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Utilizing the Land-Based Learning Model for the Clemson Agricultural Safety, Growing Safe Tigers Program

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UTILIZING THE LAND-BASED LEARNING MODEL FOR THE CLEMSON AGRICULTURAL SAFETY, *GROWING SAFE TIGERS* PROGRAM

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by
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ABSTRACT

The Clemson Agricultural Safety, *Growing Safe Tigers* program was developed in 2019 with the goal of increasing the awareness of agricultural safety in South Carolina. By utilizing the land-based learning model, a need for agricultural safety education was identified through incident surveillance strategies. Agricultural incidents were quantified using AgInjuryNews.org and recommendations were made for the program to provide more tailored information to the four regions of South Carolina, based on the primary cause of incident for each region.

Educators' understanding of place and interconnected systems was determined pertaining to agricultural safety to provide a baseline for how agricultural education teachers in South Carolina utilize resources. With one focus group, 22 agricultural educators provided the program with information regarding their competencies and current needs to allow them to better educate youth about agricultural safety. Recommendations, based on themes, were provided to the program on curricular improvement to best aid agricultural educators in teaching agricultural safety.

Intervention was achieved through the program's field days. Four regular field days were hosted, along with one condensed field day. Regular field days were held at Clemson University Research and Education Centers (RECs), and the condensed field day was held on Clemson University's main campus. A total of 365 students ages 14-18 attended the regular field days and 113 students attended the condensed field day. At all field days, pre and post-tests were administered to the students to gauge their agricultural safety knowledge that was gained during the field day. A total of 127 students completed

both the pre and post-test at the regular field days. Three out of the four regular field days produced post-test means with statistically significant differences. The condensed field day produced 27 completed pre and post-tests with statistically significant differences between the pre-test and post-test means.

By implementing an adaptation of the land-based learning model to identify the program as the partner for SBAE programs, including their agricultural education students and teachers, a better understanding of curriculum updates, educational strategies, and place-based needs can be developed to continue to increase awareness of agricultural safety.

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CHAPTER ONE

INTRODUCTION

In 2021, the agricultural sector contributed 5.4% of the United States Gross Domestic Product (GDP), with 21.1 million full and part-time employees (USDA, 2023). With such a large number of employees, that include youth and migrant workers, and relatively weak regulatory protection for employees (Cooper et al., 2005), the agricultural sector has been deemed one of the most dangerous occupations, along with mining and construction (Reed & Wachs, 2004). In 2013, it was reported that 20.3 per 100,000 farm workers sustained fatal injuries while working on or around farming operations, with the risk of dying from farming more than five times higher than the risk for all other occupations (Missikpode et al., 2015). While there is information about fatalities from farming operations, data for non-fatal injuries sustained during farming operations is minimal (Missikpode et al., 2015, Rautiainen & Reynolds, 2002). A need has been determined for continued surveillance strategies to identify and limit risk factors that agricultural employees face on a daily basis (Missikpode et al., 2015).

It has also been noted that among occupations in the United States, agriculture has the highest percentage of workers over the age of 44, with the average age of the principal farm operator being around 55 in 2003 (Voaklander et al., 2009). Ushering in the idea that age-related heath changes and education must be provided to allow the farming community to safely continue their occupations (Voaklander et al., 2009). While many farmers are older, a considerable number of youth work on farms. Many farms in the United States are privately operated and call on youth to be part of the workforce on

an “as needed” basis (Hard & Myers, 2006). Often these youth called to work on the farm have little or no job training, thus placing them in a potentially hazardous workplace environment (Hard & Myers, 2006). National regulations and guidelines allow for children as young as 12 years of age to work in production agriculture, which differs drastically from other occupations (Cooper et al., 2005), thus revealing a need for research-based interventions that include both educational and engineering changes to be made in the agricultural sector (Hard & Myers, 2006).

Along with age playing a factor in risks associated with the agricultural sector, Carlson et al. (2005) found that many factors increase risks associated with farming. The factors that were determined were gender, prior injury, and increased hours of work, confirming the idea that understanding factors that increase risk in farming operations allows for targeted prevention and later the improvement of preventive programs for agricultural safety (Karttunen & Rautiainen, 2013).

The purpose of the Clemson Agricultural Safety, *Growing Safe Tigers* program is “to increase awareness of agricultural safety procedures, maintenance operations, and safety operations for youth ages 14-18 to work safely in the agriculture industry”.

Objectives

The purpose of this research was to evaluate the programming offered in the Clemson Agricultural Safety, *Growing Safe Tigers* program. The objectives were to utilize the land-based learning model (McKim et al., 2019) to:

1. Determine the agricultural injury rate for South Carolina based on the AgInjuryNews.org database and determine need categories based on the

learning topics for the Clemson Agricultural Safety, *Growing Safe Tigers* program.

2. Provide recommendations for improvement of current programming based on pre and post-test scores from youth participation in the Clemson Agricultural Safety, *Growing Safe Tigers* field days.
3. Evaluate the use of Clemson Agricultural Safety, *Growing Safe Tigers* program educational materials and teaching aids provided to high school agricultural education teachers.

Organization of Thesis

Chapter 1 provides an introduction to the topic of agricultural safety and outlines the need for safety education in school-based agricultural education (SBAE) programs. Along with background information, this chapter also provides specific objectives and the overall organization of the thesis. Chapter 2 consists of the theoretical framework, land-based learning, that was the impetus for this thesis. This chapter provides an overview of the pedological approach of land-based learning. Chapter 3 details methods, results, and conclusions for Objective 1. Chapter 4 includes all research, methods, results, conclusions, and recommendations for Objective 2. Chapter 5 consists of all research conducted, methods, results, conclusions, and recommendations for Objective 3. Finally, Chapter 6 outlines overall conclusions and future work needed for the Clemson Agricultural Safety, *Growing Safe Tigers* program. The appendix contains figures, graphs, and supporting documents not found in the body of the thesis.

CHAPTER TWO

CONCEPTUAL MODEL/THEORETICAL FRAMEWORK

Land-based learning was born through the foundation of place-based education (McKim et al., 2019). Place-based education is derived from the transition of learning and teaching from the classroom to the community, where students and participants can experientially learn from the community they are in to enact change and address concerns commonly found there (McKim et al., 2019). Place-based learning, and later land-based learning, lean on the idea of bridging two common gaps found in standard educational practices (McKim et al., 2019). Gap one is the missing link between students and their interactions with the environment, and gap two is the lack of interactions with the community where students may enact change (McKim et at., 2019). The goal is to encourage learning in "lived experiences of place," such as nature, the community, or farms, as opposed to the conventional "abstractions of place" such as textbooks and classrooms (McKim et al., 2019). Land-based learning encourages the use of the natural world as a surrogate for learning to enhance the student's ability to understand what is being taught on a deeper level (McKim et al., 2019).

Land-based learning is not brought about through a strict formula or process, but rather it can be achieved through check points (McKim et al., 2019). These four checkpoints include identification, understanding, intervention, and evaluation (McKim et al., 2019). The identification checkpoint involves students and educators identifying a local phenomenon, in this case, agricultural safety, in which they will engage. During this checkpoint, community members are also identified to provide a variety of viewpoints

and aid in the educational process (Powers, 2004). Community members identified for this checkpoint can include other agricultural teachers, farmers and producers, agricultural extension agents, and other individuals in the agricultural community. Following the identification checkpoint is the understanding check point. During the understanding checkpoint, students learn experientially from their surroundings by being placed directly in the environment (McKim et al., 2019). Within the understanding checkpoint, community members identified in the first checkpoint help guide the learning process while keeping interventions subtle to allow learning to come from the experience instead of themselves (McKim et al., 2019). For this checkpoint, understanding can occur on the farm or during agricultural industry site visits. The third checkpoint within land-based learning is intervention. During the intervention checkpoint, community members and instructors begin to become more involved in the learning process that is taking place with the students (McKim et al., 2019). Within this checkpoint, learning is transitioned from being produced by the environment that the students are in to more direct learning from the community members and instructors (McKim et al., 2019). Much like the understanding checkpoint, the intervention checkpoint still relies heavily on learning through the environment but differs because instructors act as facilitators to aid in the flow of knowledge from the place to the student (McKim et al., 2019). The intervention checkpoint can be seen as instructors lead students to a greater understanding of agricultural safety by answering their questions and presenting them with ideas that might not have previously been considered. The final checkpoint of land-based learning is evaluation. The evaluation checkpoint of land-based learning allows the student to

consider and evaluate the impacts of their learning with the community or space where the learning took place (McKim et al., 2019). This evaluation should be centered around sustainability, specifically how the learning process changed the surrounding communities (McKim at al., 2019). Sustainability, in this case, would surround the idea of agricultural safety and how it affects the communities of the students.

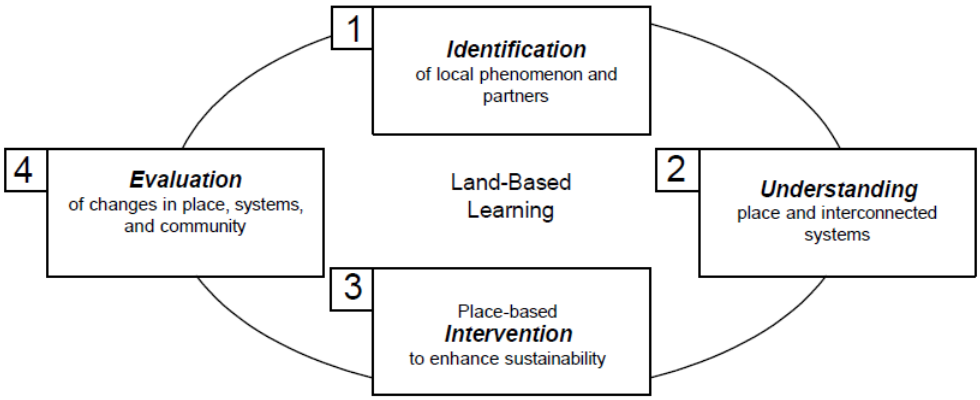

Figure 1: Land-based learning model (McKim et al., 2019)

While engaging in agricultural safety education, learners often are placed in the environment where agricultural safety most commonly occurs. Through field days, farm visits, and school-based agricultural education programs, students often find themselves among the community, learning about the many facets of agricultural safety from the environment. The Clemson Agricultural Safety Program, *Growing Safe Tigers,* leans on the idea of utilizing community members to add valuable information to the topics of agricultural safety when educating students and agricultural educators while also allowing time for both students and educators to learn from their surroundings and explore topics on their own. Following the completion of agricultural safety lessons,

students and agricultural educators are tasked with exploring ideas as to how what they learned through their agricultural safety learning experiences may affect not only their lives but also the lives of the community members they interact with on a daily basis. Students and educators are often encouraged to take what they learn during agricultural safety lessons and then inform others about the new knowledge they gained from the learning experience.

Through this research, the four checkpoints of land-based learning were achieved, Figure 2. The first checkpoint of identification was achieved by first identifying agricultural incident rates in South Carolina, thus presenting a need for agricultural safety education in the state. The second checkpoint, understanding, was achieved through the use of focus groups with SBAE teachers throughout the state. Through this focus group, the program was able to dive deeper into the level of understanding that SBAE teachers have pertaining to agricultural safety. The third checkpoint, intervention, was achieved by field days that were hosted by the program. The program instructors and community members intervened in the students' agricultural safety learning process to bring to light the many facets of agricultural safety. Finally, the fourth checkpoint of evaluation was achieved through combination of the research objectives outlined for this thesis. While this model is designed to be cyclical, leaners can move throughout the learning process in variety of ways, represented by the arrows between checkpoints.

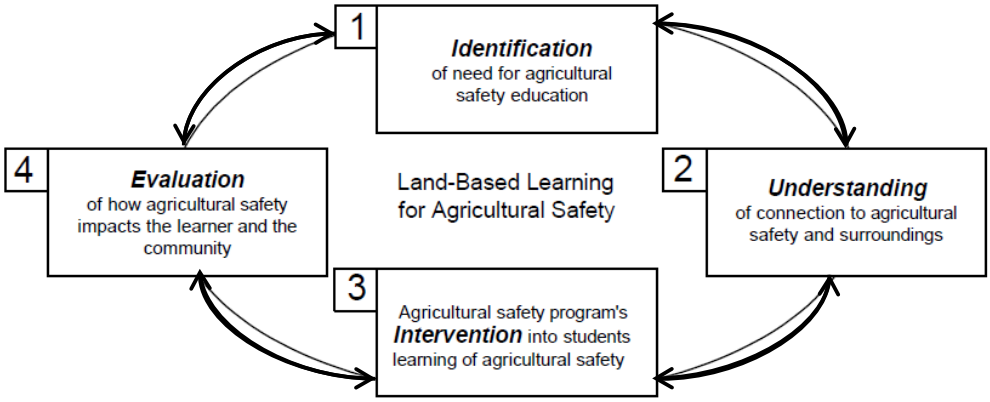

Figure 2: Adaptation of land-based learning model for the Clemson Agricultural Safety, *Growing Safe Tigers* program

CHAPTER THREE

A SUMMARY OF SOUTH CAROLINA'S AGRICULTURAL INCIDENT RATES USED TO IMPROVE AN AGRICULTURAL SAFETY PROGRAM

Introduction

The agriculture industry is one of the most dangerous industries causing a variety of injuries (McCurdy & Carroll, 2000). Nearly 1.3 billion people worldwide are employed in agriculture to some capacity, and about 170,000 farm workers are killed due to agricultural operations every year (Lehtola et al., 2008). Although the number of injuries has decreased between 1995 and the present for the agricultural sector, it remains one of the highest occupational mortality rates, only second to mining and quarrying (McCurdy & Carroll, 2000). Injury is often defined as the physical damage to an individual from energy levels outside the tolerance of human tissue, resulting in tissue damage (McCurdy & Carroll, 2000).

Agricultural injuries are prevalent in all age ranges; however, they are occur more frequently in youth between 14 and 18 years of age working on or around farms (Perry, 2003). There are nearly 800,000 child farm workers in the United States, comprising 8% of the minor workforce population for the United States (Perry, 2003). About one in every three farm deaths occur in people between 14 and 18 years of age, making up about 40% of all work-related deaths for minors (Perry, 2003), and tractor rollovers are the most common incident involving high school aged children (Namkoong et al., 2022). Mariger et al. (2007) examined the agricultural injury rates in Virginia and identified elderly farmers and children were the most commonly effected groups. Utilizing these

findings, researchers recommended that educational materials be developed to provide age-specific knowledge to the identified primary groups of individuals (Mariger et al., 2007).

Many researchers are determining methods to decrease injury rates in the agricultural industry. McCurdy and Carroll (2000) determined that engineering interventions, including increased designs in safety and increased safety training, are likely to be the most effective means to reduce injury risks and rates among agricultural workers. Namkoong et al. (2022) studied the effects of teaching high school-aged students, specifically through Virtual Reality (VR) interventions. They found test students responded positively to immersive education when working with tractor rollover incidents. Findings indicated a positive correlation between experiential learning and an increased understanding of potential safety hazards around tractor rollovers (Namkoong et al., 2022). Perry et al. (2020) found that teachers who participated in a ten-hour agricultural safety summer training program and then applied the information they learned when teaching their students about agricultural safety resulted in greater knowledge retention among the students. This greater knowledge retention indicated that an effective way of lowering agricultural incident rates is to improve teachers' understanding of agricultural hazards to educate their students better (Perry et al., 2020). Koch et al. (2020) also found that a program focused on interactive demonstrations with youth through field days resulted in statistically significant, positive influences on test scores administered to the students before and after safety training.

Jadhav et al. (2015) studied eight risk factors and their contribution to the rate of agriculture injuries. These eight risk factors were male gender, full-time farmer, owner/operator status, regular medication use, prior injury, health problems, stress or depression, and hearing loss. All of the risk factors, except health problems, significantly increased the rate of agricultural injury among those cases studied; with the knowledge of these risk factors, more relevant information can be used to provide proper preventative safety information to the farming community (Jadhav et al., 2019).

Youth that work in agricultural related jobs are seven times more likely to suffer work related injuries than those in non-agricultural related jobs (Weichelt et al., 2019). On average, one out of every 25 farm youths has a disability to some degree, and of the 25.9 million youth that lived on, worked on, or visited a farm in 2012, nearly 14,000 suffered agricultural related injuries (Weichelt et al., 2019). These statistics were obtained using AgInjuryNews.org, a web-based collection of United States news reports on agricultural injuries. AgInjuryNews.org is the only known database for the collection of agricultural related incidents in the United States that provides incidents on a state by state basis. AgInjuryNews.org adequately provides more current data than traditional reporting systems, and with this more current information, monitoring injury trends and developing prevention strategies is more feasible (Weichelt et al., 2019). The database was developed by the National Children's Center for Rural and Agricultural Health and Safety (NCCRAHS) in 2015 as a response to the National Institute for Occupational Safety and Health (NIOSH) downsizing its record system due to budget cuts (Burke et al., 2019). Since then, the Bureau of Labor Statistics (BLS) has adopted

AgInjuryNews.org as their primary means to validate the number of workplace incidents in the United States. Burke et al. (2019) found that AgInjuryNews.org is growing steadily and is continuing to supply up to date information on agricultural incidents to new and returning database users. While up to date information about agricultural incidents is provided by AgInjuryNews.org, only incidents that are large enough to receive media attention make it on the database; because of this, there is under reporting of agricultural incidents in the United States (Weichelt et al., 2019).

Objectives

The purpose of this research was to analyze South Carolina's incident rates to provide the Clemson Agricultural Safety Program, *Growing Safe Tigers*, information about areas of incident with the highest number of injuries. Specific objectives were to:

1. Determine agricultural injury rates for South Carolina between the years 2016 and 2022 based on data collected from AgInjuryNews.org.
2. Assess need categories based on injury rates to determine regions with higher specific injury causes.

Methods

To identify the injury rates for South Carolina, AgInjuryNews.org was used. AgInjuryNews.org was utilized for this research because the resource provides readily accessible information to the public about agricultural incidents in the United States, and it has the ability to be filtered based on year and state. The database was filtered to show only injuries in South Carolina. The database includes data from the years 2015 to the present. Only the incidents between 2016 and 2022 were used since the 2023 data was

incomplete. The year 2015 was not included in this study, as there were no reported incidents in 2015 for South Carolina. Article titles for each incident reported were read and then recorded into a Microsoft Excel spreadsheet. Included in the spreadsheet were the year, the population for that year, the total number of incidents, the total number of victims, and the categories. Some articles did not have clear titles as to the cause of the incident, and in these cases, additional information, such as the news articles or obituaries, were accessed to determine the appropriate category.

The categories used to group these incidents were Pesticide/Chemical, Machinery, Lawnmower, All-Terrain/Utility Task Vehicles (ATV/UTV), Animal Production, Electrical, Grain, Power Tool, and Other. These categories were selected to align with the Clemson Agricultural Safety, *Growing Safe Tigers* field day stations and the most prominent causes of agricultural incidents that were noted in the literature. Incident rates are to be used by the program to gauge areas that need the most curricular development. Once incidents were categorized, each one was mapped in ArcGIS Online, and a map of the regions of South Carolina was overlaid. With the addition of the region map, injuries were categorized by region to determine which incidents were most prevalent in each region.

South Carolina consists of four regions, the Upstate, the Midlands, the Lowcountry, and the Pee Dee. By categorizing the incidents by region, specific educational materials can be provided to target these regions based on the most common incident in each region. Agricultural production data was also analyzed to determine any relationship between the primary type of agricultural production and the leading cause of

agricultural incidents in each region. Agricultural data was retrieved from the United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS) Southern Region South Carolina County Estimates from 2020-2021. Information is provided on a county basis, with most counties reporting information to the USDA. However, some counties are not reported by the USDA due to insufficient data or to avoid disclosure of individual operations (USDA, NASS Southern Region, 2022). After all incidents were categorized, the total number of incidents was compared to the state population for each year. Populations for each year were retrieved from the United States Census Bureau. The census is only completed every ten years. Between 2016 and 2022, the only year the census was completed was 2020. The United States Census Bureau provides population estimates for years after the census was not completed. Estimates were utilized for 2016, 2017, 2018, 2019, 2021, and 2022. To determine the incident rate for South Carolina, the entire state population was used instead of only the reported number of primary farmers for the state. Researchers used the whole state population because often those injured were not the primary farmer or not directly related to agriculture.

Incident Categories

Incident categories were linked to the station topics discussed during Clemson Agricultural Safety, *Growing Safe Tigers* field days. These categories were identified as the common types of incidents that occur in agriculture.

Pesticide/Chemical

Pesticide and chemical incidents are any incident where the victim was harmed using pesticides or chemicals. Incidents in this category could result from drift, improper use of the pesticide or chemical, or improper storage of the pesticide or chemical.

Machinery

The machinery category houses many types of incidents. Incidents in this category range from tractor rollovers, vehicle-tractor collisions, tractor implement incidents, entanglements, and other machinery used in agricultural related activities. Other machinery may include skid steers, combines, farm vehicles, or moving irrigation systems such as center pivots. Some incidents may occur on a tractor or other machinery, but the tractor or machinery may not be the main cause of the incident. These incidents are not included in this category; see subsequent categories for these types of incidents.

Lawnmower

Lawnmower incidents occur while operating or performing maintenance on a lawnmower. These incidents could be lawnmower rollovers, injuries from lawnmower blades, or injuries to others while operating a lawnmower. To be included in this category, the lawnmower must be the primary means of injury in the incident.

All-Terrain/Utility-Terrain Vehicles (ATV/UTV)

Incidents involving the use of ATV/UTVs are placed in this category. Both ATVs and UTVs are common agricultural tools. Any incidents where the ATV or UTV was the cause of the incident, not only present at the time of the incident, are placed in this category. Common incidents included in the category are ATV/UTV rollovers, ATV/UTV collisions with other objects, or the operator being thrown from the ATV/UTV.

Animal Production

Animal production incidents include any incident that takes place while working around livestock. Livestock is defined as "a farm animal that is kept for use or profit" (Merriam-Webster, 1687). The animal production category does not include incidents involving non-livestock animals, such as wildlife or household pets. Incidents that could be included in this category are tramples, animal attacks, or falls from animals.

Electrical

Incidents housed in the electrical category are incidents directly related to electrical work. Electrical incidents often pertain to electrocution or injuries sustained because of faulty electrical work. An example of injuries sustained because of faulty electrical work is a fire that results in injury.

Grain

The grain category includes any incident that involves grain, grain bins, or augers moving grain. These incidents can range from grain entrapment, falls in grain bins, and entanglements involving augers moving grain. Entanglements that do not involve grain movement are not placed in this category; see the description of the machinery category.

Power Tools

Incidents involving the use of power tools are included in this category. The cause of these incidents can include power tools ranging from drills, impacts, handheld saws, sanders, and grinders. Incidents involving lathes, milling machines, or other larger fabricating equipment are not included in this category. Common incidents included in this category are injuries from saws or entanglements with drills and impacts.

Other

The other category includes several potential causes for incidents. Any cause of an incident that did not correspond with the above categories was placed in the other category. Some possible causes for incidents in the Other category could range from homicide, suicide, forestry incidents, fishing incidents, logging truck-vehicle collisions, or heat exhaustion.

Incident Examples for Methodology

Incidents presented in AgInjuryNews.org were categorized based on the information provided. Figure 3 shows an incident that was placed in the Machinery

category. The incident's title is "Man dies after being run over by tractor." The title indicated the cause of the incident was a tractor run-over. Since the cause of the incident was tractor related, this incident was placed in the Machinery category. Figure 4 depicts an incident on AgInjuryNews.org because of the key word "tractor" in the title "Man found shot dead on running tractor in Oconee Co." On AgInjuryNews.org, this incident was placed in the Machinery category; however, the cause of the incident was not the tractor. The cause of the incident was homicide; therefore, this incident was placed in the Other category.

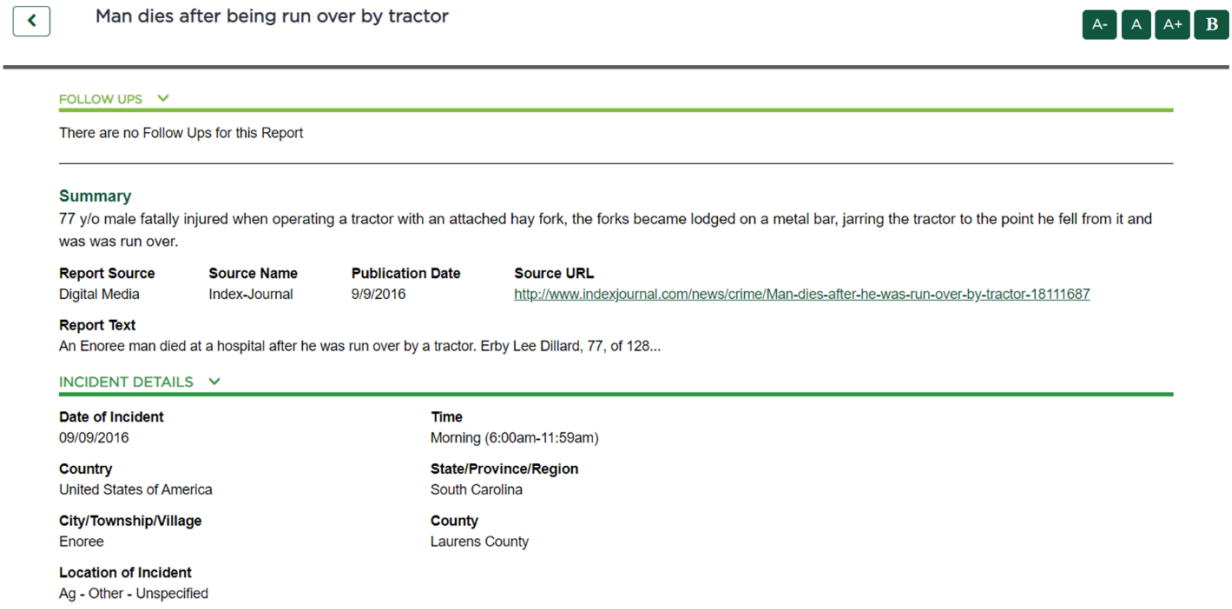

Figure 3: Incident example of machinery, image credit from AgInjuryNews.org

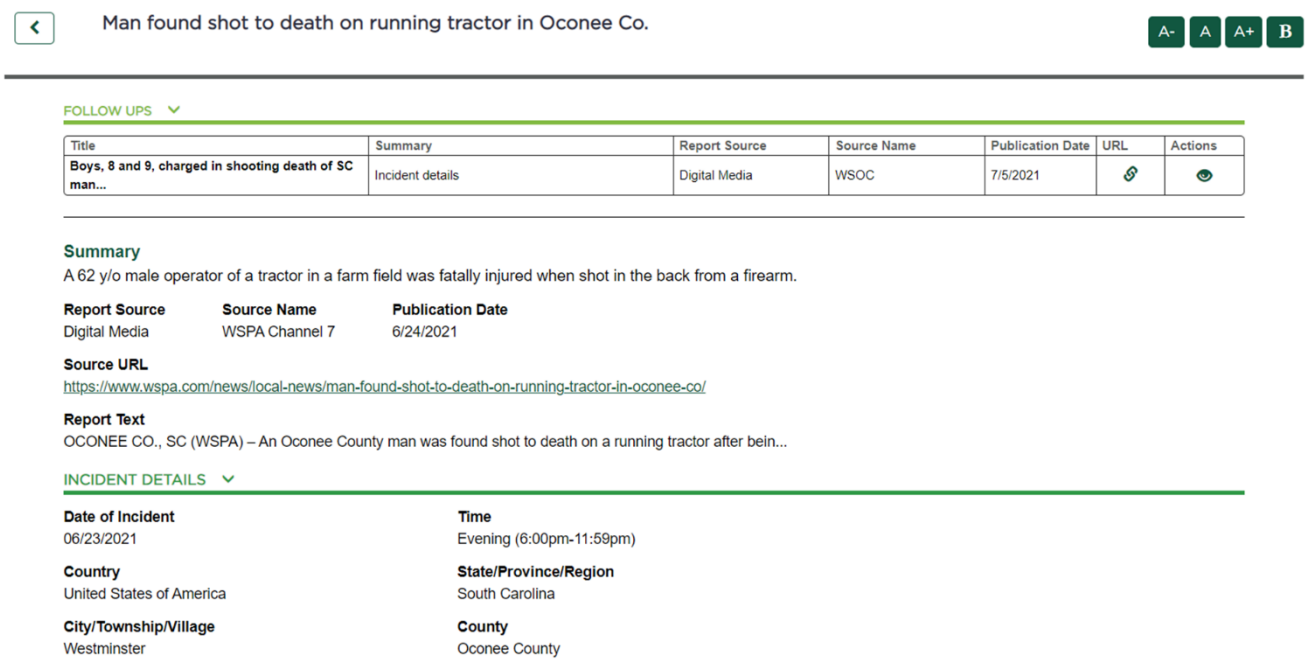

Figure 4: Incident example of other, image credit from AgInjuryNews.org

Results

In South Carolina, Machinery was the most common category of agricultural incidents and injuries. Machinery incidents encompassed tractor roll overs, power take-off (PTO) entanglements, injuries involving implements, and injuries sustained from other large equipment often found on farms. The second most common category was Other, consisting of logging operations and fishing operations. Most of the logging incidents involved logging trucks and passenger vehicles on roadways. All incident totals can be viewed in Table 1 and are described below.

Table 1. Agricultural injuries by year for South Carolina

Year	Number of Incidents	Number of Victims	Categories								
			Pesticide/ Chemical	Machinery	Lawn mower	ATV/ UTV	Animal Production	Electrical	Grain	Power tool	Other
2016	8	11	-	6	-	-	-	-	-	-	2
2017	9	21	-	6	-	-	-	-	1	-	2
2018	4	4	-	2	-	-	1	-	-	-	1
2019	12	23	-	3	-	-	-	-	3	-	6
2020	15	19	-	8	-	1	-	-	1	-	5
2021	10	13	-	1	-	-	1	-	-	-	8
2022	8	9	-	5	1	-	-	-	-	-	2
Total	66	100	-	31	1	1	2	-	5	-	26

Year: 2016

The year 2016 was the first year with reported agricultural injuries for South Carolina on AgInjuryNews.org. During this year, injuries sustained were caused by Machinery and Other. The Other category included injuries sustained through logging operations. In 2016, there were eight incidents reported, with a total of 11 victims. Of these eight incidents, six were machinery related, and two were classified as Other.

Year: 2017

In 2017, nine incidents were reported consisting of injuries from Machinery, Grain, and Other. Through these nine incidents, there were 21 victims. This number was

elevated because one of the incidents involved agritourism, with many people involved in a hayride incident on a farm. Six incidents were machinery related, one was grain related, and two were placed in the Other category. The Other category consisted of injuries sustained due to drowning, vehicle entrapment, and agritourism.

Year: 2018

In 2018, there were only four reported agricultural injuries in South Carolina, consisting of injuries from Machinery, Animal Production, and Other. Of these four injuries, two were Machinery, one was Animal Production, and the last was Other. In this case, the injury categorized as Other resulted from forestry operations. During the year 2018, there were a total of only four victims.

Year: 2019

During 2019, there were a total of 12 agricultural incidents reported in South Carolina, with 23 victims. The increased number of victims was due to many of the incidents in 2019 involving logging operations and passenger vehicles. Three of these injuries were machinery related, three were grain related, and six were identified as Other. Of those in the Other category, five incidents occurred related to logging operations.

Year: 2020

In 2020, South Carolina experienced the highest number of agricultural injuries recorded since 2016. In 2020, there were 15 reported agricultural injuries with causes of

Machinery, ATV/UTV, Grain, and Other. There were 19 victims in 2020. The increase in the number of victims was a result of collisions between passenger vehicles and logging trucks. Of those reported, eight were machinery related, one was ATV/UTV, one was Grain, and five were Other. The Other category consisted of injuries related to logging and fishing operations.

Year: 2021

In 2021, South Carolina experienced a decrease in the total number of agricultural injuries compared to previous years. During 2021, there were ten reported agricultural incidents, with 13 victims. The increase in the number of victims was a result of incidents involving tractors and passenger vehicles. Of these incidents, one was Animal Production, one was Machinery, and all remaining incidents were categorized as Other. The Other category included incidents during logging operations and boating accidents.

Year: 2022

During 2022, South Carolina experienced another slight decrease in the total number of agricultural injuries previously reported. During 2022, there were eight reported agricultural incidents with nine victims. Of the incidents, five were machinery related, one was a lawnmower related incident, and two were placed in the Other category. The two incidents in the Other category included a fishing incident and a forestry related incident. All reported incidents involved one victim, with only one involving two victims. This incident was a machinery related incident involving two children.

Regions

Incidents were also categorized by the state's geographic region. Among the four regions of South Carolina, tractor and vehicle related injuries were the most common. See Table 2 for all incidents by region. Yearly agricultural data was also considered for each region. Yearly agricultural data was retrieved as a means to relate the number of injuries to the primary form of agriculture. See Figure 5 for an example of USDA, NASS South Region South Carolina County Estimate agricultural data.

Upstate

The Upstate of South Carolina consists of ten counties and rests in the top corner of the state. The ten counties are Oconee, Pickens, Greenville, Spartanburg, Cherokee, Union, Laurens, Greenwood, Abbeville, and Anderson. The main cause of injury in the Upstate of South Carolina was tractors. Of the 12 reported incidents in the Upstate, five were tractor related. The Upstate is home to much of South Carolina's cattle production. A correlation can be seen here with the number of cattle farms requiring tractors. According to the USDA, NASS Southern Region South Carolina County Estimates for cattle in 2020-2021, every county in the Upstate reported greater than 2,000 head of cattle (2021). Four of these ten counties reported greater than 12,0000 head of cattle (USDA, NASS South Region South Carolina, 2021).

Midlands

The Midlands of South Carolina consists of 12 counties. These counties are York, Chester, Lancaster, Fairfield, Kershaw, Newberry, Richland, Lexington, Saluda, Aiken,

Edgefield, and McCormick. In the Midlands, the primary cause of incidents was vehicles. These vehicles were specifically related to the logging industry, with most vehicle incidents involving logging trucks and passenger vehicles.

Lowcountry

The Lowcountry of South Carolina is situated at the base of the state. It consists of 12 counties: Calhoun, Orangeburg, Barnwell, Bamberg, Allendale, Hampton, Jasper, Beaufort, Colleton, Charleston, Dorchester, and Berkeley. The leading cause of agricultural incidents in this region was tractor incidents. This region is primarily dominated by row crop production, specifically corn, cotton, and peanuts. There is a correlation between a large number of row crop farming operations and the leading cause of agricultural incidents being tractors.

Pee Dee

The Pee Dee region of South Carolina consists of 12 counties and is located in the upper right corner of the state. These counties are Chesterfield, Marlboro, Dillon, Marion, Horry, Georgetown, Williamsburg, Clarendon, Sumter, Lee, Darlington, and Florence. Much like the Lowcountry of South Carolina, the Pee Dee region is also dominated by row crop farming operations. Corn and soybeans are the primary crops produced in this region. The main cause of incidents in this region was vehicles. Unlike the Midlands, these incidents involve mainly farm vehicles, including grain trucks.

Table 2. Agricultural injuries by region for South Carolina

Incident Agent	Regions				
	Upstate	Midlands	Lowcountry	Pee Dee	Total
Vehicle	3	5	4	6	18
Tractor	5	3	7	4	19
Other	2	2	3	4	11
Forestry	1	1	-	1	3
Tree/plant	2	1	-	-	3
Livestock	-	1	-	1	2
Machinery	3	1	1	3	8
ATV/UTV	-	-	1	-	1
Building/Structure	-	-	-	1	1
Total	16	14	16	20	66

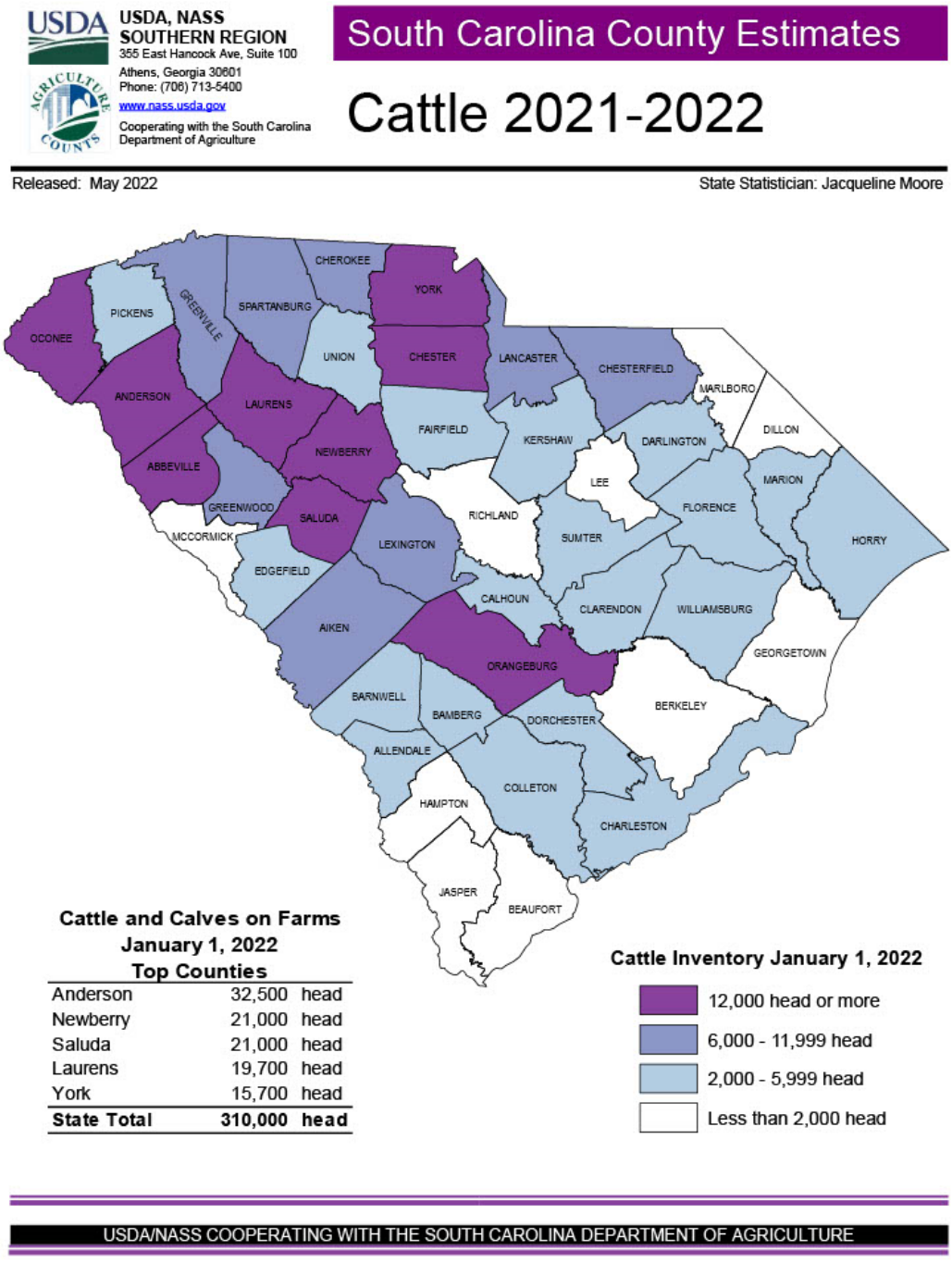

Figure 5: USDA, NASS Southern Region South Carolina County Estimates Cattle 2021-2022 Agricultural Data (USDA National Agricultural Statistics Service, 2021 Census of Agriculture.)

Incident Rates

The total number of incidents was compared to the state population for each year, as shown in Figure 6. The state's population was used as opposed to the number of farmers for each year because many of those that were involved in agricultural related incidents were not the primary farmers. Many of those involved in incidents were employees or others visiting farms. Percentages were low given that no more than 15 incidents were reported each year and the state's population was upwards of 4,900,000 each year. A spike was observed in the number of incidents in the year 2020. It was speculated that the cause of this was the COVID-19 pandemic. During 2020, much of the state's population was at home and participated in more agriculture projects at home. With more people working in agriculture, there was a spike in the number of individuals experiencing agricultural incidents. In 2021, a downward trend can be seen. It is speculated that this is because many people began to return to work following COVID-19 pandemic and were not spending as much time at home. Further documentation of incidents will be required to determine if this downward trend will continue. For detailed information about yearly agricultural injury rates, see Figure 7. Limitations were noted that only incidents included on AgInjuryNews.org are those that are severe enough to receive media attention. This resulted in a rather low number of agricultural incidents reported each year for South Carolina.

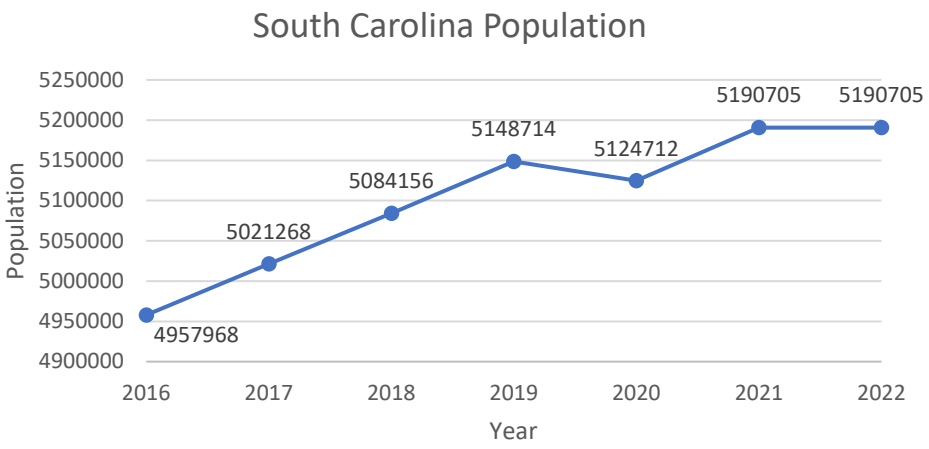

Figure 6: South Carolina state population between 2016 and 2022

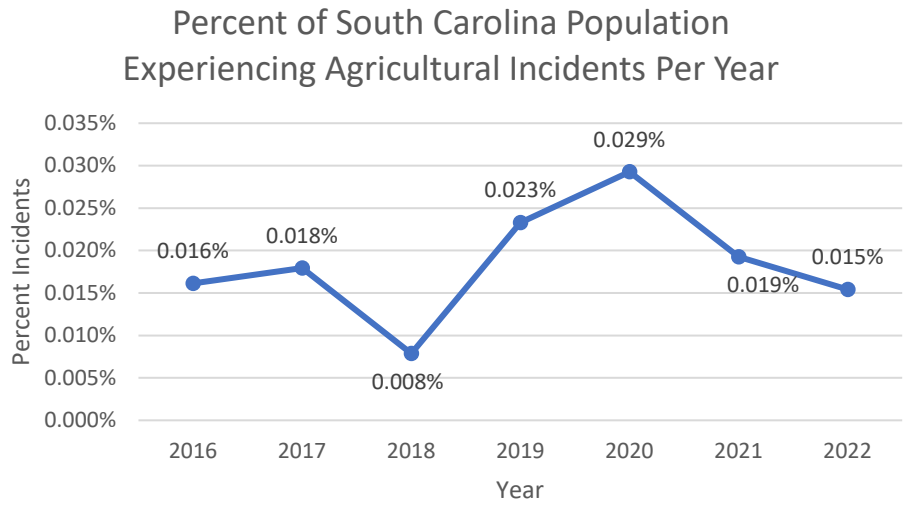

Figure 7: South Carolina incident rates reported by AgInjuryNews.org between 2016 and 2022

Conclusions

While not a complete summary of all incidents in the state was compiled, through the use of AgInjuryNews.org, South Carolina agricultural injury rates were quantified. With these findings, changes have been recommended for the Clemson Agricultural

Safety, *Growing Safe Tigers* program to provide students with the most relevant information about agricultural safety. Continued work is needed to provide a more comprehensive list and more adequate numbers of incidents for the state. By categorizing the incidents by type and region, the Clemson Agricultural Safety, *Growing Safe Tigers* team can develop additional safety material to provide each region with targeted information and instruction to help reduce the number of incidents each year. Based on these findings, more tailored information can be specified when providing agricultural safety training in each region.

To meet the needs of Upstate South Carolina residents, additional information pertaining to tractors and animal safety should be provided to help decrease agricultural incident rates. For the Midlands, safety material related to roadway safety should be provided during field days. Safety field days in the Lowcountry should include more comprehensive information about tractor safety to help decrease the number of tractor related incidents in the region. Finally, in the Pee Dee region, safety material pertaining to farm vehicles and roadway safety should be provided during field days. All additional safety materials should be distributed to high school students, other college safety programs, agricultural professionals, and those employed throughout South Carolina's agricultural field.

CHAPTER FOUR

EVALUATION OF THE CLEMSON AGRICULTURAL SAFETY, *GROWING SAFE TIGERS* PROGRAM

Introduction

In the United States, there are more than two million farms, ranches, or other agricultural operations, and this industry comprises a large portion of the economy (Weichelt et at., 2019). In 2006, an estimated 86% of farms in the United States reported youth being present on the farm at some point in time (Hendricks & Goldcamp, 2010). Many youths live on farms, always surrounded by hazards, and at an early age, are often asked to complete potentially unsafe tasks (Carrabba et al., 2000). The average age youth are allowed to operate heavy machinery, such as tractors, is 11 (Freeman, Whitman, & Tormoehlen, 1998). According to a survey reported about youth injury estimates for 2012, there were a minimum of 25.9 million youth who lived on, worked on, or visited farms that year (Hendricks et al., 2018). Of these 25.9 million youth, there were nearly 14,000 who suffered from farm injuries (Hendricks et al., 2018). The farm environment presents hazards that are ever present for youth with any type of contact with farming operations (Hendricks & Goldcamp, 2010). Youth are seven times more likely to die due to workplace operations than their non-farm peers (Goldcamp et al., 2004). It is estimated that one child dies due to agricultural operations every three days (Goldcamp et al., 2004). This number is slightly elevated due to the fact that farm managers and operators often only provide oversight to youth working on or living on farms (Kendricks & Goldcamp, 2010).

Research conducted by Weichelt et al. (2019) indicated increased vulnerability for youth that work or live on farming operations, with a majority of youth incidents involving vehicles, including tractors and All-Terrain Vehicles (ATV). Research data obtained through the use of AgInjuryNews.org identified a total of 255 incidents between the years 2015 and 2017 that involved youth (Weichelt et al., 2019). A large portion (one-third) of youth injuries occurred in youth under six while playing near vehicles, machinery, animals, or other agricultural structures (Weichelt et al., 2019). Other research has supported the concern that injuries among youth are disproportionate (Leigh et al., 2001). Most injuries occurred in youth that were left unsupervised by parents that work or live on farms. While parents are aware of these dangers, they continually place their children in hazardous situations. Strategies should be developed to better educate farm families that have youth working or living on farms (Wichelt et al., 2019).

Darragh et al. (1998) conducted a mail-in questionnaire pertaining to parental attitudes toward the risk of injury among youth on farms. They found that a portion of parents allow their seven to nine year old children to operate tractors. However, most parents did not allow their children to operate tractors until they were older than ten years old. Almost three-quarters of respondents allowed youth to operate tractors that were not equipped with Roll-Over-Protection Structures (ROPS). Most parents determined that their youth were competent enough to complete various chores around the farm based on the child's interest, previous observations of the chore being done correctly, and safety information provided during the observation time. Often negative experiences influence youths' perception of safety greater than any safety rules they were told to follow. Youth

usually take shortcuts or modify the chore they are asked to complete to increase efficiency, and often the safety rules are not thought about (Darragh et al., 1998).

The agricultural industry also varies from other industries because many farms are not covered by Occupational Safety and Health Administration (OSHA) enforcement (Hendricks & Goldcamp, 2010). OSHA generally cannot inspect farms with fewer than ten employees, with immediate family workers not included as employees (OSHA, 2023). This lack of monitoring limits the identification and reduction of safety hazards that are present in the agricultural sector and increases the need for education and surveillance strategies in this area (Hendricks & Goldcamp, 2010).

Along with OSHA exemptions, Agricultural Hazardous Occupations Orders (AgHOs) are more lenient in agricultural operations than in other industries (Hendricks & Goldcamp, 2010). Since 1970, AgHOs were introduced to oversee child labor in agricultural operations; these AgHOs have remained largely unchanged since their establishment (Mann & Jepsen, 2017). As listed by the AgHOs, eleven tasks were identified as hazardous to youth (Mann & Jepsen, 2017). These tasks were categorized into eleven categories, including tractor, general machinery, specialized machinery, livestock, woodlot, ladder and scaffold, transport, toxic atmosphere, chemicals, blasting, and fertilizers (Mann & Jepsen, 2017). While these hazardous tasks have been identified, there were also exemptions in place that allow youth to work in these areas (Mann & Jepsen, 2017). Youth exempt from these regulations included youth working on operations that were owned by their parent or legal guardian (AgHOs 1-11), youth enrolled in a high school agricultural education program that provided documentation of

specific requirements (AgHOs 1-16), and youth who have completed a tractor and machinery certification course offered by the federal Extension service or an agricultural educator (AgHOs 1-2) (DOL,1970). Along with the previously stated exemptions, AgHOs allowed youth to begin working any job at the age of 16, whereas in other non-agricultural HOs, the minimum age for youth to begin working any job was 18 (Hendricks & Goldcamp, 2010). This variation in age results in youth working and living on farms to have decreased protection from regulatory administrations (Hendricks & Goldcamp, 2010), thus, leading to the conclusion that the agricultural industry remains to be one of the least regulated industries in the United States (Weichelt et al., 2019). Many have called for policy changes that could effectively decrease the number of agricultural related incidents of youth (Hendricks & Goldcamp, 2010).

While a policy change could best decrease the number of agricultural related incidents in youth, education and training remain important components of incident prevention for now (Hendricks & Goldcamp, 2010). Burke et al. (2011) found that highly engaging safety training methods were more effective than less engaging training methods. While distance learning or e-learning has been a more cost-effective training method than traditional in-person safety training, the lack of participant engagement has presented a major issue with the transfer of safety knowledge to the students (Burke et al., 2011).

Objectives

The purpose of this research was to provide recommendations on the effectiveness of the Clemson Agricultural Safety, *Growing Safe Tigers* field day program that was provided to high school students throughout the state. The Clemson Agricultural Safety,

Growing Safe Tigers program was developed for high school students currently enrolled in a school-based agricultural education program. During field days, students circulate through various stations pertaining to different areas of agricultural safety. Specific objectives were to:

1. Determine content knowledge gained by high school students who participated in field days presented by the Clemson Agricultural Safety, *Growing Safe Tigers* program.
2. Develop recommendations for program leaders to make changes to the Clemson Agricultural Safety, *Growing Safe Tigers* program to improve awareness of agricultural safety learning outcomes for the community.

Methods

A total of five field days were offered during the 2022-2023 school year. Four were regular field days, and one was a condensed field day offered to high school students on Clemson University's main campus. Field days were five hours long, where students rotated through a variety of stations pertaining to agricultural safety. Students were at each station for roughly 20 minutes during each field day. Field days focused on the administrative controls portion of the hierarchy of controls, Figure 8. Administrative controls focus on work practices that reduce the duration, frequency, and exposure to hazards are often introduced through trainings (CDC, 2023).

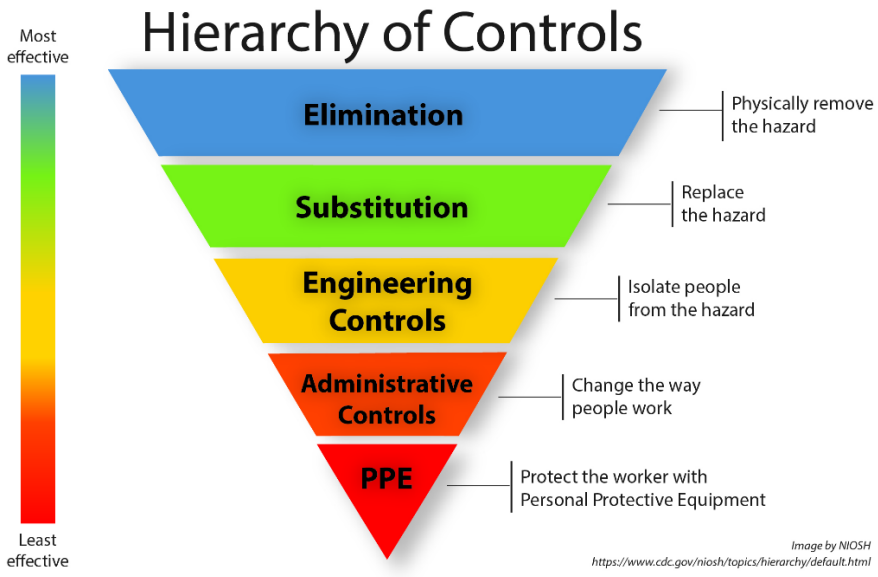

Figure 8: Hierarchy of Controls (CDC, 2023)

Pre/Post-Test Development

For the regular field days, the pre/post-test consisted of 29 multiple-choice questions that pertained to the topics discussed during the field day stations (Appendix B). For the condensed field day, the pre/post-test consisted of 15 multiple-choice questions, with the other 14 questions from the regular field day being removed because the topics were not discussed during the condensed field day (Appendix C). Questions pertained to the information discussed during field days and were derived from each station's learning objectives.

After the data analysis from the first field day at the Piedmont REC was completed, it was determined that students might be guessing at answers in the pre-test. Therefore, the option of "I don't know" was added to each multiple-choice question in the pre and post-test. Researchers determined that adding the "I don't know" option could

increase the quality of the results obtained from students (Torre et al., 2019). The option of "I don't know" allows the student to select an answer choice without randomly guessing if they were not certain about the correct answer (Torre et al., 2019). All subsequent pre/post-tests included the "I don't know" option. While this option provided students with another answer instead of merely guessing, it raised concerns that students would only select this answer because they might lack the motivation to complete the test. Questions where "I don't know" was the answer were awarded zero points. Some questions that were on the pre/post-tests were questions that pertained to general knowledge, and it was assumed that the students would have this from the SBAE program. Because of this, any pre/post-tests where "I don't know" was the consistent response, it was removed from the data.

Regular Field Days

Regular field days were conducted at four of Clemson University's Research and Education Centers (REC). The facilities that were utilized to conduct this research were the Piedmont REC, the Sandhill REC, the Pee Dee REC, and the Edisto REC. The four determined RECs align with the four regions that are present in South Carolina. These regions include the Upstate, the Midlands, the Pee Dee, and the Lowcounty. The opportunity to attend the field days was provided to all agricultural educators, the general public, and 4H staff in South Carolina via electronic mail in the Clemson Agricultural Safety newsletter that was published once a month, and additionally when special events, such as the Clemson Agricultural Safety, *Growing Safe Tigers* field days where

specifically advertised. While all parties were invited to attend these field days, mainly agricultural educators and their students attended the events. Agricultural educators were required to sign up stating how many students they would bring to aid in the planning process for the four regular field days. Through these four regular field days, 127 students completed pre and post-tests.

All four regular field days were conducted on Fridays during school hours and were offered to the students as a field trip. Field days lasted approximately five hours and demonstrated a variety of topics that aligned with research-based categories of safety needs based on previous incidents in the state of South Carolina. Topics for regular field days included pesticide safety, electrical safety, tractor safety, lawnmower/ATV/UTV safety, safe load, grain bin safety, tractor operations, and lawnmower operations. Animal safety was only offered at the Piedmont REC and Sandhill REC field days due to instructor availability. The team of instructors consisted of Clemson Extension Agents and fellow agricultural educators from across the state. At all field days, station instructors vary; however, to limit inconsistency in the information taught, station instructors were provided a lesson plan with learning objectives that outlined all the content to be taught. See Appendix A for a complete topic breakdown utilized by instructors who taught each station.

Pre and post-tests were developed to determine content knowledge gained by students who participated in the field day. See Appendix B for complete pre/post-test questions. Each pre and post-test was administered online through Google forms. Students who attended the Piedmont REC field day completed the pre-test prior to

arriving at the field day, and the post-test was completed with their teacher after the field day. With this format of students completing pre and post-tests, a limited number of students completed both tests. Some students only completed the pre-test and failed to complete the post-test. To improve the number of students completing both the pre and post-test, changes were made to how tests were administered. For all other field days, students completed the pre-test on site before the field day started and the post-test at the end of the program during the allotted time in the field day schedule. Pre and post-tests were automatically scored through the use of Google forms. Each question was worth a total of five points, with name and school being worth zero points. The highest possible pre and post-test score was 145, which were later normalized to zero. Pre and post-test scores were matched based on the students' first name and the school they attended. All names and schools were removed from the data once the pre and post-test were matched. Once pre-tests were matched with their corresponding post-tests, the overall percentage change was calculated for each individual.

Condensed Field Day

One condensed field day was hosted during the 2022-2023 school year at Clemson University's main campus in Clemson, South Carolina. Agricultural educators were encouraged to bring students to this event to allow them to gain exposure to agricultural safety and explore the options that the Clemson University College of Agriculture, Forestry, and Life Sciences has to offer them for post-secondary education. A total of 113 students attended the condensed field day, with 27 students completing

both the pre and post-test. Pre and post-tests were modified from the regular field day to only include questions about topics discussed during the condensed field day. Topics for this event included tractor safety, lawnmower/ATV/UTV safety, safe load, grain bin safety, and electrical safety.

Pre and post-tests were completed through the use of Google Forms. See Appendix C for complete pre/post-test questions. Upon completion of the condensed field day, pre and post-tests were matched based on the student's first name and school, and the percentage change was calculated. All names and schools were removed from the data once the pre and post-test were matched.

Data Analysis

Data was analyzed through the use of statistical analysis software, JMP. Field days were treated as independent samples because each field day varied slightly from the others. Some variations between field days were different station instructors and different times when pre and post-tests were completed. For some field days, electric co-ops were the station instructors for the electrical safety portion. These co-ops do not follow the programs curriculum, resulting in different materials being presented to the students. Because of this variation among field days, each were considered to be an independent sample. Paired t-tests were used to compare the mean pre and post-test scores for each field day. The distribution feature in JMP was also used to determine descriptive statistics about pre and post-tests for each field day, including means, standard deviations, and 95% confidence intervals with $\alpha = 0.05$.

Results

Data was analyzed for a total of five field days. Table 3 outlines all data and results from the analysis. It was noted that there was the potential for a Type I error due to the small number of responses. Thus, leading to the possibility of the null hypothesis of mean pre and post-test scores having no difference being rejected when it is potentially true in the population.

Table 3. Pre and Post-Test Data for 2022-2023

Field Day	Student Attendance	Sample Size	Response Rate	Pre-Test Mean	Post-Test Mean	Pre-Test Standard Deviation	Post-Test Standard Deviation	Pre-Test Confidence Interval	Post-Test Confidence Interval
Piedmont	155	65	41.94%	55.88	70.57	14.04	17.41	(52.40, 59.36)	(66.26, 74.89)
Sandhill	90	18	20.00%	50.19	61.49	16.14	15.75	(42.17, 58.22)	(53.66, 69.32)
Pee Dee	62	34	54.84%	46.45	62.78	17.59	19.30	(40.31, 52.59)	(56.05, 69.51)
Edisto	58	10	17.24%	52.76	90.00	16.66	15.23	(40.84, 64.68)	(78.82, 101.18)
Condensed	113	27	23.89%	46.17	73.33	18.57	19.74	(38.83, 53.52)	(65.52, 81.14)

Regular Field Day

For the four regular field days, 448 students signed up to attend, with a total of 365 students actually attending the field days. Three of the four regular field days produced post-tests that were statistically higher than pre-tests. Using the distribution

feature in JMP, the means for all pre-test and post-test data were determined, along with 95% confidence intervals for all four field days. Figures 9, 10, 11, and 12 illustrate the confidence intervals for each field day.

Piedmont REC Field Day

A total of 155 students attended the Piedmont REC field day. Of the 155, 65 students completed both the pre and post-test, resulting in a response rate of 41.94%. The sample size for this field day was N = 65. The mean for the pre-test was 55.88, and the mean for the post-test was 70.57. Under a 95% confidence interval, the pre-test encompassed scores between 52.40 and 59.36. With the same confidence interval, the post-test encompassed scores between 66.26 and 74.89. Since there was no overlap between the two confidence intervals, there were statistically significant differences between the pre and post-test scores amongst the matched students who completed both tests.

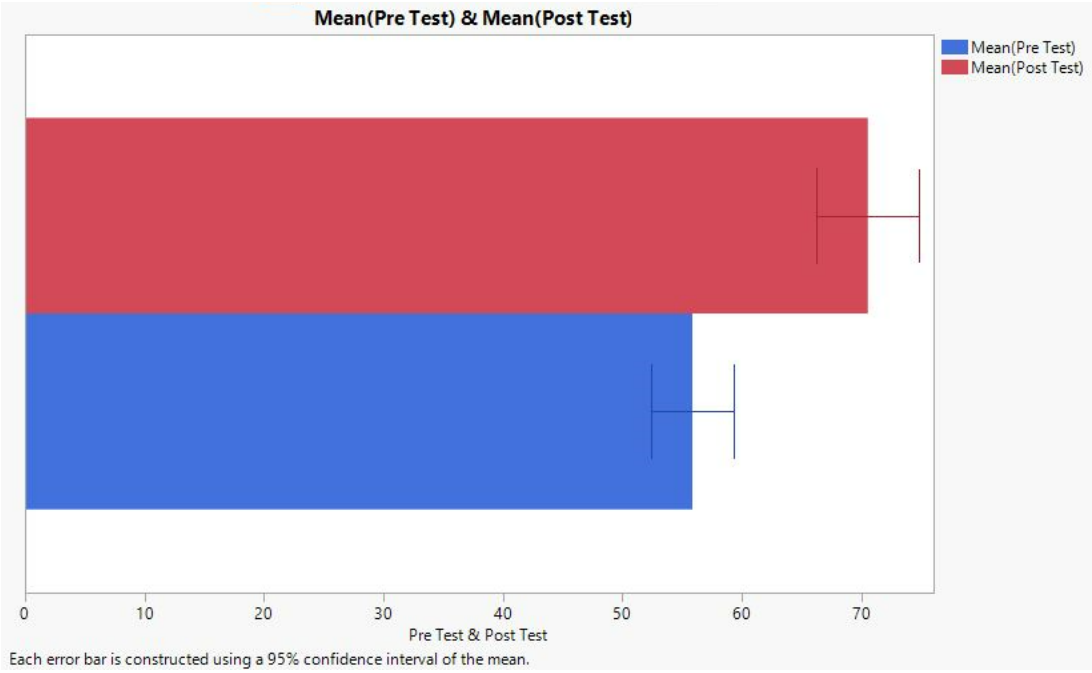

Figure 9: Comparison of means for Piedmont REC field day, including 95% confidence intervals

Sandhill REC Field Day

For the Sandhill REC field day, a total of N = 90 students attended. Of the 90 students present, 18 completed both the pre and post-tests, resulting in a response rate of 20%. The field day hosted at the Sandhill REC was the only one that did not produce post-test scores that were significantly different from pre-test scores. The sample size for this field day was n = 18. The mean for the pre-test was 50.19, and the mean for the post-test was 61.49. The pre-test had a 95% confidence interval of 42.17 to 58.22, while the post-test had a 95% confidence interval of 53.66 to 69.32. There was an overlap between the two confidence intervals leading to no significant difference between the pre and post-test scores of the students.

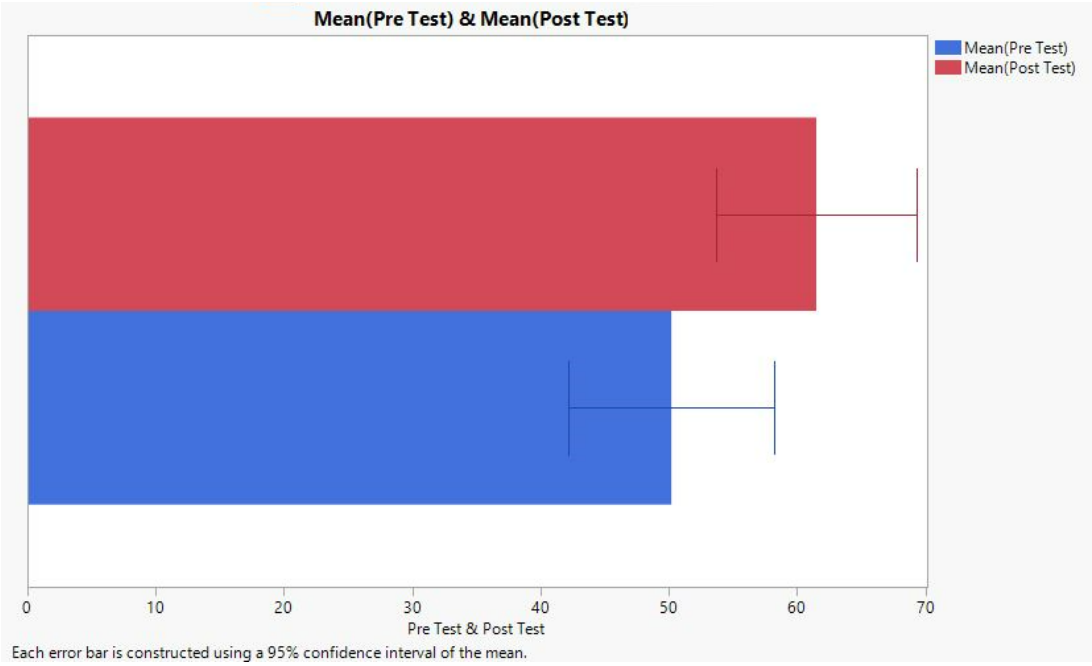

Figure 10: Comparison of means for Sandhill REC field day, including 95% confidence intervals

Pee Dee REC Field Day

For the Pee Dee REC field day, N = 62 students attended, and 34 of the students completed both the pre-test and post-test, leading to a response rate of 54.84%. The field day at the Pee Dee REC had a sample size of n = 34. The mean for the pre-test was determined to be 46.45, and the mean for the post-test was 62.78. The pre-test had a 95% confidence interval of 40.31 to 52.59, while the post-test had a 95% confidence interval of 56.05 to 69.51. This field day produced statistically significant differences between pre and post-test scores for students, as there was no overlap between the two confidence intervals.

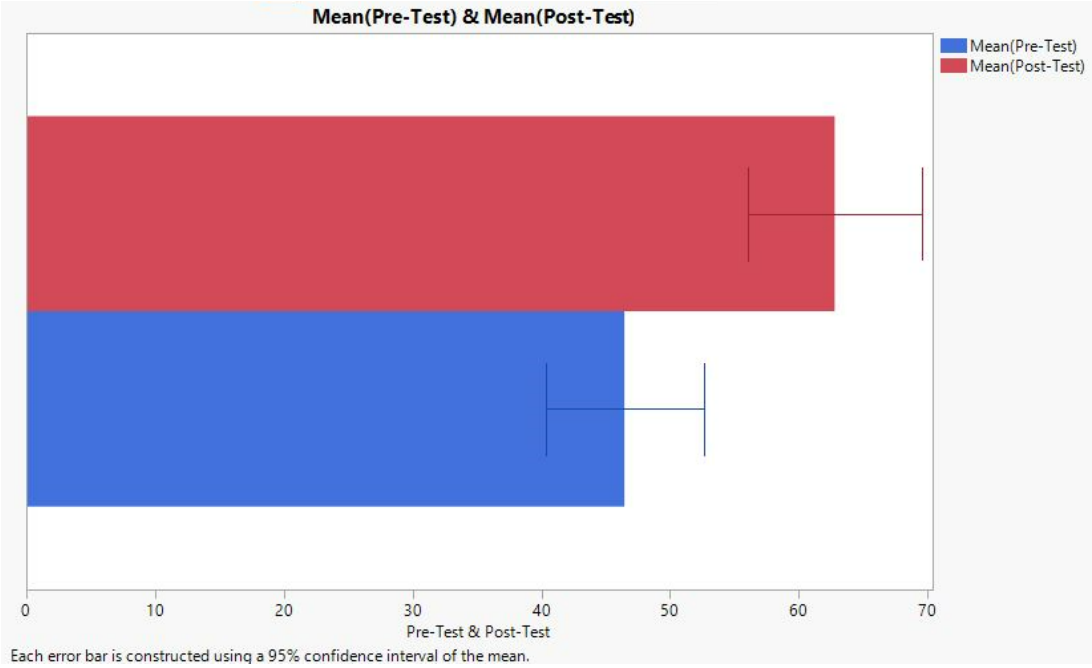

Figure 11: Comparison of means for Pee Dee REC field day, including 95% confidence intervals

Edisto REC Field Day

The field day at the Edisto REC hosted 58 students, with only 10 completing both the pre and post-test. The response rate for this field day was 17.24%. While this field day produced the lowest response rate, it produced the greatest difference between pre and post-test scores. The sample size for this field day was n = 10, with a pre-test mean of 52.76 and a post-test mean of 90.00. The pre-test confidence interval was 40.84 to 64.68, and the post-test confidence interval was 78.82 to 101.18. One outlier was recognized in the pre-test data with a score of 10.34. Because this field day had such a small sample size, there are some limitations when generalizing this information. Such a small sample size results in a poor representation of the intended population.

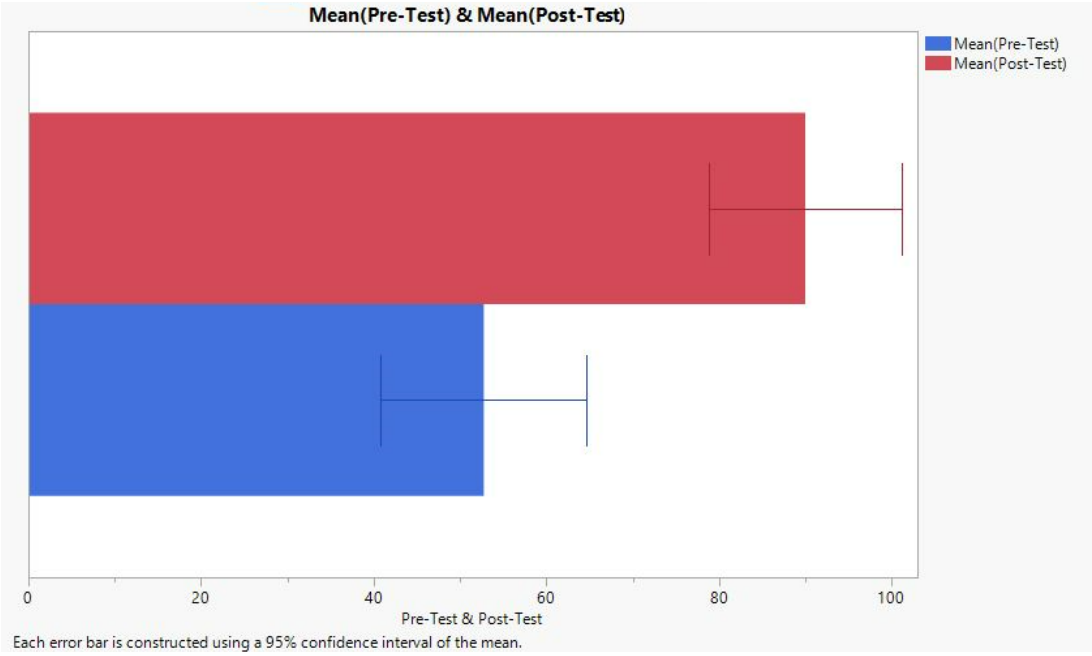

Figure 12: Comparison of means for Edisto REC field day, including 95% confidence intervals

Condensed Field Day

During the condensed campus field day, a total of N = 113 students were on campus. Of the 113 students, 27 completed both the pre and post-test. The response rate for the condensed field day was 23.89%. The sample size for the condensed field day was n = 27. The mean for the pre-test was 46.17, and the mean for the post-test was 73.33. Like three of the previous four regular field days, the condensed field day produced post-test scores with a statistically significant difference from pre-test scores. The 95% confidence interval for the pre-test was 38.83 to 53.52, while the post-test had a confidence interval of 65.52 to 81.14. Figure 13 depicts confidence intervals for the condensed field day.

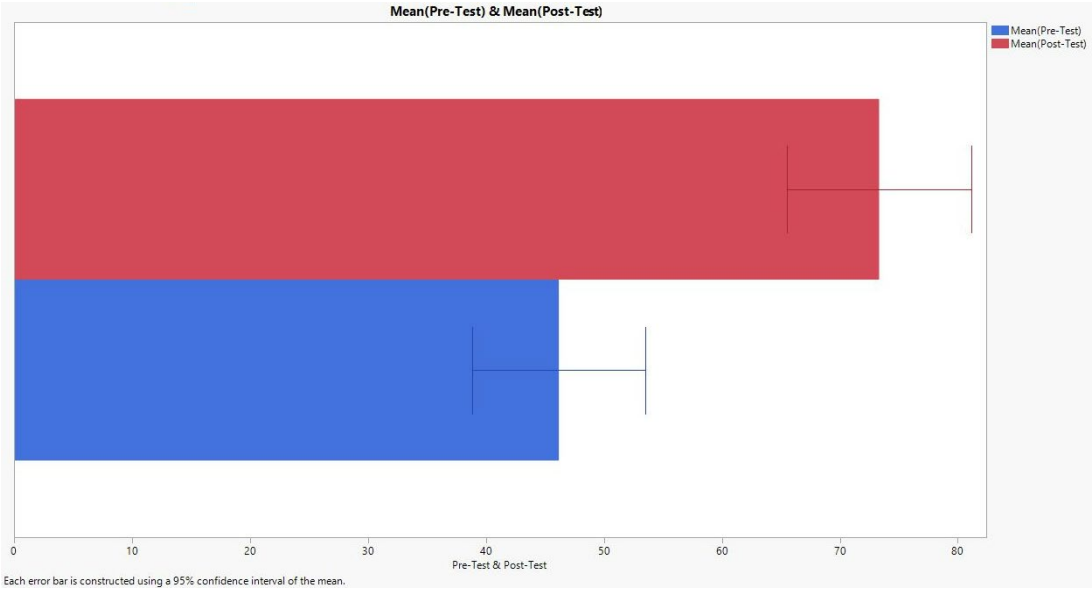

Figure 13: Comparison of means for condensed field day, including 95% confidence intervals

Recommendations

While a majority of field days hosted by the Clemson Agricultural Safety, *Growing Safe Tigers* program during the 2022-2023 school year produced statistically significant differences between the students' pre and post-test scores, there is room for program improvement. Recommendations for the program are provided via four subcategories, including Data Collection, Station Instructor Preparedness, Outreach Abilities, and Needed Materials. The Data Collection section dives into the idea of modifying data collection methods to produce high-quality data for future research. Station Instructor Preparedness consists of recommendations to better equip station instructors prior to field days. Outreach Abilities highlights changes that should be made to make field days more accessible to all schools throughout South Carolina. Finally, Needed Materials discusses materials that should be modified or developed to better meet the needs of students in South Carolina.

Data Collection

Current data collection methods for pre and post-tests include having students complete pre and post-tests at the beginning and end of the field day while they are on-site at the field day location. While that procedure resulted in 127 responses for the 2022-2023 school year, 365 students who attended the field days did not complete a pre-test, post-test, or both tests. Currently, students have the opportunity to receive prizes at the completion of the field day if they answer questions presented after the field day in a whole group setting. To help increase completion of pre and post-tests, students should be required to complete both tests before being given the opportunity to compete for the prizes. If the student did not show proof of completing the pre and post-test, they would not be eligible for the prize portion of the field day.

Pre and post-test completion could also be increased by working with students' teachers to encourage or require them to count pre and post-test completion as a graded assignment for each student. It would be encouraged that the student does not receive the grade they made on either the pre or post-test, but rather the students receive a 100 for completing the pre and post-test or a 0 for not completing the pre and post-test.

One barrier identified during field days was that some students do not have a mobile device or there was inadequate service to complete the online pre and post-test. To remove this barrier and improve data collection, paper copies of the pre and post-tests should be offered to those students who either did not have a mobile device or if adequate Wi-Fi service becomes a problem. When these limitations occurred, students borrowed their friend's or teacher's mobile device to complete the test. However, this often slowed

the pre and post-test process down, as there were only a few devices that the other students could use.

Station Instructor Preparedness

Currently, depending on the REC location, the station instructors vary. While this provided students with various experiences depending on which field day they attended, there was variability in some of the material taught at each station for each REC. It is recommended that prior to each field day, a training program be offered for station instructors to be briefed on the topics that must be covered for the station they are teaching. Station instructors were provided with little guidance on the topics presented to the students. By providing a brief training program to station instructors using the curriculum that was developed, they would be better equipped with the knowledge that must be transferred to the students during the short duration of time they are in each station. Station instructors should also be presented with interactive activities that students could complete while in each station. The activities would reinforce the topics discussed and provide the students with more experiential learning opportunities. Station guides have been developed to aid in the training process. The station guides outline the objectives and information that should be discussed during each station and provide essential questions that would benefit the students. Station instructors should be made aware of the outlined learning objectives in the station guides to help achieve the goals for each station. Along with equipping station instructors with the needed information,

the station instructor training would also allow time for instructors to ask questions about the format and style of the instruction that is best suited for the students.

For those instructors that commonly travel with the agricultural safety team, yearly training should be provided to best equip instructors with knowledge about the topics they will teach. During the training, instructors should also receive any updates about the program and any questions should be answered about the layout, plan, and program's goals.

Outreach Abilities

The Clemson Agricultural Safety, *Growing Safe Tigers* program's goal was to host a minimum of four field days at RECs in South Carolina. While these RECs are situated throughout the state, some schools struggle to attend field days, as their closest REC might be up to two hours away for the school location. The travel time presents a problem as field days are held during school hours, starting at 9 am and ending at 2 pm. The program timeframe limits travel time to about one hour, depending on the school district. Travel time to attend field days at the RECs has specifically been a problem for agricultural educators in the mid-upstate as they are situated between the Sandhill REC and the Piedmont REC, both of which are about two hours away, depending on the school. To better meet the needs of agricultural educators and students within this area, field days should be offered at locations other than the RECs. Field days should be hosted at local farms for schools that cannot travel to a REC during school hours.

Issues have also been noted with the time required for agricultural educators to plan trips. Currently, field day dates are scheduled about two months prior to the event, and then dates are released to agricultural educators via a special events newsletter. Agricultural educators have expressed concerns about not having ample time to plan a field trip and have it approved by their school district. To remedy this issue, it is recommended that dates be set at the beginning of the school year and agricultural educators be informed of all dates. Many events and activities occur throughout the year for school-based agricultural education programs. The South Carolina Agricultural Education academic calendar should be reviewed when planning the field days to improve accessibility for all to attend. Along with an initial announcement of dates, reminders should be distributed the month prior to the field day.

While the newsletter has appeared to be an effective means of communication for some agricultural educators, others do not check their emails regularly, or they might not receive the emails due to emails being blocked by their district's server. There is also the issue of agricultural educators relocating to new school districts and their emails changing. Currently, the agricultural educators email list that the program has is only updated annually, meaning that if an agricultural educator changes schools or a new individual is hired after the list is updated, they might not receive the information about field days. To prevent agricultural educators from not receiving emails, it is recommended for the email list to be updated biannually, once in August and once in January.

Needed Materials

When pre/post-tests were developed, the tests were specifically aligned with the curriculum developed for each station. Questions were aligned directly with the outlined learning objectives. While these learning objectives were provided to station instructors, many questions on the pre and post-test were consistently missed by students. One such question that was continually missed was "True or False: The blind spots are the same for all animals." The learning objective of animal blind spots is outlined in the Animal Safety Lesson Plan, Appendix A, although many students continually missed this question. There is a need for learning objectives to be communicated more directly to students. Students should be presented with learning objectives before each station to ensure that they are aware of the intended purpose and learning goals at each station.

While data collection is important for understanding the effectiveness of this program, areas of South Carolina have different needs depending on the major production type in each area. For example, the Upstate of South Carolina is very livestock-heavy, with little row crop industry. In contrast, the Lowcountry is very row crop heavy, with little livestock (USDA, NASS South Region South Carolina, 2021). Modifying the curriculum taught at each station based on major production areas for each region of South Carolina could better meet the needs of students in these areas. It is important for students to be exposed to all areas of agricultural safety; however, it could be more beneficial if they received in-depth information about the agricultural safety topics they encounter daily.

While curricula have been developed for each station, some lack visual aids and hands-on activities. One such station is the animal safety station. Previously, live animals were brought to safety days; however, this was stopped because of biohazards fears. With no animals for the students to interact with, the animal safety station has become limited to the hands-on activities that can be demonstrated. There is a need for additional teaching aids to be developed to provide students with the desired hands-on experiential learning to maintain their interest and motivation to engage and learn.

Conclusions

As the Clemson Agricultural Safety, *Growing Safe Tigers* program is still relatively new, changes are needed to better serve and educate the high school youth of South Carolina. Changes to make this program more consistent yet tailored to each region of South Carolina are an important step in ensuring that students who attend field days receive information about agricultural safety that could benefit them in their future endeavors. Changes must also be made at an instructor level that will provide students with the same experience, whether they attend a field day at the Edisto REC or the Piedmont REC. Along with material development, changes need to be resolved to ensure consistent data is collected to continue the evaluation process of this program. Some discrepancies between data collection methods at each field day included in this research need to be made more consistent. While these recommendations were made with the pre and post-test scores of 127 students at four regular field days and 27 students at one condensed field day, pre and post-test analysis should be conducted to continue the evaluation process of this program.

CHAPTER FIVE

DETERMINATION OF SBAE TEACHERS' UNDERSTANDING OF PLACE AND INTERCONNECTED SYSTEMS RELATED TO AGRICULTURAL SAFETY

Introduction

Agricultural work is one of the most common forms of employment around the world (Frank et al., 2004). While this is true, in the United States, only a few individuals provide food and fiber for the rest of the United States (Frank et al., 2004). Pressure to provide food and fiber placed on agricultural workers only increases the risk of incident or injury in the profession (Frank et al., 2004). The Clemson Agricultural Safety, *Growing Safe Tigers* program was developed at Clemson University to educate youth aged 14 – 18 about the many hazards surrounding agriculture (Koch et al., 2020). While this program has been developed and has shown a positive relationship between attending field days and higher post-test scores after participation (Koch et al., 2020), there is still room for program improvement. Clemson Agricultural Safety, *Growing Safe Tiger* field days often occur with School-based Agricultural Education (SBAE) programs (Koch et al., 2020). Researchers and community individuals are able to be with the participants for five – six hours to allow for an exchange of safety information from the program leaders to the students (Koch et al., 2020). While any amount of exposure is important to the development of safety knowledge, students often require safety information to be reinforced by their agriculture teacher in a SBAE program (Hubert et al., 2003). An agricultural educator in a SBAE program often employs the idea of land-based learning to bridge the gap between the information that is learned in the classroom and work by

presenting students with opportunities to use what they have learned in real-world situations (Dailey et al., 2001, McKim et al., 2019). Agricultural educators encourage students to learn from their surroundings and incorporate learning from their environment, as opposed to learning from a standardized curriculum that is commonly found in the classroom (McKim et al., 2019). SBAE programs provide students with a variety of unique hands-on opportunities to further both their academic and vocational skills (Hubert et al., 2003). Within a SBAE program, agricultural education teachers promote the development of safety consciousness if the teacher follows proper safety practices, conveys a positive attitude towards safety, and communicates safety expectations to students (Hubert et al., 2003). While educators may promote safety inside and outside of their classrooms, often, youth partake in risky behavior and bend or break the rules of safety based on their own perceived risk (Reed et al., 2003).

While safety instruction from educators is important, not all educators have the same attitude or knowledge about agricultural safety (Hubert et al., 2003). Hubert et al. (2003) found that first year teachers or teachers with limited experiences are more receptive to agricultural safety concerns, and females tend to incorporate more safety topics into coursework than their male counterparts. Hubert et al. (2003) also found that incidents or injuries of students often go unnoticed by agricultural educators. When incidents or injuries go unnoticed, students do not receive the proper corrective actions to prevent these incidents or injuries, therefore reinforcing improper safety habits in the students. Agricultural educators must also act as safety role models to their students. If educators do not follow or promote agricultural safety procedures and rules, students will

often neglect to follow them and do not understand the consequences or risks associated with their neglect of safety procedures (Hubert et al., 2003). While it is important for educators to act as safety role models, it is unrealistic to believe that every teacher can and should know all information about safety and then instill that knowledge in their students (Myers & Dyer, 2004)

Currently, it is unknown whether safety educational programs lead students to safer behaviors or if they have an actual change in their ability to understand and avoid injury (Reed et al., 2003). However, it is suggested that safety education programs be evaluated systematically to determine effectiveness, if program objectives are being met, and if materials developed by a program are beneficial to those intended recipients (Reed et al., 2003). There are many effective ways of evaluating programs; focus groups have become common methods of evaluation (Rennekamp & Nall, 2000). Focus groups are often used during the program design and improvement phases of the program development process. Focus groups work by guiding individuals that are similar through a facilitated discussion (Rennekamp & Nall, 2000). Focus groups are often more favorable than semi-structured or structured interviews because the format allows for ideas and thoughts to be shared around the group, which might trigger different thoughts in other individuals (Xerri, 2018). When working with educators and SBAE programs, it is important to evaluate the educator's practices (Hubert et al., 2003). Research conducted with educators allows for the investigation of different teaching practices and can potentially improve teaching and learning strategies (Xerri, 2018).

Objectives

The purpose of this research was to determine changes in place, systems, and community of the agricultural safety education materials developed by Clemson Agricultural Safety, *Growing Safety Tigers* program in SBAE programs in South Carolina.

1. Determine SBAE teachers understanding, in the context of land-based learning of agricultural safety and surroundings of place and interconnected systems.
2. Provide recommendations for program and curricular improvement to the Clemson Agricultural Safety, *Growing Safe Tigers* program to initiate changes in place, systems, and the community.

Methods

To determine SBAE teachers' understandings, in the context of land-based learning, of agricultural safety and surroundings of place and interconnected systems provided in the agricultural safety materials developed by the Clemson Agricultural Safety, *Growing Safe Tigers* program, a focus group was utilized. Focus groups were chosen as the ideal method of qualitative research as they allow and encourage participants to interact and share their ideas with the group and can result in the development of new ideas in other participants (Harlin et al., 2007). Individuals who participated in the focus group were attendees of the South Carolina Farmer and Agribusiness Association (FAA) Annual Convention. The South Carolina FAA Annual Convention was selected because SBAE teachers can choose to attend this event as part

of their state professional development requirements. Educators were not required to attend this event; however, many of them do.

There were no pre-determined requirements for educators to be considered to participate in the focus group. Participation was entirely voluntary and posed no risk to those who participated. Educators were informed about the focus group at the FAA convention welcome dinner the night before the scheduled meeting was held the next day. A brief description of the research and the program was provided to the group, and they were encouraged to come and share their thoughts and ideas. The focus group lasted approximately one hour, comprising 22 participants and one facilitator. Participants included a wide variety of educators. Years of service ranged from first year teachers to 33 years of teaching experience. Participants also came from varying agricultural backgrounds. Some educators grew up on farms, while others found their way into agriculture because of their participation in high school SBAE programs.

The focus group was recorded with both audio and video recording devices. Questions presented to participants included demographic questions, safety competency questions, and questions pertaining to the needs and wants of the educators. See Table 1 for a complete list of questions.

Table 4. Summary of Focus Group Questions

Question 1:	Have you or a group of your students participated in the Clemson Ag Safety Program? If yes, how have you used what you learned, and how have you implemented the instructional resources provided? If not using the materials – ask WHY? What would be better for you?

Question 2:	How many years have you been a high school agricultural teacher? 2a. What background do you have in agriculture? Did you grow up on a family farm? 2b. Do you teach agricultural safety in the courses in your program? Yes – or NO – consider how you will respond if NO – need a set of questions that you follow up with. If YES: Follow up: Ask for courses where safety is taught. Ask for ways safety is taught in these courses. If NO: Follow up: Ask why safety is not taught. **2c.** How comfortable do you feel about teaching agricultural safety?
Question 3:	How much agricultural safety professional development or instructional resources have you experienced or been given access to? **3a.** Where do you go to look for information? What sources do you use? **3b.** What are the specific resources that you use in your lessons? **3c**. Of the safety professional development or instructional resources you have access to, how helpful has it been to implement in the courses where you teach ag safety?
Question 4:	Of the information that you have accessed, how easy is it to access? **4a**. Would you utilize the information to implement it into the courses where you teach Ag Safety more if it was able to be accessed in a different manner? **4b.** How do you prefer to receive information to use in your lesson planning for Ag Safety?
Question 5:	Do you think the CU Ag Safety information is beneficial to the students? **5a.** How actively do the students engage in the safety information? **5b.** Is there anything that you would change about the types of information that are provided to you and your students?
Question 6:	Is there anything that the Clemson Ag Safety program could do for teachers across the state that would increase the usefulness of the information that we provide? **6a.** Would it be beneficial for the Clemson ag safety program to continue developing information and providing it to high school ag teachers? Why? Or why not? How? Any specific needs or concerns to barriers you have when teaching Ag Safety to your students? Do you have any suggestions for teaching aids, projects, or other ideas to help teach about ag safety?

Qualitative Data Analysis

Following the completion of the focus groups, the audio and video recordings were transcribed and analyzed to find the common themes among the participants' responses. Focus groups were recorded with Zoom and saved to the cloud to produce the audio transcription later. Researchers then examined the transcription with the recording to correct any issues that were found with the audio transcript. Once the transcription was

complete, participants were assigned a random number to retain anonymity. Each part of the transcription was labeled with the participant's assigned number. The constant comparative method (Glaser, 1965) was used to determine similarities between participant responses. Responses that were similar were highlighted and then grouped into themes. Finally, recommendations were provided to the program based on the identified themes.

Results

Presence of Agricultural Safety in the Classroom

A total of five themes were identified through the focus groups. The first theme, Presence of Agricultural Safety in the Classroom, revealed that agricultural safety is most commonly taught in high school agriculture mechanics classes. Study participants reported, “mostly teaching agriculture safety in their agriculture mechanics classes, and not really getting into a lot in ag science classes.” Participants also reported specifically teaching agricultural safety when discussing equipment operation, as the educators felt “safety is really big in that area.” Another common instance when agricultural safety was taught was during OSHA10 training, and participants indicated that mainly upper-level students received this training. Finally, participants indicated that the most common type of agricultural safety that students received pertained to general shop safety and that “on the farm safety” is not a common topic of discussion. General shop safety includes the discussion of power tool safety and other common tools and hazards that are often found

in fabrication shops, while “on the farm safety” refers to more machinery or tractor related safety that educators might not be as familiar with.

Facilitator:

Do you teach agricultural safety in the course of your program?

Respondent 1:

I currently do mostly in my AG mechanics classes, we don't get into a lot in ag science, but we do a lot of sort of equipment safety, general shop safety, OSHA certification, stuff like that with those kids.

Respondent 2:

I currently teach all ag science classes, so I have not done specific safety courses. I do touch on it and talk about safety, but as far as carrying it through and making them be OSHA certified, I have not.

Respondent 3:

So, I teach an ag mech and equipment operations classes right now.

So, safety is really big there. Equipment safety, like everything in the shop, woodworking equipment, welding equipment, everything like that. And then tractor, skid steer safety.

General Needs and Support

The second theme, General Needs and Support, presented the ideas of the additional support that educators wished to receive from the Clemson Agricultural Safety, *Growing Safe Tigers* program. The overwhelming response from participants was the need for more resources, including visual aids, videos, and online resources, that were more condensed. Educators presented the fact that "they do not have a year to teach the students safety like they do in higher level education." Participants also presented concerns about the potential liability that educators face by teaching agriculture. They wished for a standardized agricultural safety test to be provided to all students to limit liability risks. Educators also presented concerns that technology and industry change daily and wished they had "an ever-evolving lesson for safety that meets industry standards." The final type of support educators needed was education materials that meet students' needs who might have different accommodations. Participants indicated how "their biggest challenge is special needs kids because they try to make accommodations for them, and it kind of limits what they can do with their other students." Participants suggested the need for more diversified materials for students on various academic levels, learning abilities, and languages.

Facilitator:

So, the next question asks what safety is taught and what are the ways safety is taught in your courses. I'll leave that up for just a minute or so just to see if

anybody has anything they want to talk amongst the group about what's working and what's not working for you with the safety classes that you're teaching.

Respondent 13:

I think posting a video or something where kids can see, hey, this is dangerous. Having that visual would be really helpful when you talk about it.

Respondent 5:

I mean, I'm kind of on the same page as everybody. I wish there was some kind of standardized test or something that we could give them that protects us because I have a lot of, hey, y'all watch this, kids in my class.

Respondent 20:

Special education has been an extremely big concern for us… accommodating them has been really difficult because they're lower level than what I'm even used to, which is new. Again, I think the videos are good, but if, maybe, they could be dubbed in Spanish or have Spanish subtitles, that would be great for our Spanish-speaking students as well.

Respondent 11:

I think just resources on how to teach it so that it actually will make an impact on the kids.

Confidence in Teaching Ability for Agricultural Safety

Another general theme that was identified through the focus group was Confidence in Teaching Ability for Agricultural Safety. Participants highlighted how some felt more confident in their abilities, while others had concerns about how adequately they were teaching agricultural safety. Concerns also circled about the liability of teaching agricultural safety, as mentioned above. Others noted how their confidence level affects their student's confidence level, especially when operating equipment. There was also a general consensus that the educators were more confident in shop safety as opposed to farm/equipment safety.

> Facilitator:
>
> Alright, so the next part of that question is, how comfortable do you feel about teaching ag safety?
>
> Respondent 8:
>
> So, with, like, general shop safety, workplace safety, I'm comfortable with it, but I think we're talking about actual on the farm safety, and I think, like several other people have said, we have so many kids that have never been on the farm, so that makes it exponentially more difficult to teach that, which makes me a lot less comfortable or confident in that area.

Respondent 13:

I feel comfortable with, like, my knowledge of teaching it. I guess my biggest concern is, did I cover everything when I am teaching it?

Level of Prior Experience of Students

The fourth theme that was identified was Level of Prior Experience of Students. Participants voiced how students who "don't know anything" are not the main concern for the educator but rather "the kid that has spent hours on a piece of equipment." Participants mentioned how "the kids that don't have any kind of background knowledge are way easier to teach because they basically only have what is told to them in class." The conversation also circled around how students with extensive background knowledge may have picked up habits and ways are doing activities around the farm, and the educator finds it difficult to "break old habits that maybe dad has done for 20 years."

Facilitator:

What concerns do you face when teaching agricultural safety to your students?

Respondent 3:

So, I definitely make sure to hammer down safety, especially when I have those students who might work on a farm and are constantly using the equipment. They're so used to it, but not all farm managers are going to be constantly watching, so you never know what bad habits they might have picked up from

other workers… You always have one kid that wants to push the envelope or one kid that just doesn't pass the written test, which makes it hard to teach.

Respondent 6:

I do have more city kids that don't have a lot of experience like, I'm not sure they are really listening or comprehending what is being taught, and it makes me a little nervous when we actually get to tractor driving and other activities.

Respondent 10:

For some of my kids, they grew up on a farm, so they have that background knowledge. So, trying to reteach them the proper way of doing it can be challenging because most of them are "hey, watch this" kids.

Respondent 17:

My inner-city kids, hands down, are like, "You say it's going like that; it's going like that." But my other kids are like, "Dad and Grandpa did it this way, and that's what I'm going to do."

Availability of Resources

The final theme that emerged was Availability of Resources. Participants discussed the various resources they access to teach agricultural safety outside of the

Clemson Agricultural Safety, *Growing Safe Tigers* resources. Many indicated they draw information from other colleagues inside and outside their school. Several participants mentioned the use of OSHA10 training and other industry professionals to provide certifications to their students. Some participants mentioned using game wardens and Red Cross agents to teach the concepts of agricultural safety that are not included in the Clemson Agricultural Safety, *Growing Safe Tigers* program. Other participants mentioned the use of online training modules, such as iCEV, online Career and Technical Education (CTE) curriculum and certification testing, where students complete various modules and achieve a minimum test score before participating in hands-on activities.

> Facilitator:
>
> So, the next question is, how many agricultural safety professional development or instructional resources have you experienced or been given access to? So, is there anything that's out there that you're using, or any resources that you find are better?
>
> Respondent 19:
>
> We really use our wildlife officers, game wardens, and certified OSHA instructors in the building. They are able to kind of help us if we need help with anything that we don't understand.
>
> Respondent 21:

We use the OSHA10 and the iCEV. The iCEV, their shop safety is pretty decent, so I give it to my ag mechs the first week of classes. They have to pass those modules. I like the hazard recognition because it's not gory.

Respondent 5:

My kids get barbicide certification because they do [pet] grooming, and that's how we clean our grooming supplies with the Red Cross.

Recommendations

Based on focus group participant responses, several recommendations can be provided to the Clemson Agricultural Safety, *Growing Safe Tigers* program. Recommendations were provided in three categories, Needed Resources, Teacher Workshops, and Standardized Safety Tests. Needed Resources comprises the resources educators feel they can incorporate into daily teaching exercises that will reveal some of the extra time it will take to implement this new material. Teacher Workshops consist of educators' desire to learn more about agricultural safety to be more competent in the area. Finally, Standardized Safety Tests encompasses the notion of a state-provided safety test to lessen educators' concerns about liability issues that may arise if students are injured while in their classroom.

Needed Resources

Through the focus groups, participants identified a number of resources they felt would benefit the students and themselves. Participants indicated they struggled to

maintain students' attention for long periods of time. Some materials that were already provided to educators were rather lengthy. To aid teachers in their ability to get important information to their students, it is suggested that materials be developed that are more condensed while still providing students with important information that is aligned with curricular objectives.

Participants also mentioned they had a wide variety of students enrolled in their classes. Some students require special needs to accommodate their learning, while other students are not fluent in English. There is an apparent need for agricultural safety materials that are gauged to meet the needs of a diverse population. Participants voiced their concerns about having to adjust materials provided to them to better fit the needs of students with disabilities. By providing educational materials tailored to meet a variety of learning needs, some of the burdens of adjusting educational materials in the classroom could be removed. Developing educational materials in other languages could help provide non-English speaking students the same opportunity to learn that English-speaking students are provided. Participants also mentioned the lack of educational materials that are accessible via a website or the Internet. Currently, almost all Clemson Agricultural Safety, *Growing Safe Tigers* program materials are not offered in an online format. Educators have received them in the past as hard copies or via a flash drive. To make educational materials more accessible for students and educators, materials should be uploaded to a website or shared folder that could be easily accessible from anywhere with an internet connection.

Teacher Workshops

Focus group participants mentioned that some do not feel confident in their abilities to teach agricultural safety to students. Some educators come from rather extensive agricultural backgrounds, while others only know agriculture from their high school and college careers. To ensure that educators provide students with the highest quality education on agricultural safety, teacher workshops for professional development should be incorporated into the Clemson Agricultural Safety, *Growing Safe Tigers* program. Not only will participation in professional development help increase teacher competencies related to safety in the classroom, but it may also provide educators with guidance on how to teach agricultural safety. Teacher workshops could provide educators with ideas and other abstract resources that could be incorporated into their daily lessons. Teacher workshops could also include a brief overview of agricultural safety topics and training on how best to teach topics to students. Many participants expressed concerns about not knowing how to convey safety information to their students, and their only known method was using lectures. During training days, educators could be provided with curriculum on how to make agricultural safety more hands-on for the students to learn, thus, encouraging students to learn from their environment and later take their learnings and employ the new knowledge in their community. The premise of the training day would be that the teachers are the students, and the program instructors would act as the teacher. Teachers could then incorporate methods outlined in the training into their daily curriculum.

Standardized Safety Test

Participants mentioned their hesitancy to allow students to participate in some activities that surround agriculture because of their fear of litigation. Participants reported providing students and parents with a safety waiver pertaining to the activities that the students would complete in their class. However, educators feared this was not enough in the event that an incident occurred in their classroom. By creating a standardized safety test that all educators could administer to their students to gauge their abilities in agricultural safety, may alleviate some of the fears of litigation educators are currently experiencing in their SBAE.

Conclusion

Agricultural educators are the surrogate for learning agricultural practices to students (Hubert et al., 2003). While the Clemson Agricultural Safety, *Growing Safe Tigers* program has developed significant materials, more work can be accomplished to better meet the needs of SBAE teachers and students. To continue the growth of this program and its goal to educate South Carolina about agricultural safety, the program needs to develop more easily accessible and diverse materials that encourage students to learn from their surroundings and can be incorporated by educators into their daily lessons that connect directly to courses outlined in the career pathways. The program also needs to provide more one-on-one support to educators to ensure they are comfortable and confident in teaching agricultural safety to their students. Finally, with fears of litigation, the Clemson Agricultural Safety, *Growing Safe Tigers* program could aid

educators by providing standardized agricultural safety tests to ensure that students are competent before participating in agricultural activities. While findings from this report include the responses of 22 agricultural educators who participated in one focus group, there are currently 162 agricultural educators in South Carolina. Each educator might have different needs for their area within the state, leading to different recommendations for the program intervention. Recognizing differing needs and providing localized programs align with checkpoint three for the intervention to be place-based to enhance sustainability. To further understand the agricultural safety needs of agricultural educators in South Carolina, additional focus groups and structured interviews should be planned and conducted to evaluate other changes needed in place, systems, and the community.

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CHAPTER SIX

CONCLUSIONS

The Clemson Agricultural Safety, *Growing Safe Tigers* program was developed in 2019. The purpose of the program is "to increase awareness of agricultural safety procedures, maintenance operations, and safety operations for youth ages 14-18 to work safely in the agriculture industry". Current educational strategies include curriculum development and providing field days across the state where students learn from their surroundings and various other agricultural educators.

Using the land-based learning model (McKim et al., 2019), the four checkpoints, 1). Identification, 2). Understanding, 3). Intervention, and 4). Evaluation, were adapted and conceptualized through this research. The identification checkpoint involves the students and educators identifying a local phenomenon and community members that can aid in the learning process. Following the identification checkpoint is the understanding checkpoint. During the understanding checkpoint, learning comes from the environment that the learner is in. Instructors that were previously identified in the first checkpoint are on the outside of the learning, allowing the students to create their own learning experience. The next checkpoint is the intervention checkpoint. During this checkpoint, community members and instructors begin to guide the learning process, while still allowing for the environment to be involved in the learning. Instructors provided valuable information that students might not receive from their environment. The final checkpoint is the evaluation checkpoint. During this checkpoint, learning is evaluated, and students

are charged with taking what they learned and incorporating it into their community to encourage sustainability.

The identification checkpoint was achieved when agricultural incident rates were determined through the use of AgInjuryNews.org, a based service that categorizes agricultural related incidents for the United States. Data was retrieved from the website for 2016-2022 South Carolina agricultural incidents. Incidents were categorized to determine the main cause of the incident, and agricultural incident rates were calculated. With the identification of agricultural incident rates, a need was determined for additional curriculum development and new educational strategies to increase the awareness of agricultural safety in the communities throughout South Carolina. Injury surveillance data must continue to be compiled to ensure that the Clemson Agricultural Safety, *Growing Safe Tigers* program is providing information that remain relevant and beneficial to the specific needs of all individuals in the counties of South Carolina.

The overall understanding of agricultural safety was also determined specifically pertaining to School-based Agricultural Education (SBAE) teachers throughout South Carolina, achieving the second checkpoint. By better understanding the educators' place and interconnected systems, additional support can be provided to them by the Clemson Agricultural Safety, *Growing Safe Tigers* program identified as the partner to the interconnected system between the teachers and their SBAE programs and students. To expand upon checkpoint two of understanding, additional work must be done to ensure that educators are receiving the support and guidance to best educate the youth of South Carolina who are enrolled in SBAE programs.

Checkpoint three, Intervention was applied through the Clemson Agricultural Safety, *Growing Safe Tigers* field days. Research was conducted using pre and post-test scores for high school students enrolled in SBAE programs, who participated in the field days and produced post-test scores that were statistically different from pre-test scores. Of the four regular field days and one condensed field day, all but one produced post-test scores that were statistically higher than pre-test scores. A limitation was identified pertaining to sample size. One regular field day had a sample size of ten, with a response rate of 17.24%. With such a small sample size, generalizing results to the intended population is not recommended. During field days, students were encouraged to learn from their surroundings, while being guided in the learning process by station instructors. This intervention was place-based to enhance sustainability. Field days were held at Clemson University Research and Education Centers (RECs) across the state. These RECs allow the students to become involved in the agricultural learning process and allow students to explore the many topics of agricultural safety. Topics for field days included, but were not limited to, tractor safety, animal safety, pesticide safety, safe load, and grain bin safety. While statistically different pre and post-tests were determined through this research, it is recommended that changes be made to data collection methods, station instructor preparedness, the program's current outreach abilities, and finally the materials that are currently provided to the students during field days. All recommendations are provided with the goal to enhance the sustainability of the program and to ensure that students are receiving the highest quality education pertaining to agricultural safety that can later be incorporated into both their lives and the community.

Finally, the evaluation checkpoint to determine the changes in place, systems, and the community was achieved through the research conducted on the Clemson Agricultural Safety, *Growing Safe Tigers* program. The purpose of this research was to utilize the four checkpoints of the land-based learning model to be conceptualized by the program. The goal of land-based learning, similar to the goals and purpose of the Clemson Agricultural Safety, *Growing Safe Tigers* program, is to encourage learning in "lived experiences of place," such as nature the community of farms, as opposed to the conventional "abstractions of place," such as textbooks and classrooms (McKim et al., 2019). Land-based learning encourages the use of the natural world as a surrogate for learning to enhance the student's ability to understand what is being taught on a deeper level (McKim et al., 2019). When students and teachers participate in safety field days they are immersed in a lived experience where they are introduced to a variety of farm equipment and operations to explore and gain awareness of agricultural safety incidents that can occur. Thus, potentially reducing the future incident rates in the counties throughout the state of South Carolina.

By utilizing the land-based learning model (McKim et al., 2019) to identify the Clemson Agricultural Safety, *Growing Safe Tigers* program as the partner for SBAE programs, including their agricultural education students and teachers, a better understanding of curriculum updates, educational strategies, and place-based needs can be developed to continue to increase the awareness of agricultural safety in South Carolina. An attempt to decrease the agricultural incident rates for South Carolina is also possible with continued intervention and evaluation practices, as depicted in the adapted

land-based learning model for the program, with recommendations outlined to enhance the sustainability of the program.

APPENDICES

Appendix A

Station Lesson Plans

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Personal Protective Equipment
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
PPE PowerPoint, PPE examples (safety glasses, safety goggles, face shield, auto darkening welding helmet, fixed shade welding helmet, ear plugs, hard hats, face/dust masks, gloves, steel toe shoes, aprons, full body suits), PPE student activity, PPE fact sheet	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What are the types and purposes of PPE?

Introduction (Interest Approach)	**Estimated Time:**
Students brainstorm ideas about items that might be considered Personal Protective Equipment. Students will then share what they believe are types of PPE.	

Learning Activity: PPE Overview	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Using the PPE PowerPoint, provide an overview of general PPE safety, the hierarchy of controls, and OSHA's requirements for PPE.	1) What does PPE stand for – Personal Protective Equipment 2) Hierarchy of Controls – Elimination, substitution, engineering controls, administrative controls, PPE. a. PPE is considered the last line of defense. i. PPE should be the last thing considered to keep you safe in the workplace. b. Other measures should be used to protect against hazards instead of solely relying on PPE. 3) OSHA requires all employers to provide employees with PPE and a safe workplace.	

Learning Activity: Head Protection	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Using the PPE PowerPoint slides 12-15, provide an overview of head protection and classes of head protection. Have students select the proper types of head protection from a variety of PPE examples.	1) Hazards that head protection can protect you from a. Falling objects b. Bumping head against fixed objects c. Accidental head contact with electrical hazards 2) Classes of hard hats a. Class G = General i. Protects against low voltage, impacts, and penetration b. Class E = Electrical i. Protects against high voltage c. Class C = Conductive i. Least protective ii. Protects against minor bumps with no voltage protection	1) Identify head protection devices. 2) Discuss when head protection should be worn. 3) Differentiate between types of head protection. 4) Demonstrate the proper use of head protection.

Learning Activity: Eye and Face Protection	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Using the PPE PowerPoint slides 15-20, provide an overview of eye and face protection. Have students select the proper types of eye and face protection from a variety of PPE examples.	1) Hazards that eye/face protection can protect you from a. Chemical splashes b. Blood and other infectious materials c. Intense light d. Dust/suspended materials e. Molten metal f. Flying objects 2) Safety Glasses a. Protects from moderate impacts from particles 3) Goggles a. Protect the eye and area around the eye from impact, dust, and splashes 4) Face Shields a. Protects from splashes or sprays b. Must be worn with eye protection 5) Welding Shields a. Protects eyes from intense light b. Protects face and eyes from flying sparks, metal splatter, and slag. 6) Respiratory Protections a. Air-purifying (APR) – dust masks, ventilated masks, self-contained breathing apparatus (SCBA), supplied-air respirator (SAR)	1) Identify eye and face protection devices. 2) Discuss when eye and face protection should be worn. 3) Differentiate between types of eye and face protection 4) Create an eye and face protection fact sheet. 5) Demonstrate the proper use of eye and face protection.

Learning Activity: Hearing Protection	Estimated Time:	
Presenter Directions	**Content Outline**	**Objectives**
Using the PPE PowerPoint slides 24-27, provide an overview of hearing protection. Discuss when hearing protection is needed and not needed.	1) Hearing protection is required at 90 dB. a. Truck traffic can be 90 dB. b. Exposure to 80 dB over extended periods of time can result in hearing loss. 2) OSHA requires employers to provide adequate hearing protection based on sound level and duration per day. 3) Types a. Disposable foam plugs b. Molded ear plugs c. Noise-canceling earplugs d. Earmuffs	1) Investigate the types of hearing protection. 2) Discuss when hearing protection should be worn. 3) Determine the proper hearing protection for various tasks. 4) Demonstrate the proper use of hearing protection.

Learning Activity: Hand Protection	Estimated Time:	
Presenter Directions	**Content Outline**	**Objectives**
Using the PPE PowerPoint slides 28-31, provide an overview of hand protection. **This portion of the PowerPoint has some graphic images. Skip these slides if necessary!** Have students discuss differences in hand protection that are provided to them.	1) Potential hazards a. Skin absorption of hazardous substances, cuts, punctures, chemical or thermal burns, loss of digits, and broken bones 2) Primary protection: keep hands away from where injuries may occur. 3) Types of Gloves a. Anti-vibration b. Chemical resistant c. Leather d. Permeation-resistant e. Heat resistant f. Cut resistant	1) Identify various types of hand protection. 2) Demonstrate the proper use of hand protection. 3) Compare and contrast times when hand

		protection is needed/not needed.

Learning Activity: Body Protection	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Using the PPE PowerPoint, slides 32-39. This section of slides explains foot, leg, and body PPE. Allow students time to pass around various body PPE and discuss when they believe body PPE should be used.	1) Foot and Leg Protection a. Shoes with steel or composite toes or instep. b. Protect from falling or rolling objects, sharp objects, wet or slippery surfaces, electrical hazards, and uneven surfaces. c. Examples of foot protection i. Impact-resistant toe, heat-resistant sole, metal shanks, chemical/liquid–resistant shoes 2) Body Protection a. Protective clothing such as lab coats, coveralls, vests, jackets, aprons b. Protects against dust, splashes, abrasions, cuts, bruises, flames, chemical or physical hazards	1) Identify the various types of body protection. 2) Determine the proper body protection for various tasks. 3) Demonstrate the proper use of body protection.

Conclusion/Summary (Reflection)	**Estimated Time:**
Have students ask questions about PPE and ask students to list one thing that they learned from the PPE Station. Have students complete the PPE questions of the post-test. Pass around various types of PPE, and have students identify when and why they would need to wear each type of PPE.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Hazard Identification
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Hazard Identification PowerPoint, hazard examples (missing guards on grinders, broken extension cords), Hazard ID student activity, Hazard ID fact sheet	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What is the process of identifying hazards? How do you eliminate hazards?

Introduction (Interest Approach)	**Estimated Time:**
Place hazard examples around the group. Have students select various items and describe what they believe the hazard is.	

Learning Activity: Near Misses/Close Calls	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Hazard Identification PowerPoint slides 4 – 7. Discuss the difference between incidents and near misses/close calls. Have students determine the root cause of hazards that are present in examples.	1) Root Cause a. Primary issue or hazard that led to an incident occurring. b. Examples i. Improper training ii. Disorganization in the workplace iii. Improper chemical storage procedures iv. Repetitive work motions that could be mitigated through other means. 2) Near miss/close call a. An unplanned event that has the potential to cause harm to someone but does not actually harm the person.	1) What are the root causes of hazards? 2) What are near misses/close calls?

Learning Activity: Identifying Hazards: OSHA's Six Steps	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Hazard Identification PowerPoint slides 8 – 19. Discuss what steps would be taken to identify hazards in the workplace or agriculture.	1) Collect existing information about current workplace hazards. a. Talk with workers about hazards they encounter. 2) Inspect the workplace for hazards. a. Conduct inspections and take photos. 3) Identify health hazards. a. Look for "unseen hazards," chemical hazards, physical hazards, biological hazards, and ergonomic risk factors. 4) Incident investigations a. Look into injuries, illnesses, close calls/near misses, and reports of concern. 5) Identify hazards associated with emergency and non-routine situations. a. Emergency and non-routine situations can present hazards that aren't common. 6) Characterize the nature of hazards, identify interim controls, and prioritize hazards for control. a. Evaluate the severity of hazards to prioritize them and implement interim control until permanent controls can be implemented.	1) What is considered a hazard? 2) What should be done when a hazard is identified?
Learning Activity: Eliminating Hazards	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Hazard Identification PowerPoint slide 20. Discuss the hierarchy of control and how to eliminate hazards using engineering controls.	1) Hierarchy of controls a. Elimination: Remove the hazard b. Substitution: Replace the hazard c. Engineering controls: Isolate workers from the hazard d. Administrative controls: Change the way work is performed e. PPE: protective equipment to keep workers safe. 2) Engineering controls	1) What are engineering controls? 2) How do engineering controls help reduce hazards?

	a. Installation of proper control measures the mitigate or eliminate exposure to hazards. b. It is often done by moving the hazard and isolating the workers from the hazard.	

Conclusion/Summary (Reflection)	**Estimated Time:**
Have students determine ways hazards could be eliminated in hazard identification examples. Students should complete the hazard identification portion of the post-test during this time.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Power Tool Safety
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Power Tool Safety PowerPoint, power tool examples (cordless drill/impact, corded drill/impact, Sawzall, circular saw, jig saw, sander), wood, Power Tool Safety student activity, Power Tool Safety fact sheet, Power Tool Safety Quiz	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What pre-checks and post-checks should be completed when using power tools?

Introduction (Interest Approach)	**Estimated Time:**
Discuss what power tools students have used and the various tasks they have used them for. Take time to have students look at and pass around various power tools.	

Learning Activity: Power tool pre-checks	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss what tools should be used for a variety of tasks and what the students should check for before operating a power tool. Discuss when and what PPE should be worn when working with a variety of power tools. Ensure that gloves are discussed during this portion.	1) Potential PPE a. PPE depends on the tool you are operating b. Safety glasses, closed-toe shoes, hearing protection c. Gloves i. If the power tool has any rotating parts, NEVER WEAR GLOVES 2) Ensure the proper tool is selected for whatever job is being completed. 3) Pre-checks a. If corded i. The power cord is free of breaks, kinks, pinches, splices, or exposed wires.	1) Develop a safety guide for proper PPE for commonly used power tools. 2) Determine the proper power tool for various tasks.

	ii. Prongers are not bent b. If battery powered i. The battery is properly secured and is the correct battery for the tool. c. Make sure the on/off switch works properly. d. For stationary tools, perform a walk-around to ensure there are no issues with the equipment.	3) Create a safety checklist to determine whether the power tool works properly before use.
Learning Activity: Power tool use	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss safety practices that should be done when operating a power tool.	1) Always use two hands when operating a power tool. 2) Ensure blades, bits, grinding wheels, or other attachments are properly secured. 3) Ensure the workpiece is properly secured in a vice or on saw horses with clamps. 4) Always be aware of where bystanders are. Ensure that any sparks, flashes, or flying debris will not hit them.	1) Discuss safe practices when working with power tools. 2) Develop a shop layout plan for working with power tools.
Learning Activity: Power tool post-checks	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss common hazards that should be checked for before storing power tools. Discuss how and when power tools should be serviced.	1) Common hazards a. Broken or altered power cords b. Batteries that have gone bad c. Broken attachments d. Issues with attachment mechanisms i. Drill chucks ii. Disc attachments 2) Power tool service a. After every use, power tools should be checked for damage.	1) Develop a service plan for regularly maintaining power tools. 2) Identify common issues that could result in

	b. Before servicing a power tool, ensure the battery is removed, or the power cord is unplugged.	the failure of the power tool. 3) Demonstrate proper use of power tools.

Conclusion/Summary (Reflection)	**Estimated Time:**
With the provided power tools and wood, have students demonstrate proper use of power tools and have them select the correct PPE. At this time, allow students to complete the Power Tool Safety portion of the post-test.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Tractor Safety
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Tractor Safety PowerPoint, Hydrostatic Tractor Fact Sheet, Gear Drive Tractor Fact Sheet, Tractor Safety Fact Sheet, Pre-Operational Tractor Check List, Tractor Safety Quiz, Tractor Safety Student Activity, Tractor Roll Over Simulator, Power wheels roll over simulator, toy tractor rollover plates, hydrostatic tractor, gear drive tractor.	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What steps should be completed to operate a tractor properly?

Introduction (Interest Approach)	**Estimated Time:**
Ask students how many have operated a tractor. Allow time for each student to answer the question. Then provide a follow-up question: "Did you wear a seat belt while you operated the tractor?" Many students will probably answer that they did not wear a seatbelt while operating a tractor. Briefly discuss how seatbelts are important to wear sometimes while operating a tractor but not always.	

Learning Activity: Roll Over Protective Structures (ROPS)	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss what ROPS is an acronym for and who developed ROPS. Discuss when a seatbelt should be worn while operating a tractor. Have students explore possible reasons for rollovers and why ROPS are important.	1) ROPS: Roll-Over Protective Structure a. It was developed by John Deere and open-sourced to other tractor manufacturers in the late 1970s. b. ROPS should never be modified. c. ROPS work by stopping the tractor from rolling completely over i. Use power wheels roll-over simulator 2) Seatbelts on tractors	1) Define ROPS 2) Determine when seatbelts should be worn while operating a tractor. 3) Demonstrate proper use of

	a. Seatbelts should not be worn if ROPS are not present or folded down. i. Allows operator to jump off and escape in the event of a rollover b. Seatbelts should be worn if ROPS are present. i. Seatbelt holds the operator in the safety area of the ROPS ii. Use the tractor rollover simulator here. 3) Roll Overs a. Often occurs when traveling across slopes. Travel up and down slopes to prevent rollovers. b. Adding loads to tractors affect their center of gravity, changing the rollover points. i. Toy tractor rollover plates explain this.	ROPS and seatbelt. 4) Create a display of ROPS working to prevent injury.

Learning Activity: Pre-Operational Checklist	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss safety practices that should be done when before operating a tractor. Have students identify common items that should always be checked before operation.	1) Pre-operational checklist a. Check all fluid levels b. Check for leaks and structural damage c. Ensure implements are appropriately attached d. Use 3 points of contact to enter the machine e. Familiarize yourself with the controls and movements f. Ensure slow-moving vehicle signage is present and visible g. Check engines hours to ensure proper oil life 2) Check before bystanders before operating your tractor. a. Tractors have blind spots that may prevent the operator from seeing people or other obstacles around them. 3) Only carry passengers if a buddy seat is present. 4) Lower all implements if not in use. 5) Drive slowly enough to keep control over unexpected hazards, and do not stop suddenly or make sudden movements.	1) Determine common maintenance procedures for tractors. 2) Create a maintenance schedule for equipment around the shop area. 3) Demonstrate proper mounting and dismounting of a tractor.

Learning Activity: Power Take-Off (PTO) Safety	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss hazards associated with PTO shafts and demonstrate proper attachment and removal of PTO-powered implements.	1) PTO: power take-off 2) PTO Safety a. Ensure all guards and safety chains are in place b. Never step over a PTO shaft c. Never wear loose clothing around the PTO shaft d. Always tie back long hair e. Shut off the tractor prior to attaching PTO	1) Define PTO. 2) Identify potential hazards around a PTO. 3) Demonstrate proper PTO safety while attaching, detaching, and working with a PTO shaft.

Conclusion/Summary (Reflection)	**Estimated Time:**
Quickly review ROPS again and have students discuss the main takeaways about tractor safety. Have students complete the tractor safety portion of the post-test. Have students practice mounting and dismounting the tractor in a safe manner. Ensure that three points of contact are made at all times.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Lawnmower Safety
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Lawnmower, ATV, UTV Safety PowerPoint Slides 1 – 11, Lawnmower, ATV, UTV Fact Sheet, ride-on lawnmower, zero turn lawnmower	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What are the main hazards associated with lawnmowers?

Introduction (Interest Approach)	**Estimated Time:**
Start by asking students if they have ever operated a lawnmower. Then, using slides 6 – 9, ask students the question on the slides. Use these questions to engage the students in the "fun facts." Read each question and allow time for students to come up with a group answer. Once they have agreed on an answer, show them the correct answer. Discuss why this is the right answer, and if they provided you with an incorrect answer, explain why their answer was wrong.	

Learning Activity: Safety Basics	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss common PPE that should be worn when operating a lawnmower and common hazards associated with lawnmowers. Be sure to discuss grass clippings on roadways and the danger this presents to motorcyclists. Next, discuss that there should never be a passenger on a lawnmower. Lawnmowers are only designed for one operator.	1) PPE a. Ear protection b. Eye protection c. Closed toe shoes 2) Discharge chute direction a. Check for bystanders and be aware of the chute direction. b. Never blow grass clippings into roadways. This can act like black ice to motorcyclists.	1) Choose the proper PPE for operating a lawnmower. 2) Identify common hazards associated

	c. Sticks and other debris can fly out of a lawnmower discharge chute at 200 miles per hour. d. Never mow with the discharge chute pointed toward trees or buildings. Projected materials could ricochet from the mower. 3) Passengers on lawnmowers a. Do not allow children to ride as passengers ever.	with lawnmowers. 3) Discuss the stipulations for passengers on lawnmowers.
Learning Activity: Pre-Operational Checklist	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the pre-operational checks that should be done before operating a lawnmower.	1) Use mowers with adequate lighting or daylight. 2) Keep all guards, shields, switches, and other safety devices in working order. 3) Pre-operational checks a. Ensure the mower is appropriate for the task and the operator is trained to use the mower. b. Check that the mower deck and discharge chute are free of materials. i. Always turn the mower off when removing materials from clogged chutes. c. Make sure blades are undamaged and in proper working order. d. Set the height adjustment lever to the proper height.	1) Determine pre-checks that should be performed before operating a lawnmower. 2) Prepare a pre-operational checklist for lawnmowers. 3) Develop a training plan for new lawnmower users.
Learning Activity: Post-Operational Checklist	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss hazards associated with PTO shafts and demonstrate proper attachment and removal of PTO-powered implements.	1) Park on even ground and in a safe location that an untrained operator cannot access. 2) Remove any materials from the engine and mowing deck 3) If a grass catch bag is present, remove and empty the contents.	1) Discuss post-checks that should be performed

	4) Raise and secure cutting blades 5) Remove keys	after operating a lawnmower. 2) Design a post-operational checklist for lawnmowers. 3) Explain the best location for lawnmowers to be stored when not in use.

Conclusion/Summary (Reflection)	**Estimated Time:**
Have students discuss something new they learned today and ask any questions about lawnmowers and lawnmower safety. Provide students with time to get on the lawnmower and test out the seat, the seatbelt (is present), and all the features of the lawnmower. Allow students time to complete the lawnmower safety portion of the post-test.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	ATV and UTV Safety
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Lawnmower, ATV, UTV Safety PowerPoint Slides 12 – 18, Lawnmower, ATV, UTV Fact Sheet, ATV, UTV	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What potential hazards are associated with ATV/UTVs?

Introduction (Interest Approach)	**Estimated Time:**
Discuss with students if they have ever operated an ATV or UTV. Have them discuss when and what the application of the use of the ATV/UTV was.	

Learning Activity: Hazards Associated with ATV/UTVs	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the main hazards associated with ATV/UTVs, such as rollovers and roadway collisions. Discuss how adding weight affects the vehicle's center of gravity, affecting how the vehicle should be operated.	1) ATV/UTV rollovers a. ATV/UTV have various rollover points, be aware of these before operating. b. Understand the vehicle's center of gravity. i. Adding weight to the front or rear changes the vehicle's center of gravity ii. Travel up and down slopes rather than across. 2) Never ride ATVs/UTVs on paved roads except to cross when safe and permitted by law.	1) Explain common rollover points on an ATV/UTV. 2) Detect the machine's center of gravity when weight is distributed to

		different locations. 3) Design a tabletop display for rollover points of an ATV/UTV. 4) Determine the roadway rules for ATVs/UTVs.
Learning Activity: Safety Procedures	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the common safety procedures for operating an ATV/UTV. Show students examples of signage placed on ATVs/UTVs to keep operators safe.	1) Safety Procedures a. Never ride under the influence of alcohol or other drugs b. Never carry passengers on a single-rider ATV c. Supervise riders younger than 16; ATVs are not toys d. Ride only on designed trails and at safe speeds e. Always keep legs and arms inside the vehicle f. Drive slowly and turn smoothly to avoid an overturn g. Do not turn the vehicle in mid-slope because of the increased risk of overturn h. Use appropriate speed on rough terrain i. Each passenger must ride in their seat, do not haul passengers in the cargo area. 2) PPE a. DOT-complainant helmet, goggles, long sleeves, long pants, over-the-ankle boots, and gloves	1) Discuss safety procedures for operating an ATV/UTV. 2) Select ATVs/UTVs that are suitable to carry passengers. 3) Specify what PPE should be worn when operating an ATV/UTV. 4) Demonstrate proper ATV/UTV

		safety procedures when operating the machine.

Learning Activity: Applications for ATV/UTVs in Agriculture	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss when ATVs/UTVs are used in agricultural operations.	1) Agricultural Applications a. Coving large tracts of land b. Surveying property, fences, and livestock c. Hauling small loads from one place to another	1) Discuss agricultural tasks that utilize ATVs/UTVs. 2) Apply ATV/UTVs in agricultural tasks.

Conclusion/Summary (Reflection)	**Estimated Time:**
Allow time for students to ask questions and brainstorm ideas about what other tasks could utilize an ATV/UTV. Students will be placed in groups of three or four. In these groups, allow them time to develop a short skit to demonstrate ATV/UTV safety. These skits should have educational value and not merely be students playing around. Students should now complete the ATV/UTV Safety portion of the post-test.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Animal Safety
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Livestock (if allowed), livestock working tools (paddles, prods), cattle chute, livestock simulator, Animal Safety Fact Sheet, Animal Safety Student Activity, Animal Safety Quiz	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What hazards are associated with animal agriculture?

Introduction (Interest Approach)	**Estimated Time:**
Ask students if they have ever had any experience working around livestock. Allow time for them to share their answers. Ask students if they ever knew anyone to be injured by livestock. Allow time for the students to share their answers. If no students have experienced this, share your experiences with livestock-related incidents.	

Learning Activity: Safety Tools for Animals	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the proper PPE that should be worn when working with livestock. Identify the common hazards that are associated with livestock. Have students brainstorm ideas of how to prevent injury while working with livestock.	1) PPE a. Closed-toed shoes (often rubber boots), long pants, a long-sleeved shirt, gloves, and safety glasses 2) Common Hazards a. Getting stepped on, trampled, bit, or kicked b. Being pinned to a solid surface c. Bacteria infections passed from livestock to humans d. Mothers can often become protective of their young when approaching them.	1) Identify proper PPE that should be worn when working with animals. 2) Discuss common hazards

	3) Common Tools a. Chutes i. Used to keep animals in one place to work on them b. Lasso i. Used to catch animals c. Paddles/prods i. Used to direct animals in an intended direction	associated with livestock. 3) Recommend safety procedures for working with livestock. 4) Select the common tools used when working with livestock.
Learning Activity: Approaching Livestock	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss safe practices for approaching livestock. Discuss the fact that each type of livestock has a different blind spot, and depending on where you approach the livestock, they might not see you.	1) How to approach livestock a. Avoid surprising the livestock: ensure the animal knows you are present b. Do not sneak up behind the animal. This might spook them c. Always pay attention to the animal to avoid finding yourself in a corner. d. Always have an exit plan. Make sure that you have a plan to escape in the event of an emergency. 2) Blind spots a. Every animal has a different blind spot b. Know where the animal's blind spots are before approaching c. If you do not know an animal's blind spot, approach the animal calmly from the front.	1) Define animal blind spots. 2) Illustrate blind spots for common livestock found in agriculture. 3) Demonstrate the proper method for approaching livestock.

Learning Activity: Equipment and Livestock	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the common hazards that can arise when combining equipment and livestock. Discuss how equipment can cause livestock to act differently and spook more easily.	1) When operating equipment around livestock, animals may spook, causing harm to others. 2) Always be aware of where livestock and others are when using equipment around livestock. Often equipment has blind spots, so it's always important to understand where livestock are as not to hurt the livestock, yourself, or others.	1) Discuss the precautions used when working equipment and livestock simultaneously. 2) Develop a plan for using equipment around livestock.

Conclusion/Summary (Reflection)	**Estimated Time:**
Allow time for students to ask questions. Elaborate on any topics that are brought up. If a squeeze chute is present, show students how to use it and allow them to practice using it. Students will then show proper operational procedures. Students should be able to operate it proficiently and explain its purpose and procedures.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Safe Load
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Safe load PowerPoint, Safe Load Fact Sheet, Safe Load Student Activity, flat deck trailer, tractor or other equipment, 1-inch ratchet straps, 2-inch ratchet straps, tire chalks, chains, ratchet chain binders, lever action chain binders	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What are the primary concerns when loading and unloading equipment?

Introduction (Interest Approach)	**Estimated Time:**
Ask students if they have ever loaded anything onto a trailer or the bed of a truck before. Allow students time to answer the question and then ask if they have ever seen anything that has been loaded onto a trailer in an unsafe manner. If no students answer, share personal experiences.	

Learning Activity: Loading/Unloading Equipment	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the process of loading and unloading equipment onto a trailer. Discuss how placement on a trailer affects the overall handling of the trailer. Touch on the idea of "fishtailing." Do a walk-around of the loaded trailer and equipment to show load placement.	1) Loading and Unloading a. Always load and unload slowly. b. If the implement is attached, keep the implement as low as possible. c. Keep equipment in the center of the trailer. d. Always engage the parking brake after the equipment is loaded. e. Use chalks or blocks to prevent the load from shifting. 2) Load placement a. Place the bulk of the weight towards the front of the trailer. b. Always center the weight in the middle of the trailer and over the axle.	1) Explain the proper method for loading and unloading equipment. 2) Discuss proper weight placement on a trailer. 3) Demonstrate proper loading

	c. If spacers are used, tiedown should be placed as close as possible to the spacer. d. Place in direct contact with the tiedown and provide blocking to prevent bundles from shifting towards one another. 3) Fishtailing a. The swaying from side to side of a trailer due to the load not being placed correctly. b. Fishtailing increases the chances of an overturn and damage to equipment. c. Traveling at faster speeds increases the chances of fishtailing.	of equipment on a trailer. 4) Identify a trailer that is loaded correctly. 5) Demonstrate proper loading/unloading techniques for equipment.

Learning Activity: Common Securement Equipment	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the common types of securement equipment. With the provided securement equipment, allow students time to interact with them. Show correct and incorrect ways of securing equipment.	1) Common Securement Equipment a. 1-inch ratchet strap: suitable for loads less than 400 lbs - small lawnmowers, ATVs, building supplies b. 2-inch ratchet strap: suitable for loads less than 2,000 lbs – UTV, hay, building supplies c. Ratchet chain binder: easy to tighten and loosen as needed but will not self-loosen. Suitable for light trucks to heavy machinery d. Lever action binder: NOT to be used on highway loads. The handle must be safely tied down because it may self-loosen 2) Number of tie-downs required a. 10,000 lbs or less – at least two tie-downs b. More than 10,000 lbs – at least four tie-downs. c. If an implement is attached, one tiedown must secure it. 3) Ensure that the securement equipment is not damaged before use. 4) When placing tie-downs, ensure that it does not hit any obstructions and pulls straight to the trailer—not bending around objects. 5) Store all securement equipment in a dry location and remove straps from ratcheting devices.	1) Identify common types of securement equipment. 2) Differentiate between the types of load securement devices. 3) Discuss laws and regulations pertaining to equipment tie-down and transportation. 4) Apply tiedown stipulations to

		loading equipment. 5) Demonstrate tiedown procedures for loading.

Learning Activity: Working Load Limits (WLL)	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Using the chains, binders, and ratchet straps, show students how the WLL is stamped or written on the securement equipment. Discuss what WLL is and what it means.	1) WLL: Working Load Limit 2) WLL is determined by the component's manufacturer 3) WWL can be found on all securement devices. a. Straps typically have a tag. b. Binders typically have it stamped into the metal c. Chains have a code stamped on the links that relate to a WLL. 4) The summation of the WLL for all securement equipment must equal half of the weight of the load.	1) Define WLL. 2) Determine the WLL for various load securement equipment.

Conclusion/Summary (Reflection)	**Estimated Time:**
Allow students time to complete the Safe Load portion of the post-test. Remove all securement equipment from the trailer and machinery and have students work together to secure the load safely. Students should properly use and place all securement equipment on the equipment.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Pesticide Safety
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Pesticide Safety PowerPoint, Pesticide Safety Fact Sheet, Pesticide Safety Student Activity, gloves, empty pesticide bottle examples, measuring cups, face masks, rubber boots, full body suits, aprons	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What are the proper handling precautions to use when working with pesticides?

Introduction (Interest Approach)	**Estimated Time:**
Have students pass around various empty pesticide containers and look at the label. Have them identify parts of the label that they feel contain important information. If time permits, have them create a list of the most important parts to share with the group.	

Learning Activity: Pesticide PPE	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss and pass around various types of PPE that should be worn when working with pesticides. Discuss common hazards that are associated with pesticides.	1) The label will outline the necessary PPE for pesticide use. 2) Common PPE a. Long pants, a long-sleeved shirt, safety glasses, gloves, and sometimes a mask or respirator 3) Common hazards a. Wind speed and direction can cause the drift of pesticides to adjacent properties and can cause exposure to non-target plants and animals. b. Water contamination: pesticides may run off from surface water and make their way into groundwater. 4) Waste containment	1) Identify common hazards associated with pesticide use. 2) Identify common PPE for pesticide use. 3) Analyze the label to

	a. Small spills: use absorbing materials like sawdust to clean up the pesticide and dispose of it properly b. Larger spills: call the state health department, such as DHEC	determine the proper PPE for each pesticide.
Learning Activity: Respond to Poisoning Emergency	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the steps to respond to a pesticide poisoning or exposure emergency. Discuss the variations between skin, ocular, inhalation, and mouth-related emergencies.	1) Steps for responding to exposure a. Stop the exposure b. Call for emergency help c. Check the label for any actions that can be taken before help arrives 2) Skin a. Drench with water b. Remove PPE/contaminated clothing c. Wash skin with mild soap d. Prevent overheating or being too cold for the exposed person e. Apply loose bandage for burns 3) Ocular a. Wash eyes with clean water for a minimum of 15 minutes 4) Inhalation a. Get to fresh air as soon as possible b. Loosen any tight clothing c. Use artificial respiration if necessary 5) Mouth a. Rinse mouth out with clean water b. Only induce vomiting if instructed to do so by label	1) Discuss causes of poisoning emergencies. 2) Identify steps to handle poisoning emergencies. 3) Develop an emergency response plan for pesticide or chemical exposure.
Learning Activity: Pesticide Label and Disposal	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Use empty pesticide container labels as examples to teach from. If a water source	1) Label a. The label contains all the important information about the pesticide	1) Explain the classification

is available, demonstrate the proper method to rinse containers.	b. The label acts as the law and must be followed. c. Information about the pesticide may also be found on the Material Safety Data Sheet (MSDS) or the manufacturer's website. d. The pesticide classification can be found on the label i. Unclassified ii. Restricted Use Pesticide (RUP): must have certification to use this pesticide 2) Disposal a. Rinse the container three times. b. Dispose of rinsate away from both surface water and groundwater sources. c. Recycle plastic container	of various pesticides. 2) Identify important information found on pesticide labels. 3) Discuss the proper method for disposal of used pesticide containers. 4) Demonstrate proper disposal of a used pesticide container.

Conclusion/Summary (Reflection)	**Estimated Time:**
Allow students to ask questions and complete the pesticide safety portion of the post-test. Have students complete the label group activity to determine all the important information for the pesticide.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Grain Bin Safety
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Grain Bin Safety PowerPoint, Grain Bin Safety Fact Sheet, Grain Bin Safety Student Activity, Grain Bin Safety Trailer, Coffer Dam, Hand Auger, Brushless Drill/Pneumatic Drill, Grain Tub, Safety Harness, Tripod	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What are the main hazards when working with grain bins?

Introduction (Interest Approach)	**Estimated Time:**
Ask students if they have ever been in a grain bin or have grain bins on their property. Have students share any experiences with grain bins. Discuss with students why grain bins exist (to store grain until the selling price is higher).	

Learning Activity: Grain Bin Overview	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Using the Grain Bin Safety PowerPoint and Grain Bin Entrapment Simulator, provide a brief overview of PPE and general grain bin safety.	1) PPE a. Mask/respirator, full-body harness with lanyard and rope, closed-toed shoes, long pants, and a long-sleeved shirt 2) Atmospheric Monitoring a. Monitors oxygen levels and harmful gases to ensure adequate oxygen and no dangerous gas levels are present. 3) Entrapment a. When a person has sunk low enough into the grain, they cannot escape it without assistance from another person. 4) Engulfment	1) Identify the PPE for entering a grain bin. 2) Discuss common hazards associated with grain bins.

	a. When a person has sunk to the point where their head is below the grain	3) Define entrapment. 4) Define engulfment. 5) Differentiate between entrapment and engulfment. 6) Discuss how atmospheric monitoring works.
Learning Activity: Causes of Entrapment/Engulfment	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Using the PowerPoint presentation, show diagrams of the three causes of entrapment and engulfment.	1) Flowing grain: moving grain acts like quicksand and moves conically when removed from bins. A person can become trapped very quickly. 2) Grain Bridging: grain becomes wet or moist, it molds and forms a crust on the surface, also known as a grain bridge. When grain is removed from the bin, a cavity forms, workers may enter the grain bin, and the bridge may collapse, engulfing the worker. 3) Grain wall collapse: grain wall forms from wet grain molding and sticks together on the bin's walls. If a worker enters the bin to knock down the grain wall, the grain may fall on the worker, resulting in engulfment.	1) Explain the three causes of entrapment or engulfment.
Learning Activity: Preventative Measures	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the measures that can and should be implemented before someone enters a grain bin. Discuss how these measures can help reduce incidents and save lives.	1) Grain quality: never store wet grain; this can result in molding and crusting of the grain. This molded grain will then need to be broken free resulting in someone getting in the bin.	1) Discuss preventative measures used in grain bins.

	2) Lockout/Tagout: these programs ensure all equipment associated with adding or removing grain from a bin is shut off and cannot be turned on while a person is in the bin. 3) Never go in alone: always have at least three people present when entering a bin, the bin entrant, a bin attendant, and an outside communicator. This allows for eyes to be on the person entering the bin and someone to communicate with when an emergency occurs. 4) Harness and anchor points: before entering a bin, ensure that all appropriate PPE is present, including a harness with a lanyard. In an emergency, a harness may be the only factor preventing a person from sinking below the grain surface.	2) Develop a grain bin safety plan for entering a bin. 3) Discuss lockout/tagout procedures. 4) Explain how lockout/tagout procedures help keep grain bin workers safe.

Conclusion/Summary (Reflection)	**Estimated Time:**
Allow students to ask questions and complete the grain bin safety portion of the post-test. If time permits, have one or two students volunteer to be entrapped in grain. Simulate a rescue with the coffer dam, hand auger, and drill.	

Lesson Plan	**Presenter:**
Presentation Topic/Title:	Electrical Safety
Audience/Program:	Clemson Agricultural Safety, *Growing Safe Tigers* program
Time:	20 minutes (station)
Materials, Supplies, Equipment, References, and Other Resources Needed:	
Electrical Safety PowerPoint, Electrical Safety Fact Sheet, Electrical Safety Student Activity Sheet, Electrical Safety Wiring Board, Electric Fence Display (if desired topic). If an electric co-op is presenting the topic, they may have additional supplies.	
Learning Outcomes – Big Ideas and Goals for the Presentation	
Essential Question:	What are common hazards when working with electrical systems?

Introduction (Interest Approach)	**Estimated Time:**
Using the electrical safety wiring board, have students try to determine what is wrong with the wiring setup. Discuss the main issues with the wiring board and how these issues could be fixed.	

Learning Activity: Electrical Codes	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss the various electric codes pertaining to powerline height, placement of buildings and bins, suitable types of cable, and other various codes for wiring houses and barns.	1) National Electrical Safety Code (NESC) a. Rules on installation, operation, and maintenance of electric power 2) National Electric Code (NEC) a. The standard for the safe installation of electrical wiring and equipment 3) Overhead Powerlines a. Portable auger systems i. It must be at least 18 feet about the tallest point of the bin ii. The loading side must be a minimum of 38 feet from the bin	1) Explain the National Electric Codes for working in shops and houses. 2) Define GFCI. 3) Differentiate between GFCI outlets and standard outlets.

	b. Fixed grain-handling systems i. 12.5 feet above the roof of the structure ii. 18 feet above the roof is easily accessible 4) Wiring Ag Facilities a. Know where underground lines are before you dig b. Use "Type NMC" or "UF" cables in wet environments because they do not have a layer of paper insulation. c. Place cables in metal or PVC to protect them. PVC is preferred because it does not corrode with moisture. d. Place switches and other devices out of reach by livestock if possible. e. Must have two grounding rods f. Ensure no bare wire is exposed from outlets and the plastic sheath is not cut. 5) Ground-Fault Circuit Interrupters (GFCI) a. Designed to prevent shock in wet or damp areas. b. It should be placed at the beginning of the circuit to protect all subsequent outlets. c. Detects current that is taking a different path back to the circuit.	

Learning Activity: Equipment and Power Lines	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss what steps to take if equipment comes in contact with a power line. If presented by a co-op, they might have a display to demonstrate these events.	1) Step Potential: the difference in voltage between the span of one step a. Voltage is highest at the source and fades through the ground as you move away from the source b. Stepping in two different voltages at the same time may electrocute you. 2) If equipment hits a utility pole, stay inside the cab of the machine until power can be shut off. 3) If the situation becomes too dangerous, such as a fire sparks, exit the cab by jumping. Never touch the ground and the equipment at the same time. From this point, do not walk as you would normally. Jump until you are to safety.	1) Define what step potential is. 2) Discuss how step potential is dangerous. 3) Construct a diagram of step potential. 4) Identify procedures for if equipment

		comes in contact with power lines. 5) Develop a plan for if equipment comes in contact with power lines.

Learning Activity: Extension Cord Use	**Estimated Time:**	
Presenter Directions	**Content Outline**	**Objectives**
Discuss what should be checked before using an extension cord. Pass around examples of safe and unsafe extension cords.	1) Always check the extension cord for damage before use. 2) Never use extension cords in wet areas. 3) Never try to repair a damaged extension cord. Replace the cord. 4) Store extension cords away from sharp objects, heat, oil, and solvents. 5) Never overload an extension cord. Stringing extension cords together could overload the cords.	1) Discuss common hazards associated with extension cords. 2) Develop a pre-checklist for using extension cords. 3) Explain the main items that result in damage to extension cords.

Conclusion/Summary (Reflection)	**Estimated Time:**
Allow students to ask questions and elaborate on any items they have questions about. Allow time for students to practice wiring up circuits. Ensure that they do not strip too much insulation off the wire and place wires and outlets in the correct place. Students can now complete the electrical safety portion of the post-test.	

Appendix B

Regular Field Day Pre/Post-Test

True or False: Audio headphones protect the user from noise levels above 85 decibels?

a. True
b. False
c. I don't know

What does PPE stand for?

a. Personal Protective Equipment
b. Personal Protective Eyewear
c. Portable Power Equipment
d. Properly Prepared Equipment
e. I don't know

A respirator or dust mask may not work properly if:

a. A beard or mustache prevents an airtight seal
b. The respirator has not been maintained or needs to be replaced
c. The respirator is too big or too small for the worker's face
d. All of the above
e. I don't know

Which of the following is a leading source of agricultural fatalities?

a. Chemicals
b. Heavy loads
c. Livestock
d. Tractors
e. I don't know

Your supervisor has asked you to do a task that you are not trained for, and you think there is a chance that you could become injured if you attempt to perform the task. What should you do?

a. Act like you know and just figure it out as you go
b. Google a YouTube video and quickly teach yourself
c. Quit your job
d. Tell your supervisor, and then ask to be trained on the task
e. I don't know

If you are injured on the job, you should:

a. Hide the injury
b. Report the injury to your immediate supervisor or first aid administrator
c. Take care of the injury yourself and continue working
d. Walk it off
e. I don't know

Choose the correct statement: When using a bench grinder, the user should always...

a. Keep both hands on the workpiece
b. Leave the bench grinder on for other users behind him or her after he or she is done using it
c. Operate near flammable materials
d. Wear gloves
e. I don't know

True or False: Wire wheels on a bench grinder pose less of a risk to the user than using an abrasive wheel.

a. True
b. False
c. I don't know

What precaution(s) should be taken when working with and around spinning tools and machinery components?

a. Gloves should always be worn
b. Loose clothing should be removed
c. Long hair should be tied back
d. Answers B and C
e. All of the above
f. I don't know

Before driving a tractor on a public roadway, the operator should:

a. Disengage the flashers on the tractor
b. Ensure the Left and Right brakes are locked together
c. Move the range lever to the lowest range
d. Remove the slow-moving vehicle sign from the tractor
e. I don't know

What does ROPS stand for?

a. Really Old Protective System
b. Ride-On Protective System
c. Roll-Over Protective Simulator
d. Roll-Over Protective Structure
e. I don't know

When should the user not wear a seatbelt when operating a tractor?

a. The user should always wear a seatbelt when operating a tractor
b. The user should never wear a seatbelt
c. The user should not wear a seatbelt when the ROPS is folded down
d. The user should not wear a seatbelt when the ROPS is up
e. I don't know

True or False: When operating a lawnmower next to a public road, the discharge chute should be pointed towards the road.

a. True
b. False
c. I don't know

True or False: You must use headlights when operating an ATV/UTV on a public road.

a. True
b. False
c. I don't know

True or False: Adding a load to your UTV does not affect the machine's center of gravity if the load is under the machine's payload capacity.

a. True
b. False
c. I don't know

Choose the correct statement:

a. 1-inch wide ratchet straps can be used to secure loads of up to 400 lbs
b. 2-inch wide ratchet straps can be used to secure loads of up to 4,000 lbs
c. It is okay to use a ratchet strap with a cut in the strap as long as the cut does not exceed 1/3 of the width of the strap
d. Knots in straps do not constitute damage, and do not render the strap unsafe
e. I don't know

Choose the correct answer: To safely secure a load on a trailer, the load ratings of the straps and binders used have to be at least...

a. 1/2 the weight of the load
b. 3/4 the weight of the load
c. Equal to the weight of the load
d. Twice the weight of the load
e. I don't know

Choose the false statement:

a. Damaged extension cord plugs should be immediately removed and replaced with new plugs.
b. Do not use extension cords in wet areas.

c. Extension cords should be kept away from sharp objects, heat, oil, and solvents that can damage the insulation.
d. Extension cords with nicks and cuts or that have been spliced should be immediately discarded
e. I don't know

Choose the false statement:
a. A portable Ground-Fault Circuit Interrupter (GFCI) is recommended when using power tools in damp or wet locations
b. Never exceed the maximum current and/or wattage rating of an extension cord.
c. Power tool cords missing the third prong (grounded wire) on its plug should be immediately removed from use.
d. Power tools with spliced wires are fine to use as long as the splice has been wrapped in electrical tape.
e. I don't know

If your tractor contacts an overhead power line, you should:
a. If there is a fire, jump from the equipment without allowing your body to touch the equipment and the ground at the same time.
b. Stay in the tractor and use your cellphone to call for help.
c. Yell to bystanders to stay back and get them to call the utility company immediately.
d. All of the above
e. I don't know

Where can you look for information on a chemical or pesticide before using it?
a. Container Label
b. Manufacturer's website
c. Material Safety Data Sheet (MSDS)
d. All of the above
e. I don't know

In case of accidental exposure to a farm chemical or pesticide, you should:
a. Decontaminate immediately
b. Seek medical attention or call the poison and drug information service
c. Take the labeled container along if seeking medical attention
d. All of the above
e. I don't know

What does RUP stand for?
a. Recommended Use Pesticide
b. Renew User's Pesticide
c. Restricted Use Pesticide
d. None of the above
e. I don't know

True or False: The blind spots are the same for all animals.

a. True
b. False
c. I don't know

The safest way to approach an animal is:

a. Jumping up and down and waving your hands from the animal's side
b. Quietly from the animal's rear
c. Slowly and calmly from the animal's front
d. Slowly and calmly from the animal's left rear
e. I don't know

When working around livestock you should:

a. Always wear gloves
b. Know your surroundings and have an escape route planned
c. Only approach animals in the morning when they are more docile
d. Only wear black colored clothing
e. I don't know

How long does a worker have to escape moving grain before the person becomes too engulfed by the grain to save themselves without help?

a. 4-5 seconds
b. 6-10 seconds
c. 15-20 seconds
d. 1 minute
e. I don't know

Which of the following is not a way that a person can become entrapped or engulfed in a grain bin?

a. Flowing grain
b. Grain bridge collapse
c. Grain wall avalanche
d. All of the above
e. I don't know

True or False: It is okay to enter a grain bin with bridged grain so long as you are wearing a full body harness.

a. True
b. False
c. I don't know

Appendix C

Condensed Field Day Pre/Post-Test

Which of the following is a leading source of agricultural fatalities?

a. Chemicals
b. Heavy loads
c. Livestock
d. Tractors
e. I don't know

Before driving a tractor on a public roadway, the operator should:

a. Disengage the flashers on the tractor
b. Ensure the Left and Right brakes are locked together
c. Move the range lever to the lowest range
d. Remove the slow-moving vehicle sign from the tractor
e. I don't know

What does ROPS stand for?

a. Really Old Protective System
b. Ride-On Protective System
c. Roll-Over Protective Simulator
d. Roll-Over Protective Structure
e. I don't know

When should the user not wear a seatbelt when operating a tractor?

a. The user should always wear a seatbelt when operating a tractor
b. The user should never wear a seatbelt
c. The user should not wear a seatbelt when the ROPS is folded down
d. The user should not wear a seatbelt when the ROPS is up
e. I don't know

True or False: When operating a lawnmower next to a public road, the discharge chute should be pointed towards the road.

a. True
b. False
c. I don't know

True or False: You must use headlights when operating an ATV/UTV on a public road.

a. True
b. False
c. I don't know

True or False: Adding a load to your UTV does not affect the machine's center of gravity if the load is under the machine's payload capacity.

a. True
b. False
c. I don't know

Choose the correct statement:

a. 1-inch wide ratchet straps can be used to secure loads of up to 400 lbs
b. 2-inch wide ratchet straps can be used to secure loads of up to 4,000 lbs
c. It is okay to use a ratchet strap with a cut in the strap as long as the cut does not exceed 1/3 of the width of the strap
d. Knots in straps do not constitute damage, and do not render the strap unsafe
e. I don't know

Choose the correct answer: To safely secure a load on a trailer, the load ratings of the straps and binders used have to be at least...

a. 1/2 the weight of the load
b. 3/4 the weight of the load
c. Equal to the weight of the load
d. Twice the weight of the load
e. I don't know

Choose the false statement:

a. Damaged extension cord plugs should be immediately removed and replaced with new plugs.
b. Do not use extension cords in wet areas.
c. Extension cords should be kept away from sharp objects, heat, oil, and solvents that can damage the insulation.
d. Extension cords with nicks and cuts or that have been spliced should be immediately discarded
e. I don't know

Choose the false statement:

a. A portable Ground-Fault Circuit Interrupter (GFCI) is recommended when using power tools in damp or wet locations
b. Never exceed the maximum current and/or wattage rating of an extension cord.
c. Power tool cords missing the third prong (grounded wire) on its plug should be immediately removed from use.
d. Power tools with spliced wires are fine to use as long as the splice has been wrapped in electrical tape.
e. I don't know

If your tractor contacts an overhead power line, you should:

a. If there is a fire, jump from the equipment without allowing your body to touch the equipment and the ground at the same time.
b. Stay in the tractor and use your cellphone to call for help.
c. Yell to bystanders to stay back and get them to call the utility company immediately.
d. All of the above
e. I don't know

How long does a worker have to escape moving grain before the person becomes too engulfed by the grain to save themselves without help?

a. 4-5 seconds
b. 6-10 seconds
c. 15-20 seconds
d. 1 minute
e. I don't know

Which of the following is not a way that a person can become entrapped or engulfed in a grain bin?

a. Flowing grain
b. Grain bridge collapse
c. Grain wall avalanche
d. All of the above
e. I don't know

True or False: It is okay to enter a grain bin with bridged grain so long as you are wearing a full body harness.

a. True
b. False
c. I don't know

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