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Hurricane Preparation and Recovery for Alabama

Tobacco Producers Guide

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DISCLAIMER

Information in this document was provided by USDA and various university Extension staff and based on shared experiences preparing for and recovering from hurricane impacts. However, individual producer situations will vary, and STATE OR LOCAL GUIDANCE OR REGULATIONS, AND INSURANCE POLICIES SUPERCEDE THE RECOMMENDATIONS IN THIS GUIDE. This guidance should not be interpreted as required actions by regulatory or insurance agencies. Check with your local Extension agent; county, State, or Federal contact; consultant; or insurance agent regarding the appropriateness of these recommendations to your specific situation.

This guidance was developed by Matthew Vann, PhD, Extension Agronomist, and Grant Ellington, PhD, Extension Agricultural Engineer, North Carolina State University, Raleigh, NC 27695, in coordination with the North Carolina Cooperative Extension Service.
The information contained in this guide is based on information from the 2019 Flue-Cured Tobacco Production Guide. Content review was provided by J. Michael Moore, PhD, University of Georgia Extension Tobacco Agronomist. Additional information can be found on the North Carolina Cooperative Extension Tobacco Portal. Photo credits: Matthew Vann

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Tobacco Producers Guide

This guide will focus on:

- Greenhouse security
- Harvest management decisions
- Standby power equipment for curing barns

Contents

Introduction

Preparing for and recovering from hurricane events

People who live and work in the Southeastern United States are unfortunately familiar with the devastation and loss of life and property that can accompany a hurricane event. While hurricanes have always been a threat to the Southeast, with an average of over two strikes per year since 1900, the threat posed by hurricanes is growing. Recent studies suggest that as ocean temperatures continue to rise, hurricane intensity is increasing. Hurricanes of the future will likely be slower moving, higher category hurricanes that produce destructive winds and flooding.

To help producers remain resilient and productive in the face of this threat, the U.S. Department of Agriculture (USDA) Southeast Climate Hub developed this guide containing steps that can be taken to prepare for and recover from hurricane events. This guide is separated into four primary sections:

- The **Building a Resilient Operation** section outlines a range of considerations and systems that producers can put in place to increase their resilience to hurricanes.
- The **Long-Term Operation Maintenance** section lists specific pre-hurricane actions and periodic checks to be done on an annual basis (before hurricane season) and monthly basis (during hurricane season).
- The **Short-Term Preparedness** section lists specific actions to be done in the week before a hurricane arrives.
- The **Post-Hurricane Recovery** section outlines activities that producers can take to minimize their losses following a hurricane. It begins with actions immediately following a hurricane that are focused on safety and continues with ongoing actions a week out and a month out.

The guide also includes four appendices, including two customizable templates for a **Farm Emergency Plan** and an **Emergency Contacts List**. Directions on what to include in these two documents is outlined in the **Building a Resilient Operation** section. There use is described in the **Short-Term Preparedness** section. Both the plan and list should be periodically reviewed, as mentioned in the **Long-Term Operation Maintenance** section. The appendix also includes an **Initial Site Planning** guide that can be referenced if purchasing or leasing new land, and **Resource Links** to helpful Federal, State and university Extension websites that are also referenced throughout the guide.

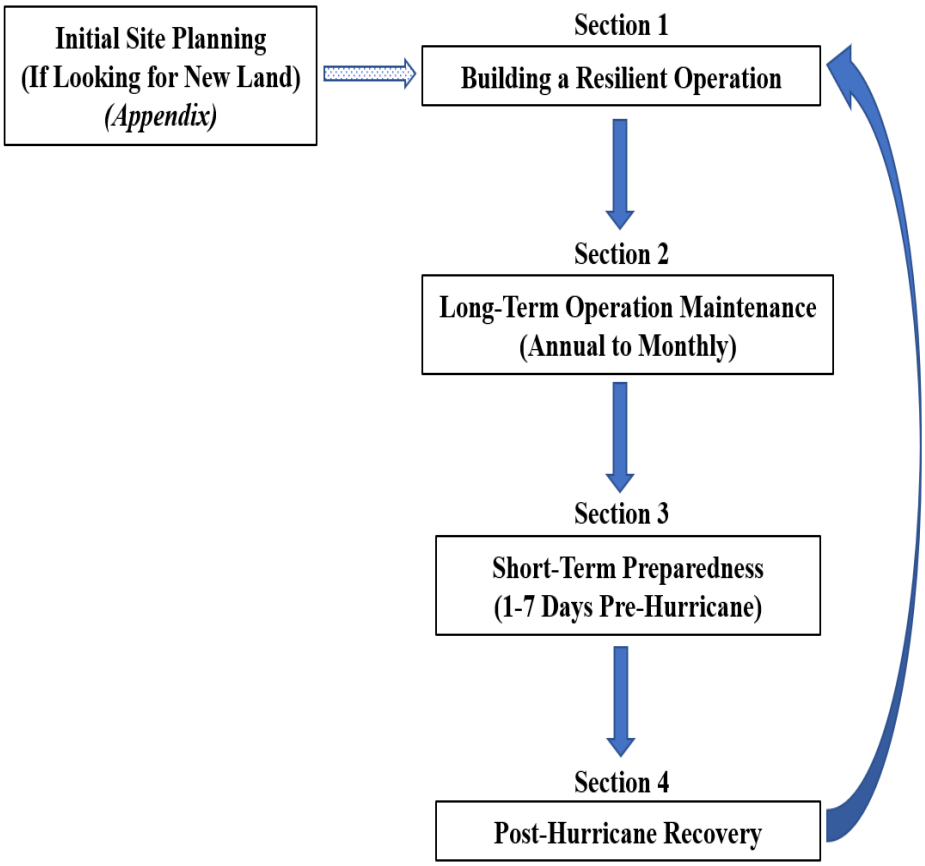

Figure I1. Flowchart for Tobacco Producers Guide

Building a Resilient Operation

Systems that are recommended to be put in place well before the arrival of any hurricane to increase productivity and reduce your risk of damage and reduce recovery time

Agricultural operations in the Southeast U.S. can implement a range of measures to increase their resilience to hurricanes and tropical storms. Contact your local Extension office and other State and Federal resources for further information.

Personal Safety

- For safety tips and resources that facilitate informed decision making before, during, and after a hurricane strikes, see the U.S. Department of Homeland Security (DHS) Ready.gov website and NOAA National Weather Service Weather-Ready Nation Hurricanes website.

Recordkeeping, documentation, and insurance

- The importance of pre- and post-hurricane documentation cannot be overstated. Assistance for disaster recovery may not be available until months or years after a hurricane. Therefore, it is important for purposes of insurance compensation and recovery assistance to do thorough record keeping of the damages and losses sustained on your farm as well as your cleanup and recovery efforts.
- The worst time to find out that you do not have enough insurance, or the right insurance, to cover your damages is when you need help recovering. Regularly review your insurance policies with your agent to be sure you have adequate coverage, including flood insurance, for your facilities, vehicles, farm buildings and other structures, and crops. Be aware that there are limitations on how soon insurance coverage will take effect. Generally, insurance policies will not cover damage if the policy was not in place before a hurricane has formed.
- Establish an inventory system so that you know exactly what's on your farm at all times for potential insurance claims and disaster recovery assistance. It is critical to have a documented inventory (e.g., photos, videos, and lists) of your house, farm buildings, vehicles, and valuable equipment on your farm *before* a disaster occurs. Maintain accurate records of harvest, equipment inventories, and supplies purchased. This inventory and documentation will be essential for filing insurance claims after the hurricane. Keep copies of this inventory in multiple places such as on your computer, off-site in a safe location, and on a cloud-based server using an established procedure to update and transmit the information weekly.

- Take these records with you when evacuating for hurricanes:
  - Inventories and documentation for insurance and disaster recovery
  - Farm Emergency Plan
  - Emergency Contacts List
- For more information, see:
  - The USDA Risk Management Agency (RMA) Crop Insurance website for news and information about insurance, including the Hurricane Insurance Protection—Wind Index (HIP-WI) Endorsement, for farmers and ranchers. Use their agent locator to search for approved insurance providers.
  - The U.S. DHS Federal Emergency Management Agency (FEMA) National Flood Insurance Program website to learn more about flood insurance options for qualifying home and business owners.

Infrastructure

Buildings

- Consult topography and flood maps when building new facilities.
- Locate buildings above the 100-year flood zone whenever possible, and construct buildings and other structures to a minimum wind rating of 140 miles per hour (mph), preferably 180 mph. For more guidance on protecting farm structures and buildings from winds and flooding, see the FEMA Compilation of Wind-Resistant Provisions and Design Guide for Improving Critical Facility Safety from Flooding and High Winds.

Power and back-up power

- Electricity plays a critical role in tobacco operations and having standby power equipment to operate bulk-curing barns during an unplanned power interruption can eliminate some of the frustration and economic risks. Create a back-up power plan, and store with your Farm Emergency Plan (see below). Check local, county, and State codes for any requirements to supply back-up power during short-term emergencies.
- Farm operations must compare the cost of standby power equipment to the potential financial loss and inconvenience resulting from extended power outages. Any standby power capacity must be adequately sized for a given number of curing barns. **Consult with your electric utility and electrician for assistance with selecting generators.**
- Stationary standby power units use an internal combustion engine coupled to a generator, commonly referred to as a "genset." Portable engine-driven units may be driven by a small engine fixed to the generator or by the power take-off (PTO) of a tractor. Approximately 2.25 hp per kW of electrical power is required to properly run a generator. For example, a 50 kW generator would require a tractor rated at least 113 hp (50 kW x 2.25). Tractor rated performance is typically

measured at the PTO. Make sure that you and all employees who use the system read and understand all of the manufacturer's recommendations on its safe operation. Contact your electrical utility provider before installing any generator.

- Make sure you have enough stored fuel for the tractors that might be used to operate PTO driven standby generators. A 50 kW generator, for example, would require a tractor rated higher than 110 hp and would consume 7 to 10 gallons of diesel fuel per hour when operated at full load. Generators rated at 100 kW and higher will require a much larger tractor, which can consume 12 to 15 gallons of diesel fuel per hour. Plan to have enough diesel fuel to operate all the tractors needed for at least 2 weeks. This would allow enough time to get any barns loaded with tobacco prior to a hurricane through the curing process or at least through the most critical curing stages so the tobacco can be stored longer with reduced risk to the cured leaf quality until power is restored.

Sizing the Generator

- **Work with a qualified electrician to size and install your back-up power system.** The first factor in determining the generator capacity you require is the size and nature of the load. In a curing barn the largest electric load is the fan motor. This type of motor can require 3 to 5 times its rated full load current while starting up, and electric motors' larger starting loads must be taken into consideration when calculating the total electrical load that the generator will need to serve. Fan electric motor sizes are typically, 10, 7.5, or 5 hp. The starting and full-load running power requirements for various sizes of single-phase motors are included in Table 1.

Table 1. The Starting and Full-Load Running Power Requirements for Various Sizes of Single-Phase, 60 Hz Electric Motors

Motor Size hp (kW)	Approximate Amps @ 240 Volts	kW Required (Starting)	kW Required (Running)
1/2 hp (0.37 kW)	5.0 amps	2.3 kW	0.6 kW
3/4 hp (0.56 kW)	7.0 amps	3.4 kW	0.9 kW
1 hp (0.75 kW)	8.0 amps	4.0 kW	1.0 kW
2 hp (1.50 kW)	12.0 amps	8.0 kW	2.0 kW
3 hp (2.24 kW)	17.0 amps	12.0 kW	3.0 kW
5 hp (3.73 kW)	28.0 amps	18.0 kW	4.5 kW
7.5 hp (5.60 kW)	40.0 amps	28.0 kW	7.5 kW
10 hp (7.46 kW)	50.0 amps	36.0 kW	9.0 kW

- The second factor to consider is whether all or only part of the barns will be operated at the same time. The total required generator capacity may be substantially reduced if part of the load can be switched off temporarily. Situations in which motors start automatically are particularly problematic because, sooner or later, several motors starting at the same time will severely

overload the system, overheating the generator and thus decreasing its operational life and potentially destroying it if the problem isn't solved quickly. Preventing simultaneous starting of motors or otherwise managing loads can reduce the required capacity (and therefore cost) of your stand-by system and prevent overload.

- It is important that the engine or tractor selected be capable of prolonged operation at high output. When selecting a generator, carefully consider both the run capacity and the overload capacity. The engine should also be capable of maintaining a very constant speed over a wide range of load conditions. Some generators have substantial overload capacity, though limited to short periods of operation. When 2 ratings are provided on the unit nameplate (for example, 10,000 W/5,000 W), the larger number is the short-term overload rating and the smaller number is the continuous-run rating achievable over long periods of time.
- The generator selected must be able to produce power at the voltage and frequency required by the equipment. Almost all electrical power used on small and medium-sized farms is 120V or 240V single-phase power, but many larger operations now operate on 3-phase power. If properly connected, 3-phase generators may be used to power single-phase equipment, but the reverse is not true: single-phase generators cannot power 3-phase equipment without expensive phase conversion equipment.
- Multiple generators or a large capacity unit is required to operate all of the barns in a large tobacco operation. This example uses Table 1 to determine the generator capacity for 10 bulk barns with a 10 hp fan motor. A 10 hp motor requires 9 kW to run but 36 kW to start, and to avoid having to size the generator to serve the starting load of all 10 motors simultaneously, each motor is started in sequence, with a maximum load occurring at the end when the last motor is started when the previous nine are already running. Then: 81 kW (9 kW x 9) + 36 kW = 117 kW required. The tractor PTO power needed is at least 264 hp (117 kW x 2.25).
- Make sure that greenhouse inflation fans have back-up generator support in case power is lost. Most inflation fans use fractional horsepower electric motors (less than 1 hp). Use Table 1 for sizing the generator.

Wiring the Generator

- The National Electrical Code (NEC), the power utilities, and good sense require that any standby generator be connected to the load through a transfer switch, a double-throw switch that prevents the accidental connection of the generator and the power company to the load at the same time. Either the generator or the power grid can be connected to the equipment, but never both. Unless a transfer switch is used, power could be fed back onto the power line from the generator, endangering people working to repair the lines. In addition, the generator

would be destroyed if the power grid were reenergized while the generator was connected to the load. The switch must be rated to carry the highest potential current; common sizes are 100, 200, and 400 amps.

- If you decide to purchase a generator with automatic (as opposed to manual) transfer equipment, get professional assistance in selecting your generator(s) and designing the overall system.
- The wiring of standby power equipment, even when temporary, should always comply with the NEC (or any local code which may prevail) and be installed by a licensed electrician. Generators should be well-grounded and positioned as close as practical to the loads in order to reduce the wire length (and thus the cost). Make every effort to protect the lines from mechanical damage, with wire run overhead if at all possible and otherwise buried.
- Post the operating procedures near each generator. Consult your owner's manual for specific safety, maintenance, and operational recommendations.

Roads

- The primary driveway into the farm should have adequate drainage to prevent flooding. The road should be well packed with a solid base that will hold up to heavy equipment and trucks during extreme conditions. For more information on maintaining unpaved roads, see the USDA Environmentally Sensitive Road Maintenance Practices for Dirt and Gravel Roads.
- If you do not have a secondary entrance to your farm, construct one if possible to provide alternative access from a different road in the event the primary entrance is blocked.
- If the farm is in a location where all roads leading in and out may flood, purchase or make arrangements to rent or borrow a boat that can safely navigate the floodwaters to gain faster post-hurricane access to your property.

Drainage

- Total water management is essential, including irrigation and drainage systems, and must take into account the water table and soil drainage.
- Increased sand content improves drainage, whereas higher silt and clay contents reduce drainage. In soils prone to developing a hard pan, perform deep tillage using a subsoil implement such as a ripper-bedder, or strip tillage to help improve soil percolation and reduce the time that water stands in flooded areas.
- Develop surface and subsoil drainage including a system of canals, ditches, beds, and/or drain tiles. Ditches between beds must have enough capacity to accommodate and channel excess water.
- Consider creating water retention areas to reduce overall flooding during low- to moderate-intensity hurricanes.

- Make sure culverts are properly designed regarding size and location.
- For more information about water management, see:
  - Sustainable Agriculture Research & Education's (SARE) *Building Soils for Better Crops* Irrigation and Drainage chapters

Water table

- The amount of flooding will be determined by your land's topography, the amount of precipitation received, and the pre-hurricane water table. The higher the pre-hurricane water table, the more likely that flooding will occur for a given amount of precipitation. The chance of flooding can be estimated by measuring the pre-hurricane water table and considering the effects of varying precipitation amounts:

  A general rule of thumb is that 1 inch of rain will cause the water table to rise about 10 inches in fine textured soils, 6 inches in most of the flatwoods sandy soils, and 4 inches in coarse sands. It may take 4 to 6 days for the water table to return to its desired levels following rains of 1 inch or more. For example, if the water table is at 50 inches, 6 inches of precipitation will cause localized flooding on fine textured soils, but no flooding would occur on sandy soils.

Irrigation

- Locate irrigation pumps in elevated areas to reduce flooding risks to the pump and install them with a backflow prevention device to avoid contamination in case of power loss. Keep the access road to the pump clear so that it is easier to bring in generators or diesel-powered pumps after a hurricane.

Trees and windbreaks

- Remove trees that could potentially blow down and block the entrance to the farm.
- If land is elevated and unprotected, consider creating wind breaks along the edge of fields. This is particularly valuable if adjoining land has bare soil and can prevent or reduce sandblasting of plants during a hurricane.
- Trees and shrubs used as windbreaks should be native species that will develop strong, deep root systems and be hardy enough to resist breaking during high winds. For example, red cedar (*Juniperus virginiana*) resists strong winds very well. Keep trees or shrubs pruned and free of dead or dying branches.
- For more information about how windbreaks can protect crops and provide economic, environmental, and commercial benefits, see the USDA National Agroforestry Center website.

Debris disposal

- Create a plan for salvage operations including a method of debris disposal. Learn what materials and the specifications regarding composition of materials the landfill nearest your farm will accept and identify alternatives if needed. For disposal of chemicals or other hazardous materials, follow specific procedures to meet U.S. Environmental Protection Agency (EPA) requirements.

Crop concerns

Variety selection

- Choose disease-resistant crop varieties to improve plant health and decrease susceptibility to outbreaks when plants are stressed. Genetic resistance to diseases commonly observed after a hurricane (Brown Spot, Angular Leaf Spot, and Target Spot) has not been evaluated in modern flue-cured tobacco varieties; therefore, it should not be assumed that certain varieties are more resistant than others are. Alternatively, plants that are healthy prior to a hurricane have a better chance of surviving the event; therefore, genetic resistance to other diseases should be used in areas with a history of those issues.

Planting dates

- To ensure that any hurricane damage to your crop is covered by your crop insurance, plant your crop before the final planting day for crop insurance in your State. This may vary by county and year, so use the USDA RMA Actuarial Information Browser Tool to determine the final planting date for your crop. While the late planting period continues beyond the final planting date, check with your insurance provider for details that may apply if you plant during this time period. Look closely at insurance policies to determine specific details, as requirements can change.

Cover crops and crop rotation

- Consider planting cover crops in rotations of 3 to 4 years to improve soil health, reduce pest pressure, and help reduce the development of disease should field access become restricted due to a hurricane. Leguminous cover crops should be avoided due to their nitrogen contribution to the soil system. Small grain cover crops, such as winter wheat or cereal rye, are much better alternatives for tobacco.
- See the following resources for integrating cover crops into your management plan:
  - USDA Natural Resources Conservation Service (NRCS) website
  - Alabama Cooperative Extension System website

  - SARE Cover Crop Economics: Opportunities to Improve Your Bottom Line in Row Crops
- To learn about cover crops and Federal crop insurance, visit the USDA RMA Cover Crops and Federal Crop Insurance website.

Emergency planning

Farm Emergency Plan

- U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations require an employer with more than 10 employees to have a printed copy of an emergency action plan readily accessible to all employees. (If you have 10 employees or fewer, the emergency plan may be reviewed orally.) For more information about emergency preparedness for farm workers, see the OSHA Agricultural Safety Fact Sheet.
- Consider bringing together a disaster planning team, which could consist of the farm owner and engaged family members, the farm manager, an insurance representative, county Extension agent, and other individuals.
- Create your Farm Emergency Plan. See **Appendix: Farm Emergency Plan** for a sample plan that you can customize for your operation. The plan should include a checklist of tasks necessary to secure the facilities, fuel supplies, chemical supplies, and equipment; protect any animals on site; disconnect electricity and gas service; ensure that critical supplies are well stocked; etc.
- Make sure all of your employees know the formats (electronic or hard copy) and locations where the Farm Emergency Plan is stored.
- Consider creating a "hurricane suggestion box" where employees can place ideas for training and planning they believe would increase the operation's resilience and safety in the face of a hurricane, based on their previous experience.

Maps and signage

- Prepare or update maps for all facilities, including locations of alternate entry/exit routes, electrical equipment (with shut-off options), fuel storage tanks (both above and below ground), propane tanks, compressed gas (for welding, etc.), and chemical spill equipment.

Hurricane tracking apps

- Download one or more computer and mobile device applications (apps) that model hurricane track predictions, send alerts, and track hurricane impacts. Given the rapid advance of mobile technologies, check for new options each year prior to hurricane season. The NOAA National Hurricane Center website is a good source for keeping up to date on the latest hurricane activities. For more information about emergency alerts, see the U.S. DHS Ready.gov website.

Roles and responsibilities

- Designate an Emergency Response Team for your farm. Members of the team should be:
  - Thoroughly trained and physically capable of performing assigned duties
  - Knowledgeable about the hazards found on the farm
  - Trained in decision making regarding when to take actions themselves and when to wait on outside emergency responders
- Define a chain of command with clearly defined primary and secondary roles and each person's responsibilities. Some individuals may not be reachable after a hurricane, so alternative levels of authority need to be established to resolve critical issues quickly. In your Farm Emergency Plan, list who will be responsible for each task and how they'll report fire, flooding, building collapses, and other emergencies. Identify procedures to be followed by the people who remain to handle critical operations.

Communication

Emergency Contacts List

- Develop and maintain a list of all people connected with your operation that should be contacted in an emergency. See **Appendix: Emergency Contacts List** for a template that you can customize. The Emergency Contacts List should include names, phone numbers, email addresses, locations, and all other pertinent information for individuals (owners, family members, employees, employee family members), emergency responders, State and local agencies, contractors and suppliers, and anyone else who is on your farm on a regular basis or provides crucial emergency services.
- Keep copies of your Emergency Contacts List—hard copies as well as electronic copies—in multiple locations including your home, office, and vehicle; with all family members and key employees; and in additional safe locations. It is a good idea to have this information stored on your and your employees' cellular devices.

Lines of communication with local businesses and officials

- Establish communication with your local law enforcement and fire departments, electricity and gas providers, and other key groups to help them understand the nature of your business so that they can respond as needed in the event of a hurricane. Let them know the number of employees typically on site, the potential impact of the hurricane on crops, and the potential hazards that could lead to environmental contamination in the event of a flood or structural damage.

Post-hurricane communications

- Purchase a battery-powered or hand-crank radio to stay up to date about conditions beyond your property in case you lose electricity for an extended period of time.
- Consider ahead of time the locations where producers and others could meet if all communication lines are down (e.g., a local feed or equipment supplier).
- Contact a local AM radio station to see whether it could serve as a communication channel in the aftermath of a hurricane.
- For more information about communicating before, during, and after a major disaster, see the FEMA website.

Electricity and gas

- Contact your local utility company for guidance on how to disconnect power in the event of downed lines. Record their instructions in your Farm Emergency Plan.
- If certain equipment requires specialized shutdown procedures, train employees in these procedures.

Equipment operation

- Train personnel in the safe operation of unfamiliar equipment (such as generators or drainage pumps) that they may have to use in case of a hurricane.
- Make sure that appropriate employees are prepared to set up your back-up generators. They should refer to your Back-up Power Plan for information about where generators and generator fuel can be found, where they should be placed in preparation for a hurricane, and how they are to be connected to the electrical loads they will power.

Drones

- Consider getting an unmanned aerial vehicle (UAV) (i.e., drone) pilot license and purchasing a UAV. Small UAV quadracopters or hexacopters that can be equipped with visual or RGB cameras are relatively inexpensive ($500 to more than $2,000). Use of UAVs will help with damage assessment if accessing fields directly is impossible or unsafe. For regulations and information about operating a UAV, see:
  - U.S. Department of Transportation Federal Aviation Administration Unmanned Aircraft Systems website
  - University of Florida IFAS Preflight and Flight Instructions on the Use of Unmanned Aerial Vehicles (UAVs) for Agricultural Applications

Chemical safety

- Take the necessary steps to prevent chemical spills from storage tanks containing fuel, herbicides, pesticides or other potentially dangerous liquids.

Basic emergency response skills

- Train all members of your Emergency Response Team in the use of various types of fire extinguishers, first aid, and CPR (cardiopulmonary resuscitation).

Long-Term Operation Maintenance

Periodic checks of systems already in place
(described in the previous section)

Prior to hurricane season

Contact your local Extension office and other State and Federal resources for further information specific to your circumstances.

Annual review of emergency planning tasks

Farm Emergency Plan review and reassessment

- Review your Farm Emergency Plan with your employees to ensure that they are familiar with all elements. Make any necessary additions or updates.
- Review your Emergency Contacts List with your employees and update it with current names and contact information.
- Review items provided in the "hurricane suggestion box," and add them to your Farm Emergency Plan or training list as relevant.

Employee training

- Identify key tasks that employees will need to complete during hurricane preparation and recovery operations.
- Once each year, provide training for all employees that will participate in the key tasks identified above.

Personal health and safety tasks

- Make sure you and your employees have up-to-date tetanus shots.
- For information and links to time-specific guidance for preparing yourself and your home, visit the U.S. DHS Ready.gov Hurricanes website.
- Download the FEMA Mobile App to learn emergency safety tips, receive real-time weather alerts and important disaster planning reminders, information about shelters and recovery centers, and more.

Recordkeeping, documentation, and insurance

- At the time of renewal, review your insurance policies with your agent to be sure that you have adequate flood insurance and coverage for vehicles, farm buildings and structures, and crops.
- Keep records of harvest, equipment inventories, and purchases of supplies up to date. Long-term records will help to establish a production baseline from

which losses can be determined. Be sure that copies of each are in a safe location chosen in the **Building a Resilient Operation** section above.

Infrastructure

Buildings and facilities

- Inspect all buildings and all facilities for structural soundness. Perform maintenance on facilities and infrastructure to repair items such as loose roofing materials or improperly/inadequately grounded electrical equipment to reduce hazard risk during a hurricane.
- Inspect greenhouses annually to ensure that structural integrity has not been compromised.

Drainage

- Field maintenance is critical for maximized crop production and minimized effects of adverse weather. Maintain field borders to allow for sufficient drainage. Before and during the peak hurricane season, make sure waterways and ditches are free of debris and vegetation to ensure that water removal may occur as quickly as possible. Keep ditches clear through a good maintenance program including chemical weed control. Regrade areas of the property that are prone to flooding to improve drainage.
- Check any new construction areas, housing developments, or Department of Transportation projects nearby to see whether they are affecting your land's drainage. Determine where the water is draining now, and address any new drainage needs before hurricane season begins.

Maintenance of trees, windbreaks, and roads

- Trees with the potential to fall on any structure should be removed prior to hurricane season. Similarly, dead limbs should be removed from healthy, non-threatening trees in order to reduce hurricane debris. Farm paths should likewise be maintained annually to ensure that travel is not inhibited during and after a hurricane. Road maintenance should include culvert reconstruction and general reconstruction if integrity is compromised.
- Maintain windbreaks with regular pruning, especially if they are close to aerial power or telephone lines. To learn more about proper pruning practices, see:
  - Inland Urban Forest Council A Practical Guide to Proper Pruning of Trees and Shrubs
  - OSHA Line-Clearing Tree Trimming Operations website
- Evaluate roads for any repairs or improvements needed before a hurricane arrives

Harvest equipment

- If possible, ensure that you have access to additional harvest equipment or increasing row capacity, as this can reduce the time required to harvest portions of your acreage under time-limited windows, such as when a hurricane is

approaching. The demand for this equipment will rapidly increase as the hurricane approaches so plan early for this contingency.

- Keep your supplemental pumps in good working order. Follow the pump manufacturer's recommended maintenance procedures included in the manual. At a minimum, bearing lubrication and the shaft seal condition require routine preventive and protective maintenance.

Generators

- Do routine annual maintenance on backup generators. Proper, timely maintenance is imperative to ensure that generators are ready for immediate use when needed.
- Operate your generators periodically at least 50% of the rated load to be sure they are functioning properly. Ensure that all essential equipment functions when powered by the generators.
- Keep generators clean at all times, as accumulation of dust and dirt may cause a unit to overheat when operating. Replace old stored fuel with new, fresh fuel. Replace fuel filters, test all generator circuits, and make sure you have all necessary supplies on hand, including spare belts and fuel filters.
- Store generators out of the weather but not covered with a tarp, as this would allow moisture to condense inside the unit and potentially cause rust.
- Make sure that all farm employees who might be involved with operating a standby power unit are completely familiar with their set-up and are trained annually on how to safely operate the equipment.

Emergency equipment and supplies

- Maintain an ample supply of emergency medical supplies, and have raincoats and boots available for employees.
- Maintain a supply of drinking water and dry and canned food sufficient for at least 2 weeks for employees who become stranded at the farm or who need to return to the farm before utility and emergency services are restored.
- Maintain an ample supply of weather-proofing supplies such as tarps and sandbags; fencing supplies; plumbing supplies; lumber, construction tools, nails, and ropes; portable lights; batteries; and battery-powered or hand-crank radios.
- Check supplies of shade cloth, greenhouse parts and covers, staple guns, staples, and poly tape.

Monthly considerations during hurricane season

See **Appendix: Resource Links** for local Extension offices and other State and Federal resources which you may consult for further information.

Weather monitoring

- During the June to November hurricane season, pay regular attention to long-term weather forecasts. Check your weather tracker daily if a hurricane is forecast to move closer to your area.

Equipment and supplies

- Check list of equipment and supplies for repairs that may be needed after the hurricane.
- Note supplies that take longer to deliver and order early to ensure they are available after a hurricane. Stockpile chemicals that are essential for your operation.
- Refresh emergency medical supplies, water, and dry and canned food supplies.
- Obtain sufficient quantities of plywood to protect windows and doors and store in a dry area. As the hurricane gets closer, plywood may be scare or unavailable.

Farm equipment

- Make sure that sprayers, tractors, and harvest equipment are in good working order to ensure that the crop can be harvested as efficiently as possible when conditions allow.
- Contact your equipment manufacturers to establish procedures for dealing with damaged equipment. Make sure you won't invalidate your warranty if you attempt repairs yourself.

Fuel

- Consider fuel needs for tractors, generators, and farm vehicles. Any fuel stored on site poses a contamination risk if storage tanks are not adequately protected from flooding, especially if stored at a low elevation. Maintain additional fuel supplies on the farm in elevated tanks protected from flooding. This could even be in trailer- or truck-mounted diesel tanks. If secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected hurricane impact.

Generators

- Verify there is adequate fuel to power the generators for at least 2 weeks.

Short-Term Preparedness

Specific actions to be done in the week
before a hurricane arrives

Bracing for the hurricane

(1–7 days before a hurricane is forecast to strike)

First and foremost, take whatever precautions necessary to protect your family, your employees, and yourself. After that is accomplished, focus on protecting your farm. Once forecasters have put your area in a hurricane's path, there are a number of precautions you should take to prepare.

Employees' roles and responsibilities

- Review your Farm Emergency Plan with all employees and discuss each person's responsibilities.
- Continue to monitor hurricane track and strength updates. Listen closely for evacuation orders in your area.
- Determine whether individual employees plan to evacuate or stay during the hurricane. For those who evacuate, establish a schedule for checking in after the hurricane so that they know the extent of the damages and when it is safe to return. For employees who stay, be sure they have safe lodging, sufficient food and water, and an established plan for checking in.
- Ensure that all managers know their responsibilities prior to, during, and after the hurricane. Handling the hurricane damage is too much work for 1 or 2 people.
- Ensure that personnel have training in first aid and key personnel know how to operate unfamiliar equipment (for example, a chainsaw to remove trees blocking roads).

Communications

- Ensure that all communication equipment is in good working order. Cellular phones are good for communication, but ensure radios are available and in good conditions of use. Keep mobile devices fully charged. Have rechargeable battery packs or charging cables for your vehicle to maintain communication. Texting may be a more valuable form of communication than calling when the phone networks may be overwhelmed.

Food, water, and cash

- Make sure your operation still has at least a 2-week supply of drinking water as well as dry and canned food.
- Secure cash reserves for purchasing supplies after the hurricane. In widespread power outages, credit and debit cards will not work, and many vendors do not accept checks.

Recordkeeping, documentation, and insurance

- Ensure that important documents are in a safe dry place and that duplicates are in alternative locations off site.
- Document the condition of your facilities, roads, equipment, and crop. Take photographs and video (where helpful), record crop maturity, and estimate yield, as this will aid with insurance claims and disaster recovery assistance. If crops are damaged or lost, these records will help with the damage assessment and post-hurricane claims. Check with your Extension or crop advisor on the best way to calculate a yield estimate for your crop.
- If you have insurance through FEMA's National Flood Insurance Program, your policy may cover up to $1,000 in loss-avoidance measures such as installing sandbags and water pumps to protect insured property. Check with your insurance provider to confirm. Keep copies of all receipts and a record of the time spent performing the work and submit these documents to your insurance adjuster when you file a claim to be reimbursed.

Equipment

- Ensure that all emergency equipment is ready (e.g., compressors and heavy machinery).
- Make sure chainsaws are in good working condition. Stock up on fuel mixture and bar and chain oil. Sharpen the chain, keep the saw file and saw wrench close at hand, and make sure you have a spare chain.
- Move all non-critical farm equipment to higher elevations or store in secure buildings.
- Move pesticides, herbicides, and fertilizers to a secure place, on high ground above any potential flooding if possible.
- Ensure that tanks containing fuel, fertilizer, and other liquids are kept full and tied down.
- Make sure that farm equipment you will need after the hurricane, such as tractors with front-end loaders or skid-steer loaders, is fully fueled and operational.
- Unplug computers and other electronic equipment to protect from electrical surges, and store these items safely.

Infrastructure

Backup generators

- Be sure your backup generators are fully operational, with full fuel tanks and portable fuel storage tanks. Your generators may have to run for several days until the power company can restore electricity. Review the owner's manual for the maximum run time and other unit specifics.

Fuel

- Ensure that all farm fuel storage tanks are full if they can be located above the likely flood level.
- Make sure that you have a minimum of a 2-week supply of diesel and gas. Be sure the supplier understands how much you use daily and that it is necessary for farm operations. If secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected hurricane impact. Consider fuel needs for tractors, generators and farm vehicles.
- Service stations will not be able to supply fuel if they do not have electric power for the pumps, so make sure portable fuel storage tanks are full.
- Any fuel stored on site poses a contamination risk if storage tanks cannot be adequately protected from anticipated flooding. Move them to higher ground or secure in place.

Electricity and gas shut-off

- Consult your Farm Emergency Plan and follow procedures for disconnecting electrical power and gas to some or all buildings and any non-critical equipment in danger of being flooded.

Buildings and grounds

- Secure building components—Check on the security of roofing and siding materials and windows and doors, and make sure all other building components are tied down securely.
- Secure outdoor objects—Secure outside objects around your farm so that they don't blow away or become hazardous projectiles.
- Protect greenhouses
  - —Properly secure greenhouse infrastructure by closing the curtains and maintaining roof inflation. Roof inflation will help to provide uniform wind resistance across the entire structure.
  - —If roof integrity is questionable, or if wind speeds will compromise integrity, remove the greenhouse roof entirely and store in a safe location.
  - —Secure all greenhouse doors and ventilation areas to improve wind resistance. Cover all greenhouse openings.

- Remove all loose material from inside the greenhouse. Loose items can damage curtains and plastic coverings, which will reduce greenhouse integrity.
- Perform a final walkthrough of the greenhouse to ensure that previous efforts to secure the structure remain intact.

Roads

- Perform a final inspection of you farm to ensure that roads and buildings are fully prepared for the hurricane. If the roads leading to the farm are likely to flood, stage your boat in a secure, easy-to-access location.

Drainage

- Check drainage ditches and culverts around your facilities and remove any debris.
- Pump down all water from ditches to the maximum extent possible.

Supplies

- Review inventories and order any additional supplies that can be delivered before the hurricane.

Crop

Harvesting

- Strategically plan harvesting to minimize the number of barns that will be in the most critical curing phase for damage to occur if standby power equipment capacity is limited or not available after the hurricane. If you have sufficient generator capacity to operate all curing barns during a power loss, then proceed with harvesting until weather conditions limit accessibility. Worker safety must be the driving factor for all decisions.
- If the crop has reached maturity, harvest the fields most vulnerable to flooding or restricted access, and/or the fields that are most mature.

Personal safety the day before the hurricane hits

- Perform a final verification of the hurricane track and strength. Listen closely for evacuation orders for your area.
- Obey all mandatory evacuation orders. Failure to do so, can put you and your workers at risk, and could tie-up rescue resources. Do not require your personnel to be present on the farm either, since they also have to prepare themselves and their families.
- Make sure your employees have evacuated to secure areas at least 1 day prior to hurricane impact. If some staff will remain on site, confirm that they have access to structures on high ground or elevated slabs or pylons that can withstand hurricane winds and rain, sufficient stores of clean water and food, medical

supplies, working radios or cell phones, and sufficient battery or generator power. Those workers remaining on site will likely need to rely on cell phone/text communication with evacuated supervisors and colleagues, since local radio and television communications often black out for several hours as a hurricane passes. Local first responders may also be out of communication at the time of hurricane impact.

- Personnel remaining on site to monitor the farm until the last moment should keep an eye on water levels in low-lying areas so that they may give sufficient warning and allow workers to exit the operation before levees, surrounding roads, and highways are blocked with floodwaters.

Post-Hurricane Recovery

Activities that can be taken to minimize losses immediately after, a week after, and a month after a hurricane

Immediately after the hurricane has passed

Safety

- Make safety your first priority. Do not rush back into a facility until you are sure it is safe. Use extreme caution due to the potentially injurious situations presented by weakened trees and damaged structures, equipment, and electrical and gas systems.
- Continue to watch the weather forecast. Are waters still forecast to rise more than they are now? Some floodwaters peak up to a week after the hurricane.

Electricity and gas

- Avoid downed power lines as these may still be live and represent an electrocution hazard. Operate on the assumption that all downed power lines are live. Remember that a downed power line on a fence may energize the fence.
- When restoring electricity to buildings that have flooded, use extreme caution and consult with an electrician and your power provider. See the Alabama Cooperative Extension System guidance on restoring electrical power after flooding.
- Natural gas or liquid petroleum (LP) gas leaks can cause deadly explosions. Check for natural gas or LP gas leaks, and if a leak is suspected, turn off the gas, evacuate the area, and notify your gas company and local law enforcement. Tell employees to stay clear.

Groundwater

- After a flood event, groundwater should be used with caution if contamination is suspected anywhere in the general vicinity.

Roads and buildings

- Before entering any buildings, check for levee breaches, rising or incoming water, and evidence of structural fire or damage.
- As soon as it is safe, call in the employees needed for inspection and clearing debris from roads. Cordon off areas that are unsafe.

Security

- Watch your farm for unwelcome visitors like looters. Secure your equipment and farm entrances, and make sure your security cameras are operational.

Recordkeeping, documentation, and insurance

- Do not begin cleaning up or repairing damage until you have thoroughly documented the damage. Contact your crop insurance adjuster as soon as possible to decide on the best plan moving forward with potential damage to your crop. (See "Within a week following hurricane impacts" below regarding post-hurricane documentation.)
- If you have experienced flooding and have flood insurance through the FEMA National Flood Insurance Program, visit their website for more information about starting a claim.

Within a week following hurricane impacts

Personal health and safety

- Take care of yourself during recovery. Disasters and the recovery period afterward take a toll on human health. Disaster recovery takes a long time and can be very stressful. For guidance to help you through this difficult time, see:
  - Colorado State University Extension Coping with Natural Disasters
  - North Carolina Cooperative Extension Tips for Handling Family Stress After Disasters

Communications

- The local supply/seed stores are often natural sources of information if the power is down and electronic communication is limited. In addition, radio stations have generators that allow them to transmit if their towers are not damaged.

Recovery assistance

- Before beginning cleanup, talk with your insurance company and consult with disaster assistance program agents to learn about available programs, eligibility requirements, and application procedures. (See "Disaster assistance" below for more information about assistance programs.)

Documentation of damage

- Many disaster assistance programs will become available after the disaster, perhaps even years later, and an operation can only receive assistance for damage that was documented. For instance, the Emergency Conservation Program (ECP), administered by FSA, can compensate farmers for repairing damage due to a natural disaster which would create new conservation problems. The work must

be documented, and farmers must have gotten authorization from their local USDA office in advance.

Photos and video

- Take photos or video first, before beginning any cleanup or repairs. Photograph and take video of damaged crops and property, with written notes describing what is in the pictures and where they were taken. This "after" documentation will be used with your pre-hurricane, "before" documentation to clearly show your losses.

Drones

- If you own and have a license to operate a UAV (i.e., drone), utilize it now to take aerial photographs of damage to your fields. Some local Extension offices might have access to drones and personnel with a drone pilot license to assist you.

Written records

- Keep a notebook with you throughout the recovery period. Describe the work you did and record all expenses. Keep a running log of names and what was discussed during conversations with insurance, State, and Federal agency contacts to create a valuable, third-party record of your recovery efforts that can be used later as documentation for disaster assistance programs. You may not remember everything that was discussed at these meetings, so have a second person involved in the conversations if possible so that one can ask questions and the other can take notes.

Disaster assistance

- Communicate early and often with recovery assistance contacts. Check in with them throughout the recovery process. Note that assistance will vary from one hurricane to the next and one budget year to the next.
- Call your local FSA Office to report any losses or damages and inquire about available assistance programs, application procedures, and deadlines.
- Check in with your local Cooperative Extension office, USDA agencies, and your State department of agriculture to see what assistance may be available following the hurricane.
- Consult the following resources:
  - FEMA Individual Disaster Assistance website to find the closest recovery center and other resources to assist you during your recovery
  - USDA Disaster Resource Center's Storm website for updates on emergency designation areas and available assistance programs
  - Farmers.gov, including the five-step Disaster Assistance Discovery Tool to learn which USDA disaster assistance programs are available to assist you with your recovery
  - U.S. Department of Labor's Disaster Unemployment Assistance Program website

- To learn more about USDA Disaster Assistance Programs that may be right for you, see:
  - Noninsured Crop Disaster Assistance Program (NAP)—FSA program that provides assistance for eligible farmers who suffer losses or are prevented from planting agricultural commodities that are not eligible for protection by Federal crop insurance
  - Emergency Farm Loans—FSA program that provides eligible farmers and ranchers low-interest loans to help them recover from production and physical losses
  - Disaster Set-Aside Program—FSA program that allows eligible FSA borrowers to skip an annual installment payment and move it to the end of the loan repayment period
  - Emergency Watershed Protection (EWP) Recovery Assistance—NRCS program that provides financial and technical assistance to quickly address serious and long-lasting damage to infrastructure and land
  - EWP Floodplain Easement Program (EWPP-FPE)—NRCS program option for converting land to permanent easements for the purpose of improving floodplain management and reducing the threat to life and property
  - Environmental Quality Incentives Program (EQIP)—Year-round NRCS rehabilitation program with funding authority to provide financial assistance to repair and prevent excessive soil erosion caused or impacted by natural disasters
  - Emergency Conservation Program (ECP)—FSA program with technical assistance through NRCS that helps eligible farmers and ranchers repair damage to farmlands caused by natural disasters

Insurance claims process

- Begin the insurance claims process (Federal, private, or both). Accurate losses of inventory and equipment may not be fully documented yet, but insurance claims can take months to resolve following hurricane events so start the paperwork now.

Infrastructure assessment and repairs

- Assess damage to equipment and infrastructure and form a prioritized list of needed repairs.
- Gather quotes from qualified vendors to make repairs to facilities and equipment. Vendors are often overwhelmed in the months following a hurricane, so making contact soon after the hurricane is important for an expedient response.
- Monitor fuel levels in backup generators and order additional fuel as needed.

Crops

Field inspections

- As soon as it is safe, perform field inspections to best identify the areas where harvest can immediately resume, where damage is minimal, and where damage is greatest.
- Remove standing water from fields to promote plant recovery from partial or complete drowning. Flooding and/or saturated soil conditions greatly reduce oxygen in the root system of the plant, conditions that produce wilting symptoms in the leaves and makes them more susceptible to sunscald if temperatures become excessive (greater than 90°F) in the days following a hurricane.

Harvesting

- Assess equipment damage and take this into account for upcoming harvest operations. This will help in developing a plan for the coming weeks and months.
- Where possible, re-initiate harvest since wind-blown leaves will begin to senesce quickly after hurricanes arriving later in the growing season. Leaf-holding ability is often compromised following extreme, late-season weather events which hasten the ripening process.
- Any fields that were damaged but not flooded and are able to be harvested should be prioritized from the least to most damaged to minimize profit losses. Leaves with severe weather damage are likely have a black color after curing, which is not desired by industry.
- The optimum window for harvest, based on limited research following Hurricane Irene in 2011, is within 7 to 10 days after the hurricane clears (Table 2). Cured leaf measurements (yield, quality, price, and value) were greatest when tobacco was harvested 2 days after the hurricane. Subsequent harvesting at 10 day intervals (the approximate amount of time required to complete a curing cycle (fill, cure, bring into order, and empty)) resulted in declining cured leaf yield, quality, price, and value. In the second harvest interval (12 days after the hurricane), cured leaf yield began to decline, although not as rapidly as the 22- and 32-day harvest intervals. In the second harvest interval, cured leaf quality, price, and value were significantly lower than the harvest timing at day 2. For further information about this study, please visit the North Carolina Cooperative Extension Tobacco Portal.

Table 2. Upper-stalk position yield, quality, price, and value as influenced by harvest delay following Hurricane Irene in 2011

Harvest Timing (Days After Hurricane)	Yield (lbs/ac)	Quality	Price (2019 USD/lb)	Value (2019 USD/ac)
2 days	1,658	90	2.09	3458
12 days	1,583	79	1.57	2906
22 days	1,421	54	1.23	1854
32 days	1,028	22	0.63	656

Notes: Cured leaf quality is assessed on a scale of 1 to 100, with 100 denoting the highest quality. Results are pooled across the varieties PVH 2110, NC 196, GL 395, K 326, GF 318, CC 65, NC 299, NC 297, PVH 1452, and CC 35

- The reductions in quality and economic metrics after hurricane Irene were largely due to reductions in cured leaf quality that resulted from wind damage and the resulting hastened ripening process. Cured leaf quality declined at each harvest interval and was lowest at the 32-day interval
- Cured leaf color also provides an estimate of leaf quality (Figure 1). When harvest occurred 2 days after hurricane Irene, leaf color was dominated by ripe to over-ripe grades of tobacco (F and K color descriptions). As harvest was delayed, leaf deterioration and respiratory losses became more pronounced, with a large portion of leaves expiring prior to harvest.

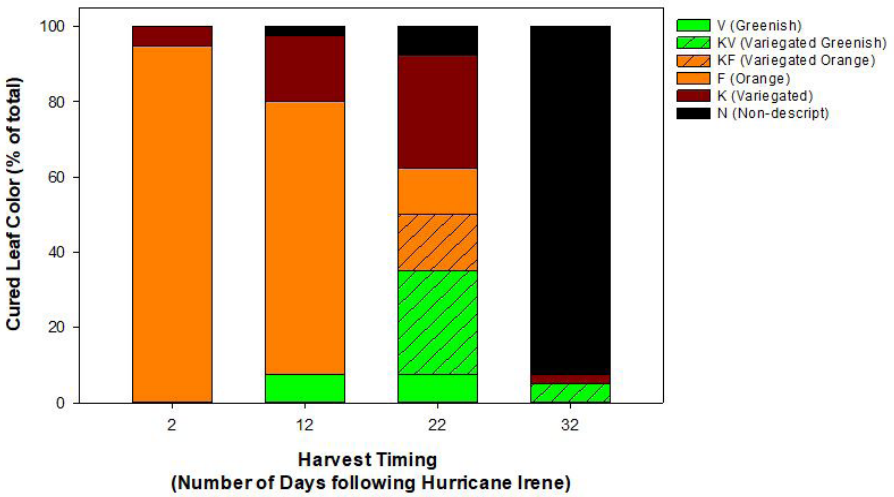

Figure 1. Upper-stalk cured leaf color as influenced by harvest delay following Hurricane Irene in 2011. Data are pooled across 10 varieties and reflect test averages of USDA color standards.

- Figure 2 demonstrates how fast leaf quality can decline when a hurricane strikes a mature crop. When harvest occurred 12 days following the hurricane, greenish (V) and non-descript (N) grades accounted for 10% of the grade distribution, thus lowering both quality and price (Figure 1, Table 2). Further delay of harvest to 22 days after the hurricane system cleared increased N grades to 7.5% of the total and variegated, under-ripe grades (KV and KF) to 42.5% (Figure 1). In addition, F and K grades were reduced to 42.5%, a decline of 48 and 58% relative to the 2 previous harvest intervals. In the final harvest interval, N grades accounted for 93% of all grades received, with KV and K grades accounting for 5% and 2%, respectively.

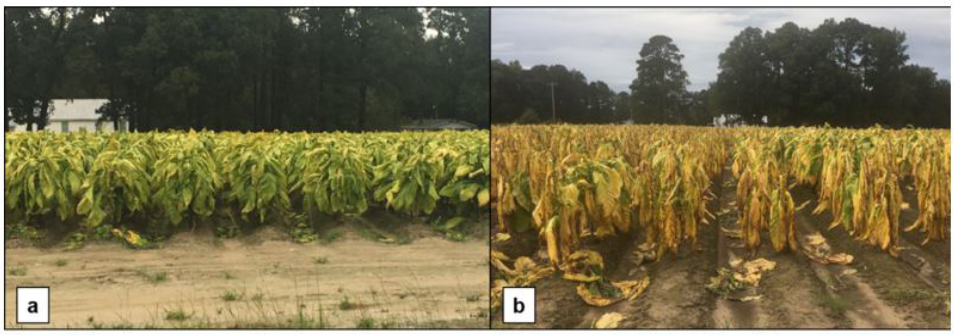

Figure 2. Leaf response to Hurricane Florence over a 72-hour period in 2018 - a.) Saturday (Sept. 15th) and b.) Tuesday (Sept. 18th).

- If standby generators are not available to operate your curing barns that were loaded with tobacco prior to a hurricane event, tobacco that would be in the critical curing stage in the barn during an extended power outage might be better left unharvested. The tobacco most certainly would have significant quality damage if in the barn without fan power and require more effort to remove. During the end of leaf drying and the stem drying phases, biological activity ceases, little or no heat is produced, and the tobacco can tolerate a much longer interruption of power without apparent damage.

Curing

- The period in the curing process when leaves are most vulnerable to damage is during late yellowing and early leaf drying (105 to 125oF dry-bulb / 95 to 105oF wet-bulb). Barns in this stage require a constant power supply, since without the circulation of air to prevent the buildup of heat, the leaf temperature can increase significantly in a short period of time and result in widespread leaf damage.
- Barns that are at dry-bulb temperatures within 18 to 24 hours of completion (160°F to 165°F) may be able to tolerate several days without power with little apparent damage. If generator capacity is limited, you could bypass barns near the end of stem drying and use the equipment to provide power to barns in the more critical curing stages.

- Operate your generator safely! Be familiar with and follow the maintenance and safety instructions in the manufacturer's manual. To prevent carbon monoxide poisoning, never operate generators inside any type of fully enclosed structure or partially enclosed structure.
- If no generator capacity is available to provide electricity, damage to harvested tobacco can be reduced, especially early in the yellowing stage, if the tobacco can be cooled to near ambient conditions by opening all barn air vents and doors to allow heat to escape. However, the longer the barn remains without electrical power the more likely significant damage will occur to the tobacco.

Diseases, pests, and weeds

- Diseases may develop if the crop has been flooded for 3 or 4 days.
- If your fields have been flooded with off-farm water sources, be aware of weed seeds that could have been carried in, presenting a new weed problem on your farm. Be aware of the management implications in subsequent seasons.

Potential salt damage

- Higher soil salt levels can accompany hurricane surges and cause severe damage and die-back to your crops. Tobacco is classified as sensitive to salt water and yields will decrease with elevated salt levels. Avoid measuring EC with a probe, as this will result in artificially high values.
- The most important salts to be aware of after a hurricane surge are sodium, chloride, and some extended nitrates. Some of the salts can be leached out with additional watering, but this can also result in nutrient deficiencies that must be addressed with fertilization following a soil test.
- Contact your University Extension office if you suspect your crops have been damaged by salt water.

Within a month after hurricane impacts

Recovery assistance and insurance claims

- After many natural disasters that result in widespread damage, additional programs often become available to aid with agricultural losses. These programs are not guaranteed, however, and are generally handled on a case-by-case basis depending on the hurricane's impact. In addition, some programs require additional processing time for a special appropriation from the U.S. Congress and Presidential approval.
- While a special allocation may not be immediately available, it is important to document losses and to illustrate to your legislators the impact of the hurricane on your operation. This information will help promote policy decisions and additional allocations that may become available.

- Continue to follow up on the insurance claims process. Begin filing for any additional State or Federal disaster assistance programs for hurricane recovery.
- Visit the USDA Disaster Resource Center Storms website for updated information about FEMA aid and other disaster programs.
- Continue to document everything and keep a record of conversations with agency contacts. This creates a valuable, third-party record of your recovery efforts that may be used later as documentation for assistance programs.

Organic certification

- If your farm is organic, it is important to consider how the hurricane impacts may affect your certification. Temporary variances from some organic practices are possible, so contact your certifier to determine whether your practices qualify. It is most important to report prohibited substances that may have infiltrated your farm.

Infrastructure and equipment

- Continue to gather quotes from qualified vendors to make repairs to facilities and equipment. Vendors are often overwhelmed in the months following a hurricane, so making contact soon after the hurricane is important for an expedient response.
- Monitor buildings for water damage or mold development, and monitor wells for coliform bacteria.
- Refill fuel tanks and check backup generators until full power is restored.
- Perform general and preventative maintenance on any equipment that was flooded. Keep all receipts for parts and labor as well as a list of any equipment that is determined to be a total loss.
- Examine drainage ditches and canals to determine to what extent they were silted in by floodwaters and need repair and cleaning of debris. Clean and/or repair drainage ditches on site.

Crop concerns

- Reconstruct production areas to fill in washouts so that commercial crop production may resume normally the following season. Repair damage to greenhouse structure(s) to ensure integrity throughout the off-season.

Caution about adding wood debris to agricultural land

Following recent hurricanes, farmers have been approached by contractors wishing to spread chipped and shredded tree debris on their land, often paying hundreds of dollars per acre to do so. While these additional dollars may be very helpful now, you will need to consider how this influx of carbon will likely require additional nitrogen inputs to maintain crop productivity in the future. If you are approached about considering this type of contract, ask lots of questions, know exactly what is going to be applied and at what rate, and factor in additional nitrogen fertilizer costs. If you want help determining the impact of a land application for your specific operation, contact your local county Extension agent. Like many other farming decisions, this all comes down to produced income versus the additional management it will require. For more information, see University of Florida IFAS Extension Considerations Before Contracting for Chipped or Shredded Wood Debris Application on Agricultural Land

Appendix

Farm Emergency Plan

Hurricane preparedness can have a direct effect on your farm's profitability and long-term survival. For agricultural operations in hurricane-vulnerable regions, it is critical to have a Farm Emergency Plan in place outlining key tasks and different people's roles and responsibilities as you brace for the hurricane. Your Farm Emergency Plan can save valuable time in a chaotic situation when multiple challenges clamor for immediate attention, helping you prioritize your actions and recover from the hurricane as efficiently as possible.

Use this sample plan to customize for your operation. Preparation for these tasks—putting the systems in place—is described in the main guide (see "Emergency planning" in the **Building a Resilient Operation** section). Though there is some overlap with the tasks listed in the **Short-Term Preparedness** section, this sample plan is intended to be a document you can use during an actual emergency.

Before the hurricane

Tracking the hurricane

- Use your hurricane tracking app. The NOAA National Hurricane Center website is a good source for keeping up to date on the latest hurricane activities. Learn more about emergency alerts at the U.S. DHS Ready.gov website.

Emergency Response Team

- Gather the members of your farm's Emergency Response Team, who have been thoroughly trained in their respective tasks and are knowledgeable about the hazards found on the farm.
- Review the chain of command and individuals' primary and secondary roles and responsibilities.
- Discuss modes of communication as well as alternatives in case any communication channels become unusable during or after the hurricane.
- Review your farm's Emergency Contacts List.

Employees' status and location

- Review procedures to account for all people and employees after an emergency evacuation. Determine who will evacuate and who (if anyone) will stay during the hurricane. For those who evacuate, establish a schedule for checking in after the hurricane. For those who stay, be sure they have safe lodging and sufficient food and water and establish a clear plan for them to check in.

Maps and emergency escape routes

- Using the map of your farm with all buildings and contents, review emergency escape routes and hurricane preparation procedures for each building, facility, and area of the operation.

Emergency equipment and supplies

Locate the following equipment and supplies:

- Emergency medical supplies
- Raincoats and boots
- Weather-proofing supplies such as tarps and sandbags
- Fencing supplies
- Plumbing supplies
- Lumber, construction tools, nails, and ropes
- Portable lights, batteries, and battery-powered or hand-crank radios

Food, water, and cash

- Make sure there is at least a 2-week supply of dry and canned food and drinking water (at least ½ gallon per person per day) stored on site if personnel will be staying on site.
- Secure cash reserves to use for purchasing supplies after the hurricane.

Facility security

- Ensure that important documents are in a safe, dry place.
- Check on the security of roofing and siding materials and windows and doors, and make sure all other building components are tied down securely.
- Secure outside objects around your farm, so that they don't blow away or become hazardous projectiles.
- Protect greenhouses (if applicable).
- Check drainage ditches and culverts around your facilities for debris.
- Pump down all water from ditches.

Equipment

- Ensure that all emergency equipment is ready (chainsaws, compressors, heavy machinery, etc.).
- Move all non-critical farm equipment to higher elevations or store in secure buildings.
- Move pesticides and fertilizers to a secure place, on high ground if possible.
- Make sure that farm equipment you will need after the hurricane, such as tractors with front-end loaders or skid-steer loaders, is fully fueled.
- Be sure your backup generator(s) are fully operational. Fill the fuel tank(s) and portable fuel storage tanks.

Fuel

- Make sure you have a minimum of a 2-week supply of diesel and gas. Be sure the supplier understands how much you use daily and that it is necessary for farm operations. If secure storage facilities are available on site, arrange for fuel deliveries several days prior to the expected hurricane impact. Consider fuel needs for tractors, generators, and farm vehicles.
- Any fuel stored on site poses a contamination risk if storage tanks cannot be adequately protected from anticipated flooding. Move to higher ground or secure in place.
- Since fuel may be unavailable if service stations have no power, make sure portable fuel storage tanks are full.
- Ensure that tanks containing fuel, fertilizer, and other liquids are kept full and are tied down.

Backup generators

- Retrieve backup generators and fuel and place them where needed.
- Connect generators to critical electrical loads as outlined in your Backup Power Plan.

Electricity and gas shutdown

[Outline the shutdown procedures for electricity and gas, according to instructions you are given by your utilities and other experts.]

[Outline the shutdown procedures for specific equipment.]

Service or equipment to be shut down	Procedures for shutdown

Crop

[Add actions specific to your crop.]

Immediately after the hurricane

Safety

- Make safety your first priority. Do not rush back into a facility until you are sure it is safe. Use extreme caution due to the potentially injurious situations presented by weakened trees and damaged structures, equipment, and electrical and gas systems.
- Continue to watch the weather forecast. Are waters still forecast to rise more than they are now? Some floodwaters peak up to a week after the hurricane.

Electricity and gas

- Avoid downed power lines as these may still be live and represent an electrocution hazard. Operate on the assumption that all downed power lines are live. Remember that a downed power line on a fence may energize the fence.
- When restoring electricity to buildings that have flooded, use extreme caution and consult with an electrician and your power provider. See the Alabama Cooperative Extension System guidance on restoring electrical power after flooding.
- Natural gas or liquid petroleum (LP) gas leaks can cause deadly explosions. Check for natural gas or LP gas leaks, and if a leak is suspected, turn off the main property gas line, evacuate the area, and notify your gas company and the authorities. Tell employees to stay clear.

Roads and buildings

- Before entering any buildings, check for levee breaches, rising or incoming water, and evidence of structural fire or damage.
- As soon as it is safe, call in the employees needed for inspection and clearing debris from roads.
- Cordon off areas that are unsafe.

Security

Watch your farm for unwelcome visitors like looters. Secure your equipment and farm entrances, and make sure your security cameras are operational.

Insurance and documentation

- Do not begin cleaning up or repairing damage until you have thoroughly documented the damage. Contact your crop insurance adjuster as soon as possible to decide on the best plan for moving forward with potential damage assessment, cleanup, and repair.
- If you have experienced flooding and have flood insurance through the FEMA National Flood Insurance Program, visit their website to learn how to start a claim.

Emergency Contacts List

You may customize this for your operation. Delete items that do not pertain to your commodity or location and add companies or organizations specific to your commodity.

Individuals

Name(s)	Role(s)	Phone number(s)	Notes
	Owner(s)		
	Members of the Emergency Response Team		
	Other key employees or managers		

Emergency Services

Organization	Name(s)	Phone number(s)	Notes
Emergency medical responders			
Hospitals			
Fire department			
Sheriff's office			
Emergency management agency			

Utilities, Roads, and Trees

Organization	Name(s)	Phone number(s)	Notes
Electric utility or cooperative			
Natural gas utility			
Water utility			
County road department or State Department of Transportation			

Insurance Companies

Organization	Name(s)	Phone number(s)	Notes
Commodity insurance companies			

Contractors

Organization	Name(s)	Phone number(s)	Notes
Electrical contractor			
Plumbing contractor			
Mechanic			
Fuel supplier			
Generator servicing			
Equipment dealer			
Equipment rental company (emergency generators, lifts, etc.)			

Federal, State, and County Organizations

Organization	Name(s)	Phone number(s)	Notes
State Department of Agriculture			
County/ University Extension Office			
County emergency management agency			
County Health Department			
USDA Farm Service Agency			
USDA Natural Resources Conservation Service (NRCS)			
U.S. DHS Federal Emergency Management Agency (FEMA)			

Initial Site Planning

Considerations when deciding on a new location to establish or purchase farmland

The National Oceanic and Atmospheric Administration (NOAA) developed a map for illustrating the probability that an area of the country will be hit by multiple hurricanes, expressed as the number of years between hurricanes, (known as the return period, Figure A1). While no model can determine when and where hurricanes will strike during any given hurricane season, the return period map is a good indication or relative hurricane risk.

It is important to remember that this map represents a long-term average and that even if the average return rate for a hurricane is 25 years, hurricanes could still occur at one spot on successive years or even in the same year. It is also important to understand that while most data show only where hurricanes have made landfall, they can also move hundreds of miles inland causing significant wind damage and flooding.

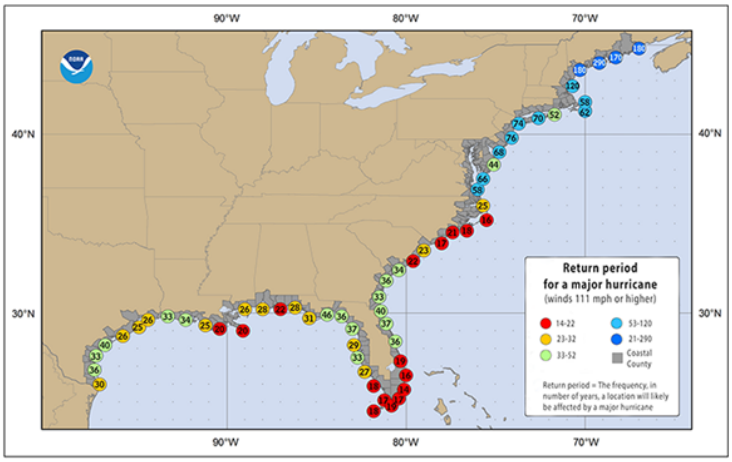

Figure A1: Return period (years) for major hurricanes for the coastal Eastern United States. Graphic provided by the National Oceanographic and Atmospheric Administration (NOAA).

Use NOAA's Historical Hurricane Tracks tool for a map and dates of hurricanes that have impacted your area in the past 150 years. The timing and track of historic hurricanes may be different than those for future hurricanes and should be used with caution.

Site characteristics

Topography

- When planning for long-term preparedness, evaluate a potential site for your operations with an eye toward reducing the risk of surface flooding or coastal storm surge. It is unlikely that all risks can be avoided. However, the negative considerations of an elevated open site are often less than those of low-lying areas susceptible to flooding.
- Land should be gently sloping with adequate drainage. Avoid steeper slopes if possible and terrace them if necessary.
- If possible, choose a site that has higher-elevation areas so that farm equipment can be easily moved to avoid flooding.

Flood risk and storm surge

- Assess historic and predictable patterns of flooding to determine which areas are at the highest risk of damage during extreme weather.
- Consult the following Federal and State-level resources for estimating flood risk:
  - U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA) Flood Map Service Center—for official flood maps
  - Alabama Department of Economic and Community Affairs Flood Map website
- In some areas, storm surge can cause flooding many miles inland from the coast. View the NOAA National Storm Surge Hazard Map to assess your risk.

Roads and utilities

- Choose a site with good roads that will allow multiple escape routes when evacuating from hurricanes and tropical storms that can cause rising flood waters, storm surge, or downed trees.
- Plan to have utilities and other critical infrastructure permanently constructed on higher ground to avoid equipment and infrastructure damage during flooding
- Search for areas with resilient electrical grids. Avoid relatively isolated sites with limited access to electrical utilities.

Production fields and greenhouses

- Construct greenhouses in areas that are not prone to flooding and free of vegetation.
- Choose areas for production fields that are well drained, which is optimal for tobacco production in general and will aid in water removal following a hurricane.

Natural windbreaks

- If possible, choose a site with natural windbreaks, such as wooded areas surrounding the field.

Resource Links

Alabama Resource Links

University Extension, State, and Federal websites

University Extension Websites	Purpose
Extension Office Locator*	Contact information for university Extension Agents in your county
Disaster*	Resources to help prepare for and recover from hurricanes and other disasters
Extension Disaster Education Network (EDEN)	Information and program resources to help with hurricane preparedness and recovery

* Alabama Cooperative Extension System

State Websites	Purpose
Alabama Governor's Office	News and information from the Governor, including evacuation orders and emergency declarations
Alabama Department of Agriculture and Industries (ADAI)	Main source for answers to your agricultural-related questions
Alabama Emergency Management Agency	Disaster assistance resources for residents

Federal Websites	Purpose
United States Department of Agriculture (USDA)	News and announcements related to agricultural commodities and disaster recovery programs
USDA Disaster Resource Center	Resources to help you build long-term resilience to and recover from hurricanes and other disasters
USDA Office Locator	Contact information for USDA offices in your county, including FSA, NRCS, Rural Development, and Conservation Districts
USDA Farm Service Agency (FSA)	Assistance with securing loans, receiving payments, and applying for disaster relief programs
USDA FSA Alabama	Focus on State FSA resources, including financial and technical information sharing
USDA Natural Resources Conservation Service (NRCS)	Financial and technical assistance for farmers, ranchers and forest landowners
USDA NRCS Alabama	Focus on State NRCS resources, including financial and technical information sharing
USDA Risk Management Agency (RMA)	Assistance with Federal Crop Insurance and managing risk
USDA RMA Agent Locator	Contact information for local RMA offices in your county
US Department of Homeland Security Federal Emergency Management Agency (FEMA)	News and information to help you prepare for and recover from hurricanes and other disasters
US Department of Homeland Security Hurricane Preparedness	Resources to help individuals prepare for and recover from hurricanes
US Department of Commerce National Oceanic and Atmospheric Administration (NOAA)	Resources to view historical, current and predicted hurricane activity and warnings in your areas
NOAA National Hurricane Center	Current and forecasted tropical cyclone activity, educational resources, and advisory warnings for your area of interest
NOAA National Weather Service Weather-Ready Nation	Latest news, information and technology to enable informed decision-making before, during, and after a hurricane strikes

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USDA Southeast Climate Hub
https://www.climatehubs.usda.gov/hubs/southeast/

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