EFFECT OF DENSITY OF STEAM FLAKED MILO ON ANIMAL PERFORMANCE, MILL PRODUCTION RATE, AND SUBACUTE ACIDOSIS[1]

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Summary

In Trial 1, 336 yearling steers (755 lb) were fed diets containing milo flaked to 22 (L), 25 (M), or 28 (H) lb/bu. The steers fed L consumed 3.2% less dry matter than cattle fed H ($P < .05$) and had 6.9% lower gains ($P < .05$). Feed efficiency tended ($P = .15$) to favor cattle fed H. The H milo was flaked 27% faster than M and 67% faster than L ($P < .0001$), resulting in lower production cost for the heavy flakes. In Trial 2, six ruminally cannulated steers were fed the same diets used in Trial 1 in a replicated 3×3 Latin square. After adaptation to the respective diets, the cattle were fasted and then overfed to simulate a drastic intake fluctuation. The L diet was fermented more rapidly than the H diet, resulting in greater ruminal pH depression ($P < .10$) following overconsumption. Under the conditions of this experiment, flaking milo more intensively than 28 lb/bu (58.7% starch gelatinization) resulted in decreased consumption, lower mill efficiency, and increased propensity for acidosis in finishing steers.

(Key words: Steam Flaking, Milo, Density, Acidosis, Mill Efficiency.)

Introduction

Current information relative to steam flaking of milo suggests that conversion efficiency by beef cattle is optimized when the grain is flaked to 22 to 28 lb/bu. However, the costs of producing various densities of flaked milo at near maximum mill load, has not been determined. Also unknown is the effect of flake density on subacute acidosis resulting from periods of intake fluctuation.

Experimental Procedures

Trial 1.

Three hundred thirty-six crossbred steers were received off wheat pasture in April, 1992. They were dewormed, vaccinated, eartagged, and stepped up to a medium-energy ration at a commercial feedyard in western Kansas. The cattle were then shipped to the Southwest Kansas Research-Extension Center in Garden City. The steers were stratified into four weight blocks and stepped up to the final ration containing milo flaked to 22, 25, or 28 lb/bu. Diets contained (DM basis) 82.5% flaked milo, 4% corn silage, 4% alfalfa hay, 7% supplement (43% CP, 8.7% urea), and 2.5% molasses. The cattle were weighed initially (May 25 and 26, 1992; avg 755 lb) and monthly until finished, at which time they were again weighed (September 27 and 28, 1992; avg 1139 lb) and slaughtered. Daily pen feed intakes were recorded.

The milo was sprayed with water and a wetting agent (Red-E-Flake®; Cargill, Inc., Molasses Div., Minneapolis, MN) and allowed to react for about 18 h prior to steaming. At startup each day, when the steam chest reached

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[1]The cooperation of Grant County Feeders, Ulysses, KS, who supplied the cattle used in Trial 1, is gratefully acknowledged.

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100°C the rolls (Ross 18 × 24 in. flaking mill, 25 hp) were warmed for 20 minutes by flaking grain to 25 lb/bu. After warmup, the rolls were tightened to flake the 22 lb/bu grain (L). When enough grain was processed for the light density treatment, the rolls were relaxed to flake the 25 lb/bu (M), and then the 28 lb/bu (H) grain. While flaking the grain for the test diets, mill load was maintained at 90% of maximum for all three densities. This resulted in average steam-chest retention times of 90, 70, and 50 minutes for L, M, and H respectively. The flaked milo averaged 79.5% DM beneath the rolls. Degree of starch gelatinization was determined on processed grain using differential scanning calorimetry.

Trial 2.

Six ruminally cannulated steers (avg 928 lb) were fed concurrently with the cattle in Trial 1. The steers were assigned in a replicated 3 × 3 Latin square arrangement to receive the same treatments as fed in Trial 1. We used a subacute acidosis challenge model in which cattle were acclimated to their respective treatment (intake restricted to 2% of BW per day, equal portions fed twice daily) for 9 days, and baseline rumen samples were taken on day 10. The p.m. feeding on day 11 was skipped, and then 1% of BW was provided in the a.m. on day 12. The cattle were allowed 90 min to consume the feed, at which time any unconsumed feed, plus ration equal to another 1.5% of BW was placed through the cannula into the rumen. Rumen samples were taken at feeding and at 3, 6, 9, 12, 18, and 24 h after. A second subacute acidosis challenge was conducted on day 13.

Results and Discussion

Cattle fed L consumed significantly less feed ($P < .05$) and gained more slowly ($P < .05$) throughout the trial than those offered H, with cattle fed M responding intermediately (Table 1). Feed efficiency tended ($P = .15$) to favor those cattle fed H. These results conflict with previous reports of improved efficiency by cattle when offered extensively processed grain. No differences in carcass parameters were attributable flake density.

At steady mill load (the situation in a commercial feedmill), grain was processed much more rapidly when flaked to H than M or L ($P < .0001$; Table 1). Increased pressure from the rolls resulted in a linear increase ($P < .05$) in starch gelatinization (Table 1). However, because electrical load was kept constant, mill throughput was decreased as flake density decreased. All costs associated with residence time and throughput (gas cost of maintaining chest temperature and electrical cost of running the mill) increased proportionately with decreasing production rate. Therefore, the L and M treatment flakes cost more per unit to produce than H.

In Trial 2, acidosis challenges with diet L reduced ruminal pH to a greater extent than those with diet H ($P < .10$; Figure 1). The lightweight grain was probably fermented more rapidly. However, there were no significant flake weight effects on ruminal concentration of either total VFA or lactate, which averaged 126.6 and 1.31 millimoles/liter, respectively. Data from Trial 2 suggest that finishing cattle fed highly processed milo are more susceptible to subacute acidosis resulting from irregular feed consumption patterns.

Under our conditions, flaking milo more extensively than 28 lb/bu (58.7% starch gelatinization) resulted in lower animal performance, lower mill efficiency, and increased animal susceptibility to subacute acidosis. Therefore, the proposed benefits from extensive steam-flaking of milo, except perhaps where light test-weight or highly variable milo is used, are suspect.

Table 1. Effect of Degree of Milo Flaking on Animal Performance, Mill Power Consumption, and Degree of Starch Gelatinization (Trial 1)

	Degree of flaking[a]		
Item	L	M	H
Performance data			
Number of pens	12	12	12
Number of steers	112	112	112
DMI, lb	18.4[b]	18.8[bc]	19.0[c]
ADG, lb	2.99[b]	3.09[bc]	3.21[c]
Feed/gain	6.13[d]	6.10[de]	5.92[e]
Production data			
Rate, ton/h	1.155[f]	1.521[g]	1.929[h]
Energy usage/ton			
Electricity, kwh	15.5	11.77	9.28
Natural gas, mcf	1.674	1.266	.997
Energy cost, $/ton	3.79	2.87	2.26
Gelatinization, %[i]	85.7	74.3	58.7

[a]L=22 lb/bu, M=25 lb/bu, H=28 lb/bu.
[b,c]Means within a row without a common superscript differ (P < .05).
[d,e]Means within a row without a common superscript differ (P = .15).
[f,g,h]Means within a row without a common superscript differ (P < .0001).
[i]Linear effect (P < .05).

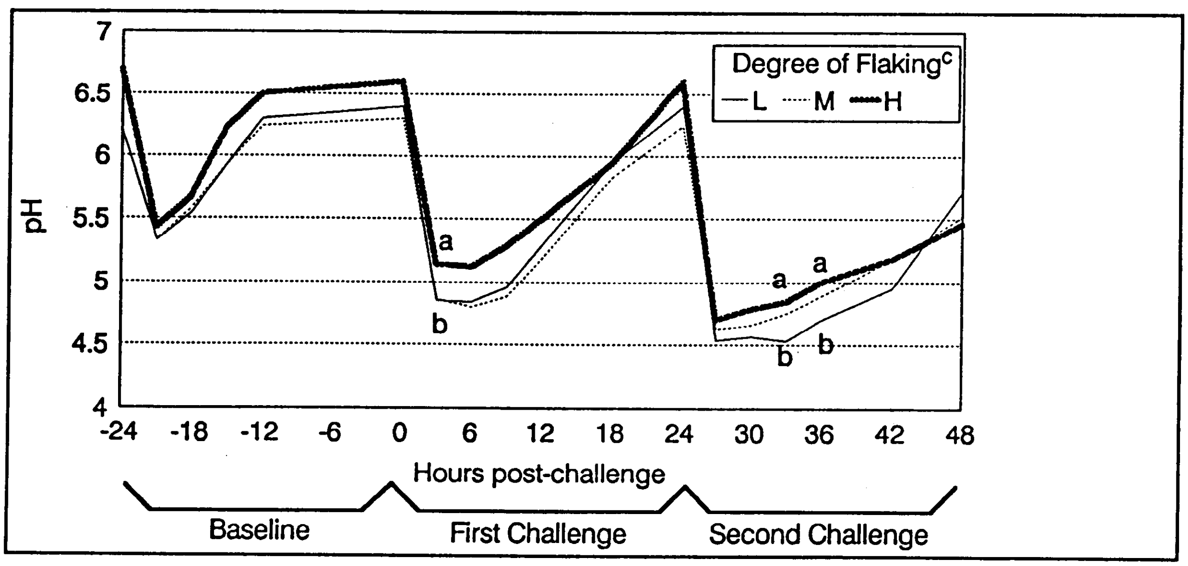

Figure 1. Effect of Degree of Flaking on Ruminal pH Changes Postchallenge ([a,b] H differs from L (P < 10.) within a sampling time; [c] L=22 lb/bu, M=25 lb/bu, H=28 lb/bu)