

Communicating Climate Smart Agriculture to Tree Nut Growers in the San Joaquin Valley of California

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Introduction/Need for the Study

California produces about one-third of the total vegetables and two-thirds of the fruits and nuts on nearly 1.2% of the United States' viable farmland (Pathak et al., 2018). However, the future of agriculture in California is at a critical juncture due to projected climate change. Increasing heat waves, temperatures, and erratic precipitation are already impacting the sector (Parker et al., 2020; 2021; Pathak et al., 2018; Swain et al., 2018). These extreme weather events are associated with increases in insect pests and associated diseases (Pathak et al., 2021; Rijal et al., 2021). These impacts provide a glimpse of a volatile future of California agrosystems that require multifaceted approaches to tackle the challenges. Farmers increasingly seek locally relevant information on climate change impacts and adaptation practices and resources for their cropping systems (CalCAN, 2018). University of California academics designed a multifaceted approach to climate-smart agriculture (CSA) education project. Part of the project activities is organizing regional and commodity-specific workshops to communicate with growers, and technical service providers (TSPs) about climate-agriculture science. We conducted a workshop with tree nut growers and TSPs in San Joaquin. This study sought to determine the participants' knowledge of CSA practices before and after a workshop to assess the knowledge gained, and the potential for promotion and adoption of CSA practices. The study aligns with the seventh goal of the U.S. agriculture education research agenda which includes designing programs to prepare people to address complex issues including climate change (Andenoro et al., 2016).

Theoretical Framework

Our study was grounded on the Theory of Planned Behavior (TPB) which supposes that when one plans on doing something, three intentional aspects play a role in the decision to act (Ajzen, 1985). These intentions include the behavior attitude, subjective norm, and perceived behavioral control. Behavior attitude relates to how one thinks and feels about a behavior, for instance, in the current era where the climate change topic is highly contested (Sanders et al., 2022). The subjective norms are related to social interactions, social pressures, and support given by members of our social circles. In our study, the pressures arise from the reported climate change trends and impacts projected to adversely affect agricultural production in California (Pathak et al., 2018) that require building capacities of growers and TSPs toward CSA programs and practices. The perceived behavioral control ascribes to an individual feeling of having the ability to accomplish the task. In our study, growers understanding of the CSA practices were perceived as behavioral control. Attending the workshop on CSA practices is one way of overcoming barriers and challenges towards climate change perceptions and CSA programs and practices.

Methodology

This study was a survey of a workshop organized in March 2023 on CSA practices for nut growers in the San Joaquin Valley, California. Participants were both growers and TSPs. A total of 36 participated, of whom 30(83.3%) completed the survey. The study focused on two questions. The scale question was designed retrospective post-then-pre format with columns side-by-side to measure the perceived knowledge before and after attending the workshop sessions. Knowledge was measured on a five-point Likert-type scale ranging from 1) no knowledge, 2) minimal knowledge, 3) basic knowledge, 4) adequate knowledge, and 5) superior knowledge. There were 10 sessions delivered by nine speakers from the University of California system. From the 10 sessions, we generated 14 Likert items. The survey asked participants to indicate their affiliation as growers and/or TSPs. All questions were developed by four research team members based on the pre-submitted PowerPoint slides by presenters and were reviewed

and modified by the project team. Data collection was on a self-administered two-page paper survey to provide feedback in the last 20 minutes of the workshop. We tested the reliability of Likert-type scale items using Cronbach's alpha. The alpha value on scale responses is set at 0.70, meaning 70% is reliable and 30% is error variance. The alpha value on the knowledge before the workshop was 0.862 and after was 0.876, which indicated a strong consistency in the responses (Taber, 2018). Data were analyzed and presented by percentages; Mean (M) and Standard Deviations (SD) with an independent samples t -test to determine if there existed differences between growers and TSPs in their knowledge before and after the workshop at 0.05.

Results

Of the workshop participants, 13(43.3%) were growers and 17(56.7%) were TSPs who included Certified Crop Advisors, Pest Control Advisors, University Academics, and Conservation Personnel. Overall knowledge about CSA practices before the workshop was "minimum" ($M = 2.88$, $SD = .590$); however, an independent samples t -test indicates that growers had higher knowledge of CSA practices ($M = 2.96$, $SD = .430$) than TSPs ($M = 2.82$, $SD = .692$); $t(23.501) = .643$, $p = .045$, Cohen's $d = .247$ (small effect size). By details, three themes including climate change impacts, whole orchard recycling (WOR) potential benefits, and WOR field considerations had statistically higher mean for growers than TSPs; conversely, nutrient management considerations after WOR had a higher mean for TSPs than growers. The knowledge after the workshop was overall "adequate" ($M = 4.12$, $SD = .459$), and there were no differences between growers ($M = 4.12$, $SD = .461$) and TSPs ($M = 4.07$, $SD = .498$); $t(25) = .191$, $p = .822$. However, themes including effects of chills on orchards, opportunities for optimal power supply, and winter cover crops had statistically higher mean for growers than TSPs whereas climate change trends and nutrient management had higher mean for TSPs than growers.

Conclusions

This study sought to assess knowledge changes related to CSA practices for tree nut growers in the San Joaquin Valley that could potentially raise awareness and influence behavioral change toward their adoption. Generally, there was a statistically significant change in knowledge from a mean of 2.88 to 4.12, reflecting a 1.24-point knowledge gain after the workshop which moved participants from "minimal" to "adequate" knowledge. Although growers had statistically higher knowledge than TSPs before the workshop, an independent samples t -test ran after the workshop did not show significant differences. The study finds that themes that were presented with more technical information were statistically significantly understood by TSPs, including climate change trends and nutrient management. However, themes that were presented and had practical aspects and/or that growers are witnessing on their farms contributed significant knowledge to growers, for instance, effect of chills on orchard crops, optimal power supply, and cover crops.

Implications

The study findings have implications for how TSPs need to design strategies for communicating climate-agriculture science, like, adopting regional, community-specific, and using narrative communication strategies for non-scientific audiences. Narrative strategies are persuasive; their structure relays cause-and-effect relationships between events which increases knowledge comprehension, interest, and engagement in topics. Such elements are vital in communicating the science of sustainability (Ikendi, 2023) and climate change topics that are contested in the U.S. (Sanders et al., 2022). The results also show a need to involve TSPs in CSA workshops to harness scientific research knowledge. The TPB speaks about the influence of members in our social circles, who are TSPs guiding the growers in their operations as change agents.

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