow and calf production trial was initiated in October 1993. One hundred and ninety eight producing beef cows were randomly allotted to nine groups. Three groups were assigned to each of the following winter supplementation treatments:

1. 5 pounds/cow/day of molasses slurry (as described above) with no fat.
2. 5 pounds/cow/day of molasses slurry with 10% animal fat (40.5 titer).
3. 5 pounds/cow/day of molasses slurry with 10% restaurant grease.

Fat was added to the molasses, feather meal, and urea slurry in place of molasses. Supplements were fed twice weekly in open troughs from December 15 through April 30 in 1993-94, and from November 15 through April 28 in 1994-95. Cows were grazed on bahiagrass pasture all year and fed stargrass hay during the winter on an as-needed basis. Cows were exposed to bulls for 90 days from March 1 to May 28. Cows were weighed and assigned a condition score on November 15, March 1, May 31 and August 24. Calves were weighed at weaning in mid-September. Cows were bled at the start of the breeding season and at the end of the breeding season, the latter being 30 days after fat supplementation was discontinued, to measure blood cholesterol Cows were palpated for pregnancy in late August.

Results

Cows consumed slurry mixtures containing either fat source very well. Field observations indicated that both slurry mixtures containing fat were eaten quicker than the molasses and feather meal mixture containing no fat. Cattle appeared to prefer the slurry containing restaurant grease over the one containing animal fat. Liquid supplement treatment did not affect hay consumption.

There were no significant treatment effects on cow weights in year 1 (Table 2). In year 2, cows fed supplements containing either animal fat or restaurant grease lost more weight ($P < .05$) during the calving season (December through February) than cows fed the supplement without fat (Table 3). During the breeding season (March through April) of year 2, cows fed both supplements containing fats gained more weight ($P < .05$ for restaurant grease) than cows fed supplement without fat. It is questionable if these differences were real treatment effects, and overall it appears that the feeding of supplements containing fat had no effect on cow weights. Body condition scores (Table 2 and 3) support the above interpretation that fat had no real effect on cow weights. In both years the body condition score of cows feed supplements with or without fat were similar ($P > .05$).

In year 2, average calving date was 12 and 11 days earlier ($P < .05$) for cows fed supplements containing animal fat and restaurant grease, respectively, than cows fed supplement without fat. This response resulted from an earlier conception date for cow fed supplements with fats in year 1. In fact, when data for cows used in both years of the study were analyzed (some cows were culled at the end of year 1 and others were added as replacements), calving date for cow fed supplement containing either animal fat or restaurant grease averaged 20 days earlier ($P < .05$) than cows fed supplement containing no fat.

It is concluded from these data that the addition of fat to a liquid supplement will result in cows conceiving earlier in the breeding season or about one heat period sooner after calving. Such a response would subsequently result in an earlier calving date, and more importantly a heavier calf at weaning. Calf weaning data in year 2 (Table 3) show this latter effect. Calves from cows fed supplements containing animal fat and restaurant grease were 15 and 22 pounds heavier ($P < .05$ for restaurant grease treatment), respectively, than calves from cows fed supplement without fat. Cow conception date and calving internal data for year 2 will not be available until the end of the 1996 calving season, and these data will be evaluated and reported. In the long term, if cows fed supplements containing fat conceive sooner after calving they would also have a higher pregnancy rate and a heavier calf at weaning.

Several workers have reported that increased blood cholesterol was associated with increased progesterone synthesis, release, and clearance, and increased follicle activity . It was hypothesized that these variables are indicative of improved reproduction. In both years blood cholesterol level of cows fed both animal fat and restaurant grease were higher ($P < .05$) than that of cows fed supplement without fat (Tables 2 and 3). This response showed that both types of fat augmented lipid metabolism and may have been responsible, at least in part, for the increased reproductive performance expressed in the present study as earlier conception after calving.

Table 1. Daily gain, feed intake, pregnancy, and blood urea nitrogen and cholesterol levels of yearling heifers fed molasses-based supplements containing urea, feather meal, or feather meal and catfish oil.

Item	Molasses urea	Molasses feather meal	Molasses feather meal catfish oil
Trial 1			
Initial wt, lb	579	575	575
Average daily gain, lb	-.15[a]	.09[b]	.24[c]
Supplement intake, lb/d	3.7	4.8	4.8
Hay intake, lb/d	6.4	6.4	5.5
Pregnancy, %	9.5[a]	31.4[b]	47.6[c]
Cholesterol, mg/dl	94[a]	97[a]	133[b]
Trial 2			
Initial wt, lb	551	551	555
Daily gain, lb	.44[a]	.71[b]	.82[c]
Supplement intake, lb/d	4.6	4.6	4.6
Hay intake, lb/d	13.4	13.4	13.4
Pregnancy, %	42.9[a]	69.1[b]	80.0[b]
Cholesterol, mg/dl	82[a]	92[ab]	143[c]

[a,b,c,d,e] Means in the same row with a different letter in their superscript differ ($P < .05$).

Table 2. Performance and blood cholesterol levels of cattle fed molasses-feather meal slurry containing either 10% animal fat or 10% restaurant grease, 1993-1994.

Item	Control	Animal fat	Restaurant grease
Initial cow weight, lb	1040	1050	1054
Feed consumed, lb/cow			
Liquid supplement	685	685	685
Stargrass hay	1091	1102	1025
Cow weight change, lb			
Calving season	-96	-101	-89
Breeding season	98	103	111
Cow condition score[a]			
Start of breeding	5.3	5.2	5.3
Weaning	5.7	5.7	5.9
Pregnancy rate, %[b]	82.2	91.8	90.2
Calving date	Jan. 7	Jan. 9	Jan. 10
Calf weaning wt., lb	457	460	454
Blood Cholesterol, mg/dl			
Start of breeding	140[c]	197[d]	199[d]
Post fat feed (June)	176	177	169

[a]Body condition scores from 1 to 9, with 1 for a thin emaciated cow, 5 for a cow with average condition, and 9 for an extremely fat cow.
[b]Pregnancy data analyzed by the chi-square procedure, with no treatment differences ($P > .05$).
[cd]Values in the same row with a different superscript differ ($P < .05$).

Table 3. Performance and blood cholesterol levels of cattle fed molasses-feather meal slurry containing either 10% animal fat or 10% restaurant grease, 1994-1995.

Item	Control	Animal fat	Restaurant grease
Initial cow weight, lb	999	1005	1037
Feed consumed, lb/cow			
Liquid supplement	815	815	815
Stargrass hay	1250	1162	1250
Cow weight change, lb			
Calving season	-36^{a}	-65^{b}	-89^{b}
Breeding season	70^{a}	84^{ab}	99^{b}
Cow condition score^{c}			
Start of breeding	5.0	4.7	4. 7
Weaning	5.5	5.3	5.5
Pregnancy rate, %^{d}	81.0	85.7	76.4
Calving date	Jan. 20^{a}	Jan. 8^{b}	Jan. 9^{b}
Calving interval, days^{e}	390^{a}	369^{b}	371^{b}
Calf weaning wt., lb	434^{a}	449^{ab}	456^{b}
Blood Cholesterol, mg/dl			
Start of breeding	116^{a}	171^{b}	168^{b}
Post fat feeding	143	145	149

abValues in the same row with a different superscript differ ($P < .05$).
^{c}Body condition scores from 1 to 9, with 1 for a thin emaciated cow, 5 for a cow with average condition, and 9 for an extremely fat cow.
^{d}Pregnancy data analyzed by the chi-square procedure, with no treatment differences ($P > .05$).
^{e}Data only for cows that conceived in 1993-1994, thus, would have been fed respective fat supplements in 1993-1994 and 1994-1995.