Evaluating Particle Size in Texas TMRs

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INTRODUCTION

With the genetic potential of today's dairy animals, early lactation rations require high levels of energy for peak performance. Formulating diets to contain adequate energy for high milk production often results in rations with high levels of grain; combine this with the lower intakes of early lactation cows, and there is little room left in the diet for fiber. Furthermore, when rations include processed forages and by-product feeds, the physical nature of the fiber may be altered, reducing its ability to stimulate rumination and saliva flow. The effects of inadequate fiber in lactation rations are exhibited as acidosis (subacute or acute), erratic dry matter intakes, decreased milk yields, lowered milk fat production, and health problems (laminitis, ketosis, displaced abomasum). Laminitis is acknowledged as the primary contributor to lameness in dairy cattle and can cost the dairy producer as much as $627/case in delayed reproduction, body weight loss, and decreased milk production (Shearer, 1996). The incidence of laminitis in confinement operations is thought to average 35% and, while there are several causes of laminitis, lactic acidosis appears the primary culprit (personal communication, J.K. Shearer).

The potential for these productive losses has precipitated the feed industry's interest in developing an on-farm assessment of ration fiber effectiveness in sustaining high levels of performance while maintaining rumen health. Particle size evaluation is one attempt to identify the proportion of the ration which is effective in stimulating cud chewing and buffer production from those which are rapidly or moderately digestible. Particle size distribution and mix uniformity should be evaluated concurrently, since the ultimate goal is to have a uniformly mixed ration with as little particle destruction as possible. With the diversity of feedstuffs and mixers available, defining the process of mixing on a specific operation is currently more of an art than science.

The mixer functions to uniformly distribute ration ingredients into a final product that serves the intended purpose. For dairy rations, the final intended purpose is evaluated using a combination of several measures, such as level of milk production, milk composition (butterfat and protein content), rumen function, and general herd health. Many times, these factors are antagonistic, i.e. the case of milk production and rumen function in the fresh or high producing cow. Nutritionists continually strive to reach an acceptable balance between the energy and fiber components in the rations of fresh and high producing dairy cows. Ration formulation is the initial factor in achieving optimum performance, but feed management has a significant impact on ration performance as well. In many cases, feeding management overrides or masks the true potential of the ration. Nutritionists often refer to three rations on the farm: *the ration formulated on paper, the ration offered to the cow, and the ration consumed by the cow*. This phrase was traditionally thought of in terms of nutrient uniformity; however, we must now think about it in physical respects as well.

There are many steps between the ration on paper and the ration consumed by the cow that can cause differences. These include scale accuracy of loading ingredients, mixer design, loading sequence of ingredients, and mixing time. There are several types of feed mixers available for commercial dairying and a crude breakdown of these would be by design: horizontal and vertical mixers. Within these categories, there is a range of types including horizontal ribbon and paddle mixers, vertical screw mixers, drum mixers, and mobile mixing boxes. The management of the chosen type affects the final ration presentation as much as the decision between a horizontal and vertical mixer. Maintenance schedules for mixers are critical, as worn or broken mixing components prohibit the mixer from functioning uniformly. Nor can mixer cleaning be overlooked, as build-up of wet feedstuffs can impair mixer function and inhibit uniform distribution of micronutrients.