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FEEDING LIVESTOCK DURING AND AFTER A DISASTER

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Feeding Livestock During and After a Disaster

Introduction

Feeding livestock during and after a disaster can present livestock owners and producers with a host of challenges. This is due, in part, to unfamiliar feeds that are donated or sourced from outside the region of the emergency. Having a basic understanding of the nutrient requirements of your animals and their digestive systems, as well as the characteristics of individual feeds, is the foundation on which to build an emergency feeding program. Feed analysis is the most effective way to accurately balance an animal's diet, which may be of increased importance after a stressful event, such as a disaster. In addition, being able to effectively transition animals to unfamiliar feeds and identify potential toxicities will go a long way in keeping animals healthy during times of stress.

Feeding Considerations for Monogastric vs. Ruminant Animals

In the event of a disaster, livestock may need to be fed feedstuffs that are available rather than what has normally been fed. However, quickly changing the diet can be stressful for livestock and lead to digestive issues if not done properly. Different species of livestock will have different nutrient needs based on their digestive systems and stage of production (i.e., age, growth, gestation, lactation). If alternative feeds are to be utilized, it is important to understand the nutrient content and any risks associated with each feed so that digestion problems can be avoided. Perry et al. (2003) provide insight into the differences between monogastric and ruminant animals and how those differences relate to overall nutrient requirements and feeding strategies.

Monogastric Animals

Pigs.

Pigs cannot utilize fiber, like **ruminants** or horses, so their diets are made up of mostly **concentrates**. Swine are fed concentrate diets in all phases of production. They need a high-energy, low-fiber diet with a moderate amount of protein. Nutritional needs will vary based on stage of production. The National Swine Nutrition Guide provides a source with tables on nutrient recommendations for swine in all stages of production.

Chickens.

Like pigs, chickens do best when fed high concentrate diets. Their beaks allow them to sort through feed very well, so pelleted feed is usually preferred. If pelleted feed is not available, a mash feed with small particle size (2–3 mm) should be fed. Similar to swine, chickens require moderate-protein, high-energy diets. Energy concentrates may make up to 75% of the diet. Calcium is a critical part of diets for laying hens as it is needed for eggshell formation. The National Research Council's (NRC) Nutrient Requirements of Poultry gives nutrient requirements for multiple classes of poultry and stages of production.

Ruminant Animals

Cattle.

The microorganisms in the rumen of cattle allow them to digest and obtain most of their energy from **roughages** (forages and hay). However, these microorganisms are sensitive to change. If the diet changes from a high roughage to a high concentrate without adequate time for the animal to adjust, digestive upsets can occur. If forage is limited, concentrates may make up to 90% of the diet, but cattle require roughage for proper rumen function. Cattle must be transitioned to a high-grain diet gradually or digestive disturbances can occur. Depending on stage of production (i.e., gestation, lactation) protein may need to be supplemented in forage-based diets to meet requirements. Protein also helps improve digestion of low-quality hay and other forages, more information about this can be found in WSU Extension publication EM053E Feeding Beef Cattle I: The Realities of Low-Quality Forages.

The NRC's Nutrient Requirements of Beef Cattle presents the nutrient requirements for beef cattle of many different types, sizes, and stages of production. The NRC's Nutrient Requirements for Dairy Cattle is available for free download as well.

Small Ruminants/Pseudo-Ruminants (sheep, goats, llamas, and alpacas)

Small ruminants and **pseudo-ruminants**, like cattle, are also prone to digestive upsets if major diet changes occur. Hay/forage will comprise most of their diet; however, in some cases they may need supplemental protein similar to cattle (Wieland and Noldan 2011; Van Saun 2016).

Additional specific nutritional information for small ruminants and pseudo-ruminants can be found here:

- Goats
- Sheep
- Alpacas and llamas

Monogastric Herbivores

Horses.

The stomachs of horses are similar to **monogastrics** with a single chamber and acidic conditions. Unlike ruminants, fermentation occurs at the end of the digestive tract in horses, in the cecum. Horses are somewhat more sensitive to diet changes than ruminants. They need high-quality hay (timothy, brome, orchardgrass, or alfalfa) to meet most or all of their nutrient requirements. Caution must be exercised when feeding alfalfa to horses as digestive upsets can occur if too much is consumed. Horses should not be fed moldy hay, as respiratory and digestion problems could arise (Duberstein and Johnson 2009). If horse feeds are being supplemented, a high-fiber concentrate is best in order to avoid digestive issues. A ration formulation worksheet is available from the National Academy of Science at Nutrient Requirements of Horses. This program allows users to balance diets using a variety of feeds for horses of different stages of production and workloads.

Rabbits.

Rabbits have a digestive system similar to horses and need high-quality hay. Rabbits can also be fed rabbit pellets. Feeding other grains or concentrates may lead to potential digestive issues, so if you have to feed them, do so in small amounts (Krempels 2008). Nutrient Requirements of Rabbits is available to download for free.

Concentrates (grains and their by-products)

Concentrates can be classified into two main classes: energy concentrates and protein concentrates (Table 1). Concentrates are energy dense and fed to both monogastric and ruminant animals. Monogastric livestock (pigs and chickens) need high-energy diets and require high proportions of concentrate feeds (Stein and de Lange 2007).

Ruminants can also utilize concentrates. Most concentrate feed use by ruminants is in feedlots and dairies because of the increased energy requirement for weight gain or milk production, respectively. However, for the grazing ruminant, concentrates are used to supplement the animals' diet to meet nutrient needs (Hall et al. 2009).

Table 1. Protein and energy content of selected emergency feeds.

	CP%	TDN%	NEm Mcal/cwt	CF%
Energy feeds				
Rolled corn	9	88	98	2
Barley	12	84	92	5
Oats	13	76	81	11
Rye	14	80	86	3
Triticale	14	85	93	4
Wheat	14	88	98	3
Sorghum	11	82	89	3
Dry beet pulp	10	76	81	21
Potato waste	7	82	89	9
Soybean hulls	13	77	82	39
Protein feeds				
DDG	30	99	113	8
DDGS	28	98	111	8
Canola meal	38	72	75	11
Corn gluten feed	22	80	86	9
Lentils	27	85	92	—
Peas	23	85	93	7
Chickpeas/ Garbanzo beans	20	89	93	3
Soybean meal	49	84	92	7
Wheat middlings	18	80	86	8

Adapted from Preston (2010) and Lardy and Anderson (2009).
CP = crude protein; TDN = total digestible nutrients; NEm = net energy for maintenance; CF = crude fiber; DDG = dry distiller's grains; DDGS = dry distillers grains with solubles.

It is important that pigs and chickens receive concentrate feeds with low fiber for more complete digestion. Higher fiber feeds work better for ruminants and hindgut fermenters. Ruminants and hindgut fermenters need energy feeds that are more slowly digested to prevent digestive upset. For example, potato waste is a rapidly fermentable, high-moisture feed and should only be fed as a portion of a diet. Protein concentrates can also be high in energy, but are fed as a protein, not an energy source. Feeding high-protein concentrates to meet energy requirements would cause excessive protein in the diet which can be expensive, decrease performance, and cause excessive nitrogen excretion.

Roughages (hays and other fibrous feeds)

Roughages are less energy dense than concentrates and generally higher in fiber (Table 2). Ruminants as well as hindgut fermenters, not in a feedlot or a dairy, will usually be fed diets that are mostly roughages (Hall et al. 2009). While they can be fed diets that are mostly concentrates, some

roughage in the diet is required for proper digestive tract health and function.

Alfalfa is a unique roughage because it is relatively nutrient dense. High-quality alfalfa may be best for horses and rabbits, but can also be fed to ruminants. Feeding too much alfalfa can lead to issues like colic in horses or bloat in cattle, so it needs to be monitored and limited.

In ruminants, **neutral detergent fiber** (NDF) is a predictor of **voluntary intake** because it provides bulk or gut fill. The higher the percentage of NDF in the diet, the less the animal will eat (Rasby and Martin 2008). **Acid detergent fiber** (ADF) is the least digestible plant components. ADF is inversely related to digestibility; therefore, the lower the percentage of ADF value, the higher the digestibility.

Table 2. Crude protein, NDF, ADF, and TDN content of selected forages.

Feed	CP%	NDF%	ADF%	TDN%
Alfalfa Hay	16–20	47	36	58
Sudan Grass Hay	9	67	43	57
Timothy Hay	8–11	64	40	58
Triticale Hay	10	69	41	56
Corn Stalks	5	70	43	54
Wheat Straw	3	81	57	43
Red Clover Hay	15	51	39	55
Orchardgrass Hay	10	67	40	59
Brome Hay	10	66	41	55

Adapted from Preston (2010).
CP = crude protein; NDF = neutral detergent fiber; ADF = acid detergent fiber; TDN = total digestible nutrients.

Water

Water is the most important nutrient of any livestock diet. Animals need access to fresh water at all times (Table 3). It is important to account for the amount of water your livestock consume, so that if the animals' current water supply is lost, in the event of an emergency or disaster, you are prepared with an adequate alternative water source.

Toxicity

An excess of certain nutrients in a livestock diet can cause toxicity and lead to health problems and sometimes even death. Understanding the components of a feed before it is fed is important. For example, distiller's grains and corn gluten feed or meal can be high in sulfur. If dietary sulfur is too high, toxicity can occur in ruminants and pseudo-ruminants. To avoid problems, know how much sulfur a diets contains, including sulfur in the water supply.

Table 3. Recommended daily feed and water consumption of selected livestock.

Animal	Amount of water/day	Amount of feed/day
Lactating cows	20–25gal/day	Free choice hay, protein supplement to meet requirements
Dry cows	5–15 gal/day	Free choice hay
Lactating sow	3–7 gal/day	8 lb of grain
Dry sow	3–6 gal/day	2 lb of grain
Lactating ewe/doe	2.5–3 gal/day	Free choice hay, protein supplement to meet requirements
Dry ewe/doe	1–2 gal/day	Free choice hay
Chickens	1 gal/20 birds	3 lb of grain/20 birds
Horses	10–15 gal/day	Free choice high quality hay
Rabbits	0.1–0.25 gal/day	Free choice high quality hay
Llama/alpaca	2–5 gal/day	Free choice hay

Adapted from Markwick (2002), Almond (1995), and FEMA (2013).

By-product feeds can also be high in potassium, phosphorus, and micronutrients (Lehmkuhler and Burris 2011). Sheep are especially sensitive to copper in the diet; feed that is commonly fed to other livestock may lead to copper toxicity in sheep. If feed tags or labels are available, producers should read them before feeding to avoid running into toxicity issues. Information on how to read a feed tag is available in the WSU Extension publication FS138E Feed-ology: How to Read a Feed Tag.

Nitrates can also pose problems for livestock. Plants can accumulate high levels of nitrates when under stress, such as heat, drought, and soil fertility imbalance. Feeding roughages high in nitrates can lead to nitrate poisoning. Forage that has any risk of nitrates should be tested (Norberg and Llewellyn 2014). Further information on nitrate poisoning in ruminants can be found in WSU Extension publication FS139E Nitrate Poisoning in Ruminants. Additionally, prussic acid may pose issues to cattle, most commonly those grazing sorghum, Sudan grass, or sorghum-Sudan grass hybrids. More information about prussic acid poisoning is available in WSU Extension publication FS129E Prussic Acid Poisoning in Livestock. Hay should also be free of mold as it can pose many risks like respiratory problems, especially to horses. If moldy hay has to be fed, then it should be moistened to reduce dust and mixed with other mold-free feed. Feeding moldy hay should only be done as a last possible alternative and under very careful management (Nix 2011).

Digestive upsets

Animals are very sensitive to changes in their diets. **Acidosis**, **bloat**, **colic**, and **laminitis** or **founder** can occur if livestock are fed improperly. Acidosis occurs in ruminant animals when the pH in the rumen drops and becomes too acidic. This can occur if animals are transitioned too quickly or fed too much of a highly fermentable feedstuff, such as those with high amounts of starch (i.e., grains and other concentrates). These can also cause laminitis or colic in horses, and ulcers in pigs (Constable 2015). Bloat can also occur if ruminants are fed too much highly digestible feed or too much of a legume like alfalfa, clover, or green lush forages such as wheat pasture.

Transitioning Livestock Diets

Changing a diet incorrectly can lead to digestive problems or poor animal performance. If a diet change must be made, it is best to do so in a gradual manner. New feed should be introduced in small amounts, and mixed in with a familiar feed. The diet can then be transitioned, slowly reducing the amount of familiar feed and increasing the amount of new feed. It is best if the diet is transitioned over a couple of weeks to allow the animal to adjust to the new feed (Chiba 2014). Transition time will depend on what feedstuffs are being fed, but in many cases the transition can take place in 10–14 days.

Conclusions

Feeding livestock during or after a disaster can present challenges to owners and producers. However, successfully selecting and feeding unfamiliar feeds can be achieved if caution is exercised. Understanding your animals' nutrient requirements, the nutrient composition of feeds in the diet, as well as how they digest their feed will go a long way in keeping them healthy during times of stress. Transitioning slowly to unfamiliar feeds is the highest priority. For more information on selecting and utilizing emergency feeds or to discuss specific feeds and feeding considerations, contact your local WSU Extension office or your veterinarian.

Glossary

acid detergent fiber (ADF). The highly indigestible part of forage, which includes lignin, cellulose, silica, and insoluble forms of nitrogen.

acidosis. Increased acidity in the rumen. Prolonged periods of acidosis can lead to increased acidity of blood.

bloat. Excess accumulation of gas in the stomach.

colic. Abdominal pain caused by gastrointestinal disorders.

concentrate. Animal feeds high in energy and low in fiber.

founder. See laminitis.

laminitis. Inflammation of the hoof.

monogastric. Animals with a simple, single-chambered, acid-secreting stomach.

neutral detergent fiber (NDF). The plant cell wall components. NDF is sometimes used to predict intake in ruminants.

pseudo-ruminant. Animals that have a similar digestive process to ruminants, but do not have a four-chambered stomach.

roughage. Animal feed high in fiber and lower in energy than most concentrates.

ruminant. Class of animals with a multi-chambered stomach consisting of the reticulum, rumen, omasum, and abomasum.

voluntary intake. Amount of feed consumed when intake is not restricted.

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