JOURNAL OF THE NACAA

ISSN 2158-9459

VOLUME 15, ISSUE 1 – JUNE, 2022

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Sequential Unrelated Livestock Fatalities at a Farm: A Case Study

Abstract

Accidental ingestion of toxic plant materials and contact with microbes are important causes of livestock fatality. In 2020, four fatalities of beef calves, that had grazed at two separate pastures (Pasture A and Pasture B, respectively, separated by a mile), were reported to have occurred within two months of each other. Two independent necropsies, first on one of the three animals that grazed on Pasture A and the second, on the animal that grazed on Pasture B, and site-visits to both pastures were carried out to determine the cause. Foamy discharge from the mouth of distressed calves indicating agonal death was reported in all animals. Two to three cupful of plant seed material were also recovered from the gut of the animal that grazed on Pasture B. Visits to Pasture A revealed two groves that contained approximately 20 black cherry (Prunus serotina) trees along the periphery of pasture where the animals had grazed, with branches brought down by storms on the ground at one location. We alluded to the possibility that the three animals died of cyanosis caused by accidental ingestion of wilted cherry leaves. Pasture B was a contained by fencing and had indicated signs of overgrazing revealed by poor forage stand and bare spots exposing soil. Seed material recovered from the gut was identified as that of smooth crabgrass (Digitaria ischaemum). We alluded to the possibility that the fourth animal died of

clostridial infection. The producer had indicated that the vaccination program of this animal did not include protection against clostridial infection. The veterinarian who performed necropsy on this animal also speculated clostridial infection as a likely cause, however, the presence of large quantities of seed material was confusing. We hypothesized that the acidic environment created by excessive grains promoted rapid multiplication of clostridial bacteria resulting in quick animal mortality.

Introduction

Livestock fatality from ingestion of toxic plants accounted for $250 million in lost revenue to producers in 1988 (estimated to be $600 million in 2022 based on 2.4% annual inflation rate; Nielsen,1988). Poisoning from clostridial infection, especially among calves, is another cause of fatality. While statistics related to economic impact of clostridial poisoning is not readily available for USA, a study in Brazil revealed that livestock fatality due to deaths from clostridial botulism affected 0.4% of livestock herd. (Soares et al., 2018). The researchers also concluded that the cost of immunizing the herd using polyvalent vaccines was 22.22% of the financial loss incurred due to animal mortality from clostridiosis.

Clostridial poisoning can manifest as agonal symptoms, similar to those caused by accidental ingestion of certain types toxic plants (De Backer et al., 2021; Niilo, 1980; Vance, 1967). Therefore, additional troubleshooting and performance of a necropsy and/or histopathological examination may be essential to quantify the cause accurately. Site-visits are essential to determine the presence of any toxic plants in a pasture following livestock fatality. An inventory of poisonous weeds and their respective poisoning symptoms are taken into consideration while determining the cause.

The objective of this case-study is to elucidate the cause of animal fatalities at a farm in West Virginia that occurred in quick succession. We also outline a series of steps for troubleshooting such situations. The information presented may be useful for county agents, producers, or agricultural practitioners who encounter similar situations.

Methods and Materials

On September 25, 2020, a producer reported mortality of four calves at a farm in Preston County, West Virginia. There was a total of 16 calves of a similar age on the farm, indicating a morality rate of 25%. A site visit was carried out on October 2nd, the producer provided additional information on the events that preceded the animal fatalities. The animals had grazed on two separate pastures, Pasture A that was located about a mile from Pasture B adjacent to the main barn of the farm. The fourth animal that grazed in Pasture B remained in the main barn itself till it died. This animal had no physical contact with any of the other animals that had died previously. A Holstein x Jersey cross, it was born in January, 2020 and had been purchased at an auction in April, 2020. It was housed along with two other Holstein calves of similar age. Following purchase and transportation from the auction site, the animal demonstrated symptoms of shipping fever (listlessness and poor appetite) and hence was administered a dose of 'LA 200' (long-acting oxytetracycline). The following day, the animal appeared to improve and began to eat well and continued to progress to a normal, active condition. It received its initial dose of Triangle 10 on April 14, 2020 and its booster on April 28, 2020. Additionally, this animal was treated with scours boluses on April 14 & 15 and received Ivermectin pour-on fly control on May 16, 2020. It was offered adequate nutrition and health care although the vaccination program did not include protection against clostridial infection.

The three animals that grazed in Pasture A were mixed-breed beef calves.
Each animal received 2.25 kg (5 pounds) of 18% 'Dairy Grower' pellet daily. The animals had continuous access to fresh water and hay and forage in the pasture when available. The vaccination program for the calves was 'Triangle 10', a 10-way vaccine that covers most commonly-seen respiratory and reproductive diseases.

Necropsies were performed by two separate veterinarians, from Hagerstown MD and Grantsville, MD, for the Calf-3 (from Pasture A) and Calf-4 (from Pasture B), respectively (Table 1).

Results and Discussion

The three calves that had grazed in Pasture A died between late-July and early-August 2020 (Table 1). Of these three calves, two died in quick succession and were found dead in the pasture itself. The third calf died about three weeks later at a shelter in the farmhouse. It was brought back to the farmhouse after showing signs of distress. It died the following day in early-August. The cause of death could not be determined following necropsy of this animal.

The predominant weed species in Pasture A were spiny pigweed (Amaranthus spinosus) and tall ironweed (Vernonia gigantea) comprising about 10% weed cover. It was also observed that black cherry (Prunus serotina) trees were present in two groves in the periphery of this pasture, totaling approximately 20 trees (Figure 1). Some of the trees in the groves were unhealthy, dropping leaves whereas others appeared to be healthy. In one of the two groves, several limbs that had been brought down by storm events were also observed. Thunderstorms were reported in Preston County, WV on July 21, July 27, and August 6, 2020. No prior abnormal weather events were observed until then.

A fourth calf, contained in Pasture B adjacent to the main barn, died during the third week of September (Table 1). The veterinarian who performed necropsy of this calf speculated clostridial infection as a potential cause, but could not could not determine it conclusively. During necropsy, two- to three-cupful of plant seed material were recovered from the gut which led the veterinarian to suspect plant-related poisoning as a potential cause. The veterinarian recommended that the seeds be identified.

At the time of site visits, two other calves were observed actively grazing in Pasture B where the fourth animal had grazed. The forage was grazed down to almost bare ground indicating overgrazing. The percent weed cover in this pasture was estimated to be 30-40% based on visual assessment (Table 2).

Weed seeds collected from the rumen of the fourth dead calf were identified as those of smooth crabgrass (Digitaria ischaemum) (Figure 2). The seeds appeared to be black due to loss of the outer bracts (lemma and palea) resulting in the presence of mostly true seed (caryopsis) material following the rumination process.

Based on the all the information gathered, we speculated that the first three calves (Pasture A) ingested toxic quantities of wilted cherry leaves from the ground. The unusually dry summer of 2020 could have reduced the quantity of desirable forage matter in the pasture, leaving animals relatively hungry. Then the storms that passed through the area, at different times, may have caused cherry limbs or leaves to fall to the ground. This could have resulted in significant amount of cherry leaves within the reach of grazing animals. Therefore, it is likely that the first three animals died from consumption of cyanide toxins induced by wilting of cherry leaves. Reports of animal fatality following lethal ingestion of cherry leaves following a storm is not uncommon. Producers usually take precautions to remove animals from such pastures and to clean up the area prior to reintroducing animals for grazing.

Toxicity from accidental ingestion of poisonous plants has been well established in livestock and is considered to be a serious impediment in livestock production (James et al., 2019). Abnormal environmental conditions, high grazing pressure, and lack of understanding have been attributed as common causes of fatalities due to plant poisoning (Panter et al., 2007). Among cherry trees, the black cherry (Prunus serotina) is considered to be one of most dangerous in terms of concentration of cyanide in leaves (Wright et al., 2008). An average of 212 mg of HCN is present in 100 g leaves; 110 g (0.25 lb) of leaves can cause death of a 45 kg (100 lb) animal. Smeathers (1972) determined that fresh black cherry leaves were potentially more toxic to cattle than wilted cherry leaves. Separately, Smeathers (1973) determined that wilted black cherry leaves are safer than fresh leaves for cattle consumption. MacKellar (2017) and Cothren (2020) indicated that wilted cherry leaves following a storm can be highly toxic to livestock. They reported that once the leaves have dried the risk from toxicity reduces significantly.

Once the wilted leaf is ingested by a ruminant animal, HCN is released into the gut and absorbed into the bloodstream. All animals can be affected by cyanide release from wilted leaves, but ruminants are especially sensitive to toxicosis. Clinical signs may include increased salivation (slobbering), increased respiratory rates, weakened pulse with increased heart rate, convulsions, and rapid death. The typical case will also show bright red mucous membranes; this is very characteristic of cyanide poisoning when observed with the other aforementioned clinical signs in livestock.

Smooth crabgrass is a warm-season forage grass and is hence considered to be desirable and palatable. Toxic effects in mammals, related to smooth crabgrass or its seed, have not been documented in the literature. Other weeds present in the pen (Pasture B) were not considered to possess toxic attributes either.

Based on all the information gathered, we independently alluded to the possibility that clostridial infection from exposure to contaminated soil in the overgrazed pasture was the likely cause of sudden death of the fourth animal (Figure 3). The bloody, foamy nasal discharge (Figure 4) is a sign of agonal death associated with clostridial infections (Songer, 1996). Such bacteria are considered normal inhabitants of the GI tract where they usually remain inert. Even when they leave the GI tract and enter tissues, enteric clostridial bacteria do not typically cause problems. The veterinarian who performed the necropsy on the animal had also suggested clostridial infection as a plausible cause pending identification of unknown seed material recovered in large quantities from the dead animal’s gut during necropsy.

While it is unlikely that the seed material (grain) of smooth crabgrass found in the rumen caused mortality, it may have an indirect role. Excessive amounts of grain will change the pH in the gut to a favorable acidic environment, at which point clostridia multiply rapidly to kill the animal.

In West Virginia, while Clostridium is not a constant threat, animal fatalities do occur frequently when unvaccinated calves are turned into the pasture for grazing during summer months. Clostridium is present everywhere in the soil, in every pasture; there are over 25 strains of clostridial bacteria, and some are deadly (Janezic et al. 2016). Non-enteric strains of clostridial bacteria enter the body through wounds or scratches on the skin or raw spots/ulcers in the mouth, etc. Once the non-enteric bacteria are in the tissues, strains such as tetanus or blackleg can proliferate quickly and produce gas in the tissues further aggravating the condition causing rapid animal death (Raymundo, 2014).

The standard 8-way vaccines which cover the most dangerous non-enteric strains of Clostridium should be used in endemic areas where this is a problem. If adequate pasture land is not available, a producer may consider a 2-vaccine series and minimize foraging from the dirt (i.e., provide supplemental hay as needed) until the vaccine becomes effective, about 2 weeks after the 2nd dose.

It has been noted that periods of intense weather events such as tornados can disturb the soil making animals prone to accidental ingestion and or contact of such deadly bacteria by animals, leading to sudden infections (Disasa et al., 2020).

Follow-up interviews with the producer revealed that older branches of the cherry trees in the pasture were pruned to mitigate cyanide-poisoning risks. A vaccination program has also been followed in the farm since the incidents. Except for a stillborn calf (for reasons unknown), additional animal deaths did not occur in the farm.

Removal of black cherry trees from pasturelands is a good precautionary measure to mitigate risks during instances of unpredictable weather patterns. Otherwise, removal of fallen leaves following a weather event or other environmental causes would be necessary prior to reintroduction of animals into the affected pasture. Good husbandry practices such as proper vaccinations, rotational grazing, weed management, and supplemental nutrition, should also be considered by a producer. We have also outlined a list of questions to be considered while performing the troubleshooting procedure with the producer (Table 3).

Table 1. Summary of livestock casualties at a farm in West Virginia in 2020, and possible causes.

Calf ID	Death Date	Age	Location	Provisional Diagnosis	Significant Findings
1	Late July	7 months	Pasture A	Cyanosis due to cherry leaf ingestion	Agonal death symptoms
2	Late July	8 months	Pasture A	Cyanosis due to cherry leaf ingestion	Agonal death symptoms
3	Early August	8 months	Pasture A	Cyanosis due to cherry leaf ingestion	Agonal death symptoms
4	Late September	9 months	Pasture B	Clostridial infection	Agonal death symptoms

Table 2. List of weed species in a 0.2 Ha (0.5 acre) fenced-in pasture in West Virginia, where mortality of the fourth calf occurred following grazing.

Common name	Latin binomial	% Cover
Common ragweed	Ambrosia artimisiifolia	15
Smooth crabgrass	Digitaria ischaemum	15
Lady's thumb	Persicaria maculosa	5
Pennsylvania smartweed	Polygonum pensylvanicum	3
Yellow foxtail	Setaria pumila	2

Table 3. List of suggested questions to consider while performing livestock mortality troubleshooting.

No.	Suggested troubleshooting question
1.	History of animal husbandry practices including vaccination/s.
2.	Inventory of weeds where animals grazed.
3.	Weather information (any unusual events).
4.	Necropsy report.
5.	Any past instances of livestock mortality.
6.	Exposure to potentially toxic materials stored in the farm/barn.
7.	Age and history of the barn.
8.	Source and quality of animal feed.
10.	Source and quality of water.
11.	Pesticides applied to source forage/s.
12.	Incidence of animal disease/s.
13.	Abnormalities in physical condition of the animal.
14.	Presence of toxic mold/fungi in the vicinity of barn/farm.

Figure 1. Black cherry (Prunus serotina) trees in a grove adjoining a pasture where three calves grazed prior to mortality.

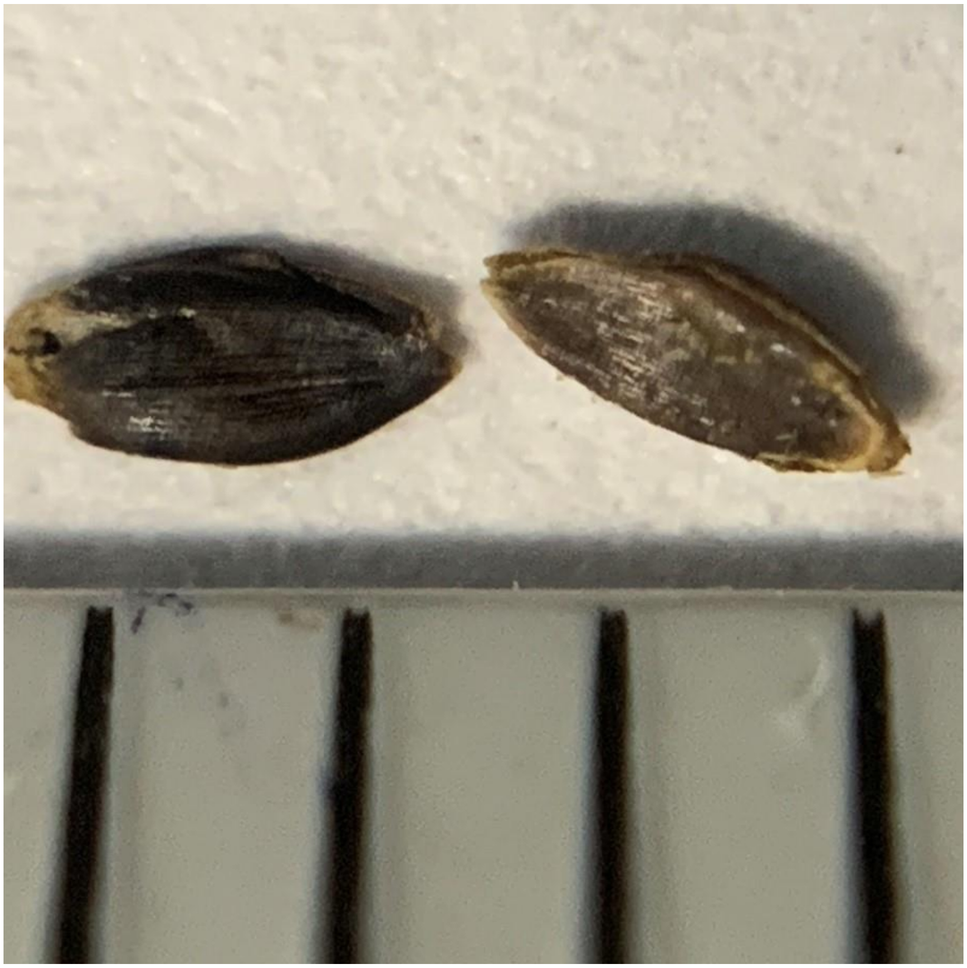

Figure 2. Smooth crabgrass (Digitaria ischaemum) seeds recovered from a calf's rumen following necropsy (scale used: 1mm).

Figure 3. Pasture where the fourth calf died showing the short herbage and potential access to soil borne bacteria.

Figure 4. Foamy nasal discharge of 4th calf indicating agonal death often associated with clostridial infection.

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