

## North Central Region

Center for FSMA Training, Extension  
and Technical Assistance

# Produce Safety Alliance Grower Training Knowledge Assessment

REGIONAL RESULTS

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## Introduction

The Food Safety Modernization Act (FSMA) was passed by Congress, and then in January 2011, signed into law by President Obama. The law consists of seven Rules, including the Produce Safety Rule, which applies to those who grow, harvest, handle or pack fresh fruit and vegetables. One requirement 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 (NCR) the training is offered by university extension departments and state departments of agriculture/health.

In collaboration with partners from the 12 NCR states, the North Central Region Center for FSMA Training, Extension and Technical Assistance (NCR FSMA) evaluated these trainings using a knowledge assessment. This report shares the results from 50 trainings held in the winter of 2019-20.

## Methods

The knowledge assessment was developed by Dr. Catherine Shoulders at the University of Arkansas. The knowledge assessment is a quiz with 25 questions related to the seven modules of the PSA Grower Training. Training participants were asked to complete the quiz on paper before beginning the training and again after the training. The NCR FSMA states have been utilizing the knowledge assessment since 2017.

Trainers collected the paper copies and sent them to the NCR FSMA evaluation team. Data was entered into an Excel™ spreadsheet to create the dataset. Pre-test and post-test 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 pre-test and a post-test from the same person were included in the analysis. (In a few cases, a person completed only the pre-test or only the post-test.) The evaluation team received **891** complete responses from **50** trainings in the NCR in 2019-2020. In total, 3,161 complete responses have been received from the region since 2017 from 183 trainings (Table 1).

The NCR FSMA evaluation team analyzed the data using SPSS™. They assigned each question to the related PSA Grower Training module and calculated a total score for each module. (The module to which each question was assigned is listed in Appendix A.) They averaged the scores by module and then rescaled the average so that each module is on a scale from zero to five. Rescaling allows comparison of participants' knowledge of each module with another.

In addition, trainers completed a cover sheet for each training and returned the cover sheet along with the pre-tests and post-tests. The cover sheets provided information including the date of the training, the location, names of trainers, the number of participants, and whether the training was targeted towards any special population. Special populations tracked included Plain clothes growers (which includes Amish and Mennonite growers), minorities, local food growers, military veterans, non-English/limited English language, and other. Several trainings were hosted for Plain clothes growers in the region in 2019-2020 and one for local food growers, a first in the region. Three trainings were delivered using remote delivery due to the COVID-19 pandemic, also a first.

**Table 1: Over three years, ten North Central Region states have participated in the knowledge assessment.**

	2017-2018		2018-2019		2019-2020	
	respondents	trainings*	respondents	trainings*	respondents	trainings*
Illinois	0	0	84	5	179	7
Indiana	91	9	159	14	56	5
Iowa	184	11	162	14	130	9
Kansas	57	3	58	6	71	5
Michigan	0	0	274	13	178	8
Minnesota	131	5	264	15	71	5
Missouri	62	3	152	10	116	6
Nebraska	54	2	12	2	15	1
South Dakota	9	1	16	1	0	0
Wisconsin	179	6	322	13	82	5
<b>Total</b>	<b>767</b>	<b>40</b>	<b>1503</b>	<b>93</b>	<b>891**</b>	<b>50**</b>

\* this is the total number of trainings in the dataset- some trainings may have been held but knowledge assessments were not collected or shared to be added to the dataset.

\*\* Column total does not add up, because Missouri and Kansas include one remote training offered collaboratively by the states with 7 respondents.

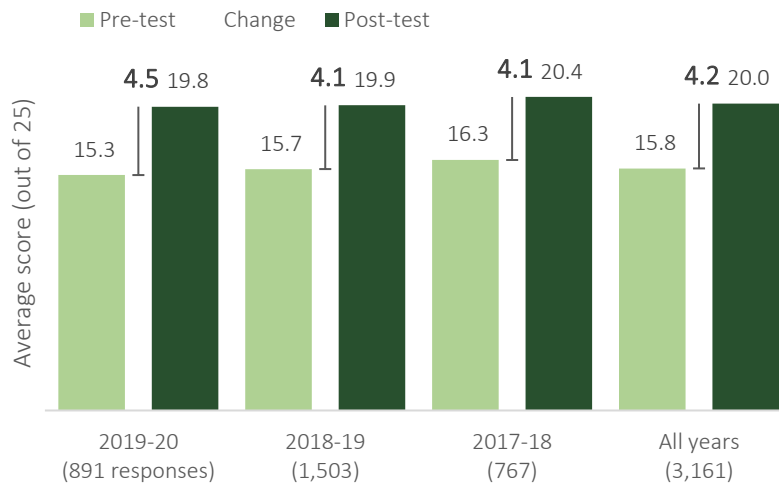
## Results

### How much did respondents' food safety knowledge improve during the training?

On average, scores increased by 4.5 points out of 25 possible in 2019-2020.

Respondents' knowledge of food safety and FSMA have improved in all years of training. On average, respondents' scores improved by 4.5 points (out of 25) from the pre-test to the post-test in 2019-2020, 4.1 points in 2018-19, and 3.1 points in 2017-18, as shown in Figure 1. The difference between pre-test and post-test scores is statistically significant for all years ( $p=0.001$ ), meaning the difference is not likely due to chance, but to a true difference between pre-test and post-test scores in the population.

**Figure 1: Pre-test and post-test scores are steadily declining from year to year, but knowledge gain is increasing.**



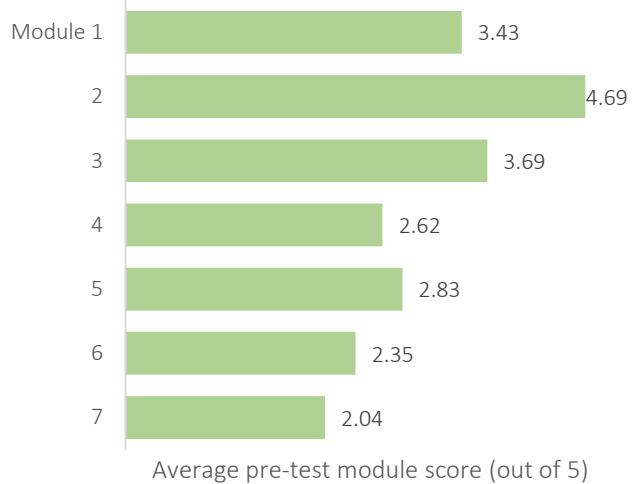
Since the first year of conducting the knowledge assessment in the NCR, pre-test and post-test scores have steadily declined, while knowledge change has steadily increased. On average, participants enter the training with a lower knowledge of FSMA and food safety now than in the past, possibly because those who attended in the first year were early adopters who already had an interest in food safety. On average, those who come to the training with a lower knowledge of FSMA and food safety learn more, which may contribute to increasing knowledge change scores over time.

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

Participants were most familiar with concepts related to Module 2: worker health, hygiene, and training.

The pre-test is especially useful for determining training participants' baseline knowledge prior to the training, so trainers can know which modules may need more emphasis. As in previous years, in 2019-2020 training, participants came to the training with the highest 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 this module harder to measure.) 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. These results are consistent with results from previous years.

**Figure 2: Average pre-test scores by module.**  
2019-2020 data



## How did participants score on the post-test?

On average, participants' scores improved for all modules from the pre-test to the post-test.

Respondents showed the greatest gain in knowledge on Modules 5 (1.3 point increase) and 6 (1.3 point increase), about agricultural water and post-harvest handling and sanitation, as shown in Figure 3.

Not surprisingly, they gained less knowledge on Module 2, as this was the module about which they already had a higher understanding prior to the training.

**Figure 3: Scores improved the most on Modules 5 and 6.**

2019-2020 data



## Which concepts continued to be unclear after the training?

Three of four questions measuring knowledge on Module 7 were among the most missed questions on the post-test.

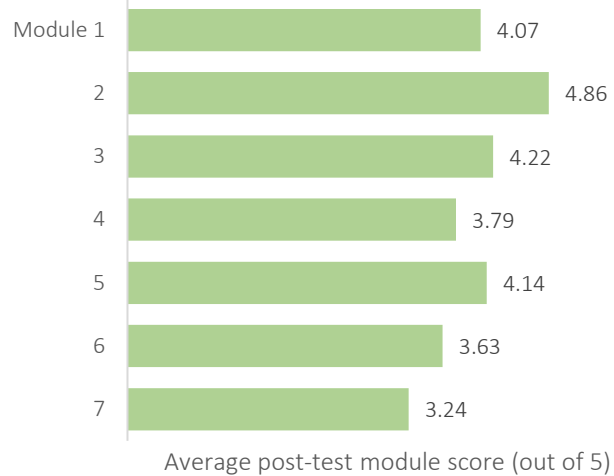
Respondents scored lowest on Module 7 on the post-test, as shown in Figure 4, which is similar to previous years.

Figure 5 shows the questions which respondents most often answered incorrectly on the post-test in 2019-2020. Six questions account for over half of all incorrect responses: questions 13, 18, 21, 22, 24, and 25. Three of these questions measured knowledge on Module 7: 22, 24, and 25. Therefore, it is not surprising that Module 7 on average had the lowest post-test score.

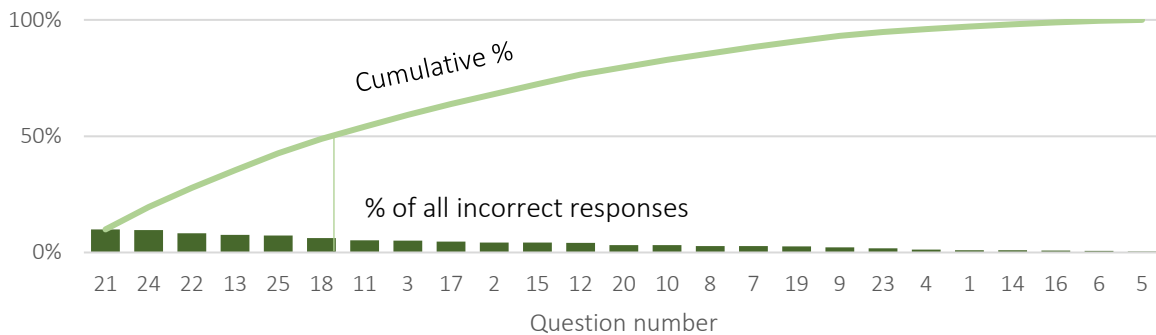
These same questions were often answered incorrectly by many respondents ever since the NCR FSMA began using the knowledge assessment. Following year 1, trainers from the NCR discussed how they might better deliver the training to improve understanding of the concepts covered by these questions. Years 2 and 3 data showed that respondents continued to answer these questions correctly at similar rates as they did in year 1. Therefore, one might conclude that these questions are “tricky” and improving scores may depend just as much on rewriting the questions as on delivering a higher quality training. For example, after year 1, trainers agreed that question 13 was poorly worded, so improvement was limited by the NCR FSMA’s inability to modify the evaluation instrument, because the survey is being used nationally.

A t-test performed at the regional level comparing the scores on these problematic questions, comparing 2017-18 (year 1) scores with 2019-20 (year 3), showed that average scores have remained the same or even gone down (questions 11 and 25). Again, this shows that these questions may be especially hard or poorly written questions, and trainers may not be able to impact participants’ understanding beyond what they are already doing.

**Figure 4: Average post-test scores by module.**  
2019-2020 data



**Figure 5: Nearly half of all incorrect responses on the post-test were from 6 questions.**  
2019-2020 data

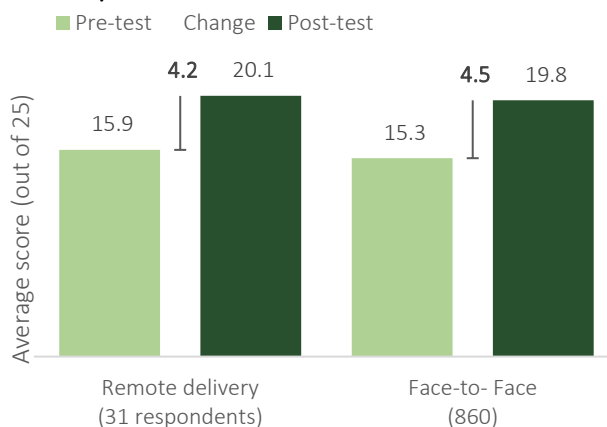


## Did scores differ at the training offered remotely?

No.

The three trainings delivered via remote delivery appear to have resulted in similar knowledge assessment scores as face-to-face trainings (Figure 6). Participants in remote delivery courses scored higher on the pre-test and post-test than participants in face-to-face trainings, on average, but differences are not statistically significant ( $p=0.365$  and  $p=0.636$ , respectively). While knowledge gain was slightly lower at the remote delivery course (average increase in score of 4.2 via remote delivery vs. 4.5 at face-to-face trainings), the difference is not statistically significant ( $p=0.662$ ). The knowledge gain may have been lower, because remote delivery participants entered the training with higher knowledge.

**Figure 6: Knowledge gain continues to be good across years.**



## Did test scores differ by population type?

**Participants in trainings for Plain clothes growers scored lower than the general population.**

NCR FSMA partners offered six trainings for Plain clothes growers in 2019-2020. Figure 7 shows that Plain growers scored lower than the general population on the pre-test and post-test ( $p=0.001$  and  $p=0.001$ , respectively). Their knowledge change (3.9) was also lower than the general population (4.6), and the difference is statistically significant ( $p=0.009$ ). These results indicate that Plain clothes growers come to the training with a lower knowledge of FSMA and food safety than the general population, and may not be able to learn as much from the training because they do not have a strong knowledge base on which to build.

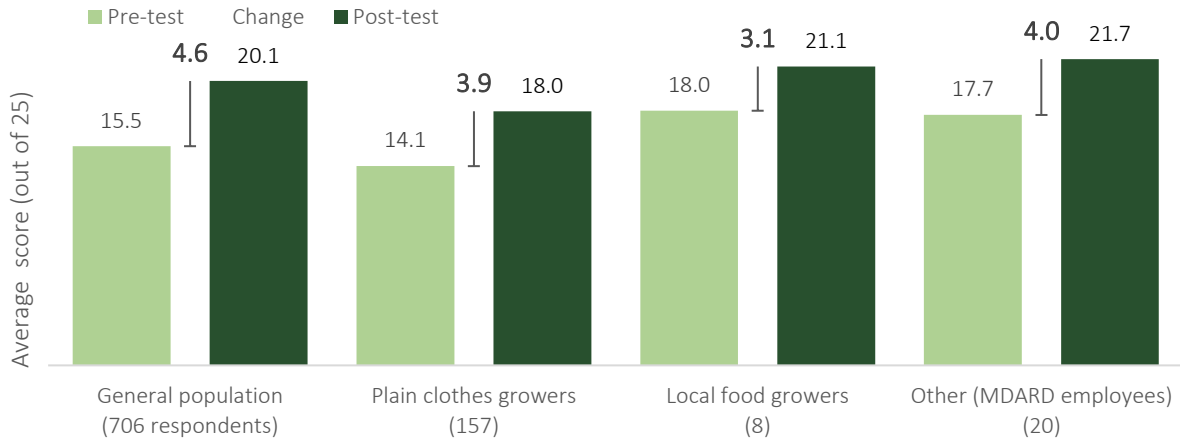
Follow-up surveys conducted by the NCR FSMA in 2020 with participants in trainings held in from July 2018 to June 2019 showed that Plain community growers were more likely to share negative comments on the survey about FSMA than the general population. Negative attitudes may also contribute to a lower knowledge gain among Plain clothes grower participants.

For the first time in 2020, an NCR state offered a training for local food growers. While it is very likely that local food growers have participated in trainings for the general population in the past, this is the first time that a training specifically for local food growers was held. Figure 7 shows that local food growers on average came to the training with a much higher knowledge of FSMA and food safety than the general population (pre-test score of 18.0 vs. 15.5), and also scored higher on the post-test than the general population (21.1 points vs. 20.1), but the differences are not statistically significant ( $p=0.066$  and  $p=.463$ , respectively), possibly because of the small number of local food growers included in the dataset which creates a high bar for statistical significance.

Finally, one additional training was held for an “other” population, in this case employees of the Michigan Department of Agriculture and Rural Development. Agency staff entered the training with a higher pre-test score (17.7) than the general population (15.5) and also scored on average higher on the post-test (21.7 vs. 20.1), also shown in Figure 7. These differences are statistically significant ( $p=0.001$  pre-test and  $p=0.001$

post-test), showing how a larger sample size can affect statistical significance. It is not surprising that employees at MDARD might have a higher knowledge of FSMA and food safety than the general population as some of these employees may have advanced educational degrees possibly related to food and agriculture.

**Figure 7: MDARD employees and local food growers scored better on average than the general population.**





## Conclusions

The third year of conducting knowledge assessments for the Produce Safety Alliance Grower Training confirms that participants' knowledge does increase by taking the course. The data has been consistent across years showing that participants generally come in with a high knowledge of Modules 1, 2, and 3 and learn much about Modules 5, 6, and 7.

Results show that each year participants in the PSA grower training enter with a lower knowledge of FSMA and food safety than the previous year. This may be explained by early adopters choosing to take the course in the first year. It is also possible that those who participated in the first year did so because they were already well connected with resources available to them through Extension or state departments of agriculture, through which they learned about the training and through which they have received information in the past to build up their knowledge of FSMA and food safety. Knowledge gain has increased each year, possibly because participants have more to learn, because their baseline knowledge is lower at the start of the training.

Year 3 was the first time courses have been delivered using remote delivery because of the COVID-19 pandemic. Knowledge assessment results showed that participants in remote delivery courses learned as much as participants in face-to-face trainings. This is good news given the fact that remote delivery will likely continue to be used in the next training season. However, the number of participants in trainings offered using remote delivery was low, so future data collection at remote delivery trainings will help determine if remote delivery courses perform as well as face-to-face trainings.

In year 3 the training specifically for local food growers was also offered for the first time. While participants in that course came to the class with a higher knowledge of FSMA and food safety and scored higher on the post-test, the results were not statistically significant. The number of participants was low (eight), so it cannot be determined whether the population of local food growers has a higher knowledge of FSMA and food safety than the general population.

## Appendix A: Individual questions, regional results

2019-20	Pre-test	Post-test	Assigned module
Question	% correct	% correct	
1	91%	95%	1
2	58%	78%	1
3	59%	73%	1
4	75%	94%	1
5	96%	98%	2
6	92%	96%	2
7	69%	86%	3
8	72%	86%	3
9	82%	88%	3
10	70%	84%	3
11	46%	72%	4
12	77%	78%	3
13	38%	60%	4
14	74%	95%	4
15	57%	78%	5
16	90%	96%	5
17	22%	75%	5
18	61%	68%	1
19	48%	86%	6
20	48%	83%	6
21	45%	48%	6
22	6%	57%	7
23	78%	91%	7
24	32%	50%	7
25	47%	62%	7
	<b>Pre-test</b>	<b>Post-test</b>	
<b>Most often correct</b>	Question 5	Question 5	
<b>Least often correct</b>	Question 22	Question 21	