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Sustainable agriculture and food sovereignty in Haiti: sharing knowledge and shaping understanding of food systems at the University of Fondwa

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The Association of Peasants of Fondwa (APF), a grassroots organization led by a visionary Haitian Spiritan priest, established the private nonprofit University of Fondwa (UNIF) in Haiti in 2004. The University aims to fill a gap in educational opportunities for rural youth and to develop community leaders able to steward food security, sustainable farm animal husbandry, and small business development. Since the institution's foundation, University faculty members have explored low-input sustainable agriculture techniques, which were inspired by strategies shared earlier by Cuban agronomists and adapted to the Fondwa region's mountainous terrain. While the University has faced and continues to confront many challenges related to its sustainability as an institution, this article describes the processes by which its faculty and students have conducted diagnoses of soils and crop choices, the innovations they have developed and introduced to improve harvest productivity in rural Haiti and, especially, the ways and means by which they have sought to share such (re)thinking of traditional practices with local farmers. We argue that the University of Fondwa faculty's close collaboration with local farmers and the agricultural techniques they have refined thereby have not only improved food security for the families involved but have also contributed to the creation of social capital in the countryside and enabled participating Haitian farmers to imagine a path toward food sovereignty. In addition, by educating farmers and providing them tools to improve their food production, the University has worked to close the deep inequality gap that exists between urban and rural Haiti.

KEYWORDS

Haiti, food security, food sovereignty, subsistence farming, university-citizen knowledge generation and transfer, reimagining food systems

1. Introduction

This article explores the contributions of the University of Fondwa, a nongovernmental rural higher education institution founded by a Spiritan priest in conjunction with the *Asosyasyon Peyizan Fondwa* (APF) a local peasant organization, to address the problem of food insecurity and inequality in Haiti through community engagement, creation of social capital, research, and dissemination of know-how concerning sustainable agriculture. We distinguish between food

security and food sovereignty in this analysis (Steckley et al., 2023). While food security focuses on the availability and sufficiency of nutritious food, food sovereignty is concerned with the complex relations of inequality and power (local and global) embedded in food systems. That vision, "promotes [a] democratic rights-based model that not only advocates the right to healthy and nutritious food, but also the right to determine the structure of the food system, including how food is produced, as well as the social and ecological relations that intersect food production (La Via Campensina, 2007 in Steckley et al., 2023, p.3). While "food security" is compatible with neoliberal thinking and intensive and unsustainable agriculture and labor exploitation, the concept of food sovereignty, developed in 1996 by the global peasant movement "La Via Campesina," is not. Instead, it focuses on reducing the influence of global capitalism in food production and advocates for "diverse, sustainable and democratic food provision systems across the globe (Wittman, 2015, p. 179).

Haiti adopted a Policy for Food Security, Sovereignty, and Nutrition in 2018 [Pierre, 2010; Politique et Stratégie Nationales de Souveraineté et Sécurité Alimentaires et de Nutrition en Haiti (PSNSSANH), 2018]. That statute formally embraced food sovereignty as the way forward for the country. Nevertheless, the government of Haiti has traditionally had little presence in the countryside, and the assassination of President Jovenel Moise in 2021 made the nation's security and economic situation still more fragile. We contend that, notwithstanding the many challenges the country faces in ensuring food security for its population and beginning well before the nation's 2018 policy statement, the University of Fondwa has worked to promote not only improved food security by introducing more sustainable forms of food production, but also to foster food sovereignty by providing assistance to small farmers, involving community leaders in locally appropriate agricultural innovations, and educating young rural leaders.

2. A changing agricultural firmament

Haiti occupies a land area of 28,000 square kilometers and is divided into 10 departments. Mountains comprise about 70 percent of the country's territory and roughly the same percentage of its nearly 10 million residents live in its 570 rural communal sections while 30 percent of its people reside in the nation's urban centers. As suggested above, historically, the Haitian countryside has been quite disconnected from its urban areas, and the government's 18 Ministries and State Secretariat are unable to provide even basic public services to citizens living in rural locations (Philippe, 2012). The word "peasant" appears on the birth certificates of people born in communal areas and those living there have long been stereotyped as poor and stupid. Haiti remains the poorest country in the Latin America and Caribbean (LAC) region and among the poorest countries in the world. In 2021, Haiti had a GNI *per capita* of US$1,420, placing it significantly below the lowest in the LAC region, which averaged US$15,092. On the UN's Human Development Index, Haiti ranked 163 out of 191 countries in 2021. In 2021, 65 percent of households experienced a deterioration in their incomes compared to the years before the pandemic, indicating that an already high poverty rate has most likely risen. In line with these results, World Bank estimates suggest that in 2021 poverty likely increased to 87.6 percent ($6.85/day), 58.7 ($3.65/day) and 30.32 percent when using the most extreme definition of poverty ($2.15/day). Haiti is also among the countries with the greatest inequality in the region. This is largely due to two thirds of the poor living in rural areas and the generally adverse conditions for agricultural production there, creating a welfare gap between urban and non-urban areas (World Bank, 2023).

While Haiti evidences a pedoclimatic (a microclimate with soils that integrate the combined effects of temperature, water content, and aeration) soil diversity that could permit cultivation of a wide range of crops throughout the year, in the period from March to June 2022 nearly 45% of the Haitian population, or 4.5 million people, nonetheless needed urgent food assistance (Coordination Nationale de la Sécurité Alimentaire, 2022). The food crisis in Haiti is linked to a marked decline in the degree of food sovereignty the country enjoyed until the1990s. Prior to that decade, the nation had produced about 80% of the food necessary to sustain its population. The overall lack of infrastructure and heavy reliance on rain-fed agriculture in Haiti also affects the nation's food production. Additionally, farmers' limited access to credit means that most agriculture is practiced at the subsistence level.

As a result of the neoliberal Structural Adjustment Policies imposed in the late 1980s and retained into the 1990s, the overall tariffs levied on agricultural product imports from the United States (U.S.) dropped from 40–50 to 4.5% during that period [Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural (MARNDR), 2010a; Theodat, 2017]. More specifically, rice tariffs dropped from 50 to 3%; maize from 50 to 15%; bananas, wheat, and chicken import duties from 40 to 5%; and egg and milk import fees from 40% to 0 (Pierre, 2010; Steckley et al., 2023, p.8). These measures undercut the competitiveness of locally produced food vis-á-vis items from the U.S. and increased the vulnerability and food insecurity of Haitian farmers.

The so-called Washington Consensus, underpinned by neoliberal ideology concerning how best to promote economic and social development, has driven the perspectives of the United States government as well as those of many other Western nations since at least the first term of the Reagan administration (1981–1985). That perspective redefined "food security" and distinguished it from "food autonomy." Today, food security, is linked to the purchasing power of consumers, rather than to a country's agricultural production [United States Agency for International Development (USAID), 2000]. In this view, in a closely connected world, crops should be produced where they can be grown most efficiently and traded in the international market on the same basis. Neoliberalism calls for maximizing the role of markets in society as arbiters and mechanisms of social choices while minimizing the role of democratic decision-making. Indeed, U.S. President Ronald Reagan declared in his first inaugural address that government was the central problem confronting Americans and, by extension, other societies. Prime Minister Margaret Thatcher echoed that claim in the United Kingdom and that assertion and assumption were soon ensconced in the policies of major bi-lateral and international aid institutions and exported around the world. That ideology also emphasized the efficiencies that would purportedly arise from governments contracting with nongovernmental and for-profit entities to deliver their services whenever possible. As Harvey (2007) has succinctly characterized this political rationale:

> Neoliberalism is in the first instance a theory of political economic practices that proposes that human well-being can best

> be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong property rights, free markets and free trade. The role of the state is to create and to preserve an institutional framework appropriate to such practices. … State interventions in markets (once created) must be kept to a bare minimum because, according to the theory, the state cannot possibly possess enough information to second-guess market signals (prices) and because powerful interest groups will inevitably distort and bias state interventions (particularly in democracies) for their own benefit (2007, p. 2).

The adoption of this trade liberalization policy made it impossible for poor unsubsidized Haitian farmers, with limited access to technology and fertilizers, to compete with heavily supported growers in the United States and elsewhere and made the country increasingly dependent on the availability of cash, and foreign currency in particular, for the acquisition of the food necessary to feed its population. In addition, the continuous depreciation of the Haitian Gourde in recent years has reduced the purchasing power of households, which, as a result, have become increasingly food insecure [Banque de la République d'Haïti (BRH), 2021; United States Department of Agriculture (USDA), 2021].

Currently, only 50% of the food consumed in the country is produced domestically. That is, Haiti is highly dependent on food imports, valued at almost $1 billion USD per year (Ford and Dorodnykh, 2016). A quarter of this amount is for rice, which represents approximately 11% of the total food expenditure of urban, and 6% of rural, households. In fact, as explained above, the once flourishing Haitian rice industry has now largely been displaced by imports of that staple from the United States.

The presence of international nongovernmental organizations (INGOs), and of their donated food and seeds has also contributed to Haiti's declining capacity to attain food sovereignty. For generations, prior to the advent of neoliberal trade policies and a global emphasis on major crop production, Haitian farmers in rural communities had grown native corn, peas, and sorghum. These locally sourced plants were high in nutrients and well adapted to the country's often steep terrain and to its climatic conditions. However, beginning in the 1990s, INGOs began to provide farmers with free, genetically engineered seeds on the view, nominally, of helping them improve their crop yields. As a result, many growers largely abandoned native varietals. The new cultivars, however, were not well adapted to Haiti's soils and weather. In addition, as genetically engineered crop yields have decreased over time, farmers have had to buy seeds each season after INGOs stopped providing them free. This has made Haitian growers, the largest share of whom, as we have noted, operate on a subsistence or near-subsistence basis, even more dependent on the availability of currency and forced them to use a significant portion of their scarce (and declining) available cash for that purpose. That fact, in turn, has resulted in a rise in malnutrition and related health problems in the nation's rural population especially.

Haitian food dependency is not limited to crops, but also extends to livestock and fish. Goats and cattle are the most commonly raised animals in the country; goat herds were last estimated at 2,500,000 and cattle at 1,500,000 in 2020 (FAO, 2020). According to the same source, in 2020, there were 1,500,000 pigs, and 10,500,000 chickens. However, despite this level of livestock production across the country, Haiti's meat imports have grown to more than $161 million USD per year, with poultry alone representing more than 50% of that total [Banque de la République d'Haïti (BRH), 2021].

With this background in place, we next outline briefly the history and orientation of the University of Fondwa. Thereafter, we explore how UNIF faculty members, and their students are addressing specific crop vulnerability issues by partnering with local farmers to explore fresh possibilities. Finally, we address the evolving outcomes of those efforts. We conclude by arguing that notwithstanding the many challenges the University of Fondwa has faced and continues to confront, its faculty and students have opened up possibilities for improving agricultural sustainability and food sovereignty in rural Haiti, as well as for reducing the gap in terms of social capital and access to resources between the countryside and urban areas. While the University today relies on the financial support of external donors to operate, its roots in, and strong ties with, Haiti's rural communities and farmers and the fact that it is managed and run by local leaders with deep knowledge of the nation's agricultural heritage is contributing to efforts to develop the conditions necessary for food sovereignty in Haiti's rural communities.

3. Higher education in Haiti and the origins of UNIF

Gaventa and Cornwall (2008) have argued that knowledge, power, and freedom are inextricably intertwined. Human insecurity results from existing structures of power determining who enjoys what modicum of security. Such structures can be identified at the local, state, and global levels. The solution to deep inequalities requires much more than providing individuals with economic resources; it also demands ensuring access to basic human rights and equipping individuals with knowledge that enables them to make life choices. As Gaventa and Barrett have observed, as citizens may not see themselves with the power to act, focusing on participation alone is insufficient to encourage exercise of their agency. So understood, an increase in social knowledge is also needed to broaden people's engagement to secure that result (Gaventa and Barrett, 2012, p. 2402).

Following the fall of the Duvaliers in 1986, Haiti entered a period of democratic transition, characterized by a multidimensional liberalization of life in the country. While primary and secondary education have since become relatively more accessible to a greater percentage of the population, Haiti remains far from attaining the United Nations sustainable development goals developed for that domain. According to studies of the Haitian educational system conducted by the World Bank (2018) and UNICEF (2018), the net enrollment rate for primary school in Haiti was 55% in 2018, while that for secondary schools was 17%. These percentages vary significantly by region within the nation with enrollment figures generally higher in the country's urban centers.

Traditionally, government and international funders have emphasized support for the country's primary schools. Nevertheless, in the aftermath of the 2010 earthquake, former president René Preval also proposed expanding enrollment and funding for higher education. Preval's successor, Michel Martelly, also indicated that he viewed post-secondary education as a priority, symbolized by his decision to name the nation's first undersecretary for higher education (Downie, 2012, p. A8). Nevertheless, higher education institutions in

Haiti do not possess sufficient capacity to meet potential demand. According to data from the UNESCO Institute for Statistics (2021), only about 1% of the population of Haiti aged 25–64 had completed a higher education degree. For the academic year 2020–2021, the nation's K-12 education system produced about 70,000 graduates [Ministry of Education and professional training of Haiti: Bureau national des examen d'état (National Office for official Exams) (BUNEXE), 2021], while the State University of Haiti (UEH) and the network of public university locations in the provinces, had an enrollment of approximately 24,000 students. UEH's inability to address the demand for higher education in the country, both in terms of capacity and in curricular offerings, has spurred the creation of private universities. Private (for-profit and nongovernmental) higher education institutions in Haiti today play a significant role in higher education, enrolling perhaps 60% of all tertiary students in the country. Financing remains a major constraint for both public and private higher education institutions in Haiti, with many struggling to secure sufficient resources to provide quality education to their students.

As we have noted, farmers from Fondwa, led by a Spiritan priest born and raised in that community, Joseph Phillippe, created a grassroots organization called *Asosyasyon Peyizan Fondwa* to respond to these challenges in 1988. The group included in its aspirations the creation of a nongovernmental university whose mission was to help to create the conditions necessary for grassroots local organizations in Haiti to create wealth in their communities using locally available resources. Since its inception, APF has also provided essential public services to Fondwa, including road construction, reforestation initiatives, a health center, an orphanage, primary and secondary schools, a radio station, and a credit union. In 2001, to celebrate the 200th year anniversary of Haiti's independence, APF organized several public gatherings, which included peasant farmers as well as professors from the University of Havana, Cuba, and educators from the United States, to address the broad question of how best to serve its community's rural population. Paulo Freire, the legendary Brazilian thinker and pedagogue, inspired and informed those conversations (Freire, 1970/2000), which generated the founding ideas and ideals for what became the University of Fondwa. Participants suggested UNIF should be underpinned by a "popular education" methodology and structure; one through which peasants and international collaborators would be engaged as professors and students. The participants in these meetings identified three principal objectives for UNIF and argued that its curriculum should:

1) ensure that marginalized groups become aware of their situation (what Freire called "conscientization"),
2) encourage individual and collective efforts to build a more just society, and
3) press for needed social change (Philippe, 2013, unpublished remarks).

Guided by this vision, the University of Fondwa opened in 2004. Since its creation, UNIF has sought to work with the country's peasants, and especially those in its region (disproportionately subsistence or near-subsistence farmers), to organize and address their needs collectively. The University's leaders have embraced the view that educational opportunities ultimately must be made available throughout rural Haiti if the nation is to nurture and retain intellectual capital in those regions and develop a workforce able to participate in, and stimulate, local development. Put differently, University faculty and leaders have viewed the engagement of the peasantry in all of Haiti's 570 communal sections through participatory processes as a principal engine for long-term national economic and social development (Philippe, 2013, unpublished remarks).

In a personal interview with two of the authors in 2012, the University's founder suggested that to create wealth in a community it is necessary to work at different levels to encourage and retain social capital within it (Philippe, 2012, unpublished personal interview). Philippe saw APF's creation of the University of Fondwa as well as of a K-12 school located nearby as part of a strategy to secure development in his home village and, as an exemplar initiative for rural Haiti more broadly. In pursuit of this aspiration, UNIF has sought to strengthen agricultural production, enhance conditions for food sovereignty, and create social capital by educating rural students and conducting research in three domains: veterinary medicine, agriculture, and business management. The University's founders hoped the institution would help Haiti's peasant population to become active and responsible citizens; ensure social and economic progress in rural areas; and become a leading entity in efforts to ameliorate poverty and inequality by creating know how and social capital.

In particular, the 2012 UNIF strategic plan, whose central elements remain in place today, embraced a mission centered on peasant culture and sustainability to break a cycle of dependence on external support:

> The university will be based on a *solid ethical foundation* that respects the Haitian peasants' cultural identity, their set of values. For instance, the university will be founded on the *principle of solidarity*. The university will be based on the *principle of popular education*. That means it takes as its starting point the peasants' life experiences. … The philosophy of the university and all the subjects taught should also be based on the *principle of sustainability*. The students must be prepared in such a way that they learn to minimize their dependence on external factors and instead maximize the self-management and development of their communities. In other words, they become promoters of independence rather than dependency (University of Fondwa business plan, 2012, unpublished, emphasis in the original).

UNIF's leaders and faculty members see students not only as apprentices, but as agents of development, charged with a moral responsibility to contribute to their communal sections of origin. Father Philippe's original vision called on communities to recommend students for the University, through APF-created Local Development Committees (LDCs), grass roots self-government institutions, which would include local public professionals and organizations heads. As envisioned, each LDC would select three students in its communal section and support their education. In turn, the students would put their expertise at the service of their communities. During their education, students would be engaged in internships in the completion of which they would be expected to identify available resources and fashion possible initiatives for wealth creation (Stephenson and Zanotti, 2020).

While this mechanism has never worked as initially envisaged, due to the financial challenges confronting Haiti's rural communities, at the time of this writing (September 2023) six LCDs have been able

to fund UNIF students since the university's founding. In the 2021–2022 academic year, more than 70% of students in UNIF's School of Agriculture completed internships in institutions previously created by university graduates, while 72% of those graduates now have stable jobs or are successful entrepreneurs.

In the two most recent classifications of Haitian universities, UNIF was ranked among the first 20 of the more than 200 higher educational institutions in the country (Lafleur, 2022; UniRank, 2023). However, the University of Fondwa continues to face constraints that threaten its survival as an institution. More than 50% of the university's operating budget is comprised of external donations. That fact, and its fluctuations across time, has prevented the institution from increasing its full-time faculty and improving its research capacities. Moreover, to secure its economic survival, UNIF has increasingly accepted students without grants, which limits its leverage to address its rural development mission, as students without support do not necessarily have strong ties with specific communities in the countryside.

In 2016, UNIF was able to secure the continuing support of a few main donors through the auspices of its U.S. fundraising arm. Having achieved a degree of financial security and stability since, the University's leaders and relevant faculty have sought deliberately to address several challenges related to Haitian food sovereignty. In the roughly two decades since its foundation and notwithstanding the challenges it continues to face, given the macro-scale difficulties in the country, UNIF's small faculty has developed a solid knowledge of mountain agriculture, a know-how essential to cooperating with, and assisting, more than 80% of the country's farmers. The research and outreach activities we describe next suggest that through its practices and vision in this domain, University faculty are assisting their targeted population through a combination of modern and traditional practices. Fondwa faculty have sought to devise experiments to test possible innovations in agricultural methods in constant collaboration with local farmers. That approach seeks to ensure that area growers are vested in, contribute to, and are knowledgeable of, the potential benefits and costs of possible changes in their crop selection and planting, maintenance, and harvesting practices to the maximum extent feasible. To date, the University has developed and tested several practices in this way that have not only increased soil productivity, but also reduced the vulnerability of those who adopted them and created social capital by simultaneously ensuring that a cohort of youth with strong ties with Haiti's rural communities—UNIF's students—are aware of those innovations and farmer experiences with each.

4. A word on methods and our analytic stance

The authors of this article have been working in partnership for approximately 12 years as faculty members of our respective universities. We have visited one another's institutions, shared resources and experiences via frequent conversations, and learned deeply from one another in so doing. As such, this article is the product of sustained interinstitutional as well as individual collaboration. We report on University of Fondwa efforts based on the research and experience of faculty who have played major roles in those efforts. We likewise examine Haiti and Haitian food security and sovereignty more generally, through the lens not only of interested outside observers, but also from the perspective of those living in one of that nation's poorest regions working to develop a more sustainable future for its citizens. Given these realities, we cannot and do not claim "neutrality," but instead hope very much that we are cooperatively engaged in sharing the knowledges we each bring to our collaboration for the betterment of the Haitian population and especially its most poor and vulnerable.

It must also be noted that the realities of institutional capacity and the state of the social, political and economic context in present-day Haiti generally and in Fondwa more particularly, have mediated the availability of systematic data for this study. For instance, differently from state sponsored studies on soil fertility conducted in India (Reddy et al., 2022), Haitian scholars cannot rely on soil fertility maps or a national soil fertility management strategy since neither exist in the nation. As documented below, international NGOs, such as the Red Cross or Objectif Tiers Monde, as well as universities located elsewhere including the University of Louisiana, have supported a share of UNIF's local projects, which, when successful, can be replicated in other rural regions. However, these initiatives cannot yield the results and/or vast comparative data sets that large projects backed by considerable government funding may be expected to produce. Moreover, the overall lack of a coordinated state strategy for agricultural development constitutes a considerable challenge for UNIF and for the Haitian agricultural sector more broadly. The UNIF faculty work collaboratively with farmers not only to identify salient production concerns, but also to ameliorate or overcome ongoing crop related issues as they arise. While they collected some data, for example, on yield differences with alternate planting techniques (which we cite where available), time and resources have not yet permitted that group to develop a systematic quantitative measures approach to the multiple valences of the implications of those interventions. While at least to date the UNIF faculty have not enjoyed sufficient capacity or resources to measure systematically the diffusion patterns of the innovations that they have collaboratively developed, the evidence they possess is not trivial, and the Fondwa faculty have sought to share it via informal farmer networks. We are persuaded that the long-standing engagement of the authors of this article with UNIF together with the original data collected by UNIF faculty and students provides a solid basis for our judgments of that institution's relative impact on Haitian rural communities' steps in the direction of food sovereignty.

5. Challenges to Haiti's food production system

In addition to being threatened by the neoliberal trade conditions and policies we have described above, food production in Haiti continues to face challenges that have arisen from its history as a post-colonial state, its geographic location and geomorphology. The landownership regime inherited from the French, which has resulted in extreme fractionation of land and land ownership, the widespread deforestation arising from colonial exploitation of the land to produce sugar cane and cotton, as well as from current practices of charcoal production, the mountainous terrain, the fact that Haitian agriculture is mostly rain fed, and the nation's location in an area prone to extreme

weather events, are all factors that continue to pose obstacles to the country's farmers.

5.1. The Haitian land ownership system

The legacy of French colonization has shaped the Haitian land ownership system. Even after achieving independence, Haiti followed French land law, which prescribed the equal subdivision of agricultural plots among heirs. Thus, with the increase in the country's population, the size of inherited plots has decreased considerably, even though this phenomenon has been somewhat mitigated across time by emigration and urbanization (Barthélemy, 1989; Smucker et al., 2000). The majority of farmers in Haiti own very small plots, with more than half (53.71%) holding less than 0.387 hectares. Only 21.14% have access to more than 1.29 hectares. Approximately 7.43% of the 8, 000 farmers in the Fondwa area would be considered by existing definitions not to be working on "small farms." Indeed, plots of less than 0.387 hectares might more accurately be referred to as "micro-farms" (Scruggs et al., 2021). Figure 1 provides an overview of land ownership in the Fondwa region, which evidences this pattern.

The colonial exploitation of Haiti's arable agricultural land also played a critical role in creating the nation's current widespread deforestation, as wooded areas were cleared to make way for plantations of sugar cane, cotton, and indigo (McClintock, 2004). Meanwhile, charcoal, which provides 85–90% of Haiti's domestic and industrial energy production, is presently the nation's major cause of continuing deforestation (Bargout and Raizada, 2013).

Since the mid-1980s, the country has witnessed an unprecedented rural–urban migration, which has reduced the countryside population and agricultural workforce. Overall population growth has in the meantime raised the demand for food, with a consequent increase of intensely cultivated land and an overall drop in soil fertility [World Bank, 2019; FAO, 2020; United Nations Development Programme (UNDP), 2021]. The upshot of these trends is that ultimately, Haitian farmers have been challenged to produce more food on less arable land.

5.2. The climate

Haiti enjoys a mild climate suitable for growing a variety of crops, with the annual temperature range varying from 20 to 35°C and average rainfall exceeding 3,000 mm [United States Agency for International Development (USAID), 2018]. However, 60% of the nation's territory has a 20% slope or greater (Hylkema, 2011), which makes it particularly vulnerable to erosion and renders large areas unsuitable for mechanized farming. Meanwhile, the Caribbean basin is at the crossroads of major climatic depressions in the western hemisphere. Haiti's losses to natural disasters during the period from 1995 to 2013, for example, have been estimated to total $8.5 billion [United Nations Office for Disaster Risk Reduction (UNDRR), 2015]. The United Nations Office for Disaster Risk Reduction has calculated the material damage caused by cyclone Matthew in 2016 alone to be $1.9 billion in the departments of Grande-Anse, South, and Nippes [United Nations Office for Disaster Risk Reduction (UNDRR), 2015]. The United Nations Food and Agriculture Organization has estimated that agricultural losses from that single storm were $580 million, or 29.47% of the total value of Haiti's overall costs arising from that event (United Nations. UN News: Global Perspective/Human Stories, 2016). Disasters such as Hurricane Matthew affect food production for several years following their occurrence and thereby threaten the overall food security of the Haitian people while simultaneously dramatically increasing the vulnerabilities of the country's farmers.

5.3. Food production and consumption in Haiti

As mentioned above, Haitian growers raise a diverse array of crops including cereals (rice, maize, sorghum), legumes (beans, groundnuts) and root vegetables and fruits (yams, cassava, potatoes, bananas). Together, these constitute the basis of the Haitian diet (Pressoir et al., 2016). Notwithstanding this diversity, these foodstuffs are by and large genetically degraded today in Haiti and are providing decreasing yields. Access to quality seeds, including heirloom varietals, and

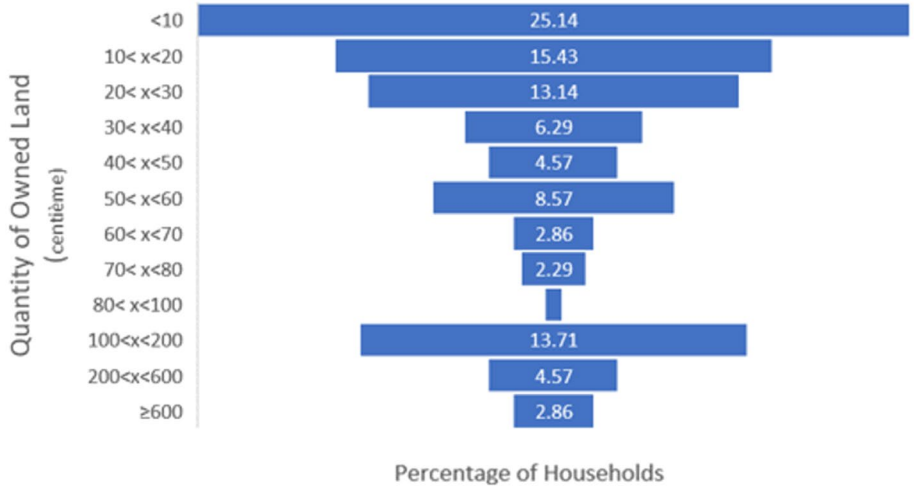

FIGURE 1
Land ownership in Fondwa. Source: Scruggs et al. (2021).

fertilizers remains very limited, particularly in remote rural areas, where road infrastructure is often poor or non-existent.

Approximately 85% of food crops grown in Haiti are consumed domestically (Pressoir et al., 2016). However, that production is insufficient to address the nutritional needs of the major share of the nation's families, who, as noted above, purchase most of the food they consume (Daméus and François, 2017). For example, a survey conducted by the University of Fondwa (Scruggs et al., 2021) found that 41.4% of Fondwa's population is living with some degree of food insecurity. That finding is in line with the national average for Haiti.

The storage and distribution of agricultural products also presents marked challenges. Many areas with relatively high production or production-potential are not connected to markets by main roads and remain virtually inaccessible during the rainy season. Thus, close to 50% of produce, especially fruits and vegetables, perishes before reaching markets. Storage and refrigeration infrastructure are also limited, forcing farmers to sell their products immediately after harvest. The overall fragility of the storage and distribution chain contributes to high seasonal price variations and to an often-poor quality of available fruits and vegetables [Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural (MARNDR), 2010b; Theodat, 2017].

The lack of a storage and distribution infrastructure deeply affects the Haitian population's food security and sovereignty. On the one hand, the inability of farmers to sell agricultural products contributes to reduced food production and encourages rural exodus. On the other hand, the price of the limited amount of locally grown agricultural commodities reaching consumers in good condition often makes them non-competitive with imported goods.

6. The University of Fondwa's contribution to Haiti's food sovereignty

The faculty of the University of Fondwa have addressed the issues highlighted here through a combination of community (peasant farmer) engagement and technical initiatives designed to improve agricultural yields, increase the nutritional value of crops, and maintain and replenish arable land. That is, University of Fondwa teaching and research are deeply community-based. Initiatives are identified by local actors, such as farmers and representatives of grassroots or partner institutions, along with students and professors. The faculty seek to address grower concerns through recursive experimentation, starting with pilot projects, and involving progressively larger numbers of farmers.

We here highlight University initiatives regarding soil fertility management, crop rotation, and high yield and nutritional value crops. Perhaps more importantly, we also profile the community engagement approach UNIF faculty has employed to develop these efforts. The University's agricultural programs have been tested and introduced in close partnership with farmers positioned and willing to risk innovation. Those growers, who are generally better educated than many in their region and have larger plots, are playing an important pioneering role in bringing about changes in food production practices in their communities. The relatively impoverished population of Haiti's rural regions (including that in which Fondwa is located) has traditionally proven risk averse and reluctant to experiment with changed production processes or new crops or varietals due to the potentially catastrophic—indeed in too many cases, life threatening—costs implicit in doing so. We contend that, while facing many challenges, the model UNIF has employed in which local farmers are not only the recipients of knowledge, but active partners in its co-production, is improving the potential for food sovereignty in the area the institution serves.

The University's experience suggests that when tightly connected to rural communities and willing to co-produce relevant knowledge that reflects not only expert understanding, but also the lived experience of farmers, higher education organizations can play an important role in changing established agricultural practices and in improving the food security of subsistence farmers. UNIF's engagement with local growers has emphasized five areas, which we briefly describe below: Improved management of water and soil fertility through crop rotation and association, introduction of short cycle varieties of cultivars, increased focus on sustainable and high yield edible roots and tubers, soil enrichment through the development of organic fertilizers; and improved fallowing practices. In addition, as we also document in this study, UNIF has contributed to closing the rural–urban gap by creating a cohort of educated local leaders. In this way, agricultural practices have increased Fondwa's rural communities' overall social capital.

6.1. Effective management of water and soil fertility

Due to its location in a rural mountainous area, where agricultural production is rainfed due to farmers' lack of capacity to invest in irrigation systems, University of Fondwa faculty members have specialized in high-altitude and organic production strategies. As such, UNIF's faculty share the view that no remediation effort in the Haitian food sector is possible without special efforts to protect the country's soils. To counteract systemic soil degradation, Fondwa faculty have engaged in preventive conservation efforts in concert with farmers to devise and test practices to limit erosion. Advocating for conservation agriculture, UNIF faculty have popularized the value of organic waste, including animal waste, in improving soil fertility. Indeed, research conducted by the University's faculty and students has demonstrated that it is possible to quadruple the yield of cultivated plant species with the use of organic fertilizers. Bossejour (2020), François (2021), and Laguerre (2021), for example, have demonstrated that the yield of bell peppers increased by 110%, the yield of eggplants increased by 150%, and the yield of beets increased by 180% by using chicken manure, horse manure, and guano as fertilizing agents, respectively. These studies were conducted in close collaboration with a sample of farmers from Fondwa. Once the efficacy of this effort had been demonstrated, 80% of local farmers adopted these methods in the next growing cycle. This soil conservation management approach consists of an integrated program, spanning from soil preparation to harvesting. During planting preparation, organic waste, which would otherwise be burned in conventional Haitian agriculture, is buried instead, to increase the clay-soil humic complex, which is essential for the vitality of the micro-organisms necessary to create organic matter. To support this soil-organic matter management system,

UNIF faculty have advised farmers with whom they are working at the beginning of every season to put earth retention structures in place to reduce erosion and limit displacement.

In addition to the use of organic waste, UNIF faculty have promoted crop association. Lack of rotation and the abuse of a monoculture planting system generally forces peasant farmers to overuse synthetic fertilizers to compensate for the soil nutrient deficiencies that arise from intensive use. Such fertilizers are expensive, not readily available in Haiti, and make farmers dependent on imports. This combination of factors increases growers' vulnerability to weather events and their general insecurity. To address this scenario, UNIF faculty have worked with local farmers to promote crop rotation and association as ways to reduce soil depletion and fertility loss. University researchers have documented the fixation of natural nitrogen by beans and groundnuts, and the significant effect of intercropping on the yield of maize and beans that results from capitalizing on that fact in planting and production design (Benjamin, 2021; François, 2021; Spaddy, 2021). An example is the association of maize (*zea mays*) and beans (*Phaseolus vulgaris*) planted in a common furrow. Beans, being a legume, fix nitrogen from the air and store it in their roots. At the time of their senescence, which precedes that of maize, beans release huge amounts of nitrogen into the soil, which fertilize the maize, contributing to a considerable increase in corn yield averages. This spatio-temporal approach to soil management also conserves water, thereby reducing the risk of flooding downstream. UNIF faculty members have tested this rotation and association approach repeatedly and it has now been adopted by many peasant farmers in the Fondwa area.

6.2. Short cycle varieties

UNIF faculty are currently experimenting with an innovative plant variety selection project, aimed at identifying high-performance substitutes for the pigeon pea (*Cajanus cajan*) and sorghum (*Sorghum bicolor*) varietals grown throughout Haiti. While the pigeon pea and sorghum forms selected as possible replacements by UNIF faculty have been in use in Haiti in various locations for more than 5 years, many farmers are not yet aware of these alternatives. Fondwa faculty and students have worked in partnership with an international NGO (Objectif Tiers Monde) and with 100 local Haitian farmers to test the adaptability of two such sorghum varieties in the communes of Carrefour and Léogâne in the West department of Haiti near the University. The project has sought to introduce varieties with a life cycle of about 3 months to obtain better agronomic performance than can be attained with traditional crop choices. The results suggest that short-cycle sorghum is highly appreciated by Haitian farmers. In adaptation tests of two sorghum varieties conducted in 2021 for about 1 year with 120 farmers, UNIF faculty found that short-cycle sorghum offered a yield of 1,400 kg/ha, which surpassed the yield of the traditional variety of sorghum (500 kg/ha) by 110%. Following conversations with focus groups conducted with the primary beneficiaries of this sorghum extension program, UNIF researchers estimated that the number of adopters of these varieties in the test area would likely double each year thereafter until fully substituting for the traditional varieties across the country (Joseph et al., 2021, unpublished report).

6.3. Edible roots and tubers

As highlighted above, Haitian farmers and the country's general population are dependent on imported food commodities, especially rice. UNIF's agriculture faculty and leaders believe that, in order to obtain food sovereignty and reduce food insecurity, Haiti must promote plant production that fosters farmers' autonomy—via seed supplies—that exhibit vigorous adaptive capacity in most agrosystems of the country and that also evidence drought and disease resistance/tolerance and produce higher yields than existing forms. A few species of edible roots and tubers (*Ipomea batatas, Discorea* sp., *Manihot esculenta*) meet all of these criteria and University faculty are now working with Fondwa area growers to develop ways to produce these varieties on existing farms. In addition, researchers have conducted multiple field experiments to identify factors that can improve yield and/or control pests and disease in the existing varieties of these crops (Innocent, 2020). This is to say that faculty recognize that not all local growers will be ready or able to take risks to adopt the suggested changes in their existing practices.

Fondwa faculty researchers were among the first to demonstrate that yams can be produced with one third of the seed volume generally used by Haitian farmers. UNIF faculty have also obtained especially promising results with the sweet potato, a very popular food item in the Haitian diet, whose varietal biodiversity facilitates its planting and production throughout the year. To date, University researchers have worked with Fondwa's farmers to introduce four fortified varieties of sweet potato: Tibêta, *Lespwapeyizan*, *Tiokap*, and *Beauregard*. *Beauregard*, a variety rich in nutrients, has so far been found in testing by local (Fondwa area) farmers to be the most productive of these crops. According to two recent studies conducted in the Fondwa region, the *Beauregard* variety yielded around 20 t/ha, which represents a 400% increase above the national average yield [Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural (MARNDR), 2019; Innocent, 2020]. Despite its high productivity, however, the adoption rate of this variety has not yet surpassed 20% due to its starchy texture when cooked, which is not favored in Haitian cuisine. UNIF is now working with its students and in partnership with a team of researchers from the University of Louisiana (United States) to ensure that farmers throughout the nation become aware of the productivity advantages of the *Beauregard* sweet potato.

6.4. *Terra preta*, medicine for degraded lands

As noted above, the pressure exerted on the soil by intensive cultivation has led to its degradation in many of Haiti's agrosystems. One response to this challenge adopted by UNIF faculty and their local partners is the nurturance of better soil. *Terra preta* loam is characterized by a dark brown to black color and varies in thickness from 50 cm up to 2 meters (Baize and Girard, 2008; Kern et al., 2009). These soils are native to the Amazon Basin in Brazil, to Ecuador and Peru, as well as to West Africa (Benin and Liberia) and the savannah of South Africa. *Terra preta* fertility is much higher than other soils because of its organic matter and nutrients, including nitrogen, phosphorus, potassium, calcium, magnesium, and manganese (Glaser et al., 2001). Researchers around the world have focused on recreating

the conditions for formation of these loams. Based on promising results of multiple experiments, some scientists have argued that *human-made Terra preta* could serve as a model for the development of agricultural practices in the tropics that could result in more sustainable yields (Glaser et al., 2001).

Accordingly, UNIF's researchers have carried out several experiments on human-made *Terra preta* and found that it is possible to triple or even quintuple the yields of several varieties of vegetables compared to surrounding soils. Milien (2020) found that *Terra preta* increased the yield of sweet peppers (5.95 ± 2.85 t/ha) threefold when compared to the average yield obtained in the surrounding area (1.89 ± 0.35 t/ha). Lindor (2021) demonstrated that the yield of *Pissum sativum* doubled when cultivated in *Terra preta* soil compared to surrounding soils (8.12 vs. 3.13 t/ha). Moreover, Sejour (2020) demonstrated that the yield of tomatoes and cabbages increased 30 and 40% respectively, when cultivated in *Terra preta*.

In partnership with the Swiss and Haitian Red Cross, UNIF faculty members have shared these findings with peasant farmers in the mountainous region of Léogâne near Fondwa, particularly in those areas most sensitive to erosion with highly degraded soils. Faculty have also worked with a small group of growers in that area to test the replicability of these results. One of the most relevant characteristics of this intervention as collaboratively designed, is that it relies on reuse of organic matter from farm residue and waste. This soil enrichment strategy has allowed engaged growers to introduce new cash crops and to obtain higher yields with fewer inputs, in line with sustainability and respect for the environment. This experiment is ongoing.

6.5. An improved fallow

Traditionally, Haitian farmers have used fallow periods to manage their fields. This involves not cultivating specific parcels for limited interludes, to manage and preserve soil fertility. However, this practice may also lead to further soil degradation. For instance, in steep mountainous areas where vegetative cover is sparse, such as in Fondwa, the soil is very vulnerable to erosion. In 2018, University of Fondwa faculty members therefore tested a project based on the introduction of legume species other than beans, as well as market gardening species, as fallow cover crops. With the introduction of cabbage as fallow cover, farmers not only found a way to utilize land after sweet potato harvesting, but they also obtained a cash crop that has yielded strong profit margins. In this way, growers participating in the partnership to date, which include nearly all the farmers working in the Fondwa region, have helped to maintain soil fertility, reduce erosion risk, improve their family's diets, and increase household income.

This innovation has permitted growers to realize an additional vegetable crop in the summer, while also protecting, enriching, and harvesting from what would otherwise have been fallow plots. That is, in addition to reducing soil erosion, this technique has increased the food security of Fondwa's households. UNIF faculty are currently working on a plan with local farmers to adapt these practices and to share them with other growers across the region and country. Even though crop rotation has been practiced for centuries in Haiti, the logic of sequential interrelated benefits among specifically selected crops has been poorly understood by the nation's farmers. With the efforts of the University of Fondwa through joint experiments between researchers and farmers, and by means of continuous dissemination of findings, 70% of farmers in the Fondwa area are today practicing this form of science-based crop rotation.

7. Experimenting alongside farmers

As the above examples have suggested, the UNIF agriculture faculty design and develop their research projects in close partnership with local farmers. Haitian peasants (subsistence farmers especially) are particularly reluctant to take the risk of planting new crops because they are not confident of yields, or how well those plants will sell in the market even if they adapt well to the soil and weather conditions of the area. In addition, in some cases, new practices require additional labor and very poor households do not have the capability to hire workers. In order to reduce risk, many farmers only gradually adopt new crop varieties, or they test new possibilities in tandem with traditional ones. For instance, UNIF has worked with the region's growers to plant beans and maize at the rate of one seed per pocket spaced 10 cm apart, contrary to the traditional planting method of 5 to 6 seeds per pocket at varying distances. Area farmers not already engaged in this experiment soon learned nonetheless that this practice required fewer seeds and resulted in improved yields. Nevertheless, most Fondwa area growers adopted an intermediate planting pattern. Instead of employing the technique of one seed per pocket, they planted at the rate of 2 to 3 seeds per pocket at a regular distance. In consequence, UNIF faculty conducted research to determine whether that strategy resulted in different yields from that initially proposed and learned that it did not. While this outcome was fortuitous, this episode highlights the high degree of risk aversion among the area's subsistence farmers even when arguments for changed practices appear to be well founded. It also suggests that the diffusion of change is likely to be a non-linear process mediated by a host of factors, even when those highlighting possible innovations are known and trusted by those whom they seek to influence.

As a general proposition, many universities are interested in helping growers conduct their research and experiments on lands their institutions own and manage. That fact implies that any innovations developed are likely to be shared only late in such processes, when investigators have determined that their results can be extended more broadly. However, undertaking these initiatives in this way can be time consuming and, more importantly, may be disconnected from the perspectives and perceived priorities of local farmers and their communities. As such they run a high risk of non-adoption, a risk exacerbated in Fondwa's case by the poverty of area growers. To address these concerns, UNIF faculty work to ensure that the interested (the "willing") potential beneficiaries of any possible innovation are involved from the outset in any research that may affect them. They can thereby help to steer and adapt those investigations in ways that address their needs and situations. In any case, since UNIF does not itself own arable land, it must rely on carefully selected groups of local farmers to help its researchers investigate possible production or soil care strategies. Faculty recruit grower /partners from among community members who are aware of UNIF and its efforts to assist farmers. University faculty have found that those growers most receptive to experimentation and adoption of new techniques are those who are literate and possess sufficient land

and capital to be able to bear some modicum of risk. Generally, after initially conducting preliminary experiments addressing a new practice, university researchers invite a group of selected local farmers to partner in the testing, refinement, and dissemination of those practices. During meetings with its grower partners, UNIF faculty members routinely present possible projects to garner their views, experience, and suggestions. These interactions are not always without conflict, but they do tend to prompt thorough consideration of the strategies/changes contemplated. Nevertheless, UNIF's strategy of partnering with literate farmers suggests that education increases local growers' inclination to innovate, thus triggering a virtuous cycle. Put differently, when employed, such demonstration plots represent an important tool to challenge the dominant imaginary of the Haitian farmers with whom UNIF faculty work as somehow lacking and doltish.

The current UNIF agricultural faculty's approach to encouraging experimentation and possible adoption of change among the farmers they serve echoes the findings of a similar case study in Malawi addressing the impact of agricultural extension on efforts to improve crop productivity (Masambuka-Kanchewa et al., 2020). In that instance, agricultural communication (AGCOM) agents were promoting farming innovations. However, AGCOM agents were disconnected from the farmers and the communities they served, they did not allow for reciprocal learning, and were not focused on specific, locally based, success stories. As a result, the solutions proposed in extension campaigns in that area of Malawi did not address the problems confronting local farmers and those growers did not trust the strategies recommended.

The UNIF faculty has been mindful of these concerns and has worked to address them in their approach to agricultural extension and communication. In another recent related study, in this case addressing the adoption of integrated pest management practices, Diaz et al. (2020) demonstrated that even in Florida, United States, farmers' negative experiences result in adverse impacts on the willingness to consider and the pace of adoption of innovations. On the other hand, when farmers have been included in the design and implementation of extension practices, they are more likely to embrace the suggested agricultural practices. In a study concerning the adoption of novel agricultural practices in Nepal, Ghimire et al. (2022) reached similar conclusions. An analysis of relationships developed via Farmer-to-Farmer (F2F) Extension System efforts (Silvert et al. (2022) also concluded that famers were likely to be more willing to consider changes in practices when involved in developing and testing them. In the meantime, Agole et al. (2022), in a study of factors affecting productivity among smallholder farmers in Uganda, concluded that community culture should be considered when working with growers to introduce possible changes in planting, cultivation, or harvesting practices. In line with these findings, Calixte et al. (2020) have emphasized the importance of local agricultural technicians in Haiti and of the dissemination of agricultural innovation through strong partnerships with farmers. These studies support the UNIF faculty's strategy of developing and testing possible changes with growers as a way both of maximizing the understanding among farmers of what is being considered and why and, as a corollary, of minimizing the potential for failure. Figure 2 offers a graphic depiction of the approach Fondwa faculty are now employing to develop and implement possible changes with area growers.

The Figure underscores the fact that farmers are involved at every stage of the process of consideration of possible changes in agricultural processes/strategies in which UNIF faculty and students are engaged. The result in principle is multiple opportunities for farmers and university representatives to bring their special knowledges to bear in ways that both inform and test the plausibility of potential changes, even before those are subjected to limited field trials. This emphasis on coproduction and cooperation can encourage trust and deepen mutual understanding among these actors even as it opens up possibilities that one or both parties might not otherwise have considered. It also results in a continuing social space in which those engaged can interact concerning the unfolding of relevant events and factors, including the vagaries, of weather, pests and markets and how those might be affecting planned efforts. Working at its best, this process will address farmer concerns, in ways they their knowledge and experience informs and alongside scientific expertise.

8. UNIF at the crossroads of conventional and organic farming

Reddy et al. (2022) have compared the outputs of traditional and organic agriculture in India. That study suggested that when organic agriculture practices were employed in rainfed hilly areas, farmers profited from the change. Those scholars found that organic strategies increased production and profits for farmers growing two different crops: paddy rice and soybeans. While that study also found a decrease in productivity when organic methods were introduced as compared to traditional agriculture in irrigated areas, overall, Reddy et al.'s findings support the UNIF faculty's generally positive assessment of the impact of organic agriculture for the rural communities they serve in Haiti, whose farms are mostly rainfed.

However, the applicability of the Reddy analysis to the very different context of Haiti should be qualified. The topographic conditions of the Haitian territory, the land tenure situation in the country, combined with a dearth of investment in the agricultural sector by the Haitian government and the lack of cash available to most farmers severely limit, as we have emphasized, the availability of chemical fertilizers. As a result, most Haitian subsistence growers practice a mix of organic and conventional agriculture, and the two cultivation systems cannot be considered separately, as in India (Reddy, 2019). For instance, a Haitian farmer who typically does not use chemical fertilizers may occasionally employ a chemical pesticide when funds are available to do so. As a result, while Haitian agricultural productivity varies according to pedoclimatic region, its overall productivity is, on average, much lower than the average global yield for comparable crops. For instance, the average global yield of corn is more than 5 times higher than the average yield for that staple in Haiti (FAOSTAT, 2021). Joseph (2013) has compared the traditional rice cultivation system (SRT) and the intensive rice cultivation system (SRI) in the Artibonite Valley in Haiti and estimated the profits for each, respectively, at 296 USD/ha (SRT) and 1,500 USD/ha (SRI). Even lower yields and incomes routinely occur in the mountain agroecosystems of the country. Moreover, and importantly, the collection of data regarding agricultural productivity and profitability in Haiti is haphazard. Haitian farmers do not routinely keep records of their farms' productivity. They also do not typically calculate or

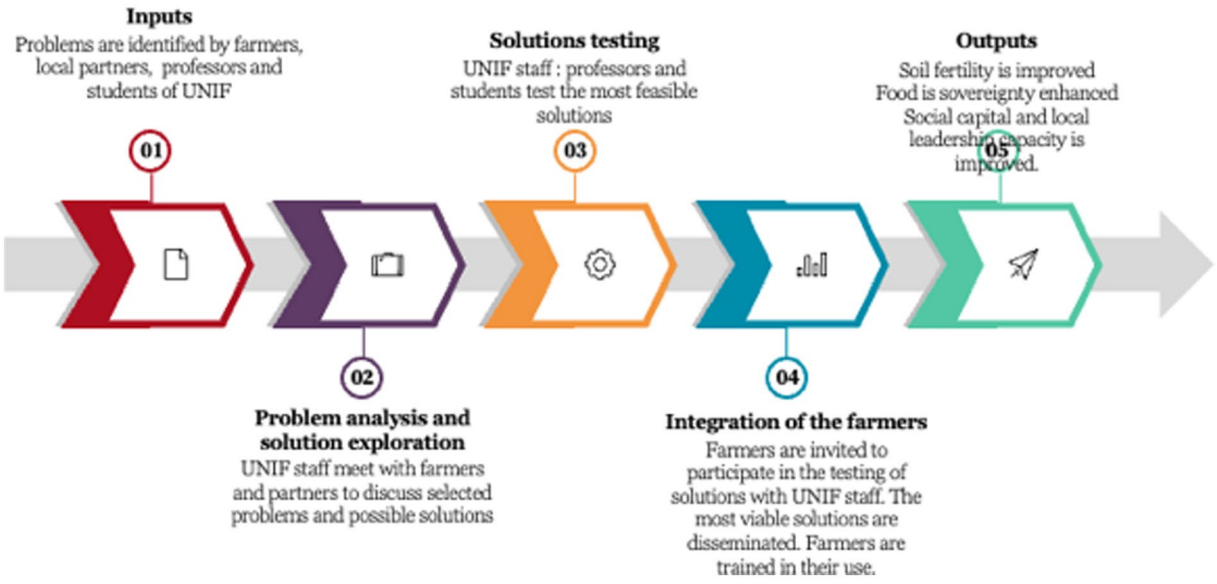

FIGURE 2
UNIF conception of agricultural change. Source: Scruggs et al. (2021).

consider the value/cost of their or family members' labor when evaluating their profit margins. As might be surmised, this situation often results in an inaccurate assessment of profitability. In any case, profit margins vary considerably among plots, as a result of the heterogeneous soils found on Haitian farmlands.

UNIF faculty are now exploring efforts to test the proposition that conventional agriculture is best practiced in the nation's plains, assuming the appropriate production factors and infrastructure can be attained, while respecting agronomic principles of water and soil fertility conservation. Meanwhile they are also examining whether agroforestry systems should be prioritized in the country's mountainous regions, within a conservation and sustainability framework. It should also be said that, as a higher education institution, UNIF is not focused exclusively on increasing food production or farm(er) profitability. Instead, its faculty are working also to develop paths toward food sovereignty. In this regard, UNIF's research activities should not be measured exclusively in terms of profitability and production. The University's contribution to farmers' vocational literacy and its promotion of cooperative practices, has also paved a path toward food sovereignty and increased social capital while also contributing to the creation of a generation of local leaders.

9. Conclusion and major lessons learned

UNIF faculty members' cooperative knowledge-generating and sharing activities have deepened farmers' agricultural literacy and provided opportunities for innovation. It is important to emphasize that, differently from international actors who tend to import new seeds and techniques with little consideration for grower preferences, UNIF is strongly connected with local farmers and its faculty routinely work in partnership with those whom they seek to serve.

The University of Fondwa's students are also a key asset for the mission of the University. They act as agents of development in their home communities, as they adopt and adapt in different regions of Haiti the innovations they learned at university. A study conducted by UNIF of its alumni in 2019 (unpublished UNIF report, 2019), found that not only do Fondwa alumni help the growers in which they reside to improve agricultural strategies, but they also often become members of grass roots organizations and cooperatives working for their development. Some become involved in local politics and are elected as CASECs, Chief of the Assembly of the Communal Section, the grassroots political subdivision within Haiti. In assuming these roles, alumni become active advocates for social change.

One of the major challenges UNIF now faces is to diversify its donor base further to ensure its financial stability. This support is necessary for an institution that cannot rely on state support, tuition, or donations from wealthy alumni. In any case, as two of the authors of this article have argued elsewhere, academic capitalism, when embraced in fragile higher education institutions, has been detrimental to the accomplishment of educational goals (Stephenson and Zanotti, 2017). Moreover, international NGO financial support is often not sufficient to bring about durable positive effects in the life of the populations the University serves. Indeed, as two of the authors of this article have argued, it may even shift local actors' foci to NGO donor priorities instead of the best interests of service recipients. This suggests the importance of NGOs being deeply rooted in the local communities they serve and accountable first and foremost to their populations (Zanotti, 2010; Stephenson and Zanotti, 2012). The population UNIF serves is among the most vulnerable in a country characterized by very high vulnerability and many of its service area subsistence farmers are enmeshed in a cycle of poverty transmitted across generations. By working persistently to develop knowledge and to share those findings in cooperatively informed ways, the University is furthering its mission to serve the farmers of its region and beyond. The local roots of the University of Fondwa's leaders and UNIF's

ongoing partnerships with growers, from the recruiting of students to its continual generation and testing of specific cropping and harvesting strategies with those farmers, has not only contributed to increasing Fondwa's farmer's resilience and improved food security, but, at the margin, it has also helped to close the social capital gap between the countryside and urban areas. Notwithstanding Haitian farmers' high level of illiteracy and relatively resistance to innovation due to the threat that failure poses to their survival, the case of the University of Fondwa suggests that offering these growers new knowledge in cooperative and collaborative ways can work catalytically to reduce inequality, not only by providing access to resources, but also, and perhaps more importantly, by creating a generation of rural community leaders cognitively equipped and open to lead needed change. In this sense, UNIF is contributing to the social change necessary for Haiti to secure food sovereignty as a nation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Virginia Tech Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

LJ: conceptualization and writing. MS and LZ: conceptualization, writing, and editing. SR: conceptualization. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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