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Meeting Stakeholder Energy Technology Education Needs Using a Mobile Demonstration

Abstract

Understanding the impact of workshops that include mobile demonstrations for describing technical applications can be useful when planning an Extension program on new energy technologies. We used a mobile demonstration in a workshop that provided information on small-scale on-farm biodiesel production. Evaluation of the workshop outcomes identified significant increases in attendees' perceptions, awareness, interest, and knowledge related to the topic. On the basis of our process for planning and conducting the workshop and the results of the evaluation, we recommend implementing a well-distributed needs assessment and using a mobile demonstration to present technology that is economically feasible to use. The workshop we describe can be used as a model for other Extension programs.

Jason P. de Koff
Associate Professor and Extension Specialist
jdekoff@tnstate.edu

John C. Ricketts
Professor and Extension Specialist
jricket1@tnstate.edu

Chris Robbins
Extension Associate
crobbins@tnstate.edu

Prabodh Illukpitiya
Assistant Professor
pillukpi@tnstate.edu

Alvin Wade
Extension Specialist (Retired)

Department of Agricultural and Environmental Sciences
Tennessee State University
Nashville, Tennessee

Introduction

Through the years, Extension professionals have used demonstration as an educational method in numerous ways for varied applications. Applying this traditional method to new topics and technologies, such as new energy technologies, can enhance clients' knowledge and acceptance of new ideas. Moreover, using a *mobile* demonstration, specifically, can increase the exposure of clients in rural areas to new technologies and educational opportunities, potentially leading to enhanced positive social and economic impacts. The project described herein took place in Tennessee but can serve as a nationwide model for using mobile demonstrations to provide Extension workshops on new energy technologies or other new technologies in areas where residents may not otherwise have access to such educational resources.

Energy is an important factor in any home or business, and renewable forms of energy are becoming a cheaper, more environmentally friendly alternative to other forms of energy. For a farmer, the opportunity to produce energy on the farm for in-home and/or on-farm use is an important alternative to producing commodities for a

local market. Agricultural producers can increase their self-sufficiency and reduce fuel costs by producing their own biodiesel using their existing crop production systems; however, many producers are not knowledgeable about the process or aware that the process can work for small-scale operations. In 2007, a group of 20 public- and private-sector scientists and educators was created to establish guidelines for providing 25% of U.S. energy needs from U.S. farms, ranches, and forests by 2025 (Acker, 2008). Among the three types of educational needs identified, Extension education was one that was recommended for every renewable energy area (Acker, 2008). Priority areas for Extension programming included education on the costs and benefits to society of renewable energy, biomass production and handling, and biomass conversion technologies (Acker, 2008). In 2012, a nationwide survey of Extension agents identified interest and educational need in the area of energy and agriculture (Kluchinski, 2012). Biodiesel ranked fourth out of 30 topics related to Extension agents' interests and first out of 30 topics related to their stakeholders' interests and needs (Kluchinski, 2012).

With respect to farmer interest in growing crops for biodiesel production in Tennessee, a study at the University of Tennessee (Jensen, English, & Menard, 2003) identified soybean producer interest in growing soybeans for biodiesel. Though the response rate for smaller farms (<100 ac) was lower than that for larger farms (100+ ac), 97% of producers surveyed indicated that they would be interested in selling some of their crop or their entire crop to a biodiesel production plant. Additionally, some Tennessee farmers have expressed interest in forming a cooperative for biodiesel production (English, Jensen, & Menard, 2005).

We determined that the best way to address farmers' interest in and need for information about growing crops for biodiesel production would be to provide relevant education to all sectors of the state through the use of a mobile demonstration. There has been little research on the use of mobile demonstrations to educate stakeholders in rural areas, but such demonstrations have been used in multiple ways to provide education and services to those in more urban locations (Gossett, 2012; Kock, 2009; Monaghan et al., 2015). Also, demonstrations have been found useful for teaching farmers about technology, such as that involved in precision agriculture (Heiniger, Havlin, Crouse, Kvien, & Knowles, 2002). With respect to the effectiveness of a demonstration as a teaching tool for biodiesel education specifically, Sallee, Davis, Johnson, Edgar, and Wardlow (2010) developed a 2-day educational program that involved providing material on biodiesel in a lecture on the first day and using a mobile demonstration unit to show differences in engine performance between petrodiesel and biodiesel fuels on the second day. Results showed that students strongly preferred the demonstration over the lecture (Sallee et al., 2010). Additionally, a demonstration can be useful for proving a technology works and for exhibiting its ease and efficiency (Seevers, Graham, Gamon, & Conklin, 1997).

Purpose and Objectives

We focused on using a mobile biodiesel demonstration to show the equipment needed to produce biodiesel from an oilseed. As suggested by Haider et al. (2015), we applied "past lessons learned to new bioenergy Extension pursuits" ("Addressing Barriers," para. 4) and were able to determine the impact of the overall program. Specifically, we incorporated demonstration into a workshop, the Mobile Biodiesel Education Demonstration (MBED) workshop, which included seminars on biodiesel production, the agronomics of specific biodiesel crops, the economics of small-scale on-farm biodiesel production, and federal assistance programs related to biodiesel production. To document the educational impacts of our project, we conducted a study guided by the following objectives:

1. Describe the impact of the MBED workshop on participants' *perceptions* of biodiesel and its small-scale on-farm production.

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2. Describe the impact of the MBED workshop on participants' *awareness* of biodiesel and its small-scale on-farm production.

3. Describe the impact of the MBED workshop on participants' *interest* in biodiesel and its small-scale on-farm production.

4. Describe the impact of the MBED workshop on participants' *knowledge* of biodiesel and its small-scale on-farm production.

Methods

We built the MBED unit in 2013 with support from a Capacity Building Grant awarded by the U.S. Department of Agriculture National Institute of Food and Agriculture in 2012. The MBED unit is a 24-ft gooseneck trailer that has concession windows and is installed with an oilseed press and a biodiesel processor (Figure 1).

Figure 1.
Mobile Biodiesel Education Demonstration Unit

Our project, therefore, allowed this normally stationary technology to be mobile and incorporated into a mobile workshop. We developed a series of presentations around the demonstration to provide farmers with information related to small-scale on-farm biodiesel production. The presentations focused on the following topics and subtopics:

- bioenergy and biodiesel production—renewable fuels standard, transesterification process for producing biodiesel, advantages and disadvantages of biodiesel;

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- agronomics of biodiesel crops—oil content of different potential feedstocks, agronomic recommendations for sunflower production, agronomic recommendations for winter canola production;
- economics of small-scale on-farm biodiesel production—equipment costs, processing costs, feedstock costs, revenue; and
- federal assistance programs related to biodiesel production—Rural Energy for America Program, Value-Added Producer Grant program.

The MBED workshop was held 10 times in 2014 and 2015 (five times each year). We selected counties to host the workshops on the basis of (a) results from a 2012 needs assessment of agriculture and natural resources Extension agents related to bioenergy programming needs and (b) Census of Agriculture data related to current oilseed production. The mobility of the demonstration unit made the workshop a convenient option for farmers and allowed us to present the workshop in a number of rural counties with low population densities (<100 people/mi^2).

We developed a 33-item questionnaire to determine the impact of the workshop. Items were developed around four constructs: perceptions (10 items), awareness (five items), interest (seven items), and knowledge (11 items). The questionnaire was formatted to serve as a retrospective postprogram evaluation tool. In this type of assessment, program participants complete a questionnaire after completing the program. For each question, respondents are asked to evaluate retrospectively and report on their status before participating in the program and to evaluate and report on their status after participating in the program. Several Extension educators support this type of approach because of its accuracy, efficiency (one administration), simplicity, and usefulness with self-assessments (Davis, 2003; Nielson, 2011; Rockwell & Kohn, 1989).

With the questionnaire, we asked participants to reflect on and rate their perceptions of, interest in, awareness of, and knowledge of biodiesel and biodiesel production prior to and after the workshop. The response choices were on a summated rating scale (e.g., Likert-type) that had the following response options: *strongly disagree*, *disagree*, *uncertain*, *agree*, and *strongly agree*. There were also seven demographics/farm capacity questions and additional questions regarding suggestions for changes to improve the workshop. A panel of experts reviewed the questionnaire, and we made revisions prior to its implementation. The institutional review board–approved protocol number for the project is HS2012-3115.

Following the 10 implementations of the workshop, we coded and analyzed the evaluations. We removed three of the 10 perceptions construct items because they were either too ambiguous or were not covered in the workshop, and we reverse coded negative statements on the survey. We calculated means and standard deviations to determine individual item scores and calculated a summated mean and standard deviation for each construct. We used paired-samples *t*-tests to determine changes in perceptions, awareness, interest, and knowledge from before the workshop to after the workshop and calculated Cohen's *d* to measure the magnitude of mean differences. We also analyzed frequencies to document how many participants scored a certain way on the rating scale.

Our findings are limited because of the design of the project itself. Randomly assigning participants would be ideal for the interpretive statistics we used to analyze results; however, randomization was impossible because the participants were volunteers in counties we selected on the basis of our Extension needs assessment and

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census data identifying geographically represented counties with the greatest oilseed production in the state. Therefore, our position is in line with scholars who have asserted that "inferential statistics can be used with data . . . if the sample is carefully conceptualized to represent a particular population" (Gall, Gall, & Borg, 2003, p.176). Also, our study is limited by the unexpected observation that some participants seemed to struggle with reading the survey.

Results

Overall Constructs

In general, across both years of the project, respondents' perceptions, awareness, interest, and knowledge related to biodiesel and small-scale on-farm production of biodiesel improved significantly from before the MBED workshop to after the intervention. A comparison of data from Year 1 and Year 2 showed only small differences in participants' perceptions, awareness, interest, and knowledge. For example, in Year 2, participants' perceptions did not significantly improve from before to after the workshop, whereas in Year 1, participants' perceptions did significantly improve. Also, Year 1 participants had significantly greater awareness of biodiesel and its production before attending the workshop than Year 2 participants did. Lastly, participant perceptions following the workshop were significantly lower in Year 2 than Year 1. The subsections that follow and Table 1 provide more detailed data related to participant changes and differences between Year 1 and Year 2.

Perceptions

Overall, participants' perceptions of biodiesel and its production significantly improved from before the MBED workshop to after the workshop ($t = 3.76$, $p < .01$). Following participation in the workshop, nearly 91% of respondents had positive perceptions related to biodiesel. This figure compares to 86.7% who reported having had positive perceptions prior to the workshop. A comparison of Year 1 and Year 2 data showed that respondents' retrospectively reported preprogram perceptions were 84.2% positive in Year 1 and 87.7% positive in Year 2. Participant perceptions after the program were 88.5% positive in Year 1 and 90.5% positive in Year 2.

Awareness

Participants' awareness concerning biodiesel production significantly increased as a result of the MBED workshop ($t = 12.87$, $p < .01$). Specifically, over 93% of participants indicated at least some awareness above the neutral response. Overall, awareness increased for 86% of the participants as a result of the workshop.

Interest

Interest significantly improved as a result of the MBED workshop ($t = 5.91$, $p < .01$). Seventy-one percent of participants who completed retrospective preprogram and postprogram responses indicated gains in interest in biodiesel production.

Knowledge

Knowledge significantly improved due to the MBED workshop ($t = 14.51$, $p < .01$). Ninety-seven percent of participants who provided retrospective preprogram and postprogram responses indicated gains in knowledge

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regarding biodiesel production.

Table 1.

Scores for Retrospectively Reported Preprogram and Postprogram Perceptions, Awareness, Interest, and
Following a Mobile Biodiesel Education Demonstration Workshop

	Year 1				Year 2				Total		
Construct	***M***	***SD***	***t***	***p***	***M***	***SD***	***t***	***p***	***M***	***SD***	t
Perceptions											
Before workshop	21.02	2.54	7.05	<.01*L	21.45	2.81	.44	.66	21.21	2.65	3.
After workshop	24.391	3.57			21.941	6.74			23.33	5.28	
Awareness											
Before workshop	16.462	2.64	9.64	<.01*L	14.902	2.53	8.77	<.01*L	15.81	2.69	12.
After workshop	20.78	2.38			20.45	1.99			20.64	2.22	
Interest											
Before workshop	22.48	4.21	4.50	<.01*L	21.72	2.98	4.26	<.01*L	22.16	3.74	5.
After workshop	26.48	5.83			24.35	4.85			25.58	5.22	
Knowledge											
Before workshop	34.34	4.78	12.84	<.01*L	35.24	4.85	7.80	<.01*L	34.71	4.79	14.
After workshop	46.58	4.47			44.72	4.88			45.87	4.71	

Note. Year 1 n = 41; Year 2 n = 31. 1Significant difference in postprogram perceptions scores between Y
2. 2Significant difference in preprogram awareness scores between Year 1 and 2. Cohen's d magnitude is
follows: S = small effect (≤0.2), M = medium effect (>0.2–0.5), L = large effect (≥0.5).

*p < .01

Individual Items

To gain a better understanding of the data, we analyzed participants' preprogram and postprogram responses for individual items in each construct. For the perceptions category (Table 2), there was a significant change observed for six of the seven questions in Year 1 and only two of the seven questions in Year 2. Specific differences between Year 1 and Year 2 related to whether (a) biodiesel production is too difficult for a farmer to do on his or her own, (b) biodiesel is economically feasible, (c) biodiesel could cost less than regular diesel, and (d) only certain diesel engines can use biodiesel; Year 2 participants remained uncertain about these aspects of

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biodiesel, whereas their Year 1 counterparts became more certain (positively or negatively) about them and did so significantly. Also, participant agreement in Year 2 remained at the same level with respect to whether biodiesel production is good for the environment and energy security, whereas participant agreement levels in Year 1 increased significantly.

Table 2.

Mean Item Scores for Perceptions of Biodiesel and Small-Scale On-Farm Production

	Year 1		Year 2		Total	
	Before	After	Before	After	Before	After
Perceptions item	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Biodiesel production is too difficult for a farmer to do on their own.R	2.83* (1.14)	3.98* (1.13)	2.87 (1.18)	3.42 (1.29)	2.85* (1.15)	3.74* (1.22)
Biodiesel is not economically feasible for a farmer.R	2.59* (.87)	3.73* (1.07)	2.71* (1.01)	3.36* (.99)	2.64* (.92)	3.58* (1.05)
Biodiesel production is good for the environment and energy security.	3.85* (.81)	4.36* (.75)	3.89 (.69)	4.07 (.86)	3.87* (.66)	4.24* (.80)
Biodiesel can cost less than regular diesel.	3.32* (1.06)	3.78* (.99)	3.04 (.98)	3.44 (.97)	3.21* (1.03)	3.65* (.99)
Diesel prices will decrease in the future.R	2.34 (1.11)	2.49 (1.43)	2.79 (.96)	2.64 (1.25)	2.52 (1.07)	2.55 (1.36)
The US will produce more biodiesel in the future.	3.55* (.90)	4.10* (.78)	3.64* (.68)	4.07* (.46)	3.59* (.82)	4.09* (.66)
Only certain diesel engines can use biodiesel.R	2.90* (.93)	2.23* (1.07)	3.14 (.95)	2.76 (.99)	3.00* (.94)	2.45* (1.06)

Note. R = Reverse-coded items. Participant indicated level of agreement with each statement by selecting one of the following options for the preprogram column and the postprogram column: 1 = *strongly disagree*, 2 = *disagree*, 3 = *uncertain*, 4 = *agree*, 5 = *strongly agree*.
*$p < .05$.

Responses to items in the awareness category (Table 3) were very similar in Year 1 and 2, and there was a significant preprogram-to-postprogram change in response values for every item. In general, most answers changed from "uncertain" to "agree."

Table 3.

Mean Item Scores for Awareness of Biodiesel and Small-Scale On-Farm Production

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	Year 1		Year 2		Total	
	Before	After	Before	After	Before	After
Awareness item	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
I know 1-15% of farm acreage can produce enough biodiesel to run farm equipment for one year.	2.95* (.80)	3.95* (.92)	2.82* (.47)	3.90* (.62)	2.90* (.68)	3.93* (.80)
I know there is federal assistance to purchase biodiesel equipment for my farm.	3.10* (.74)	4.29* (.56)	2.90* (.62)	4.21* (.41)	3.01* (.69)	4.26* (.50)
I know that soybean, canola, and sunflower can be used to produce biodiesel.	3.90* (.80)	4.51* (.51)	3.28* (.75)	4.31* (.47)	3.64* (.84)	4.43* (.50)
I know that biodiesel production is economically feasible for farmers.	2.98* (.89)	3.75* (.98)	2.96* (.51)	3.71* (.81)	2.97* (.75)	3.74* (.91)
I know that there is equipment available for smaller producers to make their own biodiesel.	3.61* (.89)	4.36* (.58)	3.03* (.73)	4.26* (.45)	3.37* (.87)	4.33* (.53)

Note. Participant indicated level of agreement with each statement by selecting one of the following options for the preprogram column and the postprogram column: 1 = *strongly disagree*, 2 = *disagree*, 3 = *uncertain*, 4 = *agree*, 5 = *strongly agree*.
*$p < .05$.

In the interest category (Table 4), there was a significant change observed for all seven questions in Year 1; however, this circumstance was observed for only four of the seven questions in Year 2. Participants in Year 2 remained uncertain regarding interest in producing their own biodiesel in the subsequent 5 years and working with other farmers to create a biodiesel cooperative. However, in Year 1, participants' levels of interest increased significantly from uncertain to interested for both activities. With respect to applying for federal assistance to produce biodiesel, there was a significant change in interest among participants in Year 1, although they still remained uncertain about taking this action. Additionally, in Year 1, participants generally agreed that they were interested enough to contact Tennessee State University or other credible sources if they had additional questions; in Year 2, participants were originally uncertain but became more certain about taking this action.

Table 4.

Mean Item Scores for Interest in Biodiesel and Small-Scale On-Farm Production

	Year 1		Year 2		Total	
	Before	After	Before	After	Before	After
	M	*M*	*M*	*M*	*M*	*M*

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Interest item	*(SD)*	*(SD)*	*(SD)*	*(SD)*	*(SD)*	*(SD)*
I am interested in producing my own biodiesel in the next 5 years.	3.00* (1.00)	3.72* (1.07)	2.93 (.80)	3.14 (.88)	2.97* (.91)	3.47* (1.03)
I am interested in applying for federal assistance to produce biodiesel.	2.77* (.78)	3.31* (1.13)	2.82 (.77)	3.00 (.90)	2.79* (.77)	3.18* (1.04)
I am interested in finding out more about biodiesel and its production.	3.80* (.86)	4.28* (.56)	3.45* (.74)	4.07* (.75)	3.65* (.82)	4.19* (.65)
I will discuss what I have heard here with other farmers.	3.46* (.56)	4.19* (.52)	3.50* (.64)	3.96* (.74)	3.48* (.59)	4.09* (.63)
I am interested in producing biodiesel/biodiesel blends on my farm.	3.26* (.86)	3.84* (1.03)	3.28* (.84)	3.55* (.95)	3.27* (.85)	3.72* (1.00)
I am interested enough to contact TSU or other credible sources if I have any additional questions about biodiesel production.	3.47* (.95)	4.26* (.72)	3.17* (.80)	3.86* (.83)	3.34* (.88)	4.09* (.79)
I am interested enough to work with other farmers to create a cooperative for biodiesel production.	3.08* (.73)	3.78* (.86)	2.65 (.77)	2.83 (.93)	2.90* (.77)	3.38* (1.00)

Note. Participant indicated level of agreement with each statement by selecting one of the following options for the preprogram column and the postprogram column: 1 = *strongly disagree*, 2 = *disagree*, 3 = *uncertain*, 4 = *agree*, 5 = *strongly agree*. TSU = Tennessee State University.
*$p < .05$.

As with awareness, responses to items in the knowledge category (Table 5) were very similar in Years 1 and 2, and there was a significant preprogram-to-postprogram change in response values for every item. In general, most answers changed from "uncertain" to "agree."

Table 5.

Mean Item Scores for Knowledge of Biodiesel and Small-Scale On-Farm Production

	Year 1		Year 2		Total	
	Before	After	Before	After	Before	After
	M	*M*	*M*	*M*	*M*	*M*

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Knowledge item	*(SD)*	*(SD)*	*(SD)*	*(SD)*	*(SD)*	*(SD)*
I know that making biodiesel involves hazardous chemicals that require certain safety precautions.	3.51* (.93)	4.34* (.73)	3.48* (.69)	4.07* (.53)	3.50* (.83)	4.23* (.66)
I know that there is waste material produced when making biodiesel.	3.41* (.84)	4.20* (.87)	3.48* (.51)	4.03* (.68)	3.44* (.72)	4.13* (.80)
I know that to make biodiesel from oilseed crops, a producer needs a seed press and a biodiesel processor.	3.22* (.65)	4.37* (.66)	3.38* (.73)	4.24* (.44)	3.29* (.68)	4.31* (.58)
I know that to make and use my own biodiesel, I don't have to meet any specific quality standards.	3.20* (.71)	4.02* (1.11)	3.07* (.53)	3.59* (.98)	3.14* (.64)	3.84* (1.07)
I know that if I choose to sell the biodiesel I produce, I must meet specific quality standards.	3.23* (.63)	4.41* (.64)	3.35* (.49)	4.18* (.39)	3.28* (.57)	4.31* (.56)
I know that the initial starting cost for equipment is between $5,000 and $25,000 depending on the type of equipment.	2.90* (.49)	4.29* (.46)	3.07* (.65)	4.28* (.46)	2.97* (.56)	4.29* (.46)
I know that sunflower and canola seeds contain about 40% oil.	3.03* (.58)	4.44* (.75)	3.10* (.56)	4.17* (.60)	3.06* (.57)	4.32* (.70)
I know that soybean contains about 20% oil.	3.00* (.51)	4.25* (.63)	3.14* (.75)	4.14* (.58)	3.06* (.62)	4.20* (.61)
I know that for every 10 gallons of vegetable oil, you can make about 9 gallons of biodiesel.	2.90* (.63)	4.24* (.70)	2.93* (.59)	4.03* (.82)	2.91* (.61)	4.16* (.75)
I know that canola is a winter annual crop that can be grown in place of winter wheat.	3.12* (.78)	4.39* (.59)	3.14* (.65)	4.29* (.46)	3.13* (.73)	4.35* (.54)
I know that sunflower generally requires 30-inch row spacing.	3.12* (.64)	4.17* (.77)	3.10* (.56)	4.00* (.80)	3.11* (.60)	4.10* (.78)

Note. Participant indicated level of agreement with each statement by selecting one of the following options for the preprogram column and the postprogram column: 1 = *strongly disagree*, 2 = *disagree*, 3 = *uncertain*, 4 = *agree*, 5 = *strongly agree*.
*$p < .05$.

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Discussion

The overall impact of the MBED workshop was large for all categories (perceptions, awareness, interest, and knowledge) in 2014 and for most of the categories (awareness, interest, and knowledge) in 2015. This level of impact is particularly important when demonstrating a new application of technology because understanding such concepts can sometimes be difficult for those learning about or engaging with them for the first time. Demonstrations have been cited by farmers as the preferred way to learn about new practices (Reisenberg & Obel Gor, 1989). Demonstrations also are largely successful in helping change farmer practices. For example, a rainfall simulator was used in Kansas to demonstrate erosion in the field, and 40% of farmers indicated they would change their farming practices as a result (Kok & Kessen, 1997). This finding is similar to the results we observed, whereby there were significant increases in participants' interest in producing biodiesel on their farms in the subsequent 5 years (Year 1) and their interest in producing biodiesel/biodiesel blends on their farms (Years 1 and 2).

A number of factors may be involved in contributing to the success of the workshop. The first is the identification of an important need area through the use of stakeholder feedback. A needs assessment of county agriculture and natural resources Extension agents in Tennessee was conducted prior to the development of the MBED workshop, and over one third of respondents (36 of 94 responding counties) indicated interest in programming on oilseed production for bioenergy. This assessment helped identify a need around which the technology and the demonstration could be applied. The second factor is the economic viability of the technology. In January 2014, 1 month prior to the first demonstration workshop of Year 1, U.S. average retail diesel prices were $3.89 per gallon, whereas in February 2015, 1 month prior to the first demonstration workshop of Year 2, U.S. average retail diesel prices had fallen to $2.86 per gallon (U.S. Energy Information Administration, 2016). Overall impact of the MBED workshop was still large in Year 2, but there was no significant change in perceptions in Year 2 and participants remained uncertain. Participants' perceptions in Year 1, however, increased significantly from uncertainty to positive perceptions following the workshop. The changes in diesel prices may have led to some of the differences in participant responses to specific questions in the perceptions and interest categories previously mentioned. In particular, the lower prices for regular diesel may have caused greater skepticism over whether biodiesel production was too difficult for farmers to accomplish on their own, biodiesel production was economically feasible, or biodiesel could cost less than regular diesel (perceptions). Lower prices for regular diesel also may have caused participants' reduced interest in producing their own biodiesel in the subsequent 5 years and in working with other farmers to create a biodiesel cooperative (interest). The lower petrodiesel prices, and associated reduced economic viability of biodiesel production, may have led to these differences in Year 2, and the implications of external factors such as these could be important relative to the potential impact of demonstrations involving new applications or technology.

The impacts of pricing and market conditions have been observed in similar scenarios related to farmer adoption of new bioenergy crops. A study conducted in Kansas showed that the greatest factor in farmers' willingness to adopt the growing of cellulosic crops was expected net returns (Fewell, Lynes, Williams, & Bergtold, 2013), and researchers in Tennessee identified market development as one issue that affected to what extent a farmer would be willing to convert to switchgrass production (Jensen et al., 2007). In terms of accepting technology, farmers are more likely to adopt a new technology if it is seen as beneficial (Adrian, Norwood, & Mask, 2005).

Conclusions

Mobile demonstrations can have great impact on Extension programming and can be critical for demonstrating new technology or new applications. The mobility aspect of such demonstrations also allows for greater information dissemination by enabling Extension professionals to reach rural stakeholders. In developing these demonstrations, as with any Extension programming, Extension professionals should place importance on identifying major needs that must be addressed. Addressing technology in the context of its usefulness to a stakeholder group and demonstrating its practical uses for that stakeholder group can lead to greater impact and can significantly improve that group's perceptions, awareness, interest, and knowledge related to the technology. The appropriate application of new technology will become even more important as newer technologies, such as mobile applications and unmanned aerial systems (drones), are continually upgraded and improved. Identifying an economic advantage associated with using the technology is also important for increasing the interest in the technology and the potential for adoption. Though there is little information on the effectiveness of mobile demonstrations, the project reported here can serve as a model for this type of Extension programming in the future.

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