

RAP



Residue Avoidance Program

Feed Mixing Systems

A livestock farmer has several choices as to the source of the feed to be used: purchase complete feeds; purchase feed concentrates and mix it with grain; purchase vitamin premixes, trace mineral premixes, protein meal, calcium and phosphorus minerals and mix them with ground grain; or a combination of the above.

Each system has advantages and disadvantages to be considered carefully. There are certain responsibilities that go with on-farm mixing of medicated feeds:

Purchase complete feeds.

- Feed supplier has the burden of complying with FDA regulations, proper drug records, storage, control of drug carryover, proper mixing, medicated feed assays, and label instructions.
- Feeder need only consider medicated feed carryover in feeding equipment (storage bins, conveyors, and feeders) and observe drug withdrawal times.

Purchase feed concentrate (contains protein, vitamins, minerals, trace minerals, animal drugs, etc.) and mix with own ground grain.

- Feed supplier has the burden of complying with FDA regulations, etc. as described above.
- Feeder must supply proper storage for the medicated feed concentrates and adhere to mixing directions to obtain legal drug levels in the finished feed.
- Feeder must be concerned with medicated feed carryover in mixing equipment in addition to feeding equipment and observe drug withdrawal times.

Purchase feed premix (vitamins, trace minerals, drugs), protein source, and mix with own ground grain and other feedstuffs.

- Feed and/or drug supplier must comply with FDA regulations regarding drug premix production and labeling.
- Feeder needs to comply with FDA regulations, including obtaining "new drug approvals" where required, proper drug storage facilities, drug inventory and usage records, and an accurate scale for weighing drug premixes.
- Feeder must be concerned with getting drug premix adequately blended into the finished feed and with medicated feed carryover in all of the equipment.

Combination of above choices.

- Considerations depend on the combination selected.

Feed Mixing Equipment

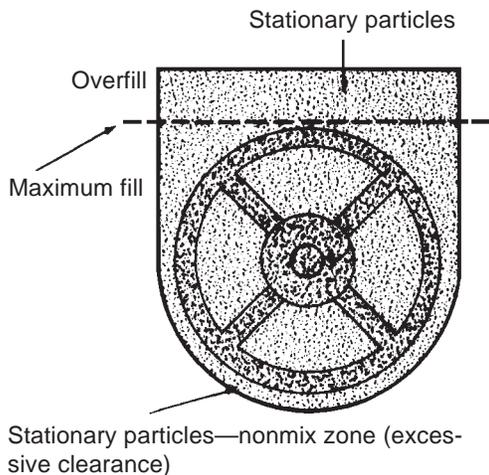
Mixers used on the farm are usually horizontal, vertical, proportioner mills, or grinder-mixer combination. Of these, the last is the most common.

Horizontal mixers are used when sizable quantities of feed are mixed (10 tons or more per day) and time is critical. Figure 1 shows a cross-section of a double-ribbon horizontal mixer. Note the space between the outer ribbon and the housing. When the mixer has been emptied, some residual feed will remain in this space. Some mixers can be adjusted to reduce this space to about $\frac{1}{4}$ inch, which reduces the feed carryover to an innocuous level in the majority of cases.

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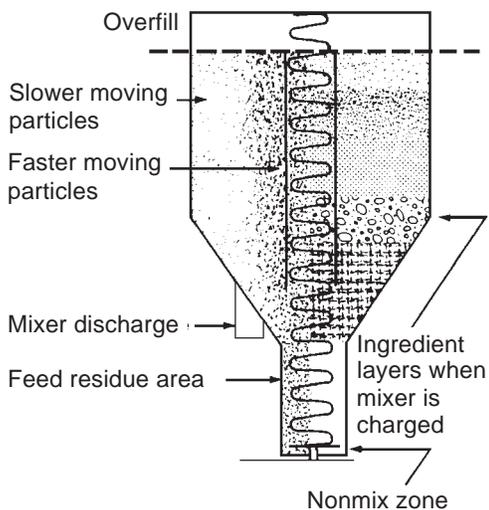
Figure 1. Double ribbon horizontal mixer.



Cleaning, flushing, or sequencing of feed batches may be needed to reduce residue potential after the production of certain medicated feeds.

Vertical mixers are used when the daily feed throughput of a horizontal mixer is not needed. A typical single-screw vertical mixer is shown in figure 2. Note the location of the mixer discharge. A considerable amount of feed will remain in the mixer after the last feed leaves the discharge opening. If a clean-out opening is provided down on the "boot" of the mixer, the residual feed could be removed there. If it is not removed, there can be a significant amount of carryover into the following batch of feed (40 pounds or more).

Figure 2. Single screw vertical mixer.



Double-screw or twin-screw vertical mixers usually provide a satisfactory mix of feed for most single-screw vertical mixers.

With proportioner mixers, volumetric measures are used to meter the required proportions of each ingredient. An advantage of this system is continuous operation over extended periods. Limited observation of these types of systems indicates several drawbacks that are important in feed quality:

1. Calibration can be a problem. The ingredient feeders should be checked regularly (at least once a week) for accuracy. When this is not done, the feed produced can differ significantly from the formula being used. Calibrations should also be made whenever changes of ingredients occur, including new shipments.

2. Accurate metering of drug premixes is difficult with a volumetric system, and may result in over- or undermedicating of feeds. One way to avoid this problem is to premix drugs with a carrier (i.e. ground corn) so that larger volumes of the premixed drugs are used per ton of complete feed.

3. Medicated feed carryover in the mixing chamber of the back of these units can be significant. Withdrawal feeds mixed after medicated feeds may have significant drug residues.

Grinder-mixers are basically single screw vertical mixers with additional equipment added (figure 3). Presence of the added equipment increases the quantity of residual feed left in the machine (may be 150 pounds or more) after the last feed comes out of the discharge auger.

Obviously the potential for significant carryover of medicated feed in grinder-mixers is high. A switch to a nonmedicated feed requires an intense cleaning of this type of machine. Physical cleaning (i.e. vacuuming, sweeping, or washing) is the most effective means of avoiding contamination of subsequent batches.

Flushing ground corn through the grinder-mixer may be a suitable cleaning method if the flushout material can be stored for use in later medicated batches. Flush materials must be identified as to drug content and future use (i.e., sulfa flush, in sulfa containing feed). In addition to flushing, sequencing batches of feed so that medicated feeds are manufactured together followed by feed that will go to livestock not close to slaughter (i.e. breeding herd) will reduce residue problems.

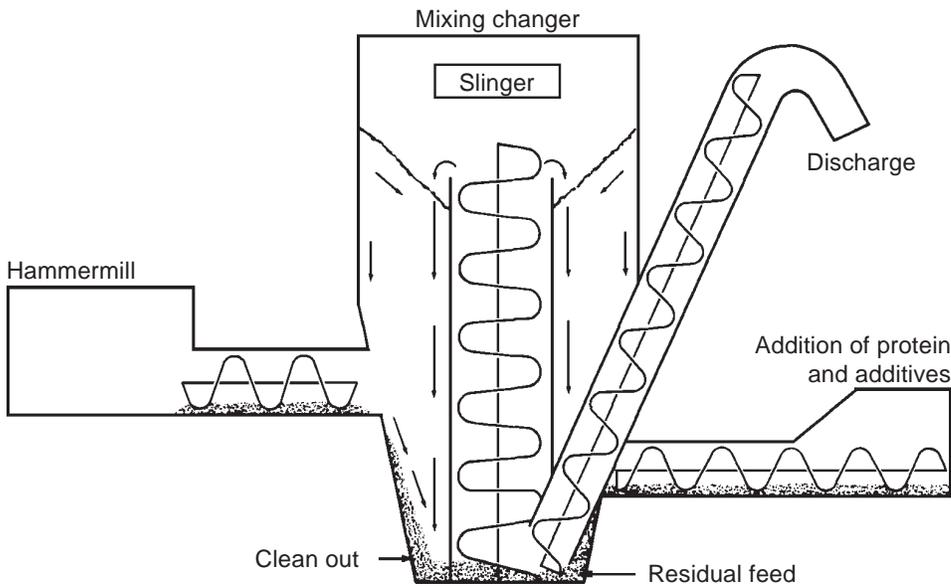
Irrespective of the method(s) used, a mixing record including data, feed mixed, bin(s) delivered to, and medication used should be kept.

Some producers have found these precautions impractical and have purchased a second grinder-mixer to produce withdrawal feeds as a way of avoiding drug carryover.

The following recommendations for on-farm mixing of medicated feeds will minimize the possibility of drug carryover.

1. Know the labeled uses, mixing instructions, and withdrawal times for all medications used.

Figure 3. Grinder-mixer unit.



2. Clean the mixer before use to avoid contamination with previous medicants.

3. Do not exceed mixing capacities of equipment. Premix all medications into large enough quantities for accurate weighing and mixing. Where stationary mills are used, follow manufacturer's instructions on premixing and adding medications.

4. Establish a mixing order for all ingredients. One recommended order is:

- a. ½ of soybean meal or supplement,
- b. medication and/or vitamin premixes,
- c. ¼ of soybean meal or supplement (to flush premix into mixer),
- d. mineral premix,
- e. remainder of soybean meal or supplement.

Mix thoroughly while grinding corn. Then add ground corn and mix for 8 to 10 minutes, or according to manufacturer's instructions. Proper mixing is all-important. (Adapted from Dale Hull, 1970, Ag Engineering, Iowa State University.)

Measurement of ingredients can be by volume or by weight. Weight measurements are most accurate and

should be used whenever possible. For volumetric mills, volumetric methods will give satisfactory results when regular calibrations are made. Follow manufacturer's calibration recommendations.

6. Whenever possible, mix all feeds containing medications in sequence. Then clean equipment before manufacturing unmedicated feeds. Make finishing or withdrawal feeds after cleanup and before other nonmedicated feeds have been made.

7. Clean out mixer after medication use by flushing with several hundred pounds of soybeans or ground corn. Remove flush; identify and store for future medication usage.

8. Keep all medications in a well-lit storage place, with enough room to avoid cluttered storage and preserve original packages. Rodent and insect control should be continually practiced. Insecticides and other farm chemicals should **not** be stored in this area.

9. Read all labels and observe withdrawal times.

10. Periodically sample purchased premixes, supplements, and finished feed made from these feed ingredients. Label and hold these samples until 3 months after livestock have been marketed.

11. Clean out augers, holding bins, delivery wagons, and feeders before withdrawal feed is manufactured and conveyed. Augers can be flushed with ground corn or other suitable flush material. Bins, wagons, and feeders can be swept out. Do not put withdrawal feeds into bins or feeders with medicated feeds.

How Much Mixing Time Is Needed?

First, make allowances for the mixing times claimed by the manufacturer. Often these are overly optimistic, even for ideal ingredients and conditions.

Second, a mixer test is the only sure way of determining adequate mixing time for a mixer in an installation.

In mixing tests, many double-ribbed horizontal mixers and twin-screw vertical mixers can be expected to do an adequate mixing job in 4 to 5 minutes after addition of the last ingredient. The size and the speed of the screw and the amount of feed in the mixer can vary the mix time. Some horizontal mixers, poorly designed in terms of agitator speed, configuration of agitator components, and material flow patterns, and vertical mixers with inadequate screw speed, worn screw flights, and inadequate size have been observed to take 20 or more minutes for poor to barely adequate mixing of feed ingredients.

What Is Incomplete Mixing?

Incomplete mixing occurs when one or more ingredients are not present in a feed sample taken at mixer discharge in the same percentage as the percentage of the ingredient(s) used to charge the mixer. Barring weighing errors and omissions, this percentage should be the same as in the production formula.

Incomplete mixing can often be corrected by adjustments of mixers or by replacing components that are worn or otherwise inadequate for the purpose. An example is adjustment of mixer ribbons to reduce the space between the ribbons and the mixer shell. Another example is the replacement of worn or damaged ribbons, paddles, or screw conveyors.

Procedural changes may improve feed mixing. The sequence of ingredients and additives put into the mixer can affect the ease with which a component is blended into the total mix. Additions of the small volume materials to part of the protein source early in the mix cycle allows more time for complete mixing to occur. Increases in mixing times often improve uniformity of feed mixing. Small volume items such as drug or mineral premixes should be added directly to the mixer rather than through an auger system. If added through an auger, it should be followed with sufficient corn or protein to flush it into the mixing chamber.

What appears to be incomplete mixing is sometimes caused by weighing inaccuracies or personnel errors. Failure to perform all operations indicated on production formulae or feed tag instructions (i.e., addition of correct amounts of all specified ingredients) or inadvertent substitution of ingredients not called for in the formula are common errors.

When analysis of production samples indicates a variance from desired standards, initial investigation should include a check for accuracy of the formula, the weighing equipment, and possible malfunctions of equipment. Examples of equipment malfunctions include incomplete closing of slide gate, scales calibration, or incomplete addition of ingredients.

Where Does Incomplete Mixing Occur?

Feed mixers and blenders are designed and installed for the specific purpose of mixing; therefore, incomplete mixing is a deficiency in this

equipment or in its use. Table 1 lists some problems encountered with mixers that could result in incomplete mixing of feed. Correction of the problem should result in satisfactory mixing.

Table 1. Sources of Incomplete Mixing Problems.

Mixer type	Possible problems
Vertical Mixer	Design does not allow complete mixing Design results in slow mixing Insufficient mixing time Worn screw Electrostatic hang-up
Horizontal Mixer	Design does not allow complete mixing Design results in slow mixing Overfilling results in a nonmixing layer at top Insufficient mixing time Agitator design does not move ingredients throughout mixing area Agitator clearance allows a layer of immobile ingredients next to mixer shell Worn agitators Electrostatic hang-up

Every livestock producer has the responsibility to use medications in accordance with the label directions. A careful manager can avoid feed contamination problems by following the management practices outlined. A complete up-to-date set of records can further help to avoid problems and should include the following:

- Date of batch mixing,
- Mixing order and amount added,
- Mixing time,
- Feed storage location,
- Number of animals fed and amount/head
- Medications used, amount, and concentration,
- Dates mixers, bins, conveyors, and feeders were thoroughly cleaned out.

File: Animal Science 8

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