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### Abstract

State crop scouting competitions (CSCs) promote agriculture by introducing youths in Indiana, Iowa, and Nebraska to various agricultural disciplines while focusing on integrated pest management (IPM). High school students compete as teams to address crop management issues at various stations. Each station is led by university representatives. Two surveys were conducted to determine the impacts of the competition on students. Results indicate that students improved in skills key to future careers and that they learned about aspects of IPM. CSCs can serve as models for states that wish to improve ties between university-based Extension specialists and state high schools.

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## Introduction

Integrated pest management (IPM) is an important, though often underutilized, crop production strategy (Wise & Mueller, 2011; Barrett, Soteres, & Shaw, 2016), and a clear understanding of it is key to the success of future agricultural personnel. The IPM approach to crop production involves carefully considering the economic and ecological benefits of using available, nonpesticide pest management options and strategies, and combinations thereof, prior to making a pesticide application decision in order to promote human and ecological health (Food and Agriculture Organization of the United Nations, 2016). Understanding IPM is increasingly important for the sustainability of agriculture, and knowledge of key agronomic practices will be necessary in order to practice IPM effectively.

Goecker, Smith, Fernandez, Ali, and Goetz Theller (n.d.) estimated that an average of 57,900 annual job openings for students in food, agriculture, environment, and renewable resources would be available between 2015 and 2020. To fill these jobs, it is important that land-grant universities successfully recruit high school

students into their agricultural programs. According to Wildman and Torres (2001), some of the most influential factors for students when choosing to pursue a career in agriculture include experiences in agriculture and the friendliness of faculty members and departments at a university. If land-grant universities are going to be successful in recruiting and training future agricultural personnel, it makes sense for them to recruit from a pool of students already engaged in agricultural groups such as FFA, 4-H, and so on (Russell, 1993). It is also important that land-grant universities begin to engage with these students early in their high school careers to help them develop their knowledge of IPM and help them develop the communication, critical thinking, and observation skills they will need for successful careers in agriculture (U.S. Department of Labor Bureau of Labor Statistics, 2015). State crop scouting competitions (CSCs) were designed with these purposes in mind.

CSCs are contests for high school students that occur annually in each of three states: Indiana, Iowa, and Nebraska. They are facilitated by the state's land-grant university (Purdue University [Purdue], Iowa State University [ISU], and the University of Nebraska–Lincoln [UNL], respectively) and emphasize a hands-on, team-centered approach to learning IPM. The model for the competition was established at ISU in 2011 and was expanded to Purdue and UNL in 2014.

At a CSC, teams from high schools participate in a series of crop scouting tasks. University faculty, staff, or graduate students serve as station leaders, and an emphasis is placed on the interactions between university representatives and students to promote an understanding of the diverse specialties within agriculture. At ISU, select stations are staffed by agribusiness and commodity group personnel.

The primary goal of the CSCs is to promote agriculture by introducing youths to agricultural disciplines. They also serve to educate youths on IPM concepts and help them develop key life skills including communication and problem solving. Additionally, the competitions serve as recruiting tools to showcase the broad range of agricultural disciplines available at land-grant universities.

## Objectives

The purpose of our survey was to evaluate the perceived impact of state CSCs. To accomplish this, we conducted a survey in 2015 of both team coaches and student participants in Indiana and Nebraska and of team coaches only in Iowa. We evaluated whether the CSCs achieved the following goals:

1. Increase student awareness of careers in crop agriculture.
2. Increase student knowledge of IPM.
3. Improve student skills in leadership, teamwork, communication, studying, problem solving, and diligence.
4. Generate a more favorable student opinion of the state's land-grant university.
5. Engage students in an enjoyable, hands-on learning experience.

## Program Description

Three states held CSCs in 2015: Indiana (Purdue), Iowa (ISU), and Nebraska (UNL). Teams in all states were given similar study materials prior to the competition. During each contest, teams progressed through a series

of stations at set time intervals, earning points on the basis of their ability to diagnose the problems presented to them and suggest appropriate management techniques. Station topics included in at least two of the three states included

- corn growth staging,
- field scouting,
- insect identification,
- nutrient deficiency,
- plant diseases,
- soybean growth staging, and
- weed identification.

## Evaluation Methods

Outcomes were measured through two surveys distributed after the competition. One of the surveys was designed for team coaches and the other for students. At Purdue, survey distribution occurred during lunch, prior to winning teams being announced. At UNL, surveys were conducted after winners were announced. At ISU, surveys were sent to team coaches only, months after the event was completed.

## Results

### Survey Data: Indiana, Iowa, and Nebraska Team Coaches

The return rates for the team coach surveys were very high: 100%, 83%, and 80% of surveys were returned in Indiana, Nebraska, and Iowa, respectively. The majority of coaches in Indiana had worked in agricultural education for 4 or more years (answering either 4–5, 6–10, or >10 years); at Nebraska, 80% of the coaches had worked in agricultural education for over 6 years; and in Iowa, 63% of the coaches had worked in agricultural education for more than 10 years. When asked to rate whether their overall experience with the competition was positive on a Likert scale ranging from 1 to 5 (1 = *strongly disagree* and 5 = *strongly agree*), 100% of Indiana and Iowa coaches chose *strongly agree*. In Nebraska, 75% chose *strongly agree* and the remaining 25% chose *agree*.

Coaches were asked what skills students improved in as a result of participation in the CSC. They were given a list of choices and told to circle all that applied (Table 1). In all three states, 100% of the coaches indicated that the students' problem-solving skills improved. In both Indiana and Iowa, 100% of leaders reported that the students' teamwork skills improved, and 88% reported that the students' communication skills improved. In Nebraska, 100% of leaders said the students' study skills improved, and 80% indicated that the students' teamwork skills improved.

**Table 1.**

Team Coaches' Agreement That Students Improved Skills Through Participation in Crop

Scouting Competitions in 2015

Skill	Purdue	University of Nebraska–	Iowa State
	University (%) <sup>a</sup>	Lincoln (%) <sup>b</sup>	University (%) <sup>c</sup>
Communication	88	60	88
Diligence	50	60	13
Leadership	75	20	63
Problem solving	100	100	100
Study skills	75	100	38
Teamwork	100	80	100

aPercentage of respondents out of 8 who indicated that students improved.  
 bPercentage of respondents out of 5 who indicated that students improved  
 cPercentage of respondents out of 8 who indicated that students improved.

### Survey Data: Students

The response rates for the student survey were similarly high, with 94% and 98% of students at Purdue and UNL, respectively, returning their surveys.

Students were asked to rate their level of agreement with several statements regarding the effect of the competition on their views of agricultural disciplines and the hosting land-grant university. Responses were based on a 5-point Likert scale (1 = *strongly disagree* and 5 = *strongly agree*). Results were averaged (Table 2). A mean between 4 and 5 was considered strong agreement, and a mean between 2 and 3.9 was considered agreement. Responses were very positive. All statements, with the exception of one at Purdue and two at UNL, were categorized as garnering strong agreement. The highest levels of agreement related to positive overall experience with the CSC; the mean for students attending the Purdue CSC was 4.6, and the mean for those attending the UNL CSC was 4.5.

**Table 2.**  
 Degrees to Which Students Agreed with Statements Concerning Participation in Crop Scouting Competitions in 2015

Survey question	Purdue University			University of Nebraska–Lincoln		
	No. <sup>a</sup>	M <sup>b</sup>	SD	No.	M	SD
Participation in the crop scouting competition made me more aware of potential careers with agriculture.	30	4.3	0.78	30	4.1	0.78
Participation in the crop scouting competition	30	3.8	1.2	30	3.7	0.84

made me more aware of degree opportunities at Purdue University/UNL.

Because of my participation in the crop scouting competition I have a more favorable opinion of Purdue University/UNL as a whole.

Overall, my experience with the Purdue University/UNL Crop Scouting Competition was positive.

*Note.* UNL = University of Nebraska-Lincoln.  
 aNumber of respondents. bBased on a 5-point Likert scale; 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *strongly agree*.

To gauge how much students felt they learned from participating in the CSC, we asked them to rate their knowledge increase in various areas. Responses were based on a 5-point Likert scale (1 = *strongly disagree* and 5 = *strongly agree*) (Table 3). A mean response of greater than 4.0 was considered strong agreement. For all subject areas, with the exception of nutrient deficiency at UNL, students strongly agreed that their levels of knowledge increased.

**Table 3.**

Degrees to Which Students' Knowledge of Various Subjects Increased as a Result of Participation in Crop Scouting Competitions in 2015

Subject	Purdue University			University of Nebraska–Lincoln		
	No. <sup>a</sup>	<i>M</i> <sup>b</sup>	<i>SD</i>	No.	<i>M</i>	<i>SD</i>
Corn growth staging	30	4.3	0.98	26	4.3	0.78
Field scouting	30	4.3	0.84	26	4.2	0.61
Insect identification	30	4.3	0.92	26	4.2	0.69
Nutrient deficiency	30	4.3	0.84	26	3.9	0.82
Plant diseases	30	4.4	0.85	26	4.1	0.65
Soybean growth staging	30	4.4	0.85	26	4.4	0.57
Weed identification	29	4.1	0.95	26	4.1	0.82

aNumber of respondents. bBased on a 5-point Likert scale; 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *strongly agree*.

## Comments

Coaches and students at Purdue and UNL and coaches only at ISU were asked to comment on what they liked best about the competition and to record any additional comments they had. Their responses to these open-ended prompts were particularly useful for gauging their overall opinion of the competition and determining what they found most impactful.

Comments from coaches in all three states were extremely positive. For example, a coach from Purdue remarked, "This is an amazing hands-on, real-life competition that interests students and holds their attention." With regard to the question about what respondents liked about the competition, one Purdue coach said, "The whole thing. I cannot replicate this in the classroom." At UNL, a coach reported liking "the hands on experience," and another noted, ". . . students can use resources they bring and work together. It's also very relaxed." At ISU, coaches commented that the competition "truly tested the 'farmer' in [the] kids . . .," ". . . exposed high school students to agronomy and helped open their eyes about career possibilities in crop production," and "help[ed] students prepare for a future career."

Responses from students were positive as well. One Purdue participant responded, "I am going to continue to participate in this contest to broaden my knowledge of agriculture until I graduate high school." With regard to the question about what respondents liked about the competition, a Purdue participant responded, "EVERYTHING! It was small, the leaders at the stations explained everything in detail, literally everything was awesome!" UNL students responded in a similar manner, with comments such as "It was a great experience and I would definitely come back if I got the opportunity to" and "I liked learning about agronomy and I am more aware about crop scouting." The student who made the latter remark also wrote, "This was a very pleasant experience. I'm glad such a real life competition is put together for youth."

## Discussion

Results from the study indicate that the goals of the CSCs were achieved. Students learned tactics important to the practice of IPM and developed skills important for future success in an agricultural career. The competitions also generated more favorable opinions of the land-grant universities hosting them and made students more aware of the myriad career paths within agriculture.

In addition to verifying the impacts of the CSCs, the findings highlight the importance of hands-on engagement of Extension specialists with youths and suggest that the CSCs can serve as models for future partnerships between university-based Extension specialists and high schools. This is the first known study to assess the impact of such a program on students. A similar program is conducted at Michigan State University, called Crop-O-Rama (Thelen, Renner, & Copeland, 2009), but information on that program's direct impact has not been documented.

Encouraging university-based Extension agricultural specialists to work with youths in agricultural programs can be valuable to both parties involved (Ricketts & Place, 2005). Typically this is a role that county or regional Extension educators fill, and although those cooperation efforts are important, interactions between youths and campus-based Extension specialists can serve a specialized niche. The CSCs provide unique venues where high school youths can interact directly with Extension specialists and graduate students from a variety of agricultural disciplines. Interactions with specialists in a university setting helps introduce youths to areas of agriculture they may have been previously unfamiliar with, and these personal interactions can serve as a recruiting tool for the university by providing positive interactions between university personnel and high school students. Many survey comments indicated the positive impact of direct interactions between students and station leaders, demonstrating the value that both students and coaches place on such interactions.

Putting together a CSC does not come without challenges. Advanced scheduling is necessary to accommodate Extension specialists, and poor weather on the day of the competition can result in the competition's being



forced inside, as participants at UNL experienced in 2014 and 2015. Funding for the program also can be difficult to obtain. However, we believe that the benefits of the CSCs to high school students and the land-grant universities involved outweigh the challenges.

We found that by focusing on career skills and creating an enjoyable, hands-on experience for participants, CSC leaders were able to successfully engage high school students in an educational competition. In doing so, university-based Extension made a contribution to youth agricultural education. It also created a unique experience for Extension specialists and gave graduate students an opportunity to engage in youth Extension activities.

Future goals for the CSCs include the addition of a regional competition that will allow the top two teams from each state competition to advance to a multistate competition. This will help give students an opportunity to further test their knowledge at a regional level and interact with their peers in nearby states.

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