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Pasture & Soil Management Following Tidal Saltwater Intrusion

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The Texas Gulf Coast is highly susceptible to tidal surges from hurricanes. Fortunately, significant inland flooding from tidal surges has been infrequent, although these events have decimated crop and pasture lands and resulted in numerous questions regarding the re-establishment of winter and permanent forages. The long-term impact to soil productivity from tidal surges is largely dependant on soil texture, the level of soil moisture prior to the surge, and the duration of the saltwater inundation. Following Hurricane Ike (Sept. 2008), significant forage and rowcrop acreage was inundated by saltwater for 12 to 240 hours. Redmon and Provin toured these areas approximately 10 days after Hurricane Ike, collected soil samples and observed the following:

- Forages under saltwater for 24-48 hours: Bermudagrass recovery is apparent with most leaf tissue showing a healthy green color. The bahiagrass we observed had some discoloration and curling of leaves. Some other species appeared to be brown and desiccated due to exposure to salt water, although a number of weed species, including nutsedge remained yellow green to green.

- Forages under salt water for 48-96 hours: All bermudagrass leaf tissue appeared to be brown. This could be due simply to the plants being submerged for an extended period of time or to excessive desiccation of the leaf material due to prolonged exposure to the salt water. We did observe, however, some green stem material and normal rhizomes indicating the potential for recovery of the bermudagrass. Other species were brown and desiccated.

- Forages and all other species under saltwater for >96 hours: All bermudagrass leaf tissue appeared brown and many stems were also desiccated and broke under pressure. Rhizome health differed depending on sampling. All other desired forage species appeared dead.

Salinity levels will only be remediated by leaching with fresh water. In the case of most of the hurricane affected area, this will only occur with rainfall or flooding from irrigation water if available. Leaching removal of salt out of the upper soil profile will occur most readily in sandier soils with good drainage. Because heavy clay soils have very slow subsoil permeability, short-term leaching of salts is unlikely. A more effective means of reducing salinity in these soils is through the dissolution of soil salts and overland flow of salt containing water to drainage ways. This method of salinity reduction requires that field edges and existing ditches and drainage ways are clear of debris.

Short-term establishment of winter forages and re-establishment of permanent forages may be limited by salinity. Many forages, such as ryegrass and most clover varieties are relatively sensitive to higher salinity levels, while some species, such as bermudagrass, are more tolerant of salinity and flooding. The most important thing a producer can do at this time is to collect and submit a soil sample for a salinity test. An emergency campaign for tidal surge soil salinity assessment has been implemented by the Texas AgriLife Extension Service Soil, Water, and Forage Testing Laboratory at College Station. Forms for this campaign are available from the Texas AgriLife Extension Service county office in the impacted areas. The following laboratory recommendations apply ***only*** to soil samples to be collected for tidal surge-induced salinity analysis.

Soil Testing

Immediately following tidal water drainage, collect surface 0-3" deep soil samples from each representative area. The shallower than normal sampling depth is used to evaluate the impact of the recent saltwater flooding and potential for immediate re-vegetation.

Each sample submitted to the laboratory should be comprised of 10 to 15 individual subsamples from each representative area. A representative area is one comprised of similar vegetation, soil texture and duration of saltwater inundation. The laboratory will analyze the sample following drying and pulverization using a simple 2:1 slurry method, thus allowing rapid sample turnaround. The laboratory report will provide the producer with an assessment of the soil salinity and viability of various crops and forages at the soil salinity level. Table 1 indicates the effect on forage productivity, but does not indicate whether or not newly established forages will germinate or survive as seedlings on the salt-affected sites.

Table 1. Soil salinity tolerance levels for commonly used forage crops.

	Yield Potential, 2:1 EC umhos/cm				
Crop	100%	90%	75%	50%	Maximum EC
Ryegrass	1075	1525	1900	2425	2875
Sorghum	1750	2150	2800	3775	5175
Wheat	2425	2850	3400	4200	5525
Barley	2425	2850	3400	4200	5525
Bermudagrass	2700	3150	3725	4550	6025
Sudangrass	1250	2150	3175	4500	6475
Rye	2950	3275	4175	5175	6700
Oat	2100	2275	2525	2875	3525
Soybean	2100	2275	2500	2875	3525
Corn	700	1125	1675	2400	3525

Proper soil pH and fertility are required to achieve the yield goals listed above. The Tidal Surge Soil Salinity Assessment will not provide routine soil fertility information or recommendations. This information can only be determined using a 0-6" soil sample (producers should not use the 0-3" sampling depth for fertilizer recommendations). Similar to the influence of freshwater flooding, available soil nitrogen is often very low due to leaching and other loss mechanisms. However, the long-term impacts of saltwater inundation can be minimized through good soil fertility and grazing management.

Re-vegetation Guidelines

<u>Removal of Dead Standing Material</u>

It will be difficult to achieve successful establishment of winter or spring forages with the level of dead standing material that currently remains in many of the affected area. This material should be removed for three reasons:

- To allow for increased runoff of precipitation and help remove some of the accumulated salt on the soil surface.
- To facilitate preparation of any seedbed required for forage establishment.
- To enhance the potential for any broadcast seed to germinate and not be shaded out by the dead standing competition.

Dead standing material should be removed via a prescribed fire. Using a prescribed fire involves careful consideration of ambient temperature, wind speed, and relative humidity. Before conducting a prescribed fire, however, consider the following aspects:

- Be certain your county does not have a burn ban in effect. Currently, most affected areas along the Texas Gulf Coast have a burn ban in effect.
- Carefully inspect the pasture to be burned and make sure there are no hazardous materials in the pasture, field or drainage way. Propane tanks, refrigerators, petroleum containers, tires, and other items are often deposited by tidal surges.

Seedbed Preparation and Seeding

Producers should carefully monitor the salinity levels of their soil and only attempt to establish forages when the soil analysis suggests it is appropriate. Depending on the soil type and degree of salt accumulation at a site, several rainfall events may be needed to reduce salt levels. A light disking operation will be beneficial under most circumstances. There may still be some organic residue remaining on the soil surface that could inhibit broadcast seed from reaching the soil surface. Additionally, saltwater can result in the formation of crusts that seal the soil surface, prevent infiltration of rainfall or irrigation, and thus limit leaching removal of salts. If the soil test for salinity indicates ryegrass may be established, seed may be broadcast directly into the ash bed following a prescribed fire. For small grains (barley, wheat, rye, and oat), sorghum-sudan hybrids or sudangrass, a prepared seedbed will be needed. Thoroughly disk the area to be established and either use a drill to place the seed into the soil approximately ¾" to 1½" inches deep, or broadcast the seed onto the prepared seedbed and lightly disk the seed into the soil. See Table 2 for suggested seeding rates for some potential forages for the affected area.

Table 2. Seeding Rates for Various Forage Crops.

Forage Crop	Seeding Rate (lbs/acre)
Ryegrass	30-40
Sorghum	25-40
Wheat	90-100
Barley	90-100
Bermudagrass	10-15
Sudangrass	25-30
Rye	90-100
Oat	90-100
Soybean	60-70
Corn	25-35

The degree of damage to existing warm-season perennial grass pastures cannot be fully assessed until spring green-up. At that time, producers will be able to identify areas that will require re-establishment. Successful establishment of warm-season perennial forages at that time will depend on whether soil salinity in the affected areas has decreased to an acceptable level.

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