Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
https://foodsystemsjournal.org

Farmer attitudes and perceptions toward gleaning programs and the donation of excess produce to food rescue organizations

Susan P. Harvey [a] *
University of Kansas

Rebecca Mount,[b] Heather Valentine,[c] and Cheryl A. Gibson [d]
University of Kansas Medical Center

Submitted November 15, 2021 / Revised March 30 and June 9, 2022 / Accepted June 10, 2022 / Published online September 8, 2022

Citation: Harvey, S. P., Mount, R., Valentine, H., & Gibson, C. A. (2022). Farmer attitudes and perceptions toward gleaning programs and the donation of excess produce to food rescue organizations. *Journal of Agriculture, Food Systems, and Community Development, 11*(4), 77–88. https://doi.org/10.5304/jafscd.2022.114.016

Abstract

Food waste and food insecurity are two concurrent major public health issues. To address them, gleaning programs can reduce waste and enhance food security by diverting produce to food pantries. To understand the experiences of farmers and gleaning programs, interviews were completed with 12 farmers who had participated in a gleaning program and 16 farmers who had not donated produce through a gleaning program within the Greater Kansas City metro area. For farmers who had participated in the gleaning program, the ease of donating and tax incentives were primary benefits. Inadequate experience and inefficient volunteers were cited as challenges. Farmers without experience with gleaning programs cited safety and liability issues as concerns. Because farmers communicate frequently with other farmers, food rescue organizations should consider enlisting their support. Communities and government agencies should provide financial support to improve the resources and infrastructure of gleaning organizations to improve farmer-gleaner relationships.

[a] * Susan P. Harvey, PhD, CHES, Assistant Professor, Department of Health, Sport, & Exercise Sciences, University of Kansas; 1301 Sunnyside Ave., Room 161; Lawrence, KS 66045 USA; +1-785-864-0799; suharvey@ku.edu

[b] Rebecca Mount, MS, RD, LD, Study Coordinator, Department of Internal Medicine, University of Kansas Medical Center; Kansas City, KS; rmount2@kumc.edu

[c] Heather Valentine, MS, RD, Research Administrative Assistant, Department of Internal Medicine, University of Kansas Medical Center; Kansas City, KS; hvalentine@kumc.edu

[d] Cheryl A. Gibson, PhD, Professor, Department of Internal Medicine, University of Kansas Medical Center; Kansas City, KS; cgibson@kumc.edu

Author Note

No potential competing interest was reported by the authors, and the authors have no prior or existing relationship with After the Harvest.

Funding Disclosure

This work was supported by the Hall Family Foundation and After the Harvest.

Keywords
Food Insecurity, Food Waste, Food Loss, Gleaning Programs, Communication, Community Food Security

Introduction

Food waste and food insecurity are two concurrent and systemic public health, economic, and social issues in the United States (Lee et al., 2017). The U.S. Department of Agriculture defines food waste as wasted food, beginning at the farm and occurring anywhere in the supply chain (Minor et al., 2020). While it has been difficult to estimate a baseline for U.S. food waste due to variations in methodologies and measurement, a comprehensive analysis conducted by the nonprofit Rethink Food Waste Through Economics and Data (ReFED) estimates that the annual amount of food wasted in the U.S. is 62.5 million tons (ReFED, 2016). Much of this food thrown into landfills is nutritious, edible food (Gunders, 2012) that could provide much needed nourishment to food-insecure individuals and families. Defined as limited access to nutritionally adequate and safe foods obtained in socially acceptable ways (Anderson, 1990), food insecurity (FI) is a major public health concern which has been further exacerbated by the COVID-19 pandemic (Gundersen et al., 2020; Holben & Marshall, 2017). In 2020, it was estimated that 10.5 percent, or 13.8 million American households, struggled with FI (Coleman-Jensen et al., 2021). Moreover, it is estimated that an increased number of people in certain subgroups of the population, including among children, experienced FI in 2020. FI rates were higher over a 30-day period from mid-November to mid-December 2020 for households in which an adult family member was unable to work as a result of the pandemic (16.4% FI in the 30-day period), or was unemployed and unable to look for work because of the pandemic (20.4% FI in the 30-day period) (Coleman-Jensen et al., 2021).

In 2015, the Environmental Protection Agency (EPA) developed the evidence-based Food Recovery Hierarchy, a model prioritizing the actions that communities and organizations can take to prevent and divert food waste (U.S. Environmental Protection Agency, 2015). Each tier of the Hierarchy focuses on different management strategies, with the top levels representing the most ideal methods to prevent and divert wasted food. For example, the second tier emphasizes addressing food insecurity through food donations to food banks, soup kitchens, and homeless shelters, thereby reducing food waste and supporting local communities.

Although composting in farming operations does not itself contribute to food waste, composting falls near the bottom of the Food Recovery Hierarchy, just above the last resort of sending food to landfills. It is estimated that 10.1 million tons of potentially edible fruits and vegetables are lost at the farm level each year, representing 16% of total food waste (ReFED, 2016). Though the reasons for lost or wasted food at the farm level are complex, it is important to note that very little waste is sent to landfills. Instead, unharvested crops are typically composted on-site or left to be tilled into soil (Kowalczyk et al., 2020; Sönmez et al., 2016). Thus, this potentially edible food from the farms could be used to address FI. In recognition of this, in recent years there has been increasing emphasis on resource conservation and more sustainable farming practices, to meet intensifying population demands (Kowalczyk et al., 2020; Minor et al., 2020; Rose et al., 2019). The American Academy of Nutrition and Dietetics released a position statement in 2017 advocating for systemic and sustained action to achieve food and nutrition security in the U.S, which included initiatives to promote access to fresh produce and food recovery programs (Holben & Marshall, 2017).

A possible solution that has gained attention in promoting food security is gleaning programs (Beyranevand et al., 2017; Hampl et al., 2005; Hoisington et al., 2001; Kowalczyk et al., 2020; Lee et al., 2017). Gleaning dates back to Biblical times, when Hebrew farmers were encouraged to leave a portion of their crops in their fields for poor community members and for travelers. Today, gleaning can be defined as gathering leftover fruits and vegetables after a harvest (Lee et al., 2017). Many gleaning programs recover leftover produce items as efforts to reduce food waste and address FI in their communities (Hoisington et al., 2001). Nonprofit and religious organizations often serve as the backbone for the efforts (Hoisington et al., 2001; Vitiello et al., 2015). Gleaning programs are con-

sistent with the EPA Food Recovery Hierarchy, as gleaning promotes the second tier of the pyramid, to utilize potentially wasted food to feed hungry people (U.S. EPA, 2015). However, despite the feasibility and growing popularity of on-the-farm-gleaning programs, only a small portion of potentially edible food at the farm level is recovered through such programs (Minor et al., 2020).

Just as the reasons for food waste are complex, the reasons for the lack of U.S. gleaning programs are equally complex. At the forefront of many farmers' minds are liability concerns and legal ramifications of food donations (Minor et al., 2020). In an effort to address some of these concerns, in 1996 President Bill Clinton signed the Bill Emerson Good Samaritan Food Donation Act (Bill Emerson Act, 1996), which aims to absolve individuals, organizations, and businesses of potential civil and criminal liability for injuries, such as foodborne illness, resulting from the use of the donated items, with the exception of cases of gross negligence or intentional misconduct (Haley, 2013). Gleaning is a covered activity under this act. In addition to liability protections offered to farmers through this Act, in December 2015 Congress passed the Protecting Americans from Tax Hikes (PATH) Act, which permanently extends an enhanced deduction for tax-paying businesses, including farms, that donate food to food banks or other charitable organizations (Harl, 2016).

Despite the push to expand gleaning programs throughout the U.S. with the added liability protections and potential tax deductions, there is still a greater need to understand why there are only minimal food recovery rates at the farm level. Much of the literature thus far has focused simply on measuring and quantifying food losses at the farm level (Lee et al., 2017; Sönmez et al., 2016). Therefore, the purpose of this study is to explore facilitators and barriers among farmers to participate in gleaning and produce donation programs.

Methods

This study is part of a larger program evaluation of a food rescue organization in the Greater Kansas City metro region, After the Harvest (ATH), a non-profit that aims to fight hunger, improve nutrition, and reduce food waste. ATH provides a volunteer program in which leftover produce is gleaned from fields and delivered to agencies feeding hungry people (ATH, 2021). As part of the program evaluation, telephone interviews were conducted with farmers who had donated produce to the gleaning program, as well as farmers who had never donated.

Participants

This study took place within the Greater Kansas City metro area and included farmers who had donated their excess produce to ATH, as well as farmers who had never donated produce. ATH program staff provided contact information for both groups of farmers.

Instruments

Two separate interview guides were developed and used for the phone interviews with each group of farmers. Questions were formulated based on an extensive literature review of other gleaning studies and reports, and specifically to conduct a program evaluation of ATH's gleaning program. For the farmers who had donated, a 23-item interview guide was developed that included questions involving the decision to donate, the facilitators and barriers to participating in the ATH gleaning program, the likelihood of continuing to donate, and demographic questions. An 8-item interview guide was developed for the farmers who had not donated to assess their knowledge of the ATH gleaning program, to understand what they had done with leftover produce in the past, and to assess their likelihood of participating in the gleaning program.

Procedures

ATH staff provided contact information for 116 farmers who donated to ATH in 2017 and 2018 via five different methods, with many farmers donating through multiple avenues. Table 1 provides a summary of each of the donation method categories. Within each category, farmer contacts were stratified by total number of pounds of produce donated to ATH and were categorized as low, medium, or high donors. Once stratified, contacts were randomly selected to determine which farmers to interview, which allowed for each farmer to

Table 1. Farmer Donation Methods

Donation Method	Description
Gleaning	Volunteers helped harvest donated produce at a farm or garden
Market Salvage	ATH picked up already harvested produce at the end of a farmers market
Farm Salvage	ATH picked up already harvested produce at a farm
Distributor Salvage	ATH picked up already harvested produce at a large-scale distributor or wholesale
Truckload Program	Large farmers or distributors that donate semi-truckloads at a time

have an equal chance of being chosen and which provided an unbiased representation of farmers. Multiple attempts were made to contact each farmer via phone, with some contacts also receiving emails from the evaluation study team.

In addition, ATH staff members shared contact information for 136 area farmers who could potentially donate produce to ATH but had yet to do so. Based on calculations of the number needed to provide an estimate that would accurately represent these other farmers, 56 farmers were randomly selected to participate in phone interviews. If a potential donor did not have a telephone number listed, then the farmer was replaced with another farmer contact among those remaining on the original listing. Of the 56 farmers selected, evaluation staff members attempted to contact each farmer three times.

Data Analysis

Audio recordings of the interviews were transcribed verbatim and were checked by researchers for completeness and accuracy prior to data analysis. Transcripts and field notes from the interviews were analyzed using the constant comparative method and data triangulation in order to identify recurrent themes (Denzin, 2017; Strauss & Corbin, 1990). After transcription, an open coding process was carried out. A priori codes were based on categories within the semi-structured interview guides, and exploratory codes were established during the open coding process. Researchers conducted a simple thematic analysis using immersion and crystallization techniques to finalize the themes (Crabtree & Miller, 1999). All data was analyzed separately and then brought back together to find convergent themes across both transcripts and field notes and all research team members.

Results

Twelve farmers who had participated in ATH's gleaning program and sixteen farmers who had never donated through the gleaning program were interviewed. For clarity, we have organized the interview results according to those farmers who had participated and those who had not.

Experience with Gleaners

Twelve farmers reported that they had had ATH gleaners come to their farm or orchard to glean excess produce. Table 2 provides demographic information of the farmers who had participated in ATH's gleaning program. Results from the interviews were categorized into four main themes. A summary of key interview quotes for each theme can be found in Table 3.

Theme #1: Decision to Donate. Farmers who had donated produce through the program had learned about it primarily through word of mouth from other participating farmers. Farmers also commented that they had received information through direct mailers from ATH providing information about their programs and services. Unequivocally, the decision to participate in the ATH gleaning program was attributed to three primary reasons: to reduce waste, to put the unharvested produce to good use by donating to an organization dedicated to addressing FI, and for the tax incentives that are offered to farmers for food donation. Many of the farmers were acutely aware of the FI problem within their region because as farmers, their own livelihood of food production had often strained their own budgets. As one farmer explained:

> I like to see it [produce] get used. It's always a shame to till-in, you know, that you just

Table 2. Farmers Who Had Donated Demographic Information

Farmer Characteristics	Farmers Who Had Donated (*n*)
Race/Ethnicity	
African American/Black	1
Caucasian/White (not Hispanic)	11
Total Years Farming	
<10 years	4
10–20 years	5
>20 years	3
Farm/orchard income (past year)	
<$10,000	2
$10,000–$99,999	3
≥$100,000	3
Size of Farm	
<5 acres	7
5–10 acres	2
>10 acres	3
Number of years donated	
≤2 years	2
2–9 years	7
≥10 years	2
Produce Grown	
Variety of fruits and vegetables	4
Variety of vegetables	7
Fruit	1

> destroy a crop that has a calorie value to somebody…I'm fortunate that with the ability to grow I'm not food insecure, but I also live on a budget, you know, and on an income that many people would be considered food insecure with. And so I know how tight it can be as an individual in food so the least we can do is give back what we can to our community.

It is also important to note that farmers indicated that without the gleaning program much produce would have been left in the field to be tilled into the soil. Farmers left product in their field often because of the poor appearance of the produce, which they knew would not sell at farmers markets or other local businesses. While the nutritional quality of these products was the same as other produce, farmers admitted that many of these products would have been left in the field to be tilled into the ground or for composting. Farmers reiterated that with the gleaning program, they knew they were able to put this produce to better use by meeting a social need within their community.

Theme #2: Benefits from Donating. For this theme, farmers once again emphasized that one of the primary benefits of gleaning was putting unharvested produce to good use within their community. Specifically, farmers focused on the ease of donating through the gleaning program. The farmers appreciated the efficiency and communication efforts of ATH staff and volunteers to facilitate the process. Farmers commented that it was extremely easy for them to participate, as they did not have to expend their own time, effort, and staffing to harvest the unused crops. As one farmer indicated: "I know the produce is being used and I know that the people who come to do the gleaning have been trained so they're respectful of my garden. They're not stepping on everything and they follow the instructions that I request. So they only harvested the pieces that I asked them to." Additionally, the consensus among the farmers was that there was accurate reporting by ATH staff on their produce donations, which facilitated their use of the federal tax incentives.

Theme #3: Barriers to Donation. Interestingly, farmers cited very few barriers to participating in the ATH gleaning program. The barriers that were cited were more the result of a short window of time to glean specialty crops and a shortage of volunteers showing up to glean the larger crops. In addition to a shortage of volunteers, two farmers also reported staff showing up with inadequate resources, such as pallets or containers, to collect the harvested produce; in these instances, the farmers provided what was needed from their own supplies. Farmers also cited constraints on their own operational side, in that they were extremely busy, especially during the growing season, and sometimes lacked oversight on their end to think ahead to schedule gleaners to come to their farm. One farmer reported that during the growing season he regularly gets over 100 phone calls a day, and he

had missed a call or voice message from gleaning staff. Another farmer indicated feeling that communication was poor with ATH staff, as the information the farmer provided them from year to year was not taken into consideration or followed up upon in subsequent years.

Theme #4: Likelihood of Continuing to Donate Through the Gleaning Program. The farmers were asked if they would continue to donate through the ATH gleaning program. Of the

Table 3. Experience with Gleaners: Themes, Subthemes, and Key Quotes

Themes and Subthemes	Key Quotes
Theme #1: Decision to Donate	
Subtheme 1.a. To Reduce Waste	▪ "I just thought it was a better use than just letting it go to waste." ▪ "Because we don't believe in wasting food."
Subtheme 1.b. To Help Food Insecure Individuals and Families	▪ "I feel good about having more options to get our produce into people's hands." ▪ "I knew that they [ATH staff] would distribute it [produce] where it was needed" ▪ "They [ATH staff] distribute [the food] to all different pantries around the town…They share the wealth."
Subtheme 1.c. For Tax Incentives	▪ "Well, primarily because there's a tax break…you can write it off on your taxes. I think they would do a much better job if they would market to the growers that way." ▪ "Tax deductions."
Theme #2: Benefits to Donating	▪ "With their gleaning crew we can just tell them where it's at and if it's in a field we're working in at the time, we can just kind of show them and walk away and continue our stuff on the other side of the field or something…And so that makes it easy to donate on our end when we aren't having to dedicate much staff time to, you know, caretaking the volunteers." ▪ "Well number one, we know that this is the right thing to do…because we believe in what they're doing. And it's the most valuable use of that produce." ▪ "Well, what's there not to like? I mean it's mostly volunteers, people who are doing a good deed and seeing that things don't go to waste. Doing it for people that need it. So, it's a no brainer, really." ▪ "[I appreciate] just how efficient they [ATH volunteers] are…and it's just a way to feel like I'm giving back without really doing the effort."
Theme #3: Barriers to Donation	▪ "I guess my biggest barrier/complaint is we raise a lot of specialty produce, a lot of fruits and berries. They have a very short shelf life and if we have extra or in the past have wanted them [ATH volunteers] to glean, a lot of times they can't get here soon enough. Or, I'll donate something and they'll need ten people to harvest and they'll show up with two [volunteers]." ▪ "I'd say the barrier on our end is just being too busy. Sometimes it can be hard to coordinate something…at 50 acres we're one of the largest vegetable producers in our area. And we're with a limited staff…and so it just comes down to labor constraints and timing and all of that. It can just be hard for me to look two weeks ahead and go, 'oh, we're going to have extra spinach' and then call them and get it all coordinated. Usually we have a quick turnaround time of when we decide a crop is done, terminate it, and get something else planted…and we can miss out on opportunities just frankly because of timing." ▪ "Here in the past year or two they've had some containers and stuff. I think they finally have a budget for that. A lot of times we've had to supply boxes and picking stuff."
Theme #4: Likelihood of Continuing to Donate Through the Gleaning Program	▪ "[I'm] very likely [to have ATH gleaners come back to my farm]. Because I know the produce is going to be used. Because I believe in their mission, and because they're well-trained staff and nice people." ▪ "100 percent [I will continue to use the ATH gleaning program]. So we don't waste food…because they [ATH volunteers] were very capable and they get through things fast and they show up at even a last minute call- they'll send somebody over." ▪ "Not as likely as in the past. Sometimes it's just not worth the hassle, to be quite honest with you…the last few years [we] haven't been contacting them as much as we had. We'll just find an alternative use for it or just let it rot."

twelve farmers, ten indicated they were very likely to continue to donate, one indicated they would likely not continue to participate, and one farmer did not respond. All the farmers reported that they would recommend other farmers to participate in the program and had done so in the past.

Of the ten farmers that indicated they would continue donating through the program, their responses echoed much of what has been indicated in the previous themes. First, the convenience and efficiency of having someone else come to their farms to do the harvesting made their continued participation likely. Second, they knew that the food was going to an organization that would distribute it to food banks. As one farmer explained, "They're [ATH] an amazing resource and I just hope other farmers would take advantage of such a program. This food has to be … used and valued by other people and it's not when we end up wasting it."

For the one farmer who indicated that they most likely would not continue to participate, their reasoning included the need to harvest specialty crops within a short timeframe, and the lack of experience of volunteers that were sent to do the gleaning. The latter was cited as one of the barriers to participating in the gleaning program. The farmer explained, "Sometimes their [ATH] intentions and what actually gets done are a little ways apart."

Farmers Who Had Not Participated in Gleaning Programs

Of the 56 farmers who had never donated to ATH and were contacted, sixteen farmers (28.6%) were interviewed. Among the 40 potential donors who were not interviewed, one farmer declined to be interviewed, 18 farmers did not answer or return calls after repeated attempts, ten telephone numbers were incorrect or no longer in service, seven farmers were no longer growing produce, and four contacts were not produce growers. Table 4 provides farm characteristics of the 16 farmers who were interviewed. Interview transcripts were categorized into themes including current farming and donation practices, knowledge of ATH, and likelihood of participation in the ATH gleaning program.

Current Farming and Donation Practices.

When asked what share of their produce the farmers sell, a variety of responses were received. Eleven of the 16 farmers (67%) reported selling their produce. Eight farmers stated they sell all the produce they grow, one reported selling about 90%, one farmer sold about 75%, and another farmer sold about 50%. One farmer reported being unsure of how much produce is sold because they operate a "you-pick" farm and they do not harvest the produce.

For the growers who reported not selling their produce, three farmers reported they donated all their produce to schools, educational initiatives, local churches, or social service organizations, such as Catholic Charities, Salvation Army, and food pantries. A different grower was affiliated with a private raised-bed community garden that rents out space to individuals.

Nine potential donors reported having excess produce that they were not able to sell. When asked what they did with their excess produce, seven of the nine potential donors reported having destinations for it. Six farmers reported donating

Table 4. Farm Characteristics for Farmers Who Had Not Participated in Gleaning Program

Farm Characteristics	Farmers Who Had Not Donated (n)
Type of Farm	
Farm	11
Urban farm	2
Raised-bed community garden	2
Orchard	1
Total Years Farming	
<10 years	5
10–20 years	8
>20 years	2
Size of Farm	
<5 acres	10
5–10 acres	2
>10 acres	4
Produce Grown	
Variety of fruits and vegetables	10
Variety of vegetables	5
Fruit	1

the produce to food pantries and other agencies, and one farmer provided their excess produce to family members. For the farmers who were not already donating excess produce, they were somewhat to very willing to donate to local food pantries.

Knowledge of ATH and Future Likelihood of Donating to the ATH Gleaning Program. Farmers were asked if they had heard of ATH, and thirteen farmers indicated that they were familiar with the organization. When asked if they would be interested in having volunteer gleaners come to their farm to harvest excess produce, most farmers indicated that they would. Eleven (67%) indicated that they would potentially be willing to participate in the program if they had excess produce in their fields, one farmer indicated that they did not have excess produce, one farmer was not asked, and three farmers responded that they would not be interested. For the three farmers who reported that they would not want to participate, one farmer indicated that they had plenty of help to harvest excess produce. A second farmer explained, "I just don't want somebody out here fooling around." The third farmer indicated that "there's a little bit of a liability issue. My tax people and attorneys told me about that. I think that's a good program, but I don't think we're much of a fit for it…"

Discussion

While food waste at the farm level appears to be much less compared to consumer-facing industries (ReFED, 2016), current research suggests that unharvested produce items could be donated to address FI within communities, and to meet the second tier of the EPA Food Recovery Hierarchy (Hoisington et al., 2001; Kowalczyk et al., 2020; Lee et al., 2017; Minor et al., 2020; Sönmez et al., 2016). Gleaning has been proposed as one method to recover leftover produce items from the fields. While it is important for communities to understand the infrastructure and support in place necessary to develop efficient gleaning programs, it is equally important to understand the perceptions of donation through gleaning programs, both from the viewpoint of farmers who have donated through gleaning programs in the past, and from those farmers who have not donated. This study attempted to fill in some of the current gaps in the literature by interviewing both groups, and to further explore and understand farmer perceptions of gleaning programs, and the facilitators and challenges to participating in such programs.

In this study, the feasibility and efficiency of participating in a gleaning program were two of the more consistent findings from the farmers who had donated. However, farmers also acknowledged how busy they were, particularly during the growing season, and that it was sometimes difficult to coordinate with gleaning program staff the times that volunteers could come to glean their fields. One primary barrier reported by farmers was lack of time to communicate with ATH staff about excess produce that needed to be gleaned. While farmers reported that ATH staff was generally consistent in reaching out throughout the year to extend their volunteer services, responding to forms of communication such as phone calls and mailers was not prioritized due to the daily operations of overseeing and running a farm. Although some farmers reported they already donated their excess produce to food pantries and other agencies, they potentially could partner with ATH to simplify the donation process without needing to have volunteer gleaners come to their farm. Through their market salvage and farm salvage programs, ATH is able to have volunteers travel directly to farmers markets and farms to pick up excess produce that has already been harvested, which would allow farmers to donate their produce without additional time or effort added to their already busy schedules. With the mechanisms that they already have in place, ATH ensures produce already harvested can reach food pantries and other agencies in a timely and efficient manner without an added burden to the farmers.

While most farmers in this study reported satisfaction with the efficiency of gleaning volunteers, a couple of farmers indicated some issues with the volunteers who came to their farms. Lack of efficiency and training of volunteer staff, inadequate number of volunteers, and insufficient resources were cited as primary concerns. Farmers noted that they had very little time to oversee the gleaners, so trust in the gleaning organization and its volunteers to be well-trained and efficient was critical for

them to continue their participation in the program. This aligns with prior research from Lott and colleagues (2020) that successful gleaner-farmer relationships were grounded in trust and a farmer-centered process. Although gleaning programs often heavily rely on volunteer staff, it is advantageous for the organizations to properly and rigorously train staff and volunteers prior to gleaning, and to ensure that the appropriate amount of resources, such as pallets and crates to hold the produce, are available. Adequate training of volunteers, along with signing liability waivers, protects farmers from liability concerns and is a vital aspect of gleaning programs (Kowalczyk et al., 2020). Furthermore, it is important for staff to understand the types and amounts of produce to be gleaned, so that an adequate number of properly trained volunteers are on site to relieve farmers from having to oversee such activities. In sum, efficient processes are needed to optimize gleaning schedules so as to improve gleaning operation performance and to scale up programs, increasing the amount of crops rescued. Allocation of funding from communities and government agencies to improve the resources and infrastructure of food rescue organizations would facilitate this process (Lee et al., 2017).

It is worthwhile to note that nearly all farmers in this study, both those that had participated in gleaning programs and those who had not, are interested in reducing food loss and providing healthy food for vulnerable individuals and families in their communities. This aligns with prior research in which farmers agreed or strongly agreed that gleaning programs are useful in helping to increase access to fruits and vegetables in low-income areas (Lanier & Schumacher, 2017). However, as research has indicated, farmers are concerned with liability issues, and many are unaware of the tax incentives available from participating in such programs (Kowalczyk et al., 2020). For farmers that had participated in gleaning programs, they emphasized that this is important information to communicate. Furthermore, there should be emphasis on helping farmers to understand liability protections that are in place to reduce their concerns about donating food to organizations, or having volunteers glean produce from their farms.

One notable finding from this study is the amount of communication between farmers. Many farmers had heard about the ATH gleaning program through other farmers, and they also spoke with one another about their experience with the program. Farmers discussed the ease or difficulties of participating in the program, which could further facilitate or impede other farmers to participate in gleaning programs. Discussion could also serve as an opportunity for farmers to understand more about the tax incentives and liability protections through conversations with one another. As communication was a key factor that farmers cited in either participating in the program, or fully participating throughout their harvest season, the communication between farmers could serve as an important facilitator to foster the use of gleaning programs among farmer communities. This finding is rooted in foundational research on communication within social systems or specific populations (Valente, 1993; Valente & Rogers, 1995). The communications theory of the diffusion of innovations is grounded in rural sociology, describing the adoption of new practices or ideas that gain momentum and spread throughout a social system. The interpersonal communication between farmers about farming practices and new technologies served as the foundation for this theory (Rogers, 2010). Though gleaning itself is not considered an innovation, the very nature of communicating with other farmers about gleaning programs, liability protections, and tax incentives are enough to consider applications of this theory to recruit farmer stakeholder recruitment and participation.

Limitations

There are limitations to this study that should be taken into account by future research studies. First, our study sample included farmers within a specific geographic region, limiting the generalizability of our findings to other areas. However, we randomly selected farmers to enhance representation of low, medium, and high donors to approximate what would have been obtained if we had interviewed all listed farmers. Although our sample size was small, other researchers have found similar findings when examining gleaning facilitators and challenges. The main purpose of the farmer interviews was to serve

as a program evaluation tool for ATH's gleaning program, while the original intent of interviewing farmers who had never donated was to gauge interest in donating to ATH in the future. Subsequently, only limited information about demographics and crops grown were collected. Future research efforts should collect important farmer characteristics and type of major crops grown. In addition, the use of both quantitative and qualitative approaches to explore farmer perceptions, attitudes, and participation in gleaning programs would strengthen and add richer detail to our study's findings. Third, this study only gathered data from the farmer perspective. Future research should incorporate perspectives from both farmers and gleaning agencies to understand how successful relationships can be built and sustained between these two entities.

Conclusions

Food waste in the U.S. is a significant environmental, economic, and social issue that warrants much more attention. Likewise, increasing rates of FI, which are projected to rise even further due to the COVID-19 pandemic, remain a critical public health issue (Gundersen et al., 2020; Wolfson & Leung, 2020). By addressing food waste and food loss, communities could help to create a more sustainable food environment in which potentially wasted food items are used to provide nutritious and healthy food for vulnerable populations (Galanakis, 2020). Field gleaning is one potential solution that could help address FI within communities, while simultaneously reducing food waste, creating a more sustainable environment, and thus fulfilling the second tier of the EPA Food Recovery Hierarchy. Moreover, gleaning leftover produce from fields to donate to food banks facilitates the availability of healthier food options for food insecure individuals and families, who typically have poorer diet quality and an increased risk for diet-related diseases than their food-secure counterparts (Gundersen & Ziliak, 2015; Holben, 2010).

Results from this study present two noteworthy findings that community agencies should consider when developing and overseeing gleaning programs. First, it is critical for agencies that oversee gleaning programs to ensure that volunteers are well-trained and that adequate staffing and resources are available to glean the produce. This alleviates burdens on the farmer side to oversee gleaning operations. Furthermore, agencies should be more proactive in keeping records of different farmers and the type of produce they grow and when it is most likely available for gleaning.

Second, it is important to emphasize the extent of interpersonal communication that occurs between farmers. Gleaning agencies should consider recruiting a farmer champion within their community who has worked with gleaners and would be willing to speak with other farmers about the programs that are available, including the liability protections and tax incentives. Perhaps this could help to further facilitate the growth and use of gleaning programs by farmers.

Both food waste and FI are complex issues, and communities must take on a more collaborative and holistic approach to strengthening their food system. One such method is for community agencies to work with farmers in the development of gleaning programs. The literature supports the acceptance and feasibility of gleaning programs as simultaneously reducing food loss at the farm level while providing nutritious foods to low-income families (Hoisington et al., 2001; Kowalczyk et al., 2020; Vitiello et al., 2015). However, it will take a thoughtful and collaborative approach that entails building relationships with farmers and advocating for a strong farmer voice to support the growth of such programs. Likewise, agencies need to ensure that they have the infrastructure, support, resources, and volunteer network in place to facilitate a strong gleaning program. This will require collaborative action from multiple community agencies and farmers, but is a feasible way to reduce food loss and promote food recovery efforts at the farm level.

Acknowledgments

This project involved many individuals who gave their time to share their views and insights and we are especially thankful for their participation. We also want to express our appreciation to the After the Harvest staff members who provided invaluable guidance, comments, and suggestions throughout the course of the project.

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