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Sri Lanka, Sustainable Agriculture

Sustainable Agriculture and Education Against the Complexities of Sri Lankan Food Insecurity

Solving Food Insecurity in Sri Lanka

Sri Lanka is a beautiful island near India that boasts rich cultural heritage and a strong agricultural sector, but also struggles with food insecurity and poverty. This country's history with agriculture can tell a story about community and resourcefulness responding to environmental factors. But it can also tell a story of performative environmentalism and legislative mistakes causing widespread struggle. Reliance on agriculture in Sri Lanka is for consumption and for economic gain, making it imperative that farmers are supported in high production and low impact growing solutions.

Background: People, Land, and Climate

Sri Lanka, with gorgeous coasts, towering mountains, and even plains is home to 22,000,000 people (World Bank). These people highlight great diversity, adding different contributions to the agricultural sector. This ethnic, cultural, and religious diversity is mainly caused by the country's prime location for trade and colonization prior to gaining independence in the mid 20th century (Mihiranie S., Jayasighe J. K., Jayasighe C. V. L.). The main ethnic groups are Sinhalese, Tamil, and Muslim and the main religion is Buddhism although Hinduism is another ancient religion that is popular (Peiris and Arasaratnam). These different lifestyles all come together around food. In Sri Lanka, food is a shared connection in communities. Their tradition is to keep in touch with the nutritional, health-related, and therapeutic aspects of food products. There are many staples to Sri Lankan cuisine. The first is a starchy element such as milk rice, pittu, or boiled cassava roots. Accompaniments to this include curried cashew, malluma, or curried jackfruit seeds. This adds rich flavor and great nutritional value. Dessert can be dishes such as Asami, Kalu Dodol, and Mung Kevum (Mihiranie S., Jayasighe J. K., Jayasighe C. V. L.). These recipes are more than just sustenance, they're a product of hard work and deep traditions. Family life is also very important to the nation. Typically, multiple generations live together, and food is a way to pass down family traditions and share time together. Therefore, it's of the utmost importance to protect Sri Lankans' access to food, and by extension access to their family roots.

But food isn't just significant in a cultural sense, it's an essential part of many peoples' livelihoods. In fact, a quarter of the population relies on the Agriculture industry for employment and 40% of the land is set aside for farming (World Bank). These farmers are forced to be innovative with their farming methods. This is mainly due to the climate and water access. The Southwest quadrant of Sri Lanka is known as the 'wet zone' due to the heavy rainfall it experiences and the main monsoon season from May-September. Inversely, the rest of the

country is called the 'dry zone' and it's common there for droughts to last longer than 3 months (Peiris and Arasaratnam). This contrast in conditions means that while part of Sri Lanka is drowning in rainfall, other parts experience the negative effects of intense droughts. The monsoon seasons also cause variability in food security throughout the year, with times of prosperity and times of hunger occurring. An additional indicator of this challenge is Sri Lanka's place on the Global Climate Risk Index (UNDP). This means that climate change puts additional stress on the ecosystems of Sri Lanka. The most vulnerable communities here are feeling its effects the most as the country deviates from building water security.

Different environmental and geographical factors also cause a great difference in soil type. The 'wet zone' holds lots of red-yellow podzolic soil. This is characterized by high acidity and poor fertility for agricultural pursuits. The 'dry zone' has mainly reddish-brown earth soil. This red in color soil has a poor water-holding capacity but can be rich in certain nutrients making proper soil management imperative to the soil's fertility. Brown latosolic soils, found mostly in the Central Highlands, have a fertile top layer with lower levels tending to be leached of nutrients due to excessive rain. Probably the most favorable soil is the alluvial soil found along rivers. This soil is very fertile and can lead to high yields of healthy crops (Peiris and Arasaratnam). This means many villages in Sri Lanka, especially rural farming focused communities, are based around various water sources (UNDP). A redeeming quality about Sri Lanka's land in relation to agriculture is the excess of flat land. All in all, with proper management and government support, the country has the potential to successfully fill certain food needs of their people and produce surplus crops for export.

Problems With Food Security: Synthetic Fertilizer Ban of 2021

Addressing the problem of Sri Lankan food insecurity is already challenging for a few main reasons. These circumstances include the weather/geography, cultural norms, and the broader ethical concerns of sustainable agriculture vs. industrial farming. But issues of food insecurity in Sri Lanka were further complicated by the government's ban of agrochemicals in April of 2021, a change that happened suddenly without a proper bridge between old and new ways. Agrochemicals are defined as any pesticides and synthetic fertilizers. The difference between chemical and organic fertilizers is in how the nutrients are distributed. Chemical fertilizers deliver nutrients that are available to absorb immediately into the plants in a concentrated amount. Organic fertilizers hold lower content of nutrients that the soil must break down for plants to absorb, which improves long-term soil health (Stifel).

The results of the synthetic fertilizer ban were detrimental to the stability of Sri Lanka. A major economic crisis occurred in 2022 (World Food Programme). It had a massive impact on individual families, as well as the broader picture of the Sri Lankan economy. As far as the big picture goes, from 2021-2022 the GDP went down by a whole 3% (World Bank). Although this economic decline is attributed to many factors, such as Russia's invasion of Ukraine causing a spike in fuel and food prices and ongoing recovery from the COVID-19 pandemic, the synthetic fertilizer ban was crippling for the agriculture industry. In June of 2022, the food price inflation surpassed 75% and by July 38% of households in Sri Lanka were considered moderately or severely food insecure (ADB). Due to the plan's harmful outcomes, it was reversed after only 7 months in effect. But those 7 months were immensely consequential. During that time, rice

harvests dropped by 32% and tea production dropped by 18%. These shocking statistics just highlight the scale that this plan was impactful on. Furthermore, it's estimated that the loss of tea production and export during this time brought about \$425,000,000 of lost profit (Stifel).

Although some relief efforts helped early in the crisis, the percentage of the population living in food insecurity dipped and rose again after the relief dried up (World Food Programme). A shocking 90% of Sri Lankans reported skipping meals to save money during this time (Paul).

The statistics of the country say a lot. But the heartbreaking effects of this food crisis are best observed in the stories of individuals. The story of Naduni, an 18 year old at the time of the economic crisis, tells about struggles, setbacks, and ultimately perseverance. Naduni's father supported the family as a paddy farmer before the synthetic fertilizer ban. But the fuel shortages and rising operational costs of being a farmer resulted in him losing his job. This left her family struggling to put food on the table and survive. This had a terrible impact on Naduni's education. She was always top of her class, but the stress of this situation took her away from this. She said "I am mentally down all the time. I can't focus on my education anymore". Thankfully, Naduni had great support in her education and she used literature as a way to cope and find inspiring ways to problem solve in her situation. But getting out of this type of situation isn't the reality for many. The catastrophic effects of the synthetic fertilizer ban sent many women leaving the country to become domestic servants, typically ending the educational pursuits of their daughters back home as they pick up the slack left behind (Room to Read).

This is the kind of struggle that brought thousands of protesters pleading for government action in July of 2022. Many call the chemical fertilizer ban a 'humanitarian disaster' (Paul). This decision was mainly pushed by the president at the time, Gotabaya Rajapaksa, despite hefty opposition to this plan. After the disaster of this plan, he spent over 50 days "self exiled" in Singapore. Although unsuccessful, the intent to move away from synthetic fertilizers had valid drawing incentives. A major example of this is the problem with non communicable diseases, such as the chronic kidney disease epidemic. Agrochemicals have been proven to increase risk for these kinds of diseases. A synthetic fertilizer ban would also alleviate some pressure on foreign reserves that Sri Lanka was using on importing agriculture related chemicals (Stifel). Additionally, the heightened vulnerability of Sri Lanka to climate change makes going green look more favorable. Going completely organic would make Sri Lanka the first nation ever (Paul). But clearly, there's a reason such restrictive legislation doesn't dominate the global approach to agriculture. If a "sustainable farming" solution doesn't work for the farmers and communities it impacts, it isn't truly sustainable. With Sri Lankan people and the economy relying heavily on the jobs, profits, and products of the agricultural sector, the government must create policies to support growth and profitability for all while protecting the republic's access to economic liberty.

Finding Solutions

With the unique needs of farming in Sri Lanka's climate, integrating sustainable agriculture practices to be conscious of water supply and support soil health is key to improving the country's agriculture sector. Sustainable agriculture means using farming to meet the needs of existing and future generations (O'Connor). This entails striking a balance between using techniques that do good for the planet and paying mind to the financial needs of Sri Lankan people while not causing harmful disruption to culture or tradition. This kind of action has been

present, it just needs to take place on a larger scale and to be modernized with new science and technology that's emerged. The Veddā, a group indigenous to Sri Lanka, believe in the interdependency of the social, economic, environmental, and spiritual systems (Mihiranie S., Jayasighe J.K., Jayasighe C.V.L.). This belief is important to solving Sri Lanka's food insecurity problems in a productive way. It should be noted that each component of a successful and stable country will impact each other. Too much change in any category can throw off the balance of the whole. This group's commitment to balance between the human-forestry relationship and the health of their people is admirable. In the end more lenient efforts, in contrast with the all-or-nothing approach of the government's agrochemical ban, leave room for variation in needs and will produce more successful outcomes. Sustainable farming will look different region by region, as many different conditions and needs present themselves throughout the country.

Rice production is arguably the most important to Sri Lanka. This staple food is one that they are nearly self-sufficient in producing to meet the needs of the nation (Mihiranie S., Jayasighe J.K., Jayasighe C.V.L.). During colonization schemes early in Sri Lanka's history, 248,000 acres of land in the dry zone were allotted just to paddy farming, the plant that holds the rice grain (Peiris and Arasaratnam). A 2016 study showed that rice alone fills 45% of the caloric needs of the country and 40% of the protein needs. This makes it clear that using sustainable approaches for paddy farming is a high priority. Rice growing is split into two seasons. The 'Yala' season is the dry season and the 'Maha' is the wet season (Mihiranie S., Jayasighe J.K., Jayasighe C.V.L.). Each of these times has unique needs and will therefore benefit from different sustainable practices.

During the 'Yala' season water conservation takes center stage. Drip irrigation and compost use are the most fitting sustainable practices during this time. Drip irrigation is a system that can be installed to deliver water directly to the roots of a crop. Paddy fields typically utilize basin irrigation, where fields are flooded to hold water in the growing area. This can result in uneven irrigation and water waste, where drip irrigation can be more precise and waste less water. This is crucial when there's less water availability in the 'Yala' season. Composting is when decomposed organic matter is used as fertilizer. This has been shown to improve the soil's water-holding capacity (Foodwise). Increased water-holding capacity is a huge benefit during the 'dry season' to conserve water. Compost is an excellent way to make farming more sustainable while protecting the economic side of agriculture. It is, however, a solution where some limitations must be acknowledged. A study examined by the International Water Management Institute showed that even using all of the urban waste compost, manure, fecal sludge, and paddy straw available in Sri Lanka, they would fail to meet the Nitrogen requirements needed for rice by 50% (Stifel). That is just considering rice production. This just means that compost is a contribution to sustainable farming, not a "fix-all" kind of solution. Other fertilizer needs can be filled by importing organic fertilizer and when necessary chemical fertilizers being used in moderation. At the end of the day, the more compost is utilized, the more healthy rice production will be.

In the 'Maha' wet season, Soil health should be the main priority. Use of cover crops and conservation tillage can be very effective techniques to aid in paddy farming. The method of cover crops involves planting a different kind of crop in the offseason of a field. The main benefit of using cover crops is that it lets the soil naturally replenish its nutrients. The crops used must

be picked strategically, as different plants have different nutritional needs. Clover, turnips, and radishes are commonly used as cover crops for paddy growing. In addition to the increased soil fertility and organic matter, this practice can also reduce weeds. Conservation tillage is another farming technique that promotes healthy soil. This can entail lower frequency tilling or using special kinds of plows to only partially till the soil in a field. To be considered conservation tillage, there must be at least 30% of crop residue remaining on the surface of the soil. In the 'wet season', the reduction of soil erosion that conservation tilling offers is of great benefit (Foodwise). Since rice is so important to Sri Lanka's culture and self-reliance, using these methods can help to increase yields and overall health of paddy even with difficult changing weather conditions.

Although rice is a big deal in Sri Lanka, most of the farmers' earnings through crop export are from tea. They're especially known for their world famous Ceylon Black Tea (Mihiranie S., Jayasighe J.K., Jayasighe C.V.L.). It can be beneficial to use sustainable practices for all crops, it's just important to know which practices are helpful in which conditions.

For the 'wet zone', monsoons and heavy rainfall are experienced. This area is known to have a dense population, holding most of the 20% of urban inhabitants in the country (Peiris and Arasaratnam). This has a result of less arable land and difficult natural conditions to navigate. In addition to the cover crops and conservation tillage that would benefit paddy farming in the 'Maha' season, rotational grazing is an outstanding way to use the cards dealt to the 'wet zone' in a strategic way. This is when you move livestock between fields throughout the growing season. This is a mutualistic relationship between the crops, livestock, and even the land. Typically, this is done with cattle, but the large religions dominating Sri Lanka mean that the country has low meat consumption and even lower beef consumption. In fact, a whole 70% of Sri Lanka's animal protein intake comes from fish. The other makeup of animal protein supply is mainly from chickens and goat meat (Mihiranie S., Jayasighe J.K., Jayasighe C.V.L.). Both chickens and goats are great contenders for rotational grazing, meaning this practice won't disrupt cultural normalcy. As the livestock feed on the field, it trains the soil into higher water absorption, which decreases water runoff. This is relevant to the climate of the 'wet zone' because water runoff can strip nutrients from the soil. The livestock will also add to the organic matter of the field, decreasing reliance on fertilizer. These benefits will help the overall soil health of the field. (Foodwise). Overall, this is a way to use a piece of land for multiple purposes. It's a very helpful way for farmers to make money when land resources are scarce.

For the 'dry zone' in Sri Lanka, similar practices can be used as in the 'Yala' season. Drip irrigation for example, can be effective for other kinds of crops as well. While drip irrigation would replace basin irrigation in paddy farming, it can replace irrigation through conventional sprinkler systems for other crops. In fact, it can save up to 80% more water while increasing yields (Foodwise). This is because sprinkler irrigation creates great water loss from evaporation. This method is probably the most favorable when trying to conserve water, but it does carry an expensive initial cost, which might not be achievable for all farmers. Irrigation scheduling is a free alternative that can also provide water saving effects, just on a smaller scale. This is simply watering crops during the night when the temperature is cooler. This lowers the rate of evaporation and gives water time to seep into the soil. These procedures are particularly important for Sri Lankan farming since the country's water stress is at 90% (UNDP). This means that 90% of the available water resources are being used. It's of great importance to save water

when possible and these ways of incorporating sustainable farming are an excellent way to do that.

No matter which crops are being produced or which weather conditions are occurring, the goal for a new era of farming in Sri Lanka is to produce as many crops as possible, in the most sustainable way possible. This heightens opportunities for exporting goods after filling local needs, which ultimately means more money in the hands of farmers.

Implementation

The key to implementing these sustainable agriculture practices is gradual change and utilizing natural incentives and education to bridge the gap between old and new methods of farming. In the beginning phases of big changes like these, moderation is important. Small steps forward are still steps forward. The foremost thought here is working with nature, rather than against it (O'Connor). To grasp the scope of how changes in the agricultural sector affect Sri Lankan people, it can be helpful to examine the country's multidimensional vulnerability index (MVI). MVI is a way to show different areas that put people in a vulnerable position of falling into poverty. It's split into the Education, Health/Disaster, and Living Standards categories. Each section has even more subcategories. There are two main MVI concerns in Sri Lanka as of a 25,000 household survey in 2023. Almost 50% of the population is vulnerable in the "Adaptive Capacity to Disaster" section. This means that they would struggle to cope with the effects of a disaster. In a place with such unpredictable weather, especially with their heightened risk to climate change, having a stable food supply is a game changer in the event of an emergency. Using the proper farming methods to work with the natural ecosystem better a community's access to food sources and a farmer's security to dependable income. This is necessary to bounce back from a disaster. Sustainable farming is a solid way to improve upon this statistic. The other very concerning MVI statistic is that 35% of the population is vulnerable in the "Water Source" category. Although it's impossible to control how much water is available in the country, it's very important to be calculated about how water resources are used. Once again, the sustainable farming practices can help to conserve water making widespread access to water more available (UNDP). It has also been shown that sustainable farming implemented in developing countries has an impact on poverty reduction by 2-3x the effectiveness of the equivalent growth in different industries. Additionally, revenue from agriculture contributed 52% to poverty reduction in developing nations. Within four years of introducing these sustainable agriculture methods, harvests could improve by about 80% (Zamarelli). The benefits of sustainable farming speak for themselves. It's just a matter of making these facts widely known and providing resources for implementing sustainable agriculture methods.

That will always start in the classroom and with the generations to come. Rather than asserting control, the government should work with current and future farmers to become more sustainable, a lesson clearly learned in 2021. Sustainable agriculture is all about lasting through the test of time. A focus on education is crucial. Agriculture is a wide source of employment in Sri Lanka, so informing children in school about the benefits of sustainable agriculture leads to a successful farm of the future. It's simple to implement this into the science curriculum. Plus, these topics are interesting and relevant, which makes attending school feel worthwhile. Most of the population of farmers are supportive of a gradual change to sustainable agriculture (Stifel).

It's just a matter of taking that leap into a revolutionized version of Sri Lankan agriculture. It's about lowering dependency on agrochemicals and mindfully using the resources from the beautiful place that Sri Lanka is. With these steps and time, healthy food in Sri Lanka can become more accessible to the general population.

Closing Remarks

Although hardships in the agriculture world are bound to occur, the need to put food on the table for one's family will persist everywhere, in all conditions. Providing widespread access to healthy food is a very achievable goal in Sri Lanka. By using sustainable farming methods, the resilient people of Sri Lanka can establish a booming agriculture sector and have a positive impact on the global state of the environment. But they can't be expected to improve upon the climate crisis alone. The world continues to see many developing countries take the negative effects of climate change through unpredictable monsoons, droughts, and shocking temperatures. This is despite their much smaller negative impacts on the environment compared to larger and more developed nations. It's important for all countries, especially those with the most shocking carbon emissions to do their part. With these changes, Sri Lanka can move towards a more sustainable tomorrow for the amazing people that call it home.

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