CFAES

Feedstuff Identification

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Introduction

Identification of feedstuffs is a common activity in youth livestock educational contests. We incentivize the memorization of feedstuffs and their nutrient classes because knowledge of feedstuffs is required for so many aspects of animal agriculture, including ration balancing, feed purchasing, and farm management. Unfortunately, rote memorization of feedstuffs on paper seems much easier than the visual identification partly because feedstuff appearance can vary (e.g., distiller's grains) from the single picture in a study handout. If the youth exhibitor has not been instructed properly on what key attributes to hone in on, then they will struggle to consistently differentiate feedstuffs with any accuracy. Our intention is to provide some tools that help to instruct towards key attributes rather than blunt memorization of a picture or factsheet.

Key Features in Feeds

When identifying feedstuffs, focus on the following key features: color, particle size, shape, texture, and smell (taste is not recommended). By sorting feeds using these features ***and, in this order,*** it is simple enough to assign feedstuff names with some practice.

Figure 1. Corn gluten meal (L) contrasted with corn distiller's grains (R). Notice how the corn gluten meal particle size and color are more consistent throughout the sample whereas distiller's grain often has greater variability in particle size and color within a sample.

Color

Feedstuffs come in a variety of colors but to the novice, many of them appear just as "dirt colored", tan, or brown. Save these drab-colored feedstuffs until the last and start with the colors that are outstanding. Anything bright blue is automatically a copper source, including anything with a teal color of blue (representing a different oxidation status). Golden colored feeds sort next as corn-related, then very dark brown samples upon closer inspection likely have a dark red tint to them (blood). The remaining samples are gray and need to be sorted further down the line.

Particle Size

Particle size is probably the most ignored and yet most useful mechanism to visually sort feedstuffs. When evaluating particle size, look at both the average particle size ***and*** the range of particle sizes. For example, among corn and corn products, we can easily grasp the difference between whole shell corn and cracked or ground corn (broken versus tiny chunks or powder, respectively). However, corn gluten meal and distiller's grains are a bit trickier at first glance. They can both overlap on golden to yellow color, but the fine grinding of corn gluten meal leaves a feedstuff with a homogenous particle size that varies little in color (Figure 1). Meanwhile, distiller's grains is the dried, cooked remainder from a mash process that leaves more variation in light to dark color and greater range in particle size within the sample.

As another example, fish and feather meals also have a similar color to wheat middlings. However, the flakes that come off the wheat grain when processed are much larger and flatter compared to a finely ground feather meal that looks similar to sand. It would be nice to say that all meals are finely ground, or all byproducts are chunky. Unfortunately, particle size is more closely related to the method by which the feedstuff is produced as byproduct

Figure 2. White salt (L) contrasted with urea (R). Notice the rounded shape of the urea versus the crystalline shapes within the salt sample.

characteristics are an aftereffect of the processing stream from which they originate. Thus, some meals are chunked, such as soybean meal, canola meal, or cottonseed meal. Whereas, some meals are finely ground, such as corn gluten meal, feather meal, and fish meal, or even powdered as is the case with some blood meal products.

Shape

Circling back to the blue copper samples mentioned previously, shape is a nice feature to differentiate some minerals and non-energy feedstuffs. Copper sulfate, for example, is bright blue but also the sulfate forms a crystalline structure that stands out compared to a teal-green copper hydroxychloride in microsized beads. Similarly, urea has the same opacity as common salt, yet they are very different feedstuffs. Urea is formed into tiny, round beads while salt forms a crystalline structure similar to copper sulfate (Figure 2). The same could be said for dicalcium phosphate (gray, beaded) versus ground limestone (gray, chunked). And trace mineral salt mixes will often have a combination of these shapes and colors, tipping the hat that it is a blended mineral product.

The shape is also a giveaway in byproduct fiber products. For example, wheat middlings is flattened whereas soybean hulls, a common mix-up, displays a rounded shape on close inspection (Figure 3). The rounded shape in these hulls comes from the round shape of the original soybean. When it is cracked, the hull retains the shape of the soybean.

Texture

At this point, we probably need to sort off our cottonseed and other unique fiber products; puffy white seeds or puffy white seed hulls (shells) are whole cottonseed or cottonseed hulls, respectively. Peanut hulls, almond hulls, beet pulp, and citrus pulp all have very unique, stringy textures related to the foods from which they came. A wheat bran or brewer's grains will also have a course, fibrous texture that is irregular but should look like it comes off grain that was run through a grinder.

Smell

Without knowing what a feedstuff is, it is not recommended to taste feedstuffs because they may pose a health risk. For example, copper sulfate can cause burns to the tongue and lips, and some feedstuffs improperly stored could carry pathogens. However, smell and taste are linked, and some feeds will be difficult to differentiate without a keen sense of smell. For example, both feather meal and fish meal are very similar in appearance: sandy gray, perhaps tiny white particles (fish bone or feather). Unless you luck into some stray feather fragments, it could be difficult to tell the difference between them. However, while feather meal can sometimes be difficult to smell (many say it smells like driving past commercial poultry barns or litter piles), fish meal has a very distinct "fishy" odor that smells like the seafood market.

Figure 3. Wheat middlings (L) contrasted with soybean hulls (R). Soybean hulls have a rounder shape to them because of the oilseed's spherical shape.

Distiller's grains should also have a very good smell to it, yeasty corn that is almost bread-like. Many feeds can have color overlap with distiller's grains, but few will have that smell. Meanwhile, apart from the chunked, pale color (see particle size and texture above), soybean meal should have an ether type of smell in most cases that stems from the process by which soy oil is extracted. What doesn't have a smell, you might ask? Most minerals don't carry any smell with them at all; they don't even smell like a dusty feed plant.

Assigning a Nutrient Class

Now that you have a method for identifying feedstuffs, the next step is assigning a feedstuff to its respective nutrient class. Choosing one specific nutrient class can be particularly difficult, particularly when a feedstuff is high in multiple nutrient classes such as a fat/protein or fat/carbohydrate combination. But when a feedstuff provides significant quantities of nutrients in multiple classes, think about ***why*** the feedstuff is added to a diet. Is it added as a cost-effective source of protein? Does it provide effective fiber? Despite a high protein or carbohydrate content, is a feedstuff fed to add energy density to the diet in the form of fat? The key is to prioritize the nutrient for which the feedstuff is primarily utilized.

Arguably, whole cottonseed is fairly high in fiber (carbohydrates), seed oil (fat/lipid), and protein. However, one must consider why the cottonseed is incorporated in the diet. It is not for fiber as cottonseed hulls would just as easily suit. It isn't for the protein because protein is typically already adequate in the diet when cottonseed is added. Rather, cottonseed is added to the diet as a form of fat with the intent of delivering fatty acids to the mammary gland in lactating dairy animals.

Byproduct Feedstuffs

As a last thought, one of the remarkable storylines in 21st-century animal nutrition is the degree to which animals are fed byproduct feedstuffs which originate as waste streams from human consumable products. As examples, we grow considerable corn volume for ethanol production and soybean for food oil production and generate two leading byproduct feedstuffs: distiller's grains and soybean meal, respectively. As byproducts are incorporated with greater value into animal diets, we sometimes refer to them as co-products – indicating that we harvest for two parallel product streams. The production of soy oil and soybean meal from soybeans is a prime example.

Energy			
Carbohydrates	**Fats (Lipids)**	**Proteins**	**Vitamins/Minerals**
Barley (Steam Rolled, Rolled, Whole)	Whole Cottonseed	Blood Meal	Salt
Beet Pulp	Whole Flaxseed	Corn Gluten Meal	Calcium Carbonate
Cracked Corn		Distiller's Grain	Copper Sulfate
Cottonseed Hulls		Flaxseed Meal	Copper Hydroxychloride
Dried Molasses		Feather Meal	Dicalcium Phosphate
Ground Corn		Fish Meal	Ground Limestone
Oats (Steam Rolled, Rolled, Whole)		Meat & Bone Meal	Magnesium Oxide
Rice Bran		Soybean Meal	Trace Mineral Mix
Steam Flaked Corn		Soy Protein Isolate	
Soybean Hulls		Urea	
Wheat Middlings			
Whey Concentrate			
Whole Corn			
Whole Wheat			

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