



Rotating Drum Mixers

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Rotating drum mixers are becoming more popular in the feed industry, particularly among manufacturers of premixes and base mixes. The mixing occurs in response to the tumbling action of the ingredients as they are elevated and dropped in the drum. As a consequence of this mixing process, there is less mechanical friction and heating of the ingredients.

Rotating drum mixers also are less expensive than other types of mixers and require less horsepower per ton of capacity. However, drum mixers may not be as labor efficient as other types of mixers. Mixing times for a rotating drum mixer are similar to a vertical mixer and longer than horizontal

mixers. (Extension publication MF-2052 discusses stationary vertical and horizontal mixers.)

The objective of this bulletin is to provide information about the two types of drum mixers: single-action and double-action.

Single-Action Rotating Drum Mixers

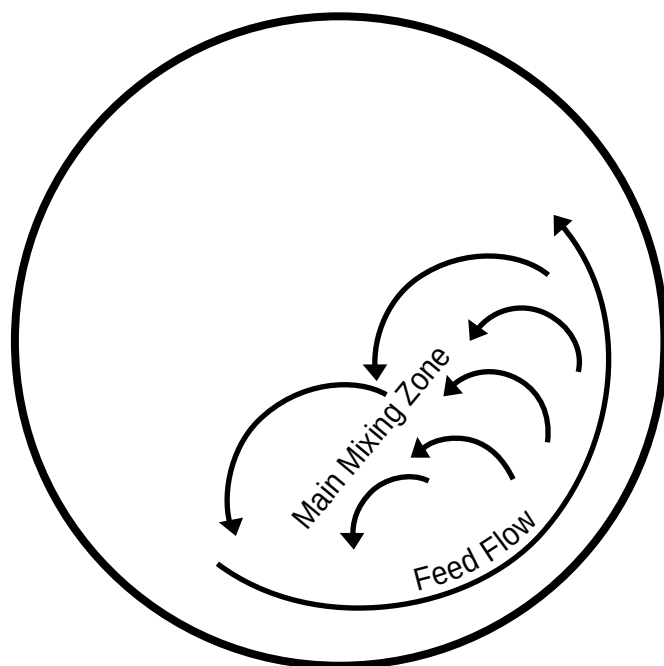
A single-action drum mixer mixes the feed using only drum rotation. Figure 1 shows the mixing action of a drum mixer. This mixer is similar in concept to a vertical (front loaded) clothes dryer. Mixer vanes pick up the feed at the bottom of the drum and carry it to near the top where it free-falls back to the bottom of the drum. The feed enters and exits the mixer through an opening at the center of the side wall. Figure 2 shows the mixing performance of a 2-ton single-action drum mixer rotating at 3 revolutions per minute. A complete mix (designated by a coefficient of variation of less than 10) was obtained with a 5-minute mix time. Further information pertaining to mixer performance testing is provided in Extension publication MF-1172.

Double-Action Rotating Drum Mixers

Figure 3 is a schematic of the double-action rotating drum mixer. This mixer has two mixing actions that include the rotation of the drum and a rotating screw conveyor through the center of the mixer. Scoops in the back of the mixer direct the feed into the opening of the screw conveyor. Mixing occurs as ingredients are directed into the conveyor at the back and expelled in the front. The screw conveyor also is used for unloading.

Figure 4 shows the performance of the double-action rotating drum mixer. Mixer efficiency tests were conducted using a $\frac{3}{4}$ -ton (1,500-pound) mixer rotating at 7 revolutions per minute using a sow feed

Figure 1. Rotating Drum Feed Flow Pattern



formulation. The mixer required an 8-minute mix time after the last ingredient was added to obtain an adequate mix or coefficient of variation of less than 10 percent. Two trials shown on Figure 4 compare the sequence of ingredient addition. Even though the coefficient of variation was less than 10 percent after 1 minute mixing time in the second trial (lower line on the figure), visual observation of the feed found inadequate mixing had occurred. It was concluded from these trials that a minimum 8-minute mix time should be used for the double-action rotating drum mixer tested. Other trials in the study showed the ingredient addition sequence should be protein source first, microingredients second, and, finally, the ground grain.

Batch Size

Like all mixers, overfilling a drum mixer can seriously impede the mixing process. With drum mixers, it is important to fill at or below the maximum mixing volume in the drum to permit the desired tumbling action. Underfilling a drum mixer does not appear to be harmful to the mixing process, however, mixing time remains constant. A study at Kansas State University using a double-action rotating drum mixer found that a batch size of one-third the mixer capacity required the same mixing time as a full batch.

Figure 2. Rotating Drum Mixer; 2-ton, 3-RPM

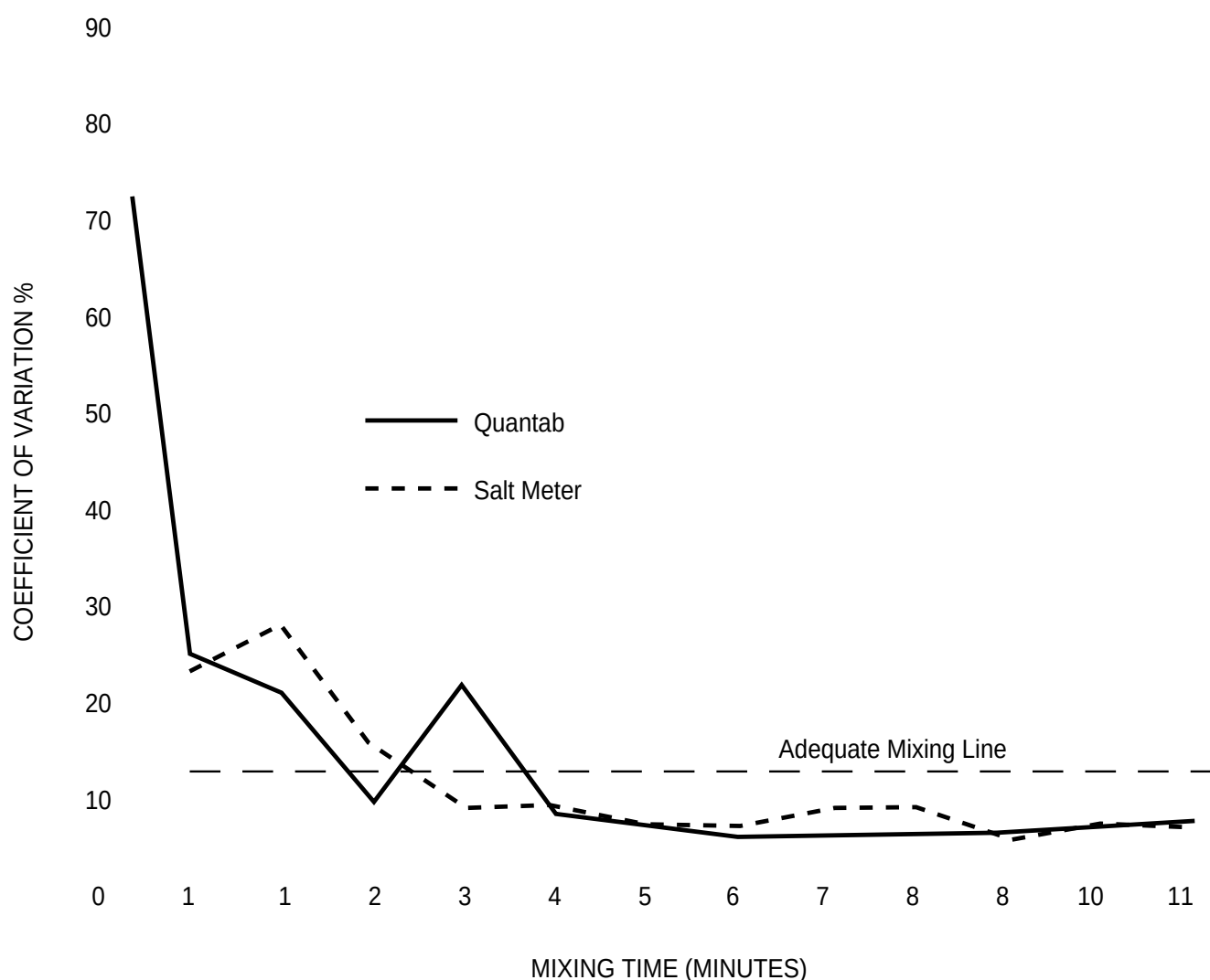
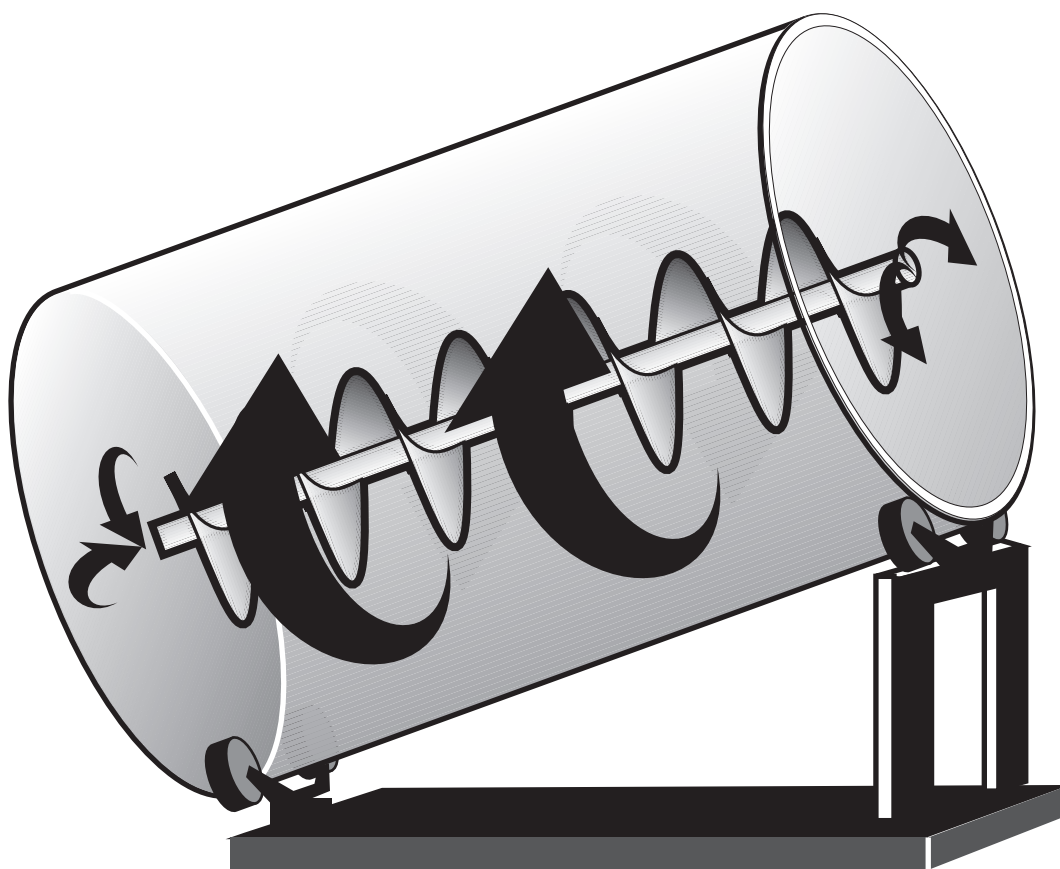


Figure 3. Schematic of the double action rotating drum mixer

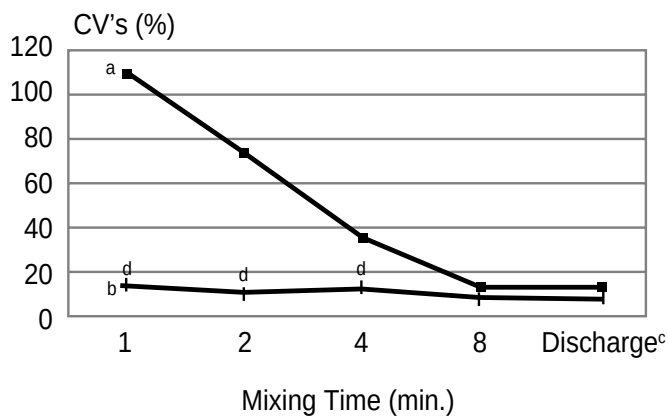


Liquid Addition

Another trial conducted looked at the addition of liquids to the drum mixer. The dry feed was adequately mixed prior to the addition of white grease fat. After the fat was added using a spray bar, a 5-minute mix time was used. Sampling showed the fat was adequately mixed using the additional 5-minute mix time.

Some drum mixers may be difficult to clean out. Addition of liquids or medicated ingredients in the mixer may create problems since construction limits access for cleaning of the mixing vanes or scoops. The liquids should be injected or sprayed on the mixed feed. A spray bar should be used to direct the liquid onto the feed and not onto the sidewall or mixer vanes.

Figure 4. Calculated CV's (%) for ingredient addition sequence



^aSequence: sorghum, SBM, wheat midds, premix.

^bSequence: premix, wheat midds, SBM, sorghum.

^cDischarge rate of 500 lb./min.

^dVisual inspection of the feed and variability between replications indicated feed may not be consistently uniform at these times.

Installation

Rotating drum mixers can be used as an alternative to horizontal or vertical mixers for mixing feed. Drum mixers are best suited for stationary mills. This type of mixer may not be adaptable to existing mills unless modifications can be made to the handling equipment. Floor space required for a double-action drum mixer is similar to a horizontal mixer. A single-action mixer requires similar floor space as a vertical mixer but not as much height. However, since the drum chamber revolves on a drum mixer, more room is needed around the outside of the mixer. Clearance areas around all sides of the mixer should be 5 feet minimum. This provides room for a railing 2 feet from the mixer and then a 3-foot walkway. Before installation, OSHA regulations should be reviewed and one's insurance company contacted to ensure proper safety precautions are followed.

Summary

Factors such as ingredient sequence, batch size, ingredient particle size, and ingredient density will effect the mixing time and uniformity of the finished feeds. When planning a feed mill, an 8-minute mix time should be used in the time analysis per batch of dry feed when considering a single- or double-action rotating drum mixer. An additional 5 minutes should be added to the mix time when adding liquids such as fats.

References

- MF-1172. 1995. *Testing Mixer Performance*. KSU Cooperative Extension Service. Manhattan, KS.
MF-2052. 1995. *Stationary Mixers*. KSU Cooperative Extension Service. Manhattan, KS.

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned.

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