

North Central Region

Center for FSMA Training, Extension
and Technical Assistance

Produce Safety Alliance Pre and Post Grower Training Knowledge Assessment

NCR Results (2018)

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Introduction

The rise in reported food-borne illness outbreaks has sparked an urgent need for transformation regarding the nation's food safety system. The focus of responding to a food-borne illness shifted to prevention in January 2011 when the Food Safety Modernization Act (FSMA) was passed by congress and signed into law by President Barack Obama. The law consists of seven rules, one of which is the Produce Safety Rule, which applies to those who grow, harvest, handle or pack fresh fruit and vegetables. One of the requirements of the Produce Safety Rule is that fruit and vegetable growers take an approved food safety course. The Produce Safety Alliance (PSA) Grower Training is the first approved course and in the North Central Region the training is offered by state departments of agriculture often in collaboration with the cooperative extension service.

The North Central Regional Center for FSMA Training, Extension and Technical Assistance (NCR FSMA) evaluated these trainings using a knowledge assessment. This report shares the results from trainings offered in eight states by NCR FSMA partners between July 2017 and June 2018.

Methods

The Knowledge Assessment was developed by Dr. Amy Harder, evaluator for the Southern Center for Training, Education, Extension, Outreach, and Technical Assistance to Enhance Produce Safety. The full instrument is shown in the Appendix B.

The Knowledge Assessment consisted of 25 questions related to the seven modules of the PSA Grower Training. Training participants were asked to complete the quiz in writing before beginning the training and again after the training.

Trainers collected the paper copies from the growers and sent them to the NCR FSMA evaluation team. Data was entered into Qualtrics; an online data collection and analysis platform, to create the dataset. Pretest and Posttest responses were matched using a unique identification number written on each quiz, along with the date of the training, and the state.

Only responses which included both a pretest and a posttest from the same person were included in the analysis. (In a few cases, a person completed only the pretest or only the posttest.) We received **767** complete responses from **40** trainings in the NCR. The NCR FSMA evaluation team analyzed the data using Microsoft Excel (2016). Each question was assigned to the related PSA Grower Training module and a total score of correct answers was calculated for each module. (The module to which each question was assigned is listed in Appendix A.) The scores by module were averaged and rescaled from zero to five. Rescaling allowed the evaluators to compare participants' knowledge of each module with another.

Results

Note: The knowledge assessment did not include questions that would help interpret the results, such as demographics, respondents' prior food safety experience, or respondents' opinions about the quality of the training, making it difficult to determine what factors affected respondents' scores. Several factors may influence the scores, including competency of the trainer, same sequence of pre and post test questions, the PSA Grower Training curriculum, and even the quality of the knowledge assessment itself. Therefore, while trainers may be able to impact knowledge assessment scores by delivering high quality trainings, other factors may be outside of their control.

Did respondents' food safety knowledge improve because of the training?

Respondents' knowledge of food safety and FSMA did improve. On average, respondents scores improved by 4.1 points (out of 25) from the pretest to the posttest, as shown in Figure 1. The average pretest score was 16.3 (65 percent), and the average posttest score was 20.4 (82 percent). The difference between pretest and posttest scores is statistically significant at a level of $p < 0.001$, meaning the difference is not likely due to chance, but to a true difference between pretest and posttest scores in the population.

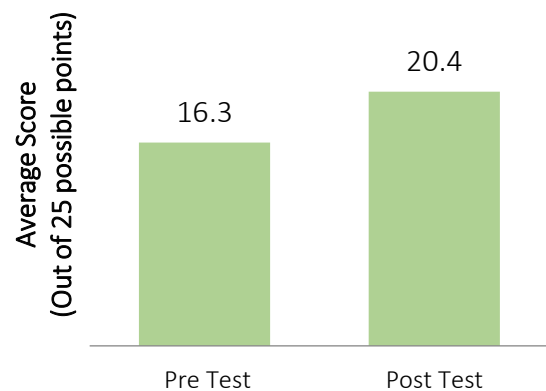
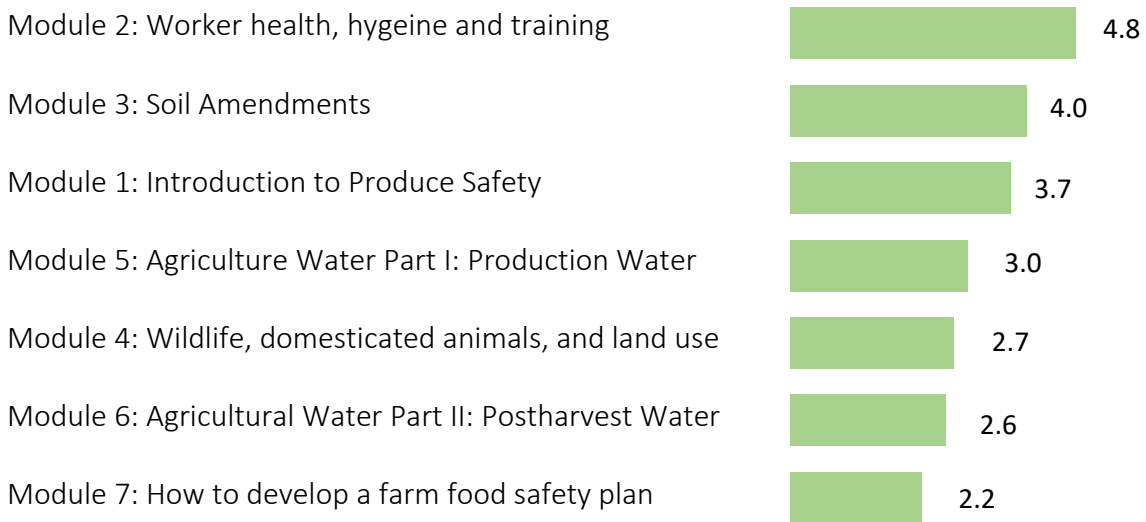


Figure 1: On average, scores on the knowledge assessment increased by 4.1 points (n=767)

What baseline food safety knowledge do participants have prior to the training?

The pretest is especially useful for determining training participants' baseline knowledge prior to the training, so trainers can know which modules may need more or less emphases in future trainings. In the NCR, training participants came to the training with a very good baseline understanding of Module 2 (worker health, hygiene, and training), as shown in Figure 2. Therefore, future trainings may not need to emphasize this module as heavily. (However, the knowledge assessment only included two questions related to Module 2, making it harder to correlate).



Average module score, on 5-point scale

Figure 2: Respondents had a good knowledge of worker health, hygiene, and training prior to the training and a poor understanding of how to develop a farm food safety plan.

Participants also came to the training with good understanding of Modules 3 and 1 (soil amendments and introduction to food safety, respectively). Respondents had the lowest baseline knowledge of Module 7 (how to develop a farm food safety plan), also shown in Figure 2. Two questions from this module were particularly hard for respondents to answer:

Question 22. Which of the following statements regarding Farm Food Safety Plans is true?

- a. The FSMA requires a written Farm Food Safety Plan
- b. The Farm Food Safety Plan only needs to include covered produce
- c. The Farm Food Safety Plan is not required
- d. The Farm Food Safety Plan should be provided to all consumers

Question 24. Which of the following records is required by the FSMA Produce Safety Rule?

- a. Worker training dates
- b. Water change schedules
- c. Soil amendment applications
- d. Management of sanitary facilities

Only **8** percent of respondents answered Question 22 correctly on the pretest, making it the least understood question on the Knowledge Assessment, shown in Table 1, and also in Appendix A. Similarly, **33** percent answered question 24 correctly on the pretest, making it the third lowest scoring question on the pretest.

Table 1: Two questions from module 7 were particularly low scoring on the pretest

Question	% who answered correctly	
	Pretest	Posttest
22	8	61
24	33	50

These questions are understandably difficult. Because PSA Grower Training includes a module dedicated to farm food safety plans, one could easily assume that farm food safety plans are required by FSMA, when they are actually not. Hence, few respondents got question 22 right. The answer choices for question 24 actually span several modules, requiring a respondent to not only recall information, but synthesize it. Therefore, we also removed question 24 from the analysis for comparison. When question 24 is excluded from the analysis, module 7 remains the least understood module on the pretest.

How did participants score on the posttest?

Figure 3 reports the participants' average posttest scores. When the post test scores were compared to the pretest, it showed the greatest gain in knowledge on modules 6 and 7, about food safety plan and agricultural water as shown in Figure 4. Not surprisingly, they gained less knowledge on modules 1, 2, and 3, as these were the modules about which they already had a good understanding prior to the training. In fact, the difference in average pretest and posttest scores on Module 2 is not statistically significant, which means we cannot conclude that participants' knowledge on Module 2 increased.

Respondents continued to score lowest on Module 7 on the post-test, as shown in Figure 3. The average posttest scores for questions 22 and 24 are listed in Table 1 (above). Only 50 percent of respondents answered question 24 correctly on the posttest, making it the least understood question. In fact, 10 percent (n=76) of respondents answered Question 24, 21 and 18 correctly on the pretest, but were incorrect on the posttest, which may indicate the training added confusion regarding which records are required by FSMA, safety data sheets and harvestable portion of the produce. Alternatively, it may indicate respondents were making a random guess on both the pretest and posttest. Either way, the Produce Safety Alliance produced a handout entitled, "Records required by the FSMA Produce Safety Rule" (Produce Safety Alliance, 2018). If not

already doing so, NCR FSMA trainers may want to include this handout in the materials they provide to growers. While participants may not have time to review the document prior to the posttest, reviewing it later at home can help reduce confusion about required records.

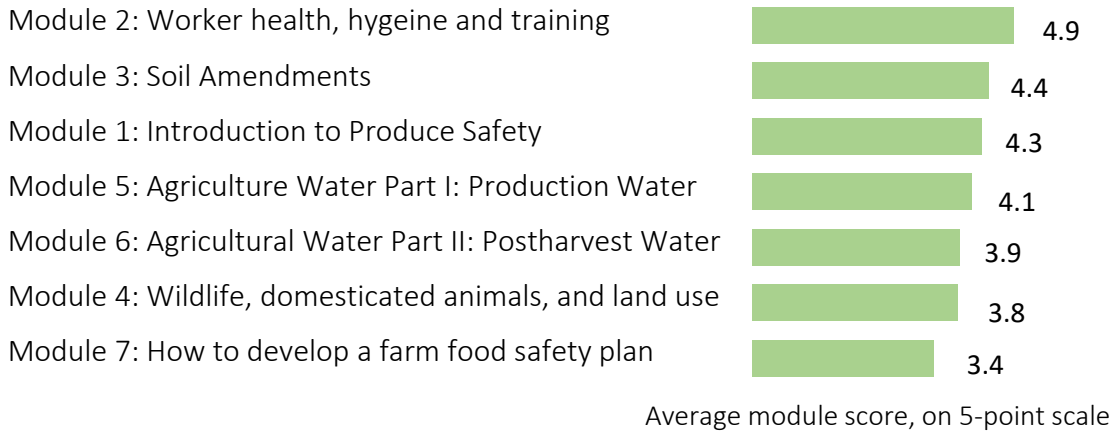


Figure 3: Respondents continued to score lowest on module 7: How to develop a farm food safety plan after the training.

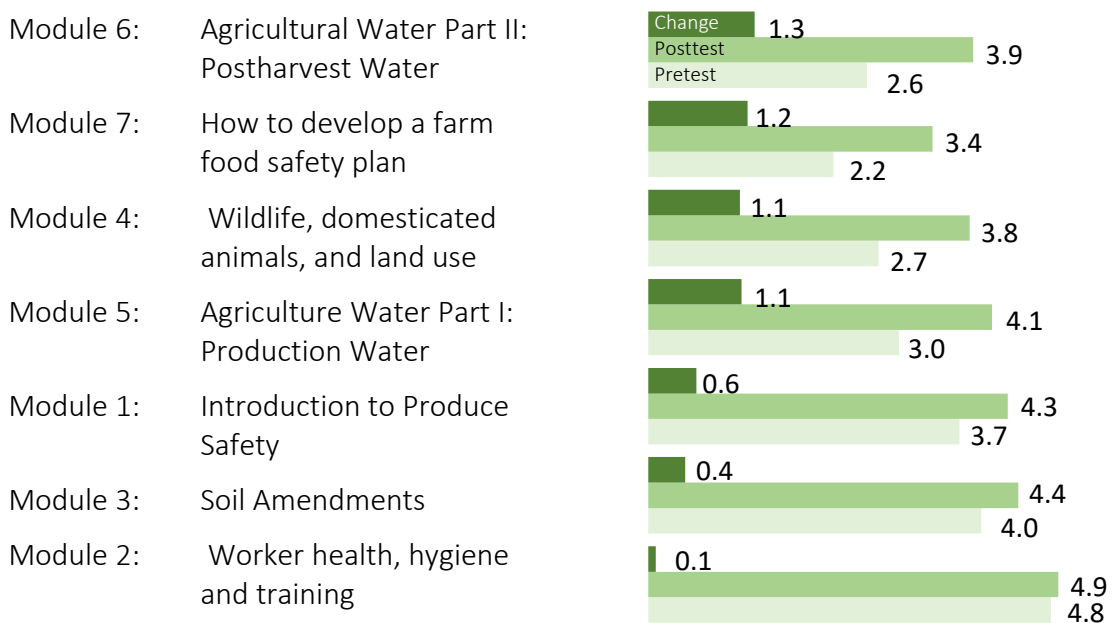


Figure 4: Scores improved the most in Modules 6 and 7, about Postharvest Water and How to develop a farm food safety plan.

Did scores differ by training location?

First, participants entered trainings with very similar levels of food safety knowledge, with pretest scores ranging from 16.0 (64 percent) at Wisconsin trainings to 17.0 (69 percent) at Kansas trainings.

The Minnesota PSA trainings stands out, because participants increased their Knowledge Assessment scores by 5 points. While they entered the training with a relatively low average pretest score (16.3), they left with the highest posttest scores (21.3). Trainers in the NCR may want to learn whether anything different occurred at the trainings in Minnesota that might have contributed to greater learning.

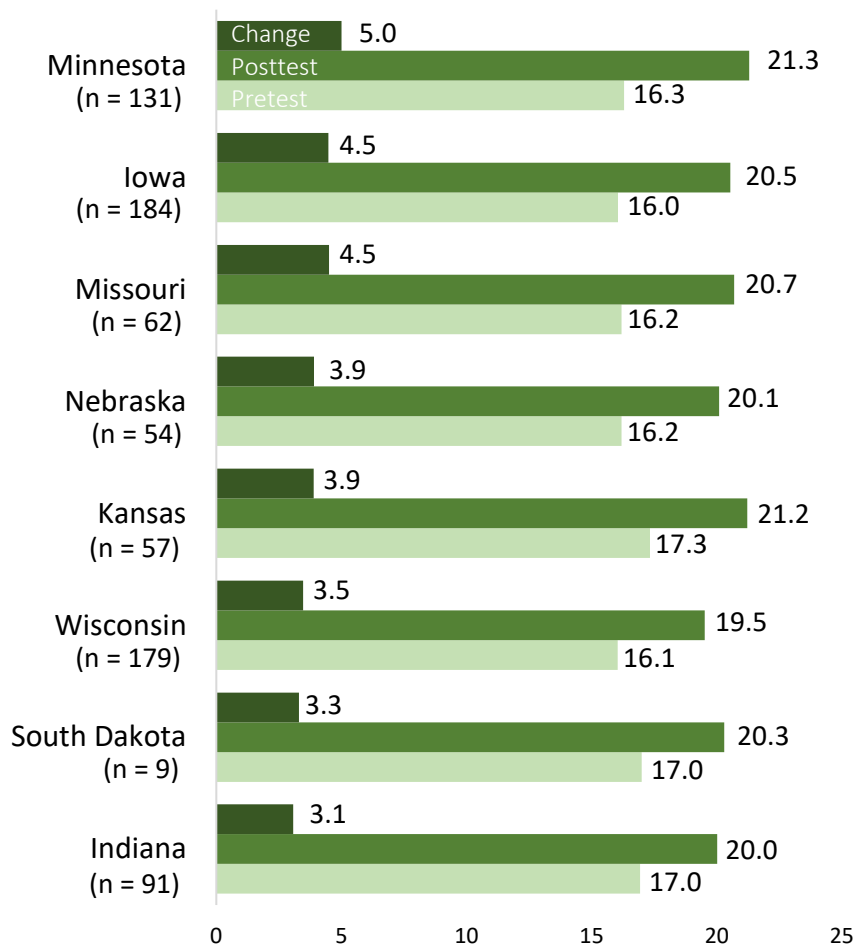


Figure 5: Distribution of pre and post test scores in different states of NCR.

Which questions were most difficult for respondents to answer correctly?

The pareto chart (Figure 6) reports the questions that were most often answered incorrectly. Questions 13, 17, 21, 22, 24, and 25 account for more than 50 percent of all incorrect answers. (The questions are written out in Appendix B.) Evaluators held a discussion during a required bimonthly NCR FSMA call during which PSA trainers reflected on why these questions proved difficult. Participants concluded that Question 13 (about reducing wildlife populations) was poorly worded, because FSMA emphasizes deterring wildlife from production areas, rather than reducing or eliminating it. They agreed Question 21 (about Safety Data Sheets) was not the most important topic covered in Module 6 and many trainers may not be giving the topic much emphasis.

Trainers agreed many growers are confused regarding Question 22 (about Farm Food Safety Plans) and some trainers may also add to the confusion. They believed that they need to do a better job of explaining that while Farm Food Safety Plans are encouraged by FSMA, they are not required.

Regarding Question 24 (about records required by FSMA), trainers agreed they needed to add slides to their presentations at the end of each module reviewing required records. They also agreed they should hand out a document from the Produce Safety Alliance about required records and review it during the training. Finally, trainers had mixed reactions to Question 25. Some thought the question was unfair, because it makes it sound as if Farm Food Safety Plans must be developed using a specific sequential procedure. Others believed the question was fair and that trainers can do more to emphasize that assessing risk is the first step when thinking of each part of the Produce Safety Rule.

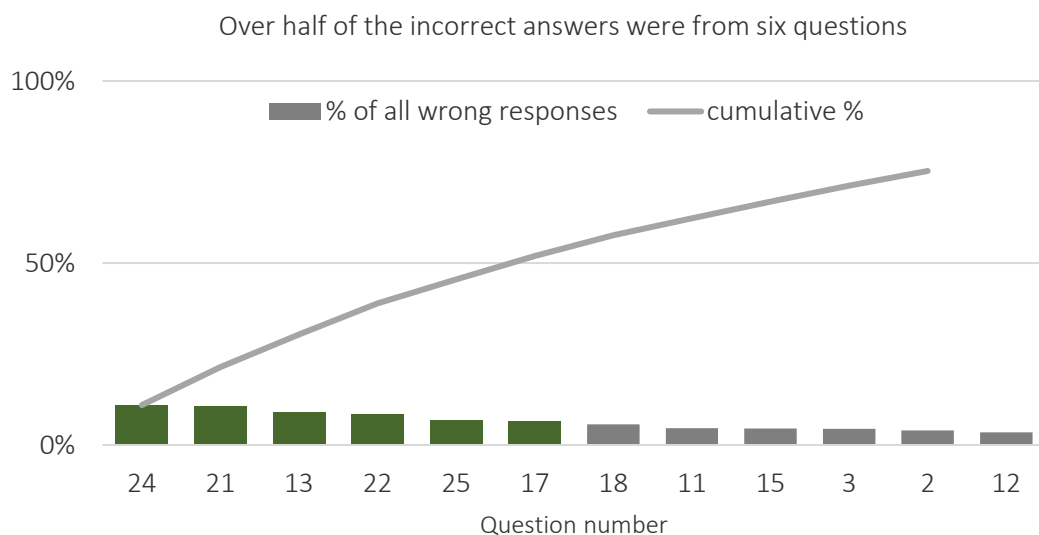


Figure 6: Pareto chart reporting the questions that were most often answered incorrectly by participants.

Conclusions and recommendations

While many factors contribute to respondents' scores on the PSA Grower Training Knowledge Assessment, such as trainer competency, course content and the quality of the assessment tool, NCR trainers may be able to further contribute to participants' knowledge gain by adjusting strategies. These recommendations flow from evaluation summarized in this report:

If not already doing so, include the following Produce Safety Alliance handout with training materials: "Records required by the FSMA Produce Safety Rule." Dedicate time during the training to review the handout and answer any questions regarding the content.

Dedicate time during a team meeting to discuss which strategies were used at the Minnesota trainings that may have contributed a high knowledge gain.

Discuss with the other NCR PSA trainers if they observed any differences in the populations who participated in past trainings that may have contributed to higher or lower food safety knowledge prior to the training. Consider requiring participants to review food safety information prior to attending the training to ensure everyone comes with a baseline understanding of on-farm food safety.

Also, different trainers may have different styles of teaching, thus communicating and sharing your ideas/challenges with other trainers may help to deliver the best knowledge to the participants. The trainers need to carefully address the concern of few questions that growers get confused with (question 18, 21 and 24). Approximately, 10 percent of the participants answered these question correctly on the pretest but incorrectly on the posttest. A proactive approach could be to indirectly talk about all the questions during the module teachings and clarify the confusion without letting the growers know that this particular question is on the post test.

Appendix A: Individual questions, North Central Region results

Question	Pretest % Correct	Posttest % Correct	Pretest Posttest	Correct Correct	Correct Incorrect	Incorrect Correct	Incorrect Incorrect	Assigned Module
1	94.0%	97.4%		92.44%	1.56%	4.95%	1.04%	1
2	60.0%	81.6%		55.15%	4.82%	26.47%	13.56%	1
3	67.9%	79.7%		59.32%	8.60%	20.34%	11.73%	1
4	83.2%	95.3%		81.36%	1.83%	13.95%	2.87%	1
5	97.5%	98.6%		96.48%	1.04%	2.09%	0.39%	2
6	94.1%	96.6%		92.57%	1.56%	4.04%	1.83%	2
7	77.7%	89.4%		72.49%	5.22%	16.95%	5.35%	3
8	77.2%	87.6%		72.10%	5.08%	15.51%	7.30%	3
9	83.8%	91.0%		78.10%	5.74%	12.91%	3.26%	3
10	72.9%	88.3%		67.67%	5.22%	20.60%	6.52%	3
11	52.3%	78.6%		45.76%	6.52%	32.86%	14.86%	4
12	84.6%	84.0%		77.31%	7.30%	6.65%	8.74%	3
13	40.2%	59.1%		31.16%	9.00%	27.90%	31.94%	4
14	71.8%	91.9%		67.67%	4.17%	24.25%	3.91%	4
15	64.0%	79.3%		55.15%	8.87%	24.12%	11.86%	5
16	90.2%	95.7%		87.09%	3.13%	8.60%	1.17%	5
17	24.8%	70.5%		21.64%	3.13%	48.89%	26.34%	5
18	65.3%	73.8%		55.15%	10.17%	18.64%	16.04%	1
19	50.2%	92.8%		47.98%	2.22%	44.85%	4.95%	6
20	58.1%	87.4%		54.63%	3.52%	32.72%	9.13%	6
21	47.7%	51.9%		37.16%	10.56%	14.73%	37.55%	6
22	8.1%	61.0%		6.91%	1.17%	54.11%	37.81%	7
23	82.7%	90.6%		77.31%	5.35%	13.30%	4.04%	7
24	33.1%	49.7%		23.21%	9.91%	26.47%	40.42%	7
25	52.3%	69.4%		44.46%	7.82%	24.90%	22.82%	7
TOTAL	65.4%	81.6%		60.0%	5.3%	21.6%	13.0%	

Appendix B: Survey instrument with answers

1. What is the overall objective of the Food Safety Modernization Act?
 - a. To prevent food safety issues.
 - b. To ensure the environmental sustainability of farms.
 - c. To promote equitable employment conditions between foreign suppliers.
 - d. To reduce federal control of local food production systems.

2. Which of the following actions in the fresh produce production and sales system is not covered by the FSMA Produce Safety Rule?
 - a. Growing
 - b. Selling
 - c. Holding
 - d. Harvesting

3. Why is the FSMA different from previous federal guidelines regarding produce, such as the “Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables”?
 - a. The FSMA provides funds to producers while previous guidelines did not.
 - b. The FSMA includes a wider range of products than previous guidelines.
 - c. The FSMA is mandated while previous guidelines were voluntary.
 - d. The FSMA includes guidelines for selling produce while other guidelines did not.

4. What is the biggest food safety hazard in fresh produce?
 - a. Improper packaging
 - b. Foreign material
 - c. Undeclared allergens
 - d. pathogens

5. What practice should be done before starting work, before putting on gloves, and after a break?
 - a. Footwear sanitization
 - b. Clothing contamination check
 - c. Application of sunscreen
 - d. Hand washing

6. Offering workers which of the following options would be in violation of farm safety standards?
 - a. Portable toilets
 - b. Tap water
 - c. Liquid soap
 - d. Reusable towels

7. Which of the following poses the greatest risk to food safety?
 - a. Chemical soil amendments
 - b. Biological soil amendments of non-animal origin
 - c. Biological soil amendments of animal origin
 - d. Physical soil amendments

8. Which of the following products is the result of converting untreated human waste into a usable soil amendment?
 - a. Manure
 - b. Heated urine
 - c. Frozen feces
 - d. Biosolids

9. Which of the following methods of soil amendment application reduces food safety risks?
 - a. Apply manure when ground is frozen
 - b. Apply manure during non-produce field rotations
 - c. Apply manure several inches off the ground to maximize covered area
 - d. Apply manure using side-dressing techniques

10. Which of the following is a method of reducing pathogens in soil amendments?
 - a. Sanitizing
 - b. Freezing
 - c. Washing
 - d. Composting

11. Co-management refers to the balance between which two factors?
 - a. Profit of the farm and its owners and pay of the seasonal and full-time workers
 - b. Conservation of resources and minimization of microbiological hazards
 - c. Efficiency of the farm's daily practices and health and safety of the workers
 - d. Maximization of produce and crop yields and minimization of farm costs

12. Which of the following should guide risk management actions?
 - a. Personal expertise
 - b. Recommendations of seasoned producers
 - c. Suggestions from consumers
 - d. Scientific evidence

13. Which of the following choices is least likely to reduce your property's wildlife population?
 - a. Decoys
 - b. Netting
 - c. Pesticides
 - d. Air cannons

14. If a crop is found to be contaminated with wildlife excreta, which of the following actions must be taken?
- The produce must be cooked before it is sold
 - The produce must be washed before it is sold
 - The produce must not be labeled as organic
 - The produce must not be harvested
15. Which of the following water sources is least likely to contain microorganisms associated with feces that can lead to food safety risks?
- Surface water
 - Ground water
 - Municipal water
 - Reclaimed water
16. Which of the following irrigation methods has the lowest risk of contamination?
- Drip
 - Flood
 - Overflow
 - Furrow
17. Which of the following is used as an indicator of fecal contamination of a water supply?
- Pathogenic *E. coli*
 - Generic *E. coli*
 - Salmonella enterica*
 - Norovirus
18. Which of the following is considered covered produce by the FSMA?
- The leaves of potato plants
 - The roots of carrot plants
 - The entire tomato plant
 - The flowers of okra plants
19. Which packinghouse zone poses the greatest concern for cross-contamination of produce?
- Zone 1
 - Zone 2
 - Zone 3
 - Zone 4

20. Which of the following statements regarding cleaning and sanitizing is true?
- Sanitizing may be done in place of cleaning when unavoidable
 - Cleaning and sanitizing are synonymous
 - All surfaces can be cleaned and sanitized
 - Surfaces that have not been cleaned cannot be sanitized
21. Safety data sheets are used to inform workers during which of the following?
- Microbial contamination emergencies
 - Physically hazardous emergencies
 - Chemical emergencies
 - Emergencies related to pests
22. Which of the following statements regarding Farm Food Safety Plans is true?
- The FSMA requires a written Farm Food Safety Plan
 - The Farm Food Safety Plan only needs to include covered produce
 - The Farm Food Safety Plan is not required
 - The Farm Food Safety Plan should be provided to all consumers
23. Who should be responsible for developing a Farm Food Safety Plan?
- An external auditor
 - A grower on the farm
 - An advisory panel
 - An FSMR representative
24. Which of the following records is required by the FSMA Produce Safety Rule?
- Worker training dates
 - Water change schedules
 - Soil amendment applications
 - Management of sanitary facilities
25. What is the first step in developing a Farm Food Safety Plan?
- List practices likely to reduce potential risks
 - Write a plan to guide implementation of possible actions
 - Detail the origins and history of the farm
 - Assess risks