Feeding and Watering Beef Cattle During Disasters

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KEYWORDS

• Emergency • Disaster • Nutrition • Cattle • Management

KEY POINTS

- Emergency nutrition and management of cattle comprise 2 phases: survival and maintenance.
- The basic elements of feeding and management essential for survival of cattle following a natural disaster are water, feed, rest, and recovery.
- The secondary objective is to maintain the current condition of cattle and reduce the potential for negative production outcomes.
- General recommendations for both survival and maintenance following natural disasters, including flooding, blizzards, and wildfire, are discussed.

INTRODUCTION

The objective of this article is to provide a general overview of feeding, watering, and managing beef cattle following select natural disasters or emergency situations. The authors rely primarily on personal experience in relating successes and failures in managing livestock-related emergencies; however, the experiences and research of others are cited when appropriate.

No 2 natural disasters or emergencies that impact livestock are alike, and each situation will have unique challenges. Animal care, feeding, and nutrition in the wake of a natural disaster or emergency require a general understanding of animal nutrient requirements, feedstuffs, creativity, and perseverance.

EMERGENCY PREPAREDNESS AND MANAGING DONATED FEEDSTUFFS

One the most challenging aspects of feeding and caring for livestock in emergency situations is the logistics associated with the management and allocation of donated feedstuffs. Incident-response personnel should identify a central person of contact

Disclosure Statement: The authors have nothing to disclose.

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Vet Clin Food Anim 34 (2018) 249–257
https://doi.org/10.1016/j.cvfa.2018.02.006
0749-0720/18/Published by Elsevier Inc.

that has some knowledge of feedstuffs, animal needs, and livestock producers in the area. A location for use as a receiving point and staging area for donated feeds should also be identified as soon as possible after the event. The staging area should be large enough to accommodate large volumes of hay and have covered storage available to accommodate bagged feeds or concentrates. The staging area should be accessible also from major roadways; it should be marked with obvious signage, and it should have available the heavy equipment necessary to handle various types of feeds on hand. An effort should be made to allocate and direct feedstuffs directly to producers, when possible, to ease pressure and space constraints at the staging area. Although difficult, the name and location of the feedstuff donor, any pertinent information regarding the donated feedstuffs (eg, identity, nutrient analysis, and nitrate content), and the name and location of the recipient of donated feedstuffs should be documented. If any problems (ie, toxicities, contamination, or presence of noxious or invasive forage species) with specific feeds become known at a later date, the recipients of those feeds can be notified immediately so that steps to mitigate unintended consequences can be taken. Donated feeds will vary considerably in terms of type, form, quality, and nutrient composition. Incoming feedstuffs should be allocated based on the relative nutrient requirements of animals being cared for and the resources available to the recipient to handle and store different types of feedstuffs. Producers should be put into contact with University Extension professionals, nutritionists, or veterinarians to seek advice regarding the use of unfamiliar feedstuffs or feeds that may have unique characteristics (ie, heat damage). Donated hay should also be monitored for contaminants (ie, foreign objects) that may injure animals or damage hay-processing equipment.

GENERAL WATER AND FEEDING MANAGEMENT CONSIDERATIONS

Maintaining cattle on limited resources for any duration of time is inherently difficult and requires skillful management. Immediately following a natural disaster (ie, 2–3 days; the survival phase), the most basic needs for survival of cattle (ie, water, feed, rest, and recovery) are of primary importance. Once the survival phase has been addressed, the secondary objective is to maintain the present condition of cattle (ie, the maintenance phase) and to reduce the potential for negative production outcomes, such as severe body weight loss or pregnancy loss.

Survival Phase

Key survival phase considerations

Water (First priority)

- 1.0 to 2.0 gallons per 100 lbs body weight
- Introduce slowly if cattle have been without access for >12 hours
- Provide tank space for 10% of animals, allowing 1 linear foot of tank space per head

Feed (second priority)

- Offer 1.0% to 1.5% body weight per day of long-stemmed moderate-quality forage (grass hay preferred)
- Restrict grain and other supplements to 0.5% body weight per day
- Limit intake of unfamiliar feeds

- Cattle should have access to abundant, clean drinking water. The amount of water required varies. In general, cattle will consume approximately 1.0 to 2.0 gallons of water per 100 lbs of body weight. Water availability may need to be increased slowly if cattle have not had access to water for periods in excess of 12 hours.[1] Keep in mind that water requirements may vary greatly with ambient temperature, relative humidity, animal health status, and existence of physical trauma.[2] Water consumption may range from 300% to 800% of dry matter intake in terms of water weight. Take care also to provide adequate access to water-delivery vessels for cattle in confinement. The following rules of thumb and calculations may be useful when estimating the number and size of water tanks needed for a given situation:
  - Provide drinking access = 10% of total animals in enclosure 1 linear foot per head
  - 1 gallon of water = 8.3 lbs
  - 1 cubic foot of water = 7.48 gallons or 62.3 pounds
  - 1 gallon or water = 231cubic inches

$$\text{Circular trough capacity, gallons} = \frac{3.14 \times \text{radius}^2 \times \text{depth (in inches)}}{231}$$

$$\text{Rectangular trough capacity, gallons} = \frac{\text{length} \times \text{width} \times \text{height (in inches)}}{231}$$

$$\text{Gallons by inch of depth} = \text{total gallons} \div \text{tank depth, inches}$$

- Feed intake of cattle immediately following a disaster will often be low because of the stress associated with the event. Therefore, initially offering cattle 1% to 1.5% of their body weight of palatable, long-stemmed moderate-quality forage (grass hay, if possible) should satiate the animals and reduce waste of feed resources that, in some cases, may be limited. Concentrate feedstuffs should be restricted to 0.5% of body weight.
- Abrupt diet transitions should be addressed within the first 3 days following the traumatic event by either limiting intake of unfamiliar feeds or offering feedstuffs that have a similar nutrient composition and profile to those the cattle were fed before the event.
- Cattle should be allowed to rest, if possible, before trucking or imposing additional stressors, such as sorting, commingling, or processing.

Maintenance Phase

- The most vulnerable cattle at risk for production losses in an emergency situation are animals with the highest nutrient requirements: newborn calves, lactating females, and pregnant females. Cattle should be sorted into management groups based on stage of production and nutrient requirements if possible. Sorting cattle into groups based on stage of production facilitates more accurate delivery of feedstuffs and reduces the likelihood of underfeeding specific classes of cattle and maximizes use of resources.
- The most critical elements of cattle nutrition in an emergency situation are energy, protein, and macrominerals (ie, calcium, phosphorous, potassium, and sodium). This does not diminish the importance or essentiality of other

macrominerals or microminerals in the diets of beef cattle; however, the aforementioned mineral elements are those upon which a primary emphasis should be placed in an emergency situation. They are the most rapidly depleted during times of injury, dehydration, starvation, or other stress and are vital for restoring normal electrolyte balance.

- The maintenance energy requirements of nonlactating pregnant beef cows, mature bulls, and weaned calves in most cases can be met with moderate-quality forages (6%–12% crude protein, 50% total digestible nutrients, dry matter basis) at an expected daily dry matter intake of approximately 2.0% to 2.5% body weight. Grass hays are often recommended for stressed cattle. However, grass hays and forages in general are frequently protein poor; therefore, additional supplemental protein is often warranted. Feeding a minimum of 1 lb per day of a 20% to 30% crude protein supplement will supply additional nitrogen to the rumen and improve forage digestion and utilization. Protein supplements include, but are not limited to, oilseed meals, corn gluten feed, dried distillers grain, and legume hays.
- Cattle should be fed daily, and no more than a 1- to 2-day supply of hay should be offered at any one time. This amount of hay will minimize wastage of potentially limited feed resources and reduce pressure on grazed forage resources of limited availability.
- Combination supplements that provide both energy and protein are ideal in emergency situations, because both may be limited.
- In emergency situations hay may not be immediately available or it may be impractical to or impossible to transport large amounts of hay. In these circumstances, feeding limited amounts of fiber-based concentrates or grains (eg, dried distiller's grains, corn gluten feed, or soybean hulls) or limited amounts of starch-based concentrates (eg, corn, sorghum, barley, or wheat) may be considered a means of maintaining cattle, when grazed or harvested forage supplies are limited.[3] Initially, care should be taken to limit intake of starch-based concentrates to no more than 0.5% of animal body weight, especially when animals have had no or limited access to such feedstuffs previously. Intake of starch-based concentrates sources can be safely increased 0.5 to 1 lb per adult animal every 2 to 4 days, provided a reasonable forage allowance is also maintained.
- Feed exogenous sources of hay (ie, donations from outside of a disaster-stricken area) in locations that can be monitored in subsequent growing seasons for the presence of noxious plant species.

EMERGENCY FEEDING DURING FLOODS

The primary concern for livestock owners following regional flooding is usually quality of available water and feed. Flood conditions, in general, may contaminate livestock water in 1 of 2 ways. In inland areas, shallow wells and surface-water sources (ie, ponds) may become contaminated with debris, farm chemicals, petroleum products, decaying organic matter, or sewage after a flood. Each affected water source must be evaluated on a case-by-case basis. Water should only be considered clean after comprehensive testing for mineral content (including heavy metals), coliforms, and hydrocarbons confirms its safety. In circumstances whereby a visual inspection reveals obvious contamination, use of affected water sources must be avoided until decontamination can be achieved. When contamination is less obvious, water sources can be evaluated by sight, feel, or smell for the presence of suspicious odors, pigments, or oily residues. In dire emergencies and for short periods of time, contaminated water that does not contain oily residues may be cleaned using unscented chlorine bleach. In the case of surface water, 1 to 2 gallons of chlorine bleach (5.25% strength) will treat 100 gallons of water. In the case of a shallow well, a solution consisting of 1 gallon of unscented chlorine bleach and 3 gallons of water can be poured into the well bore. Hydrants or faucets that are fed by the well should be opened until the odor of bleach is detected; once this occurs, all hydrant and faucet valves should be shut. After a 24-hour wait, the well should be safe to use.

The second general manner in which livestock water can be contaminated during flooding is usually limited to coastal areas. Storm surges may bring brackish water or seawater into contact with shallow-well and surface water sources for livestock. Nontraumatized animals usually avoid brackish water or seawater. In most cases, healthy animals are not at great risk for dehydration within the first 48 hours of water deprivation (CB Navarre, Louisiana State University, Baton Rouge, LA, personal communication, 2017). Conversely, dehydrated animals may drink highly salinized water out of desperation and, in so doing, further exacerbate dehydration. Surviving animals in such condition should be prevented from accessing salt-contaminated water sources and gradually transitioned to a fresh water source. This is best achieved by supplying frequent (ie, every 1–3 hours) small (ie, 0.5–2 gallon) water deliveries in such a manner that all affected animals confined together can drink at the same time.

Salt content of livestock water following a storm surge should be tested to determine safety. Salinity testing is usually available through University Extension, the Natural Resource Conservation Service, US Armed Forces, and other disaster-relief agencies. Results of salinity testing should be interpreted in light of the following guidelines[4]:

- Greater than 10,000 ppm (or mg/L): unsafe for all classes of cattle (note that 10,000 ppm = 1%)
- 7000 to 10,000 ppm: unsafe for pregnant and lactating cows, young calves, and heat-stressed cattle; potentially safe for mature nonpregnant, nonlactating, nonstressed cattle
- 5000 to 7000 ppm: safe for most classes of cattle; potentially unsafe for pregnant or lactating females
- 1000 to 5000 ppm: generally safe for all classes of cattle; however, diarrhea may result
- Less than 1000 ppm: safe for all classes of cattle

Grain and forage resources that come into contact with floodwaters can be affected in all of the same ways that water sources can be affected. An additional challenge with livestock feedstuffs that become wet is subsequent growth of molds that can put human and animal health at risk. Preserved forages (eg, hay bales and silage) should be carefully examined for obvious generation of heat or the presence of molds. Examinations of this nature should only be performed by persons wearing gloves, coveralls, eye googles, and a respiration mask. Some molds may become airborne when forages are being examined and can be inhaled to the detriment of animal caregivers.

Forage sources that are hot to the touch should be considered at risk for spontaneous combustion. If possible, they should be moved away from structures and other valuable properties to a location where they can be thoroughly spread out to minimize fire risks. Dangerously molded hay or silage will contain obvious white, gray, brown, or black plaques, especially in the interior of the forage mass; it may also carry an uncharacteristically sweet odor. Affected forages may appear dusty when the mass is broken apart or otherwise disturbed. Forages that are obviously moldy will normally be avoided by horses or ruminant livestock; however, hungry animals will consume them. In the case of necessity, certain precautions can be taken to reduce risks associated with feeding moldy forages to livestock.

Moldy forages should never be fed to horses because of the relatively high risk of colic and heaves. Similarly, moldy forages should never be fed to pregnant or lactating cattle. Inhalation of mold spores by pregnant or lactating dams may cause mycotic pneumonia, which has been implicated in late-term abortion, associated retained placenta, and mastitis. Certain molds can also be passed via milk to human and animal consumers.

In contrast, moldy forages may be fed to nonpregnant and growing cattle without major negative outcomes. Care should be taken to discard discolored or extremely dusty portions of the forage mass. Less affected portions should be offered to cattle after thorough mixing with noncontaminated feedstuffs. In the opinion of the authors, the ratio of moldy forage to nonmoldy forage in rations for nonpregnant, nonlactating ruminants should not exceed 25:75.

Moldy grains carry the same risks to livestock as moldy forages; therefore, similar precautions for flood-affected grains should be observed. A major difference between the 2 is that grains that have come into contact with water may be more salvageable than forages when conditions allow. Grain storage structures partially submerged by flood waters can be evacuated from the top via vacuum until moist grain is encountered. Obviously moist grain should be discarded, especially if it carries an odor of fermentation. Recovered and salvageable grains should be dried mechanically or spread out in the sun to a depth of 3 to 6 inches. Drying should continue until a moisture content $\leq$14% is reached. Molds are not necessarily eliminated during drying. Feeding salvaged grains to horses and pregnant or lactating cattle should be avoided. For nonpregnant, nonlactating cattle, flood-affected grains should be diluted 25:75 with clean grain in rations.

An additional consideration for flood-affected forages and grains is the potential presence of metallic foreign material. If inadvertently ingested by livestock, metallic objects can puncture the gastrointestinal tract and lead to peritonitis. To improve safety of any feedstuffs suspected of being contaminated by metallic debris, they should be processed or fed using machinery that is equipped with magnets in whatever location the feedstuffs are discharged from processing equipment, feed mixing equipment, or milling machinery.

It should be noted that pastures inundated by flood waters may contain debris or other residues harmful to livestock. Pastures and fences should be inspected following a flood event, with particular attention paid to the area where drainage occurs. Flood debris and decaying organic matter should be removed and fences repaired before readmitting livestock. Saturated soils are at risk for compaction by hoof traffic; moreover, forage plants stressed by inundation or saltwater exposure should be allowed 30 days of rest before grazing is resumed.

EMERGENCY FEEDING DURING BLIZZARDS

Beef cattle producers typically have advance warning with regard to winter storms, which allows producers to make advance preparations. Preparations often include staging feedstuffs in readily accessible locations or creating temporary windbreaks. The duration and magnitude of a winter storm often vary greatly across the impacted region. The ability of beef cattle to survive and cope with blizzard conditions is a function of both environmental conditions (ie, wind chill, precipitation, and humidity), access to shelter, and animal acclimation (ie, hair coat, tissue insulation, and body condition). In general, maintenance energy requirements increase approximately 1% for each degree below the temperature at which cattle begin experiencing cold stress. In wet conditions or when cattle have a hair coat typical of summer, cattle can begin experiencing cold stress at 15°C (59°F). In contrast, cattle with a dry winter hair coat experience cold stress at approximately −8.0°C (18°F).[5] Cold stress increases maintenance energy requirements but does not impact protein, mineral, or vitamin requirements. Cattle will consume snow and ice to meet their needs for water during blizzard conditions; thus, water is not as great of a concern. Conversely, cattle that are not accustomed to consuming snow may be hesitant to do so. Keep in mind that body heat must be expended in order to melt ingested snow and ice, which increases the degree of thermal stress placed on the animal. The most vulnerable animals are typically those maintained in open, extensive environments, such as native range, wheat pasture, or crop-residue fields. The classic response to cold stress in confinement situations is an increase in voluntary intake typically preceding the event; however, it has been documented that beef cows maintained in extensive environments spend less time grazing as temperatures decline below freezing and may not be able to graze snow-covered pastures.[6] Less grazing time effectively reduces forage intake and makes the challenge of meeting the nutrient requirements of the cattle even greater. The traditional production response to a cold weather event is to feed more of the current protein supplement being used or offer a greater amount of low-quality hay. Although the additional supplement and hay provided increase energy supply, it may not necessarily supply sufficient energy to meet the additional caloric demands associated with cold stress. Therefore, cattle experiencing cold stress should be fed relatively higher-quality hay than the basal forage or an additional small amount of grain in combination with the normal ration of protein supplement.

EMERGENCY FEEDING FOLLOWING WILDFIRE

Maintaining cattle immediately following wildfire is challenging because of the lack of available feedstuffs, because both grazed and harvested forages are generally diminished. Dehydrated cattle will voluntarily consume ash-contaminated sources of water but should not be allowed to do so if preventable; ash may contain a variety of toxic contaminants.

Cattle are often moved to temporary confinement situations or allowed to graze nonburned available forage resources (typically lush, green forages that did not ignite). Cattle abruptly turned out on lush green forages, especially mature, lactating cows, may be at risk for hypomagnesemia or "grass tetany," a condition characterized by low blood magnesium and associated with grazing lush, green, fertilized, cool-season grasses or small cereal grain pastures (wheat, barley, triticale) during the winter months.[7] The magnesium concentration in forages of this type typically meets or exceeds the requirements of grazing livestock, but the potassium concentration is usually well above that required by grazing livestock; moreover, sodium is usually well below the needs of grazing livestock. The absorption of magnesium from the rumen is dramatically reduced in the presence of excess potassium and low sodium. The concentration of potassium in saliva and the rumen increase under conditions in which sodium is limited.[8] Therefore, it is recommended that cattle abruptly relocated to lush, fertilized forages be provided ample access to loose stock salt. Salt may be force fed if not readily consumed by top-dressing or hand-blending salt with concentrate feeds. The result is 2-fold: magnesium is absorbed with greater efficiency from the rumen, and potassium absorption from the rumen is diminished. Animal care providers should be cautioned against trying to provide greater amounts of magnesium directly in the form of a self-fed mineral supplement. Although this can be a viable means to address hypomagnesemia, inorganic sources of magnesium (eg, magnesium oxide) tend to be bitter. Consumption of supplemental inorganic magnesium may be inadequate unless it is blended with a palatable grain source, such as dried distiller's grain, soybean meal, or dried molasses.

Cattle will consume smoke-damaged hay, silage, and wet distiller's grain but do not appear to prefer them. Smoke-damaged feedstuffs should be offered in limited quantities or diluted with clean feedstuffs when possible. Grinding smoke-damaged hay may help disperse the smoke smell and appears to moderately improve palatability. Feeding fiber-based energy sources (eg, dried distiller's grains, corn gluten feed, or soybean hulls) or starch-based energy sources (eg, corn, sorghum, barley, or wheat) should be considered for cattle confined temporarily. The caloric density of fiber and starch-based concentrates are usually greater than that of hay; thus, the energy requirements of more animals can be met with less delivered feed when concentrates are used in combination with hay. Cattle can be successfully maintained on concentrate-based diets that contain only 10% to 20% roughages. The nutrition and management of confined cattle require special attention. Cattle producers should seek the advice of University Extension or nutrition professionals to ensure that animal nutrient requirements are met and the appropriate amount of roughage is provided.

Following wildfire, pasture resources require rest before livestock grazing can be reinitiated. Forage yields after wildfire can be diminished. This is generally not the case when wildfires occur in the spring during years with normal precipitation.[9] In contrast, wildfires that occur during drought conditions, during the dormant season, or upon sensitive soil types (eg, sandy soil) can be expected to diminish yields and effective carrying capacities for 1 or more years. The authors suggest a conservative approach to restocking after wildfire. The following summary is adapted from a Kansas State University publication[9]:

- The length of grazing bouts is generally simpler to manage that the number of animals allowed to graze a given pasture or range. Pay close attention to forage availability and end grazing at or before 50% of peak production has been removed.
- In locations with claypan soils and adequate rainfall, stocking rates during the year following wildfire should be 75% to 100% of normal (depending on forage yield). Stocking rates can be returned to normal the second year following wildfire.
- In locations with loamy, finely textured soils, stocking rates in the year following wildfire should be reduced to 65% to 70% of normal. In the second year following wildfire, stocking rates can be increased to 90% to 100% of prefire levels.
- In locations that are drought prone or with coarsely textured, sandy soils, stocking rates in the year following wildfire should be reduced to 25% to 50% of normal. Stocking rates may be increased to 50% to 75% of normal in the second year following wildfire and returned to normal during year 3.

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