



# On increasing the contribution of locally produced fresh foods to school meals in the Caribbean

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## Abstract

The rising prevalence of childhood overweight and obesity within the Caribbean is a major public health and policy concern because obese children are at risk of developing non-communicable diseases (NCDs) later in life. Throughout the Caribbean Community (CARICOM), children are consuming unhealthy diets, characterized by energy-dense, processed and ultra-processed foods, sugar sweetened beverages, and limited quantities of fruits and vegetables. Community-based school meal programmes (SMPs) have been identified as useful vehicles to address unhealthy eating among children, and “farm-to-school” approaches have the potential to increase the availability of locally grown nutritious produce, while supporting local agriculture and reducing the region’s reliance on food imports. This paper seeks to better understand the barriers to enhancing community-based school feeding value-chains in the CARICOM, by focusing on the Eastern Caribbean Island of Nevis where there is an interest in developing farm-to-school value chains. Using key informant interviews combined with focus groups with actors along the local food value chain, we identify the following barriers to an effective community-based SMP: a lack of communication and an absence of contractual agreements between local farmers and the SMP administration; generally low levels of child acceptance of school meals containing fresh vegetables; and limited intersectoral coordination and collaboration among SMP stakeholders and local farmers. Using social network analysis, we further discuss limitations in group organization and coordination among local farmers and opportunities for SMP improvement. The results point to the need for more integrative public policy development and greater community engagement to coordinate and strengthen the farm-to school approach to school feeding.

**Keywords** Child nutrition · Saint Kitts and Nevis · School gardens · Nutrition sensitive value chains · Local food systems · Farmer cooperation

## 1 Introduction

The Caribbean Community (CARICOM) is an economic grouping of 15 member states and five associated members, comprising mainly Small Island Developing States (SIDS). SIDS are faced with important challenges to food and nutrition security due to their small size, insularity, remoteness, and proneness to natural disasters that impede the stabilization of regional and local food systems (Saint Ville et al., 2015; Connell et al., 2020). Within CARICOM (Fig. 1), food and nutrition insecurity is largely an issue of obesity<sup>1</sup>, diet-related noncommunicable diseases (NCDs) (including diabetes, cardiovascular disease and cancer), and heavy reliance on imported foods, especially energy-dense, processed and ultra-processed food and beverage products (Hickey

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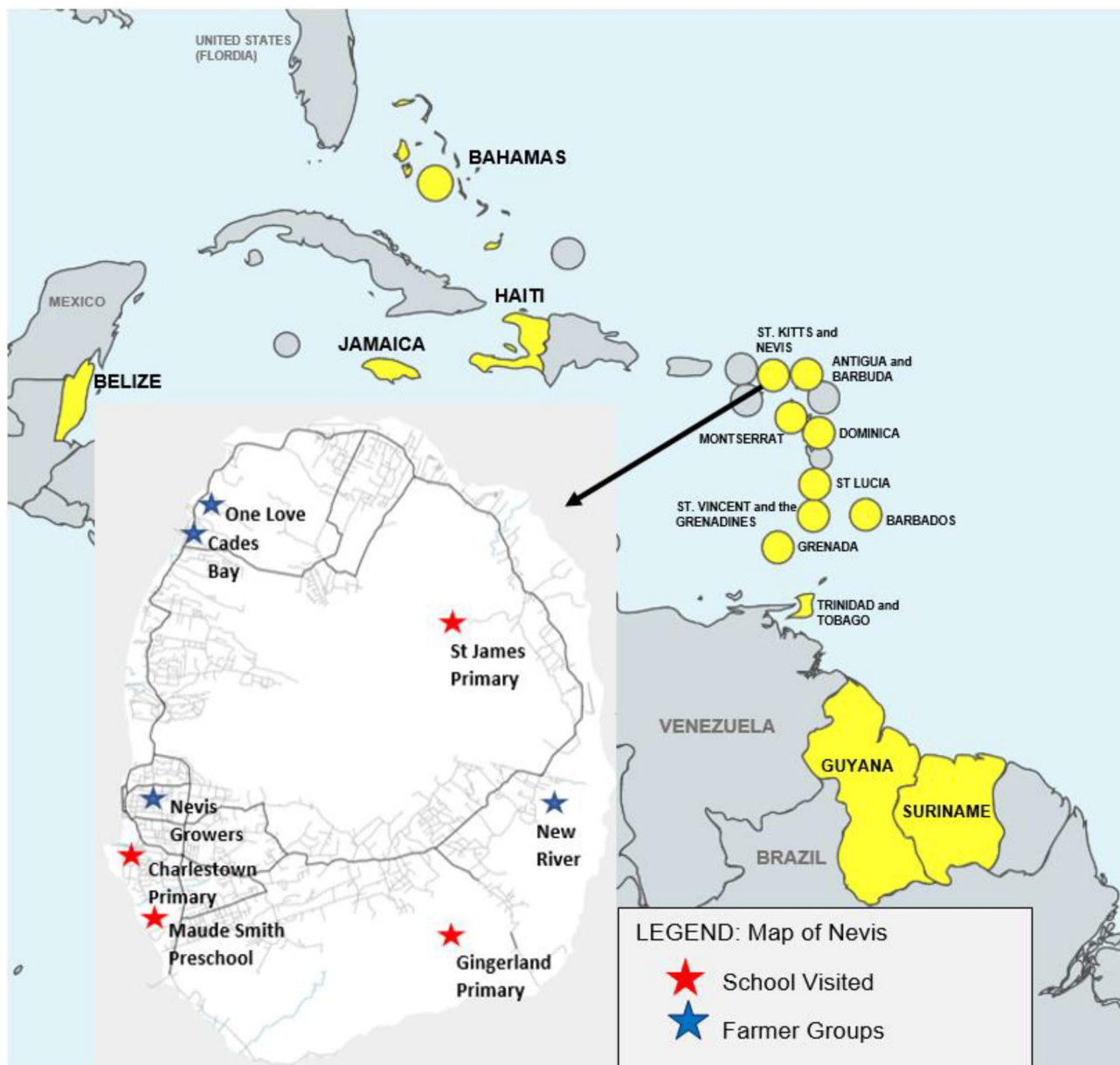
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<sup>1</sup> The probability of dying prematurely (before 70 years of age) from NCDs in CARICOM countries is among the highest in the Americas (PAHO, 2019).



**Fig. 1** Map showing the 15 member nations of the Caribbean Community (CARICOM) colored in yellow. Map of the island Nevis showing the study sites

& Unwin, 2020). Childhood obesity has become a major regional concern because its prevalence in the Caribbean has increased from less than 2.5% in 1980 to over 10% in 2015 (Sobers & Samuels, 2019). Heavier children are at an elevated risk of continued rapid increase in their weight and obese children are at higher risk of becoming obese adults, making them more susceptible to developing NCDs (Mumena et al., 2018).

The high prevalence of obesity within CARICOM is partly driven by unhealthy eating, characterized by low intake of vegetables and fruits, and excessive intake of calories, attributable to the consumption of energy-dense

food and beverage items (Saint Ville et al., 2015). Lin et al. (2018) have linked the prevalence of obesity to excessive food imports, and within CARICOM, over half of the SIDS countries import more than 80% of the food consumed, much of it low in nutrient density and highly processed (Murphy et al., 2020). Dorodnykh (2017) suggested that the issue of food import dependency in the Caribbean, and its contribution to food insecurity and obesity, can be addressed by increasing efforts to enhance domestic food production, promoting nutrition education, and increasing access to affordable, healthy food items. However, despite numerous national and regional policies along these lines (e.g., the

*Jagdeo Initiative*, 2004; the *Port of Spain Declaration*, 2007; the *Regional Food and Nutrition Security Policy*, 2010), a recent review found that, due to their low level of resources, many Caribbean SIDS lack the capacity to meet the demands involved in implementing diet-related regulatory interventions (Foster et al., 2018).

CARICOM policymakers have identified schools as important sites of intervention to promote healthy eating habits among children through national school meal programmes (SMPs) (Kirton et al., 2015). In 2021, the Food and Agriculture Organization (FAO) and The University of the West Indies (UWI) reviewed school feeding in 14 CARICOM countries and recommended an expansion of School Feeding Programmes to benefit, not only children, but local food producers and the greater regional economy (FAO & UWI, 2021). The review notes that school feeding has emerged globally as a major food security strategy and safety net for children, and emphasizes the FAO Home Grown School Feeding (HGSF) approach to provision of school meals. The HGSF approach links school feeding to local small-holder farmers to provide children with safe, diverse, nutritious and culturally appropriate meals. According to Vallianatos et al. (2004), adopting a ‘farm-to-school’ approach, that links school meals programmes (SMPs) to local farmers can offset obesity and diet-related NCDs among school-aged children by increasing the availability of healthy, locally grown produce in schools. Although a farm-to-school approach has the potential to positively impact child nutrition, local farmers, and local food systems (Lowitt et al., 2018), there are major challenges with realizing the potential within the CARICOM SIDS (Saint Ville et al., 2022). These include difficulties with ensuring consistent produce supply from local farmers, coordination of activities among agriculture, health, and education sectors, and a general absence of school meals and nutrition policies and standards throughout the CARICOM (Phillip et al., 2021; Ramdath, 2014).

Research by Sidaner et al. (2013) suggests that the key to creating and sustaining such farm-to-school SMPs is government leadership, with strong supporting legislation combined with civil society participation and intersectoral decision-making. Within the Eastern Caribbean, previous efforts have been undertaken in St. Kitts to develop farm-to-school value chains for SMPs and reduce the nation’s dependency on high calorie, low nutrient (often ultra-processed) food imports by building stronger links with local farmers (Lowitt et al., 2018). While such an approach was found to be viable, the research highlighted the need for improved domestic management of local food value chains. This requires strong support of, and cooperation and collaboration with farmers, parents, teachers, food service and administrative staff of the local SMP, nutritionists, government actors, and other stakeholders (Saint Ville et al.,

2022). The challenge is understanding how best to connect these key actors and encourage them to communicate, coordinate, cooperate and collaborate with the aim of building and strengthening nutrition-sensitive value chains for school feeding (Lowitt et al., 2015a, 2018).

This paper presents an exploratory case study of the local value chains supporting the SMP in the CARICOM island of Nevis (located in the Eastern Caribbean), where community conditions seem to favor farm-to-school approaches to improve and expand school feeding, enhance childhood nutrition, reduce food imports, and support the livelihoods of local farmers. The study aimed to better understand the barriers and opportunities for increasing the procurement of locally-grown fresh and nutritious produce for the SMP in Nevis, and to generate insight that could inform future research and policy action.

## 2 Methods

An exploratory case study approach (Yin, 2012) was used to identify potential avenues to increase the availability and use of locally grown, fresh and nutritious produce for the Nevis SMP. The study utilized qualitative methods to understand the roles and perceptions of SMP staff, local farmers and other stakeholders (government officials, health experts, teachers and parents) regarding the functioning of the local SMP value chain. Nevis offers a case where both government agencies and local community members are seeking to address issues of unhealthy eating, high levels of food imports and high rates of obesity among children, challenges that are similar to other CARICOM SIDS (Lowitt et al., 2018; Mumena et al., 2018). An exploratory approach was selected because there has been limited formal evaluation of the SMP in Nevis and other CARICOM countries. Grounded theory was used to supplement the case study approach, by allowing the development of substantive theory throughout the process of data collection and exploratory analysis (Hammersley, 2012; Oktay, 2012).

### 2.1 Study setting

The study was conducted on the Eastern Caribbean Island of Nevis (Fig. 1), part of the twin-island nation of Saint Kitts (168 km<sup>2</sup>) and Nevis (93 km<sup>2</sup>), located between the Atlantic Ocean and Caribbean Sea (Griffiths, 2020). Approximately 23% of the land in St. Kitts-Nevis (SKN) is classified as arable (World Bank, 2018). SKN has a combined population of approximately 53,000 (World Bank, 2019) and is a member state of the CARICOM. Both islands rely heavily on tourism for economic development (Thomas & Theokritoff, 2021), and over 90% of the food consumed in SKN is imported (Ford, 2015). As a result, the SMPs operating on both islands

rely heavily on imported food items for the preparation of school meals (Trotman et al., 2009; Lowitt et al., 2018). In 2016, the St. Kitts and Nevis population experienced 27.9% prevalence in childhood overweight or obesity (HCC, 2019a).

The research was undertaken in Nevis to build on and complement previous research conducted in St. Kitts that sought to develop farm-to-school approaches to school feeding in the Caribbean (see Lowitt et al., 2018 and Saint Ville et al., 2022). The SMP in Nevis is particularly suited for expanding research into community-based school feeding in the Caribbean because of the important role that parents and the community play in the functioning and funding of the SMP (FAO & UWI, 2021). Furthermore, the SMP administration in Nevis has shown commitment to delivering high quality meals to children by (a) investing in the upgrade of the kitchen infrastructure in schools; (b) recruiting a professional chef to lead efforts to improve school meal services; and (c) embracing the role of local farmers and school gardens in procuring local produce for school meals.

The Nevis SMP is sponsored by the Ministry of Education of the Nevis Island Administration and is characterized by having substantial community engagement, with parents and local and overseas donors making contributions to the programme (FAO & UWI, 2021). At the time of our study, the SMP was open to any child whose parents were willing to pay a fee of \$25 XCD (Eastern Caribbean Dollar; \$9.25 USD in 2019) per week in a cost-sharing arrangement with the government (FAO & UWI, 2021). Students also had the option to bring lunch from home if they did not participate in the SMP. During our time in the field, a national school meal policy was in the process of being developed, aiming to provide nutritional standards for school children, guide the roles of people involved with the SMP, and formalize the purchase of fruits and vegetables from local farmers. The age range of children attending primary school is 5 to 12 years; preschoolers are at least 3 years old. Of the 1,050 children attending the seven primary schools, approximately 70% consumed the SMP meals in 2017 compared with 60% in 2016 (FAO & UWI, 2021).

The overarching administrative functions of the Nevis SMP are performed by the Director of the SMP, who is responsible for addressing school needs across the island, setting meal standards, and establishing relationships with other actors. Unlike St Kitts where there is a centralized infrastructure for the preparation of school meals, the Nevis SMP functions on a decentralized school feeding model with a kitchen and its infrastructure located at each school. The school principal and/or kitchen manager plays a pivotal role in the day-to-day management and procurement for the SMP including supervising of kitchen staff, sourcing food, and handling billing. A Head Chef, employed by the Nevis Ministry of Health, ensures that the kitchen staff at all schools follow appropriate health and food safety protocols,

including the use of nutritious ingredients, appropriate portion sizes, and healthy cooking techniques, and when necessary, assists cooks with preparing and delivering meals.

## 2.2 Data Collection

Data collection occurred in June, July, October, and November 2019, and involved semi-structured interviews with 66 key informants. These consisted of 36 local SMP stakeholders (representing government officials, health experts, school staff and parents) and 30 local farmers. Throughout this paper, farmers and other interviewees remain anonymous but as shown in Table 1, individual farmers supplying produce to the SMP are designated with an ‘F’ plus a number ranging from 1 to 30. Participants were purposively selected using a combined snowball sampling and convenience sampling approach. Snowball sampling allowed us to identify participants using the social networks of other participants; convenience sampling helped to identify additional farmers to participate in the study. This was important because it was difficult to identify farmers to be interviewed due to their time-sensitive schedules. We interviewed SMP stakeholders at their place of employment or at home and interviewed farmers on their farms. Environmental scans supported the interview guide as we identified similarities and research gaps and determined appropriate questions for the study.<sup>2</sup>

Field data collection was conducted in four schools: Charlestown Primary School, Gingerland Primary School, St James Primary School, and Maude Smith Preschool (Fig. 1). Data collection focused on processes for school meal planning and produce procurement. We obtained records of the weekly menu plans, and observed cooks preparing meals, teachers gathering students into the cafeteria, kitchen staff delivering meals to children, and informally assessed the amount of food children consumed. We interviewed local farmers to better understand (a) their level of group organization; (b) the extent to which they collaborated in supplying produce to the SMP; and (c) how information flowed among them and between their farmer groups and the SMP staff. We interviewed members from four farmer groups: New River, One Love, Nevis Growers, and Cades Bay (Fig. 1). The group, One Love, was in the process of becoming a registered farmer group in Nevis but for the purposes of data analysis, it is considered a farmer group. Two of the farmer groups (New River and One Love) each invited us to attend one of their group meetings. Attendance at meetings allowed us to gain a better understanding of how group meetings were structured and conducted, how group members communicated and discussed their agricultural needs

<sup>2</sup> ‘N/A’ indicates the information is unavailable because the farmer did not respond. Cecele Brown Integrated School is for learners with a range of special education needs, education and training

**Table 1** Food items supplied by different farmers to schools participating in the school meals programme in Nevis

| Farmer Designation | Farmer Group            | Farm Location        | Produce/Food Item   | School  |
|--------------------|-------------------------|----------------------|---|---|
| F2                 | New River               | New River            | Honey Dew, Lettuce  | Charlestown Primary   |
| F3                 | New River               | New River            | Green beans, Watermelon   | Preschool N/A   |
| F4                 | New River               | Gingerland           | String beans, Cabbage, Tomatoes, Thyme, Spinach, Green Beans  | Gingerland Primary  |
| F5                 | Cades Bay One Love      | Cades Bay            | Pumpkin   | St James Primary  |
| F6                 | New River Nevis Growers | New River            | N/A   | Charlestown Primary   |
| F7                 | N/A                     | New River            | N/A   | Charlestown Primary   |
| F8                 | Nevis Growers           | Cades Bay            | Cucumber, Lettuce, Tomatoes, Lettuce, Okra  | Charlestown Primary<br>St Thomas Primary  |
| F9                 | New River               | Pot Works            | Squash, Tomatoes  | Charlestown Primary<br>Violet O. Jeffers St James Primary<br>Ivor Walters Primary |
| F11                | New River               | Cades Bay            | N/A   | St Thomas Primary<br>Violet O. Jeffers Primary                                    |
| F15                | New River               | New River            | Eggs  | Gingerland Preschool  |
| F20                | One Love                | New River            | Sweet Potatoes, Carrots, String Beans, Cucumber, Pumpkin, Yams, Green Beans                             | Gingerland Primary<br>Gingerland Preschool  |
| F21                | One Love                | Church Ground        | Bananas, Plantains, Sweet Potatoes, Pumpkin, Squash   | Elizabeth Pemberton Primary<br>Cecele Brown Integrated School                     |
| F22                | New River Nevis Growers | Nesbit Estate Castle | Bananas, Mangos   | St James Primary<br>Violet O. Jeffers Primary                                     |
| F25                | One Love                | Cades Bay            | Watermelon  | St Thomas   |
| F26                | New River               | Gingerland           | Lettuce, Tomatoes, Cucumbers  | Gingerland Primary<br>Elizabeth Pemberton Primary                                 |
| F27                | N/A                     | Cades Bay            | Pumpkins, Melons  | St Thomas Primary   |
| F28                | N/A                     | Pinneys              | Potatoes, Pumpkin, Melon, Limes, Sour Apple   | Charlestown Primary<br>Prospect Primary<br>St Thomas Primary                      |
| F29                | New River               | Gingerland           | Herbs, Green Onions   | Gingerland Primary  |
| F30                | N/A                     | Prospect             | Sweet Potatoes, Pumpkin, Sweet Peppers, Cucumber, Seasoning Peppers, Yams, Bananas, Plantains, Tomatoes | Gingerland Primary<br>Elizabeth Pemberton Primary                                 |

and how they collaborated to sustain agriculture production in Nevis. We also conducted two focus group interviews with local farmers ( $n=10$ ) and other SMP stakeholders ( $n=5$ ) and each focus group had one facilitator and one notetaker. Prior to data collection, all field research protocols were reviewed and approved by the Saint Kitts and Nevis Ethics Research Committee (#2019-06-020B) and McGill University Research Ethics Board (REB File #: 231–1018).

### 2.3 Data analysis

Data collection for most of the semi-structured interviews and all focus groups relied on handwritten verbatim notetaking because most participants were unwilling to be digitally recorded. Two trained interviewers conducted all interviews

and entered data and field notes directly on pre-printed forms. Researchers transcribed the verbatim responses using Microsoft Word and used the word processing software for a preliminary systematic analysis of responses. Thematic analysis was employed to interrogate the data after they were transcribed and organized. The themes were inductively created based on responses from participants and all themes were manually coded and refined using the NVivo software. The Principal Investigator (PI) used the Maguire and Delahunt (2017) inductive analysis guide to support the analysis. After becoming familiar with the data, each transcript was carefully reviewed and then codes were developed relevant to the aim of the study. This coding analysis was conducted using Excel. Themes and codes were then reviewed and modified in discussion with other members of the research team.

A social network analysis (SNA) (Scott, 1991) was performed to assess farmer perceptions of their social network and associated levels of organization by analyzing their reported affiliation networks. Luke (2015) defined an affiliation network as a network where the members are affiliated with one another based on co-membership in a group, or co-participation in some type of event. Degree centrality, an SNA tool which measures the number of direct links with other nodes (Zhang & Luo, 2017) was used to identify key nodes in the network. The measure “in-degree centrality” defined as the farmer with the most links directed towards them is assigned the highest centrality score. Farmers with high in-degree centrality are those selected with the highest potential to mobilize farmers to coordinate the activities needed to increase agriculture production for the SMP in Nevis.

## 2.4 Assumptions and limitations

Due to our initial dependence on local ‘gatekeepers’ to identify potential farmers to interview, selection bias was a concern in designing the field research. To reduce selection bias, we identified additional farmers to interview through convenience sampling. Researcher bias was managed through peer debriefing and careful pre-testing of interviews prior to data collection. Potential response bias was mitigated through anonymity and triangulation of data collected with different groups in different social settings, and using different methods (focus groups, observation, interviews and documentary analysis). Researchers did not interview students due to limited access, time, and resources.

## 3 Results

### 3.1 School meals planning and meal acceptance by children

Each of the schools we visited relied on its own resources to plan school meals and procure food items (this paper will focus on the procurement of fruits and vegetables), and meal planning schedules varied among schools. At Charlestown and Gingerland Primary Schools, meal planning occurred weekly, while at St. James Primary School meals were planned monthly. At each school, either the kitchen manager, the school’s head cook, or the school principal designed the meal menu, with limited guidance and input from a professional nutritionist. One informant responsible for creating menus stated how they knew what food school children needed based on a personal assessment.

*“I like to shop for food. I know what the children need, I just think of the food I would like to see children eat.”*  
(School Informant).

All school respondents reported some level of difficulty with children’s acceptance of vegetables. The kitchen staff reported that they disguised certain vegetables in meals because some children would refuse to eat vegetables if they were visible on the plate. School informants reported that children were not consuming vegetables at home, and this discouraged them from eating vegetables at school. Informants expressed the need for parents to encourage children to eat vegetables and become more knowledgeable about the SMP. Interestingly, all parents interviewed reported that they encouraged their children to eat vegetables at home and most parents expressed satisfaction with the SMP. However, a few parents mentioned that their children did not like the taste of the school meals (because of too many vegetables) or the portion sizes, which children viewed as being smaller than the amounts to which they were accustomed at home. A health sector informant believed that, based on interactions with parents, some of them may not be aware of the implications of the SMP. Many key informants reported that the education system needs to actively promote healthy eating and incorporate nutrition education into the school curriculum. Informants believed that this would help students become more aware of the benefits of consuming fresh fruits and vegetables and learn how poor eating habits can affect their health:

*“The earlier you give them healthy food, the better they can do it.”* (Farmer).

Healthcare informants expressed the need for professional nutritionists to become actively involved with the SMP to ensure that children are being consistently provided with nutritionally balanced meals.

### 3.2 Produce procurement for school meals

The produce procurement process was similar for each of the primary schools in our study, and four main sources of fresh produce (mainly fruits and vegetables) were identified: local smallholder farmers; the Marketing Division of the Ministry of Agriculture (which sources and purchases food items from local farmers then sells the produce to the SMP and other markets in Nevis); supermarkets; school gardens. The procurement process generally began with the person(s) responsible for sourcing produce (such as the principal or chief cook) selecting farmers from a known list of farmers. This list often included farmers who had previously provided produce to the SMP or farmers within their personal social network. Also listed were purchases from the Marketing Division of the Ministry of Agriculture. Sources were contacted via telephone, to request fruits and vegetables, with advanced notice of 2–5 days given for them to supply the produce.

Schools generally did not have a recurring food order or contracts with local farmers and none of the schools reported sharing their school meal menus for the semester with local farmers or the Marketing Division. Due to a reported lack of information sharing between the various school SMP administrators and the farmers, combined with perceived short notice for produce delivery, farmers and staff at the Marketing Division reported often being unable to provide the SMP with requested food items:

*“Getting farmers involved [in the SMP] is challenging.”* (Government Informant).

The SMP staff reported that when locally grown produce was unavailable, food supplies (most of which were imported) would be procured from the local supermarket. Local supermarkets supply fresh produce but also predominantly processed foods high in calories (sugar sweetened beverages, fats/oils, sodium processed staples and meats) imported via regular arrangements with shipping consolidators primarily from southern Florida (Foster et al., 2018; Gonzalez & Bruce, 2022).

All kitchen managers interviewed reported that local produce procurement posed challenges for the SMP, but also reported that sourcing produce from local farmers was their top preference: *“The challenging part for procuring food is finding it.”* (School Informant). School gardens (for schools that had a garden) were reported to be a supplementary source of fresh produce for the SMP. However, research participants reported a general lack of adequate resources devoted to the maintenance of school gardens and emphasized the need for greater government assistance. The management of school gardens varied greatly among the schools in our study. For example, Gingerland and Charles-town Primary Schools hired a part-time employee to manage their gardens. In contrast, the One Love farmer group had established a partnership with St James Primary School and in this arrangement the school garden (located at St James Primary School) was voluntarily operated by the farmer group. Working through a school garden programme named *One Tire Per Child*, the group worked with students who were responsible for taking care of individual garden (tire) plots (Fig. 2). The programme’s aim was to educate children on food production and the importance of consuming local, fresh and nutritious produce.

Several informants identified the need for additional kitchen staff and enhanced training for cooks. However, after completing data collection, an employee from the Ministry of Education noted that cooks are now required to complete training in food safety and nutrition. Informants also reported that additional coordinators could be employed to assist with day-to-day operations of the SMP.

*“More persons need to be there to supervise the program in order for it to be effective. One person alone*

*cannot do a job effectively so if ... more support from the administrative level, the program would be more effective.”* (School Informant).

As part of informal efforts to set goals and targets for local food procurement, the SMP Head Chef indicated their goal was to procure 70% of fresh produce from local farmers. However, at the time of our fieldwork (2019) neither a school meal policy nor nutritional standards were in place at the schools, and this goal was not formalized. Based on data made available by one of the larger schools, approximately 10% of SMP produce needs was being sourced from local farmers; the remainder was supplied by supermarkets.

### 3.3 Inter-sectoral collaboration

Although food items were purchased on an ad hoc basis from the Marketing Unit of the Ministry of Agriculture, the Ministries of Education and of Health were the only government institutions formally involved in the day-to-day functioning of the Nevis SMP. Some of the informants noted that other agencies, particularly the Ministry of Agriculture, needed to be formally involved:

*“Running the school meal programme should be a collaborative effort with each Ministry. All sectors should be involved with drafting legislation, providing awareness to citizens, and supporting local farmers.”* (Government Informant).

During stakeholder interviews, we found little evidence of regular communication among stakeholder groups, including the Ministry of Agriculture, regarding the planning and coordination of school meals. One central actor noted that there is no school meal policy on purchasing fruits and vegetables from local farmers because it is easier to contact the supermarket than to make meaningful connections with local farmers. While most farmers indicated they were happy to supply produce for the SMP, many suggested that schools need to initiate more targeted and timely communication so that farmers are aware of the SMP’s needs and quantities in advance.

*“The school meal programme would need to liaise with farmers, need to talk and crunch numbers. Identify the number of children the programme feeds with a dietitian to look at what a balanced meal looks like and identify a plan with produce pricing for the schools.”* (Farmer).

*“Give school subsidies, these are public schools, and they are operating like independent restaurants. Unless you have a good rate with farmers, schools are paying the same price for local produce as you and I.”* (Chef in the SMP).



**Fig. 2** School garden plots (tires) showing crops grown and managed by students, as part of the “One Tire Per Child” programme to educate children on the benefits of local food production and healthy eating

To support greater discounts on the produce sold to schools, farmers stated that government support was necessary. Farmers also reported making greater profits by supplying produce to the hospitality sector (especially hotels and restaurants) than to the SMP. Additionally, most farmers reported that they worked independently and that there was minimal organization of farmers to facilitate collective marketing and pricing of local agricultural production.

### 3.4 Produce supply networks for school meals

Table 1 shows the list of food items supplied by local farmers to schools in Nevis. It was found that farmers supplied schools with approximately 25 different locally grown food items, most of which were fruits and vegetables. In some instances, multiple farmers reported supplying the same food items to a particular school, without coordination among those farmers. For instance, Gingerland Primary School received produce from

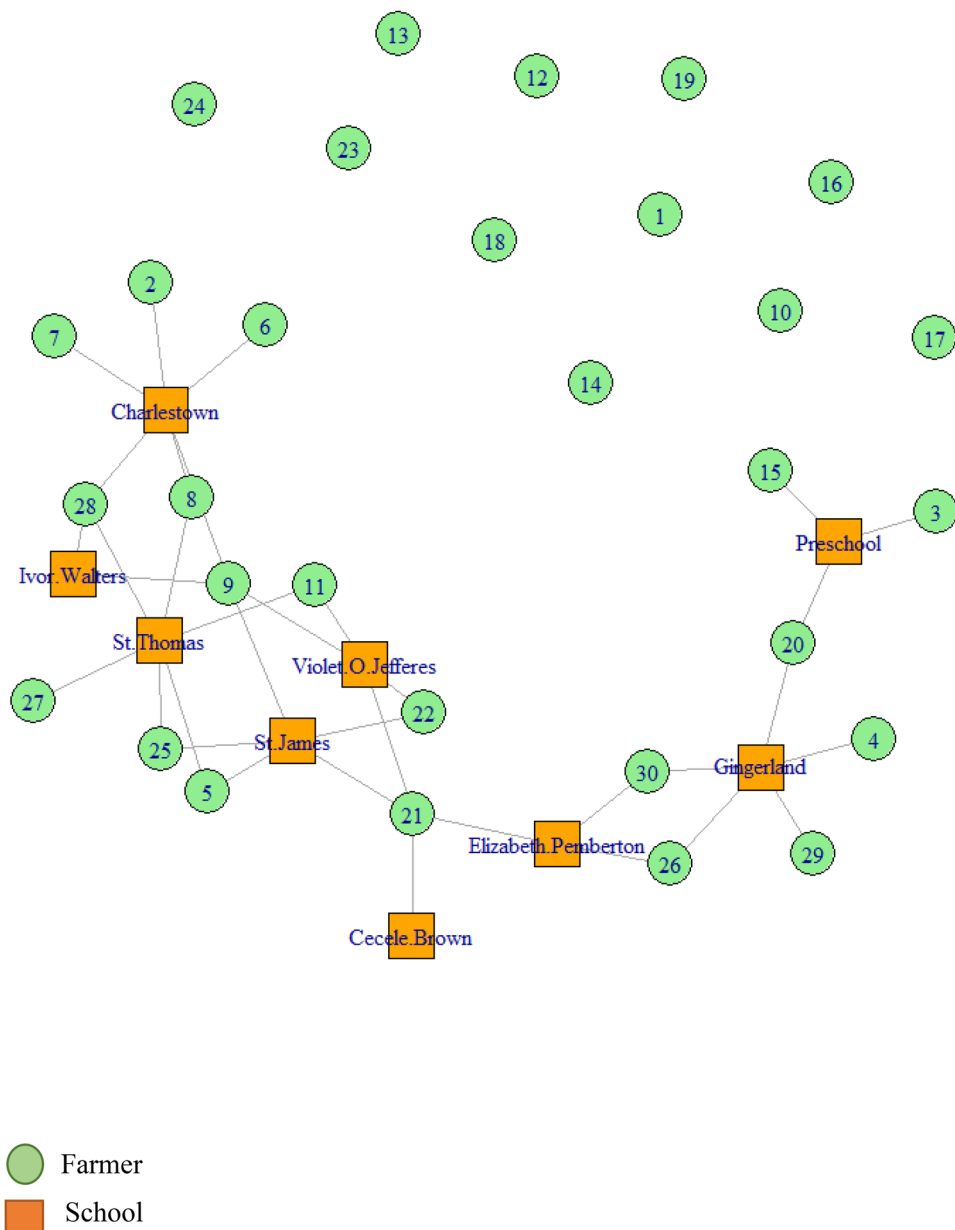
five farmers, all functioning within the same school-farmer affiliation network (Fig. 3). Within this network, farmers F4 and F20 supplied green beans, farmers F4 and F26 supplied tomatoes, and farmers F20 and F26 supplied cucumbers (Table 1; Fig. 3). Many farmers stressed the need for greater coordination and strategic planning among farmers for supplying produce to schools; they reported, however, that this cannot be done without guidance and support from the Ministry of Agriculture.

*“There needs to be an understanding of togetherness to decide what crops we should organize for the betterment of the community.” (Farmer).*

Of the 30 farmers interviewed, 19 of them supplied fresh produce to 9 of the 12 schools participating in the SMP (Fig. 3). While the analysis of the school-farmer affiliation network (Fig. 3) revealed evidence of some level of coordination between the schools and farmers, some farmers reported limitations in the organizational mechanisms for produce procurement for school meals. We further investigated farmers’ social networks and



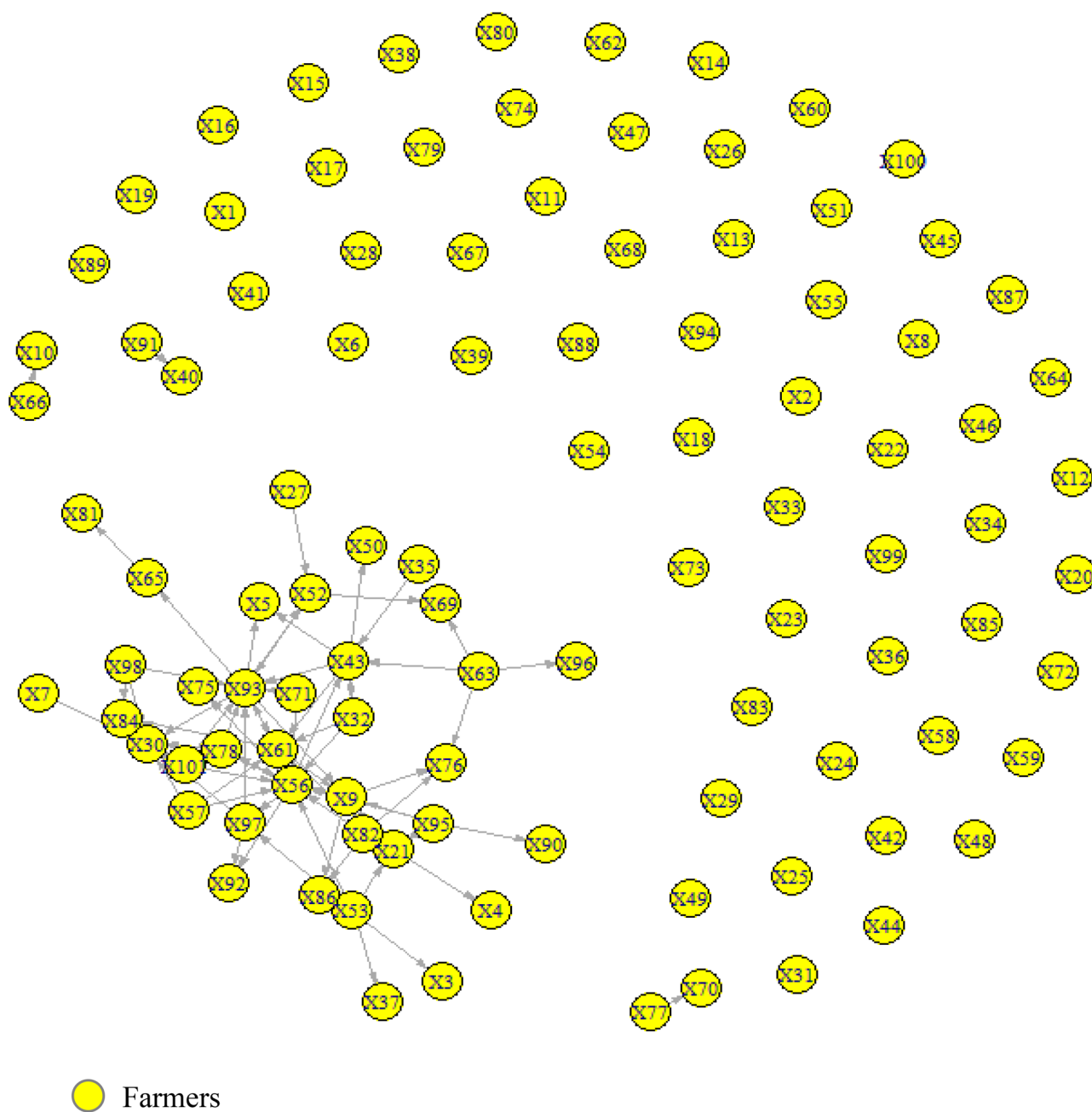
**Fig. 3** School-Farmer Affiliation Network in Nevis. This figure shows the network of farmers linked to the individual schools



social capital (Folke et al., 2005; Waddock, 2001; Saint Ville et al., 2016) to better understand factors limiting farmers’ ability to mobilize and organize for the SMP. During the interviews, we asked individual farmers to identify those farmers from whom they acquired knowledge and/or support for their farming operations; and then used this information as a proxy for some degree of rational trust (Stern & Coleman, 2015). We then created a farmer knowledge network (Fig. 4) representing all documented farmers in Nevis (based on a recent farmer’s list provided by the Ministry of Agriculture) and utilized an “in-degree” centrality measure to determine farmer(s) with the highest centrality score, i.e., considered to have the greatest potential to facilitate the coordination of local farmers for the SMP. Based on this analysis, we identified two farmers (F93 and F56) as having the highest

centrality score, a value of 7. These two farmers were also employees of the Ministry of Agriculture.

During interviews, farmers involved with farmer groups shared the frequency of group meetings and topics discussed to gain insight into the potential for collective action in support of initiatives to sustainably supply fresh foods to the SMP. Collective action occurs when two or more individuals make the efforts needed to accomplish an outcome (Sandler, 2004). Figure 5 presents results of the farmer group affiliation network. Of the 30 farmers interviewed, 25 were affiliated with four farmer groups (New River, Nevis Growers, Cades Bay and One Love). While the New River farmer group reported ties to the Nevis Growers farmer group and a One Love farmer had ties to the Cades Bay farmer group, there appeared to be



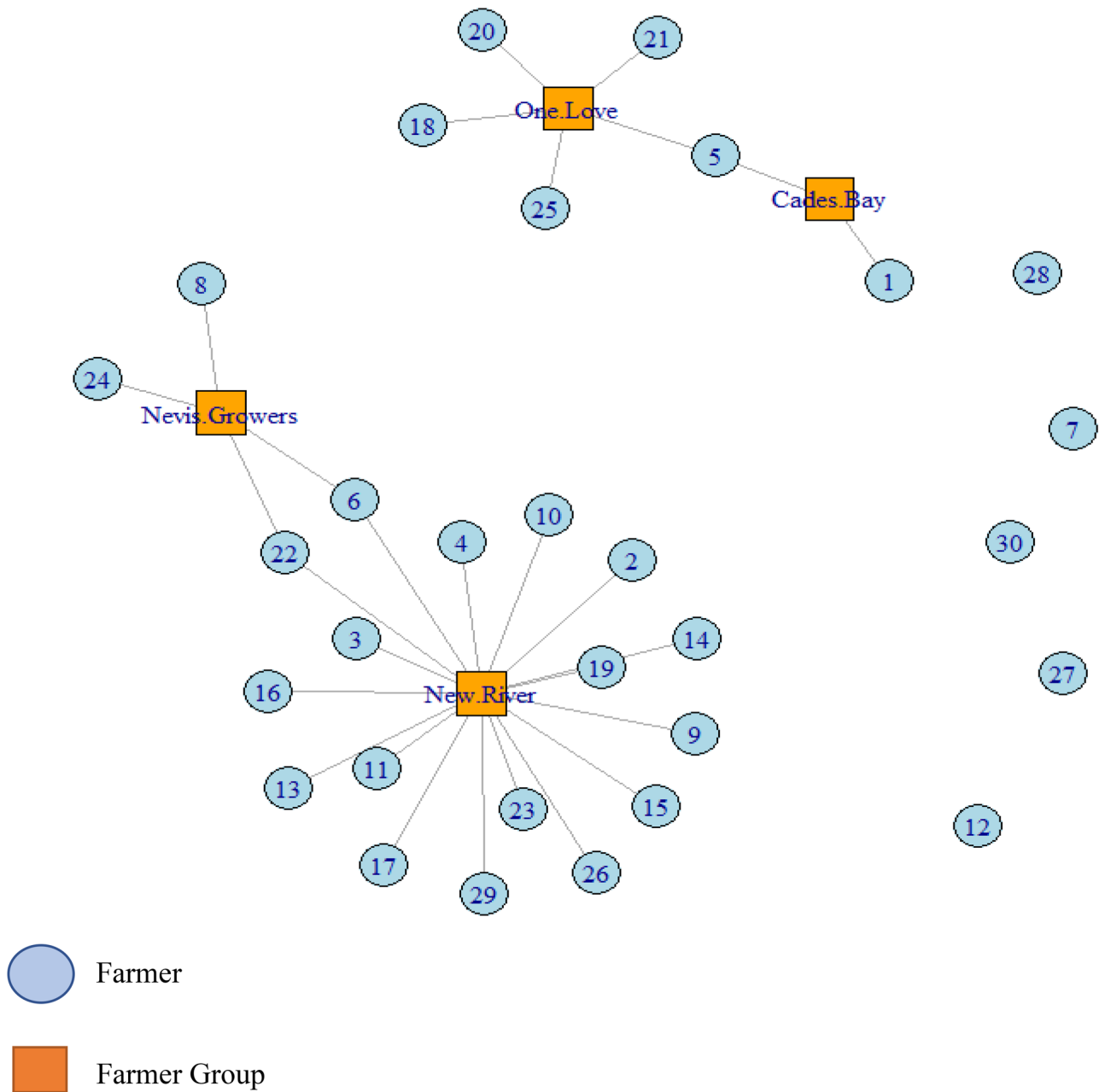
**Fig. 4** Farmer Knowledge Network in Nevis. This figure displays farmers directed ties to other farmers. When a farmer pointed to another farmer, we infer they receive knowledge and/or support from that farmer

a lack of suitable “brokers” within the entire farmer social network. As a result of these missing brokers, the network showed little evidence of information flow between the two main clusters. A broker would facilitate transfer of information from one group to another and without such an actor, farmer groups can suffer from a lack of functional connection (Kadushin, 2002; Haythornthwaite, 1996).

During interviews, farmers and farmer groups emphasized the need for support and engagement from the Department

of Agriculture to strengthen farmers’ ability to network and supply produce to the SMP. Farmers also identified better access to finance, water, crop subsidies and essential equipment (e.g., irrigation drip lines, fencing) as being necessary to sustainably enhance local food production.

*“If farmers had more assistance from institutions, we would be better organized and can primarily focus on producing for the island.” (Farmer).*



**Fig. 5** Farmer Group Affiliation Network in Nevis, showing farmer groups and active group members

Farmers reported that the Ministry of Agriculture held regular meetings with local farmers where they shared new technologies, facilitated workshops on crop production, and discussed other crop-related activities with government and non-government farmers. Though these meetings provided farmers with opportunities for education, training and knowledge translation, the farmers reported that efforts at relationship building with other farmers by government officials was not evident during the meetings.

Informants noted that extension officers and other employees from the Ministry of Agriculture also

functioned as farmers, which was perceived as leading to unfair advantages and conflicts of interest including easier access to loans and land, discounted fertilizer, and reduced cost or free access to tractors and other transport vehicles. Non-government farmers believed this allowed farmers who were also ministry staff to sell produce at lower prices. Farmers further suspected that the younger extension officers may be making farm visits merely to extract knowledge and ideas to benefit their personal farms; for this reason, farm visits were not readily welcomed and, in some cases, prohibited.

*“Extension officers are doing their own production. I tell them not to come to my farm, they’re looking for information for their personal farm.”* (Farmer).

More broadly, the interviews revealed evidence of lack of trust between farmers and personnel within the Ministry of Agriculture, and even within farmer groups themselves. For example, interviewees reported that two of the four farmer groups were not operating in a transparent manner and were undermining coordination efforts to improve local food systems. Members from these two groups expressed concern that that a group meeting had not been held in at least six months, giving rise to the feeling that the group lacked leadership, suffered from top-down communication, and offered minimal support to farmers who needed it most. In contrast, respondents from the other two farmer groups reported that their groups were functioning well due to an existing level of procedural trust, characterized by sharing of resources, engaging in joint applications for available grants, and displaying shared commitment to sustaining food production in their areas:

*“One farmer might have a problem, another might have the solution. We need assistance and can help each other collectively”* (Farmer).

## 4 Discussion

### 4.1 Produce procurement and other challenges within the Nevis SMP

This study sought to make a scientific contribution towards building nutrition-sensitive value chains for school feeding in Nevis, and in the CARICOM more broadly. Procurement of produce from local farmers is a vital component of the FAO’s “Home Grown” approach to school feeding and is a central concern for any policy seeking to implement the recent recommendation for expansion of SMPs in the CARICOM (FAO & UWI, 2021). Emerging from the research were three major themes, representing significant barriers to procuring locally grown healthy produce for school meals, thereby challenging the implementation of a sustainable farm-to-school approach to school feeding in Nevis: (1) *lack of contractual agreements between farmers and the SMP administration*; (2) *children’s acceptance of school meals, especially those containing vegetables*; and (3) *limited intersectoral coordination and collaboration among SMP stakeholders and farmers*.

Lack of contractual agreements between farmers and the Nevis SMP appears to pose the most significant barrier to procurement of locally grown produce. While we found some level of coordination between farmers and schools (Fig. 3), the produce procurement process was reported to be unstructured

and informal. As a result, the reported lack of adequate coordination and communication within/between farmer groups, and between the SMP and farmers, contributed to inconsistency and inadequacy in the supply of locally farmed food items. This resulted in SMP administrators procuring food (reported to be mainly imported) from local supermarkets and these food items were more likely to be highly processed and calorie- dense. Within the Nevis context, farmers did not receive advanced information concerning the food items required by the SMP, so their ability to engage in crop production planning and timely delivery of produce to the SMP was hamstrung.

Although the SMP may have represented a market opportunity for local farmers in Nevis, they found that the procurement process fell short of expectations. Supporting our findings, Shrestha et al. (2020) emphasized the need for contracts between farmers and school meals programme administrators to improve the vegetable supply chain for school meals in Nepal. These researchers highlighted the importance of coordination mechanisms between SMP administrators and local farmers in the Caribbean. Further, previous surveys of farmers in St. Kitts and St. Lucia have shown that the absence of buying contracts for local crops contributed to limitations in market access of smallholder farmers (Lowitt et al., 2015b). Specifying, through contracts, the obligations of suppliers (farmers or groups of farmers) and buyers (schools) as business partners can potentially improve market access and resolve market failures (Wuepper & Sauer, 2016).

The research reveals that an additional barrier to developing a farm-to-school SMP based on locally sourced fresh produce relates to difficulty with children’s acceptance of healthy food items, especially vegetables. The lack of input from a professional nutritionist into the planning and delivery of school meals may have contributed to the meal acceptance barrier within the SMP. Research previously conducted on school feeding in St. Kitts by Besso (2014), showed that based on measurements of “plate waste” (food waste), “test meals” designed through collaboration among local, regional and international professional nutritionists resulted in higher levels of acceptance by children than meals from menus where there was no professional intervention. The absence of a school meal policy (HCC, 2019b, c) to guide menu planning and ingredient selection for the SMP may have also contributed to challenges with meal acceptance by children.

The observation that children were not consuming vegetables at home, and thus not motivated to consume vegetables at school, is profoundly important. It underscores the potential for unhealthy eating habits at home to undermine efforts to promote healthy eating in school and implies the need to enhance nutrition education both at home and in school. St James Primary School reported promoting healthy eating among parents by engaging them through social media platforms in discussions of school feeding and providing pictures of school meals. However, the impact of such

initiatives on meal acceptance is unknown. In a study on the role of parents in promoting healthy eating among children, Nepper and Chai (2016) concluded that while early exposure to unhealthy eating in the home influences children's food choices and overall health, strategies can be found to overcome these barriers. The influence of the home environment on eating habits of youth was also emphasized by Reicks et al. (2015). Additionally, the price of the school meals may be a burden for lower-income households since all students usually pay the same fee for school meals. In 2016, 22% of people in Saint Kitts and Nevis lived in poverty (UNICEF, 2021) and in 2022, 21% and 31% of the population were severely or moderately food insecure, respectively (WFP et al., 2022). Financial support is available for socioeconomically disadvantaged students participating in the SMP and private sector sponsorships are also available for children receiving school meals. Providing safety nets to ensure food access for children is significant and contributes to addressing issues of inequity in food and nutrition security.

Although the SMP administration aims to source fresh food from local farmers, we recognize the importance of diverse suppliers, including local supermarkets, to ensure produce diversity for school meals, reduce the SMP's vulnerability to fluctuating market conditions, and benefit from price reductions that could flow from competitive markets (Fitzsimmons & O'Hara, 2019; Saint Ville et al., 2017). However, supermarkets in the Caribbean rely on wholesalers and distributors who tend to focus on the importation of non-perishable food items (dry goods) and processed foods, with little emphasis on fresh produce (Gonzalez et al., 2015), which necessitates a cautious approach. Previous research has shown that increasing access to processed foods and products such as sugar sweetened beverages often operate in parallel with declines in fresh local produce markets and increased availability of ultra-processed foods (Timmer, 2017). Such changes often negatively impact people who lack nutrition education such as those living in poverty, those who are socially disadvantaged, and children (Popkin et al., 2020).

School gardens have been reported to positively impact children's food choices, increase their consumption of fresh produce, and provide another avenue for children to learn healthy eating habits, while gaining an opportunity for hands-on nutrition education (Graham et al., 2005). The *One Tire per Child* school garden programme in Nevis presents a good opportunity to expand and reinforce food and nutrition education through experiential learning from school gardening. While the school gardens have the potential to increase the use of local foods in school meals and provide food and nutrition education for children, respondents identified limitations in financial and human resources for maintaining and operating school gardens as an impediment to optimizing their role in nutrition education and produce supply to the SMP. For example, fruit crops in school gardens were

considered difficult to manage and maintain due to the need for high-quality fencing to prevent monkeys and other pests from damaging the crops. One employee from the Ministry of Education noted that administrators of each school in the SMP should consider having an employee dedicated to the operation of the school garden. In addition to strengthening experiential learning from school gardens and incorporating nutrition education into the school's curriculum, other emerging ideas and suggestions to enhance nutrition education of children and parents included farm field trips for children, and workshops for parents on the philosophy and process of the farm-to-school approach to school meals.

#### 4.2 Intersectoral coordination and collaboration

Respondents were generally concerned about limitations in human and other resources to coordinate and support the SMP across the different school sites; hence, inefficiencies in coordination and collaboration may have also contributed to lack of capacity to effectively manage the procurement process. Results suggest that the SMP administrators were unable to effectively build relationships and foster communication and coordination across sectors and with local farmers. This raises an important policy question: *how* to make the connection between farmers and schools more systematic. Figure 3 shows that schools are indeed connected with farmers in their social network; it seems that coordination and collaboration mechanisms within the SMP administration and between the SMP and farmers need to be strengthened so that farmers can supply local produce more efficiently. Furthermore, farmers asked for a system where they can supply produce on a year-round basis, but that the Ministry of Agriculture would need to engage in formal arrangements with farmers and the SMP.

*"If more hands were on deck, more people will participate with the same goals/objectives in mind. We are all working towards the goal of feeding people. We need tolerance for each other and must be synchronized."* (Farmer).

Our results also suggest that there is an opportunity for better brokering of supply- and demand-side actors in the school feeding value chain to enhance policy and community success in support of a sustainable procurement system. In particular, the Ministry of Agriculture, in consultation with the Ministry of Education, was viewed as having high potential to better coordinate farmers and provide incentives for them to benefit from the market opportunities provided by the SMP. One option to improve domestic agricultural production would be to establish new SMP-affiliated farmer groups, such as supply clusters or through cooperatives or associations (Lutz et al., 2017); this can help farmers achieve production goals and profit targets, while also meeting the needs of local SMPs. Engaging farmers in the school meal

planning and procurement processes alongside SMP staff may also help build partnerships and strengthen local agricultural productivity (Goudappa et al., 2016). This is another area where assistance from the Ministry of Agriculture could be helpful to overcome the identified lack of resources, time constraints, and stakeholder capacities.

### 4.3 Social capital and network-level coordination for School Meals

Social capital is defined as “features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit” (Putnam, 1995). It is developed by investing in social relationships entailing trust, shared identities, and values (Folke et al., 2005; Waddock, 2001). Social networks are known to play an important role in influencing farmer knowledge and decision-making in the Caribbean (Saint Ville et al., 2016), and the development and operation of farmer groups (Reed & Hickey, 2016; Saint Ville et al., 2016). However, relatively little research has focused on the network of social relations surrounding farmers in the Caribbean. Despite the lack of a formal farm-to-school procurement structure for the Nevis SMP, our analysis of the school-farmer network (Fig. 3) did indicate some degree of coordination between schools and farmers in Nevis. Previous studies have shown farmer groups may have the potential to strengthen local food systems and maintain competitiveness of smallholder farmers through the process of collective action (Fischer & Qaim, 2014; Saint Ville et al., 2016). Our results indicated that direct government support is viewed as crucial for farmer group success in Nevis.

*“This is a government level program. The government can help with inputs and crop planning.” (Farmer).*

This view corroborates research in China which found that in addition to group leadership, financial and technical support from government contributes to the development of successful farmer groups (Garnevska et al., 2011). Additionally, the lack of brokers (see Fig. 5) posed a challenge for optimizing farmer organization to sustainably and reliably meet the SMP produce demand of the Nevis SMP.

We also found that the farmers who participated in our study were obtaining technical information and support principally from two farmers who were employed by the Ministry of Agriculture (Fig. 4). This suggests a high possibility that these farmers possessed the necessary technical understanding and social capital to coordinate local agriculture production. There may be an opportunity to work through these existing social networks to mobilize farmers and better coordinate crop planning and scheduling that could benefit the SMP. However, most local farmers reported relying on family and friends for their farming needs, potentially limiting effective knowledge exchange through more centralized agricultural extension services (Edelman et al., 2004; Steinfield et al., 2009). Here, distrust and

competition were cited as factors that limited communication among farmers, hampering efforts to improve organization. Farmers reported that incorporating relationship-building techniques during meetings organized by the Ministry of Agriculture and improving the knowledge of extension officers on crop production could help strengthen farmer organization in Nevis.

Future research could examine the social ties existing among individuals within the broader farm-to-school communities to better understand how they interact on a day-to-day basis to achieve individual goals through sharing and leveraging knowledge, and identify individuals’ roles, guiding principles and organizational supports; thereby creating opportunities for social learning and building capacity (Pattinson et al., 2016). In particular, the *One Tire per Child* school garden program offers an interesting case where relationships developed between farmer and school communities can provide lessons for local public policy initiatives.

## 5 Conclusion

Identifying novel strategies to meaningfully connect local farmers to the SMP will be essential to ensuring the level of collective action required to sustain and enhance community-based school feeding value chains in Nevis. This research has uncovered some barriers to participation that will require further attention, and has identified important supporting roles for government institutions, particularly the Ministry of Agriculture. The results suggest that institutional and community-level efforts to re-organize so that local farmers can meet the produce needs of the SMP in Nevis could increase market opportunities for farmers, reduce the island’s reliance on imported foods, and potentially improve nutrition outcomes for children by increasing their access to locally farmed, nutritious produce. Given that the SMP in Nevis delivers meals to children that are based largely on imported food items, the research results derive significance for the Caribbean and beyond by pointing to the need for more integrative public policy development and greater community engagement to coordinate and strengthen the farm-to-school approach to school feeding.

In Nevis, farmers are capable of organizing agriculture production when there are adequate levels of trust, information sharing and/or jointly obtained resources to achieve commonly agreed goals. This raises questions for agri-food policy and research in the region, including how to engage and incentivize the diverse network of actors working along the farm-to-school food value chain; how to link farmers and form farmer groups to increase local food production; and how to more efficiently recognize and utilize the social capital already existing in the local agri-food system to improve the sustainability of SMP produce procurement. Areas that could benefit from greater policy attention include the establishment of contractual agreements between schools and

farmers to better structure and schedule the food procurement process and incorporating nutrition education into the school curriculum.

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## Declarations

**Ethics approval** All field research protocols were reviewed and approved by the McGill University Research Ethics Board (REB File #:231–1018) prior to data collection.

**Consent to participate** Informed and written consent was obtained from all individual participants included in the study.

**Consent for publication** Informed and written consent was obtained from all individual participants for whom identifying information is included in this article.

**Conflict of interest** The authors declared they have no conflict of interests.

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