8-1-1966

Good Feed Mixing Practices

D. R. Zimmerman

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AS-349
August, 1966

D. R. Zimmerman, Animal Sciences Department

The days when feed was mixed with a scoop-shovel are long gone. Modern formulas include minute amounts of trace minerals, vitamins, and drugs. A careful job of mixing must be done to get equal distribution of all ingredients throughout a batch of feed. Poorly mixed feeds may result in inferior animal performance, wasted microingredients, illegal drug residues in animal products, or even death. The farmer who is interested in obtaining the maximum return on money spent for feed and in producing quality animal products will make sure his feed is adequately mixed.

Proper mixing is dependent on a number of factors. Many of these factors are listed and discussed in the following paragraphs.

Buildings and Housekeeping

Feed handling and mixing facilities must meet certain basic requirements. However, they needn't be elaborate and expensive. All facilities must be weather-tight. Rodents must be controlled in ingredient storage areas. A separate room or enclosed area should be used for storage of feed additives and premixes. The areas where ingredients are weighed and mixed should be well lighted. The floors should be smooth and solid to facilitate sweeping.

Actions speak louder than words! In almost every instance the man who takes pride in the appearance of his feed mixing facilities, will make accurately formulated, well mixed feed.

Piles of spilled feed, dust and empty bags attract and harbor rodents and insect pests.

Floor sweepings should either be added to the immediate batch of feed being prepared, or they should be destroyed. Once sweepings are allowed to accumulate, their identity is lost. Adding them to a later batch of feed may contaminate the feed with unwanted ingredients.

Weighing

Weighing must be done on scales that are of adequate sensitivity. One pound of an ingredient cannot be weighed precisely on a scale having pound or half-pound marks as the smallest graduations. The scale must be of such sensitivity that a difference of plus and minus two percent of the item's weight can be measured. For example, if an item weighs five pounds, the scale used to weigh it should be graduated in tenths of a pound.

Scales should be maintained and checked periodically for accuracy with a set of standard weights. The weight pan or platform should be kept clean. This is important not only for accurate weighing but also to prevent contamination of the following batches.

When calculating the amount of drug or vitamin premix to add to a batch, it is sometimes necessary to make conversions such as from grams to pounds, and from percent to grams per ton. Also, in many cases one must account for a "dilution factor." Vitamins and drug products are rarely one-hundred per cent active material.

For instance, a product may contain 20 per cent active compound, or another product may contain 10 grams of compound per pound of premix.

Conversion factors (Table 1) are furnished here as aids for calculating the amounts of feed additives or additive premixes to add to a ton of feed.

The following example demonstrates the use of two conversion factors to solve a problem.

Problem: Using a 50 per cent arsanilic acid product, calculate the amount of product in pounds needed to fortify one ton of feed with 45 grams of arsanilic acid.

Solution A

1. First, convert 45 gm/ton to x lb/ton. 453.59 gm. = 1 lb. so to convert divide by 454. 45 ÷ 454 = 0.10 lb. of arsanilic acid/ton.

2. Then, account for the 50 per cent dilution of the arsanilic acid product. 0.10 lb. x $\frac{100}{50}$ (dilution factor) = 0.20 lb. of 50% arsanilic acid/ton.

Solution B

1. First convert 50% arsanilic acid to x gm./lb. to convert multiply by 4.54. 50 x 4.54 = 227 gm. arsanilic acid/lb.

2. Then, calculate the fraction of a pound of 50% arsanilic acid product containing 45 grams of arsanilic acid. 45 gm. ÷ 227 gm./lb. = 0.20 lb. of 50% arsanilic acid product/ton.

Mixing

There are several factors that determine the ease of mixing the various ingredients in a batch of feed. The more important factors are discussed below.

1. Type of mixer or blender

Vertical mixers - Most stationary mixers used by farmers and custom-feed mills are vertical mixers. The portable power-take-off powered mixers are of this type. These mixers have the advantages of relatively low initial cost and low power requirement. Their primary disadvantage is the long mixing time required to obtain a completely mixed product.

Horizontal mixers - These mixers are used primarily by commercial feed manufacturers. Original cost and power requirements are relatively high. However, these mixers do a thorough job of mixing in a short time.

Volumetric blenders - During operation these units continuously blend preset volumes of individual ingredients. Costs are comparable to vertical mixers. All ingredients must be free-flowing. Relatively small amounts of an ingredient cannot be added accurately using the basic blender. However, equipment manufacturers sell special attachments for blending in small amounts of feed additives.

2. Sequence of ingredient addition to mixer

The order in which ingredients are added to the mixer affects the time required to obtain a thorough mix. With corn-soybean meal rations, the mixer should be charged with 25-35% of the ground corn, followed by the vitamin, drug, mineral and protein sources and then the remaining ground grain. If liquid additions are made, their addition should be delayed until the critical ingredients (drugs, vitamins, etc) have mixed with the bulk ingredients for 60-70% of the minimum mixing period.

3. Effect of amount of an ingredient on its dispersion in the total batch

Other things being equal, the smaller the quantity of an ingredient addition, the longer

it takes to be dispersed throughout the mix. For example, 1500 pounds of corn and 500 pounds of protein concentrate may be mixed thoroughly in five minutes, whereas 1450 pounds of corn, 50 pounds of antibiotic premix and 500 pounds of protein concentrate may require 15 minutes of mixing to adequately disperse the antibiotic.

It is not advisable to add small amounts of critical ingredients directly to the batch. Instead they should first be premixed by dilution with a quantity of carrier material such as ground corn. A critical ingredient should not be added directly to a vertical mixer if it weighs less than two per cent of the batch weight (40 pounds per ton). With horizontal mixers the minimum acceptable addition is one per cent of the total batch weight (20 pounds per ton).

4. Premixing

Premixing is a must when adding small quantities of critical micro-ingredients to the mixer. A farmer who does not have the available labor for an adequate premixing operation should buy micro-ingredient premixes that are sufficiently dilute.

A number of small mixers can be purchased for preparing premixes. Besides those specifically designed for premixing, concrete mixers have been used successfully. If a concrete mixer is used, a cover should be made for the opening to prevent loss of ingredient dust.

A finely ground, relatively dust-free material should be used as a carrier. Finely ground corn is a very good carrier material.

5. Other factors affecting mixing efficiency

Several factors affect the time required to obtain an adequate mix. The type of mixer, the effect of small additions and the sequence of ingredient addition have been mentioned. In addition, wide differences in ingredient partical sizes and densities slow the mixing process.

Because there are many variables affecting mixing efficiency, no two formulas will be adequately mixed in identical times. Consequently, it is a good practice to mix for a few minutes longer than is thought necessary. In most cases adequate mixing is obtained in 15-20 minutes using a vertical mixer and 7-10 minutes using a horizontal mixer. The longer times should be used when there are small additions of critical ingredients.

6. Mixer cleanout

To prevent contamination of subsequent batches of feed, the mixer and auger system should be cleaned out after mixing a medicated feed. That is, unless the following batch contains the same drug. The bases of the auger(s) in vertical mixers and elevator legs are likely places for accumulation of feed residues. The mixer, augers, and elevators can be flushed out by running 50-100 pound of ground grain through the system. The flushing material can be used in the next batch of feed containing the drug.

Storage, handling and records

1. Feed additives

Feed additives should be stored in a protected area for a number of reasons. They are costly, and some absorb moisture from the air. Rodents can cause wastage of additives as well as cause cross-contamination. Because of the potential hazard of some drugs to health, these materials should be kept away from children. Each additive should be stored in a waterproof, "rodent-proof," well-labeled container. Plastic or metal garbage cans with lids are good storage containers. When transferring additives from storage to scale to mixer, extreme care should be taken to prevent cross-contaminations. Scoops and weigh pan should be carefully cleaned after each addition of a drug.

The operator should wash exposed areas of his body after handling concentrated drugs. He should wear a dust mask or take other precautions not to breathe dust from drugs.

2. Mixed feed storage

Care should be taken to prevent mix-up of feeds. If mixed feeds are stored in bags, each bag should have an identifying label. If feed is stored in bulk bins, these bins should be conspicuously labeled.

3. Records

Accurate records should be kept of receipts and dispersals of each feed additive. Because some additives lose potency with age, it is important to know how long an additive has been in storage. Because there are specific tolerances for residues of some drugs in animal products, it is wise to have records of when and where each was used.

Governmental Regulations

The use of drugs in animal feeds is controlled by the Federal Food and Drug Administration (FDA). Only approved drugs and drug combinations, at prescribed levels, can be used.

If medicated feeds are sold to others, the seller must register with the FDA. He must then abide by the FDA "Good Manufacturing Practices Regulations."

SUMMARY

1. Buildings and housekeeping: (a) control insects and rodents (b)separate storage for bulk and micro-ingredients (c) keep mill room clean

2. Weighing ingredients: (a) scale sensitivity - should be 2% of smallest item weight (b) scale accuracy - check with standard weights and clean platform (c) calculations - account for conversion and dilution factors

3. Mixing: (a) know the mixer's capabilities (b) add ingredients in proper sequence (c) mixing time is influenced by ingredient added in smallest amount (d) premix critical ingredients; if less than 2% of batch in vertical mixers, and if less than 1% of batch in horizontal mixers (e) materials of widely different densities or particle size are hard to mix (f) clean or flush mixer system after using a drug

4. Storage, handling, and records: (a) store feed additives in tight, labeled containers (b) prevent cross-contamination (c) wash after using drugs (d) label bags and bins of mixed feed (e) keep inventory of feed additives

TABLE 1. Conversion factors used in ration calculation

Convert	To	By	Example
gram (gm.)	kilogram (kg.)	move decimal 3 places to left	2000 gm. = 2.0 kg.
gram (gm.)	milligram (mg.)	move decimal 3 places to right	2.0 gm. = 2000 mg.
gram (gm.)	pound (lb.)	divide by 454	658 gm. ÷ 454 = 1.45 lb.
gram/pound	percent (%)	divide by 4.54	90 gm./lb. ÷ 4.54 = 19.8%
gram/ton	percent	multiply by 11, move decimal 5 places to left	45 gm./ton x 11 = 495 = .00495%
kilogram (kg.)	gram	move decimal 3 places to right	5.5 kg. = 5500 gm.
milligram (mg.)	gram	move decimal 3 places to left	95 mg. = 0.095 gm.
percent	gram/pound	multiply by 4.54	25 x 4.54 = 113.5 gm./lb.
percent	parts/million (ppm)	move decimal 4 places to right	.025% = 250 ppm
percent	gram/ton	divide by 11, move decimal 5 places to right	.011 ÷ 11 = .001 = 100 gm./ton
pound	gram	multiply by 454	0.5 lb. x 454 = 227 gm.
ppm	percent	move decimal 4 places to left	100 ppm = 0.01%

Cooperative Extension Work in Agriculture and Home Economics, State of Indiana, Purdue University and U. S. Department of Agriculture Cooperating. H. G. Diesslin, Director, Lafayette, Ind. Issued in furtherance of the Acts of May 8 and June 30, 1914.