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An Investigation of Pineapple Farmers' Experiences During the COVID-19 Pandemic Restrictions In Trinidad: Perceptions And Repsonses to Production and Marketing Challenges

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Abstract

This study, conducted in 2021, surveyed seventy pineapple farmers, representing 41.6% of the county's pineapple farming community, to assess their experiences regarding pineapple cultivation during the COVID-19 pandemic. Additionally, the study explored farmers' knowledge, perceptions, and attitudes toward issues encompassing weeds, soil erosion, food security, and food safety. Findings revealed that 51.4% of the farmers encountered challenges accessing planting materials and agricultural chemicals, while an equal percentage faced labour shortages. Moreover, 60% of the farmers reported sudden disruptions, with 54.3% having to dispose of a portion of their produce due to limited marketing and storage capabilities during the pandemic lockdown. The survey results further demonstrated no significant disparities (P=0.194) in farmers' knowledge, (P=0.117) perception, or (P=0.428) attitude towards issues related to weeds, soil erosion, food security, and food safety across different districts. In conclusion, this study highlights that pineapple farmers confronted various disruptions, including the escalating costs of agricultural inputs, constrained market access, and income loss, all attributable to the impact of the COVID-19 pandemic.

Keywords: farm operations, pineapple farmers, COVID-19 pandemic, sudden shocks, perception

Une enquête sur l'expériences des producteurs d'ananas pendant les restrictions de la pandémie de COVID-19 à Trinidad : Perceptions et réponses aux défis de production et de commercialisation

Résumé

Cette étude, menée en 2021, a interrogé soixante-dix producteurs d'ananas, représentant 41,6 % de la communauté agricole d'ananas du comté, pour évaluer leurs expériences pendant la pandémie de COVID-19 en matière de culture d'ananas. En outre, l'étude a exploré les connaissances, les perceptions et les attitudes des agriculteurs à l'égard de questions telles que les mauvaises herbes, l'érosion des sols, la sécurité alimentaire et la salubrité alimentaire. Les résultats ont révélé que 51,4 % des agriculteurs ont rencontré des difficultés pour accéder au matériel végétal et aux produits chimiques agricoles, tandis qu'un pourcentage égal a été confronté à une pénurie de main-d'œuvre. De plus, 60 % des agriculteurs ont signalé des perturbations soudaines, et 54,3 % ont dû se débarrasser d'une partie de leurs produits en raison de capacités limitées de commercialisation et de stockage pendant le confinement dû à la pandémie. Les résultats de l'enquête n'ont en outre démontré aucune disparité significative (P = 0,194) dans les connaissances des agriculteurs, (P = 0,117) dans leur perception ou (P = 0,428) dans leur attitude à l'égard des problèmes liés aux mauvaises herbes, à l'érosion des sols, à la sécurité alimentaire et à la salubrité alimentaire dans différents districts. En conclusion, cette étude souligne que les producteurs d'ananas ont été confrontés à diverses perturbations, notamment la hausse des coûts des intrants agricoles, un accès limité au marché et une perte de revenus, toutes imputables à l'impact de la pandémie de COVID-19.

Mots-clés : exploitations agricoles, producteurs d'ananas, pandémie de COVID-19, chocs soudains, perception

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1.0 Introduction

In March 2020, Trinidad and Tobago, like many other regions, implemented COVID-19 pandemic restrictions that significantly impacted various sectors of the economy. While essential services, including the wholesale and retail food sector, were allowed to operate, the agricultural community, particularly pineapple farmers, faced unique challenges due to stringent movement restrictions and health and safety concerns. These lockdown measures had far-reaching effects on the economy, leading to a decline in production and marketing efforts (Kabir & Chowdhury, 2023). Similar situations were observed globally and across the Caribbean (Blazy et al., 2021; Daley et al., 2022; Haqiqi & Horeh, 2021; OECD, 2021; Pu & Zhong, 2020; Mussell et al., 2020).

Pineapple farming, distinguished by its labour-intensive nature and substantial reliance on various agricultural inputs for weed, soil, and nutrient management, presented distinct challenges during the pandemic. Unlike quick-to-market crops such as vegetables, pineapple cultivation follows a longer production cycle, raising

concerns among farmers about potential disruptions in planting schedules and the subsequent impact on fruit volumes and prices. The extended production cycle also posed the risk of increased competition from imported alternatives in the local market.

The highly transmissible nature of COVID-19, primarily through close contact during interactions, posed a significant health risk to farmers, their families, and the agricultural workforce as a whole (Bochtis et al., 2020). The closure of schools and the shift to online education further complicated matters, particularly in rural areas with limited internet access, device availability, and literacy gaps among caregivers, hindering the adjustment.

Pineapples, being climacteric fruits, have a relatively short shelf-life following harvest. Typically harvested in the mature green stage, they offer some flexibility for delayed ripening. However, the pandemic's transmission risk and labour-related challenges could lead to reduced maintenance, resulting in lower crop quality and quantity during the study period.

The pandemic-induced disruptions also extended to the supply chain, including increased costs and reduced availability of essential agricultural inputs such as insecticides and pesticides in developing countries (Workie et al., 2020; Food and Agriculture Organization [FAO], 2020). Transportation costs surged, hindering efforts to combat pest infestations and threatening food security in affected regions (Gray, 2020).

Transportation challenges further affected pineapple farmers in Victoria County, who relied on their vehicles for transporting inputs, labour, tools, and produce to markets, including farm gate sales. Consequently, mobility issues compounded existing difficulties faced by farmers during the lockdown.

Farmers also grappled with farm management and reduced market access due to competition from online sales and innovative marketing strategies (Martinez et al., 2020). Pineapple sales online were primarily limited to entrepreneurs offering fresh vegetable assortments, resulting in smaller quantities of pineapples sold.

The implementation of a 6:00 p.m. curfew, coupled with challenges at markets and in marketing, reduced farmers' time spent on their farms, creating opportunities for theft. Despite heightened security measures, praedial larceny increased during the lockdown, affecting farmers' livelihoods.

Post-harvest losses were also observed due to mechanical, physiological, and pathological factors, primarily attributed to the manual harvesting process and inadequate storage methods (Alabi et al., 2021; Mthembu et al., 2022). Delays in getting fruits to consumers due to lockdown restrictions exacerbated these losses, impacting the quality of fruits sold to the public.

Given the cohesive nature of the pineapple farming community in Victoria County, characterized by a relatively small labour pool, similar production practices, common marketing channels, and shared environmental factors, the study aims to assess farmers' knowledge, perception, and responses to various issues, particularly related to food security and food safety. Unlike other crop or vegetable farming, successful pineapple cultivation relies on timely maintenance interventions. This study thus provides insights and recommendations for addressing future pandemics and exogenous risks that may impact pineapple production and the livelihoods of Victoria County’s farmers.

2.0 Methodology

With the support of the Victoria County Agricultural Office of the Ministry of Agriculture, Land and Fisheries, production data and contact information were obtained to identify all registered farmers who cultivated pineapples throughout the six agricultural districts in the region, namely Moruga, Tableland, Princes Town, Piparo, Barrackpore and Bonne Aventure. Contacting farmers who were not registered was a challenge since the government department had no official records of those persons. Consequently, this study surveyed 70 out of 168 or 41.6% of registered pineapple farmers randomly selected using an Excel random table generator. Of their willingness to participate, pineapple farmers were interviewed over a two-month (May/June) period in 2021.

The survey instrument was administered in person and on the farm. It focused on farmer experiences as it relates to production and marketing, addressing issues in relation to crop management activities such as weed management, labour use and availability, soil conservation, food safety and food security during the COVID-19 pandemic lockdown. Data and information were also collected on their farm business as it relates to the cost and availability of agrochemicals, tractors and other hired services, including transportation. The purpose of the survey was to identify the extent of issues experienced relating to the cultivation and management of their pineapple crops and marketing during the pandemic lockdown period.

The study originated from The University of the West Indies, St. Augustine Campus, where the survey instrument was designed and approved by the Department of Food Production. The data collected included descriptive statistics and were analyzed using SPSS version 27. All statistical analyses were conducted according to the recommended procedures.

3.0 Results

3.1. Characteristics of Pineapple Farmers in Victoria County

The farmers interviewed throughout the Victoria County districts were asked questions relating to their personal characteristics. The data obtained is represented in Table 1.

The survey results indicated that of the 70 farmers surveyed, 47.1% were from the Tableland District, which generally had the highest number of farmers in the county overall. The second highest number of farmers were from the Princes Town District and comprised 15.7% of the farmers surveyed, while 14.3 % were from the Barrackpore District. In the Bonne Aventure District, 10% of the farmers were surveyed, while the lowest number of pineapple farmers surveyed were in the Moruga District and Piparo District at 8.6% and 4.3%, respectively.

In terms of the length of time the respondents have been cultivating pineapples, the results indicated that 48.6% of the farmers interviewed had planted pineapples between one to five years, while 20% stated that they have been farming between five to 10 years and 21.4% stated that they were farming between 10 to 20 years. Ten percent of the farmers interviewed stated that they had been cultivating pineapples for more than 21 years.

Table 1. *Characteristics of Respondents*

Characteristics	Frequencies	Percentage
1. Districts		
Moruga	6	8.6
Tableland	33	47.1
Princes Town	11	15.7
Piparo	3	4.3
Barrackpore	10	14.3
Bonne Aventure	7	10.0
2. How long have you been a pineapple farmer?		
1-5 years	34	48.6
> 5-10 years	14	20.0
> 10-20years	15	21.4
> 21 years	7	10.0
3. Ownership status of farm		
Full ownership	24	34.3
Family owned	22	31.4
Rent or leased state land	11	15.7
Rent or leased private land	6	8.6
Other ownership	7	10.0
4.What is your age?		
18 - 24years	2	2.9
25 - 34 years	6	8.6
35 - 44 years	18	25.7
45 -54 years	18	25.7
55 -64 years	22	31.4
>65 years	4	5.7
5. Gender		
Male	65	92.9
Female	5	7.1
6. Highest level of education attained		
Primary	15	21.4
Secondary	36	51.4

Characteristics	Frequencies	Percentage
Vocational/Technical	6	8.6
Tertiary (College and University)	6	8.6
No formal education	7	10.0
7. What is your household income?		
1001 -9999 dollars	43	61.4
10000 - 19999 dollars	19	27.1
20000 - 29999 dollars	6	8.6
30000 - 49999 dollars	2	2.9
8. Are you the sole breadwinner?		
No	19	27.1
Yes	51	72.9

Farmers were asked about the ownership status of their pineapple farms, and the results indicated that 34.3% of the farmers had full ownership, while 31.4% were cultivating family-owned lands. Fifteen point seven percent (15.7%) of the farmers were on rented or leased state lands, while 8.6% were on rented or leased private lands. Farmers who had no land tenure for their pineapple cultivation either refused to give that information or were squatting on state or private lands; this accounted for 10% of the farmers interviewed.

The farmers' age group ranged from 18 years to greater than 65 years, and of the farmers interviewed, 2.9% ranged from 18 to 24 years, while 5.7% were older than 65 years. Eight point six percent (8.6%) of the farmers were between 25 and 34 years, while 25.7% were between 35-44 and 45-64 years old, respectively. Thirty-one point four percent (31.4%) of the farmers interviewed were between the ages of 55-64 years old. It should also be highlighted that 92.9 % of the farmers interviewed were males and 7.1% were females.

The majority of the respondents, which comprised 51.4% of the farmers, achieved secondary school qualifications. An educational achievement at the tertiary level and vocational/ technical education were both at 8.6%. The second highest percentage of education was at the primary school level at 21.4%. Ten percent (10%) of the farmers interviewed did not have any formal education.

The figures obtained may be questionable since farmers may not have been inclined to disclose their true income, the responses were generally less than USD $9,999(61.4%). The second highest level of income of between $10, 000.00 USD to $19, 999.00 USD was accrued by 27.1% of the respondents, while 8.6% of the farmers stated they earned between $20, 000.00 USD to $29, 999.99 USD. The minority of 2.9% indicated that they earned more than $30, 000.00 USD. Almost three-quarters (72.9%) of the respondents stated that they were the main breadwinners in the home compared to 27.1% who indicated that they were not the main breadwinners.

3.2 Disruptions During the COVID-19 Pandemic

Table 2 shows that 36 farmers experienced disruptions in accessing planting materials and chemicals during the COVID-19 pandemic compared to 34 farmers who did not experience disruptions to access planting materials and chemicals during the pandemic. The data shows that of the 51.4% of the farmers who experienced disruptions, 25.7% lived in the Tableland district, 8.6% in Bonne Aventure, 7.1% in Princes Town, and 1.4% in the Piparo District. In the Moruga and Barrackpore Districts, 4.3% experienced disruptions respectively in each district.

Table 2. Table 2. *Responses to Farmers' Ability to Access Planting Materials and Chemicals During the Pandemic*

		Districts						Total
		Moruga	Tableland	Princes Town	Piparo	Barrackpore	Bonne Aventure	
Disruption accessing planting material and chemicals during COVID 19	No	4.3%	21.4%	8.6%	2.9%	10.0%	1.4%	48.6%
	Yes	4.3%	25.7%	7.1%	1.4%	4.3%	8.6%	51.4%
Markets stores were closed	No	8.6%	32.9%	11.4%	4.3%	14.3%	5.7%	77.1%
	Yes	0.0%	14.3%	4.3%	0.0%	0.0%	4.3%	22.9%
Lack of transportation	No	8.6%	45.7%	15.7%	4.3%	14.3%	8.6%	97.1%
	Yes	0.0%	1.4%	0.0%	0.0%	0.0%	1.4%	2.9%
Movement restriction (curfew)	No	4.3%	27.1%	11.4%	2.9%	14.3%	1.4%	61.4%
	Yes	4.3%	20%	4.3%	1.4%	0.0%	8.6%	38.6%
Security concerns	No	5.7%	40.0%	12.9%	4.3%	14.3%	2.9%	80.0%
	Yes	2.9%	7.1%	2.9%	0.0%	0.0%	7.1%	20.0%
Health and safety concerns	No	4.3%	27.1%	8.6%	2.9%	12.9%	2.9%	58.6%
	Yes	4.3%	20.0%	7.1%	1.4%	1.4%	7.1%	41.4%
Loss of income	No	8.6%	42.9%	14.3%	4.3%	11.4%	8.6%	90.0%
	Yes	0.0%	4.3%	1.4%	0.0%	2.9%	1.4%	10.0%
Other disruptions	No	8.6%	40.0%	14.3%	4.3%	14.3%	10.0%	91.4%
	Yes	0.0%	7.1%	1.4%	0.0%	0.0%	0.0%	8.6%
Total		**8.6%**	**47.1%**	**15.7%**	**4.3%**	**14.3%**	**10.0%**	**100.0%**

Across all districts, the types of disruptions experienced included market closures. Sixteen farmers (22.9%) of the respondents stated they experienced issues with market closures, while 54 farmers (77.1%) indicated they did not have issues with market closures. Another disruption encountered included a lack of transportation to carry goods to the markets. The result showed that 68 farmers (97.1%) did not have issues, while two (2.9%) experienced problems to transport their produce. During the lockdown period there was a curfew in effect, and 27 farmers (38.6%) indicated that the curfew disrupted their operations, while 43 farmers (61.4%) stated they were not affected by it. Farmers identified that security concerns also caused disruptions, as 14 farmers (20%) stated they had those concerns, and 56 farmers (80%) indicated they had no security concerns at the time. During the pandemic, 29 farmers (41.4%) had health and safety concerns while 41 farmers (58.6%) stated that they had no such concern. Loss of income was another variable investigated, and 63 farmers (90%) indicated they were not affected while seven (10%) indicated they lost income. Finally, in terms of other disruptions, 64 farmers (91.4%) indicated no to that question while six (8.6%) stated they had other disruptions.

4.0 Knowledge

4.1 Farmer Interviews on Aspects of the Availability of Planting Materials

The data collected for this section were used to determine if farmers had constraints obtaining pineapple plants during the pandemic. Twenty-five farmers had difficulty obtaining pineapple planting materials, while 45 farmers did not have any issues to obtain pineapple planting materials during the pandemic.

Table 3 shows that 25 farmers (35.7%) interviewed had constraints in obtaining planting materials, and 17.1% indicated that insufficient planting materials and poor quality planting materials were the main issues relating to planting materials availability. Forty-five farmers (64.3%) indicated that they did not have constraints in obtaining planting materials. Table 3 also indicates that in all districts, except Moruga and Bonne Aventure, the majority of farmers stated that they did not have constraints to obtain planting materials during the pandemic.

4.2 Farmers' Ability to Deal with Issues of Labour Availability During The Pandemic Lockdown

Table 4 highlights the farmers' responses to the question about their experiences with labour shortages on their farms during the COVID-19 pandemic. It also identifies the sources of labour farmers utilized and the nationalities of those labour sources. Thirty-six (51.4%) of the farmers interviewed stated that they experienced labour shortages, while 34 (48.6%) stated that they did not have any labour shortage issues during the COVID-19 pandemic. By district, farmers who indicated labour shortages during the pandemic lockdown included Tableland (21.4%), Princes Town (10%), Bonne Aventure (7.1%), Piparo (1.4%), Moruga and Barrackpore at 5.7%, respectively.

Table 3. *Issues Relating to the Availability of Planting Materials During the Pandemic*

		District						**Total**
		Moruga	Tableland	Princes Town	Piparo	Barrackpore	Bonne Aventure	
Did you have constraints obtaining pineapple plants?	No	2.9%	32.9%	12.9%	2.9%	11.4%	1.4%	64.3%
	Yes	5.7%	14.3%	2.9%	1.4%	2.9%	8.6%	35.7%
Reasons for constraints	no constraints	2.9%	32.9%	12.9%	2.9%	11.4%	1.4%	64.3%
	Accessibility of same variety	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	1.4%
	Poor quality planting material	2.9%	7.1%	1.4%	0.0%	1.4%	4.3%	17.1%
	Insufficient planting material	2.9%	5.7%	1.4%	1.4%	1.4%	4.3%	17.1%
Total		**8.6%**	**47.1%**	**15.7%**	**4.3%**	**14.3%**	**10.0%**	**100.0%**

The percentages of farmers who stated that there were no shortages of labour during the pandemic included Tableland (25.7%), Barrackpore (8.6%), and Princes Town (5.7%), while Moruga, Bonne Aventure and Piparo were recorded at 2.9%, respectively. It was observed that the districts that experienced the highest labour shortages were Moruga, Princes Town and Bonne Aventure, while those with lower labour shortages were Tableland, Piparo and Barrackpore.

From the responses of those farmers who answered "yes" to the question of how they adjusted to the labour shortages, it was recognised (see Table 4) that the majority of farmers interviewed—which comprised 31(44.3%) of farmers—did not think that the question applied to them. Four (5.7%) farmers hired family labour, while six (8.6%) hired local labour, five (7.1%) did nothing and one (1.4%) farmer answered "other," which was not identified. The remaining 23 (32.9%) farmers hired migrant labour to assist with labour shortages during the pandemic.

Table 4 also shows that the majority of respondents chose to hire migrant labour in the districts of Tableland, Moruga, and Princes Town, while farmers of Bonne Aventure and Barrackpore hired family labour for work during the pandemic. It was evident that for 42 (60%) farmers, the question was not applicable, while the remaining 18 (25.7%) farmers indicated that they hired persons of Venezuelan nationality, four ((5.7%) persons preferred not to say and three (4.3%) persons stated their labour was sourced from other nationalities—two (2.9%) from the Eastern Caribbean and one (1.4%) from Guyana.

Table 4. Issues Relating to Labour Supply During the Pandemic

		District						
		Moruga	Tableland	Princes Town	Piparo	Barrackpore	Bonne Adventure	**Total**
Did you experience labour shortages on your farm during COVID-19?	No	2.9%	25.7%	5.7%	2.9%	8.6%	2.9%	48.6%
	Yes	5.7%	21.4%	10.0%	1.4%	5.7%	7.1%	51.4%
If yes to question 15, how did you adjust?	Question does not apply	2.9%	22.9%	4.3%	2.9%	8.6%	2.9%	44.3%
	Hired family labour	0.0%	1.4%	0.0%	0.0%	1.4%	2.9%	5.7%
	Hired local labour	1.4%	2.9%	1.4%	1.4%	0.0%	1.4%	8.6%
	Hired migrant labour	2.9%	12.9%	10.0%	0.0%	4.3%	2.9%	32.9%
	Did not do anything	1.4%	5.7%	0.0%	0.0%	0.0%	0.0%	7.1%
	Other	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	1.4%
Nationality of hired labour	Question not applicable	5.7%	28.6%	4.3%	4.3%	10.0%	7.1%	60.0%
	Guyana	0.0%	0.0%	1.4%	0.0%	0.0%	0.0%	1.4%
	Eastern Caribbean	0.0%	0.0%	2.9%	0.0%	0.0%	0.0%	2.9%
	Venezuela	2.9%	11.4%	4.3%	0.0%	4.3%	2.9%	25.7%
	Prefer not to say	0.0%	4.3%	1.4%	0.0%	0.0%	0.0%	5.7%
	Other nationalities	0.0%	2.9%	1.4%	0.0%	0.0%	0.0%	4.3%
Has hiring of migrant labour increased production?	No	5.7%	27.1%	7.1%	2.9%	11.4%	5.7%	60.0%
	Yes	2.9%	14.3%	8.6%	0.0%	2.9%	2.9%	31.4%
	Don’t know	0.0%	5.7%	0.0%	1.4%	0.0%	1.4%	8.6%
Total		**8.6%**	**47.1%**	**15.7%**	**4.3%**	**14.3%**	**10.0%**	**100%**

From the data it was evident that labour from Venezuela were the most hired. Eight farmers (11.4%) from Tableland, three (4.3%) from Princes Town and Barrackpore, respectively, two (2.9%) from Moruga and Bonne Aventure Districts, respectively, also hired Venezuelans as hired labour. Two (2.9%) farmers from Princes Town indicated that they hired labour from the Eastern Caribbean, while one farmer from the same district hired Guyanese labourers.

Farmers responded to whether they felt that hiring migrant labour increased production. Table 4 also suggests that of the 22 (31.4%) of farmers stated persons that there was an increase in production due to the employment of other sources of labour. Six (8.6%) farmers stated that they could not determine if using hired labour increased their production levels, while 42 (60%) indicated that hiring migrant labour did not increase production.

In the district of Tableland, ten (14.3%) farmers interviewed was the highest response received, followed by the district of Princes Town with six farmers (8.6%), while two farmers each in the districts of Moruga, Barrackpore and Bonne Aventure accounted for 2.9%, respectively, of the farmers who responded with "yes" to the question.

5.0 Perception

5.1 Farmers' Responses and Perception of Praedial Larceny

Table 5 shows that 44 (62.9%) of the farmers interviewed did not experience farm theft, compared to 25 (35.7%) farmers who experienced farm theft and one (1.4%) farmer who did not know if farm theft occurred on his holding during the lockdown. Table 5 infers that farm theft occurred in the Tableland District, where eight respondents (11.4%) were affected. In the district of Barrackpore, six farmers (8.6%) were affected while in Bonne Aventure, five farmers (7.1%) of those who responded affirmatively were affected. In the Princes Town and Piparo Districts, three farmers (4.3%) in each district were affected, respectively. It was noted that from the data assessed, no farmers in the Moruga District were victims of praedial larceny during the pandemic.

Farmers were also asked whether they perceived that farm theft would have increased over the pandemic even though they were not victims themselves. Table 5 indicates that 42 (60%) farmers were of the opinion that farm theft had increased during the pandemic; 16 of these (22.9%) were from the Tableland District, eight (11.4%) from the Barrackpore District; seven (10%) from the Bonne Aventure District; five (7.1%) from the Princes Town District, and three (4.3%) resided in the Moruga and Piparo districts.

In the district of Tableland, 11 farmers (15.7%) did not think that farm theft increased, while in the Princes Town District, six (8.6%); in Moruga three (4.3%) farmers, and in Barrackpore one (1.4%) of the farmers who answered, did not believe farm theft increased during the pandemic. Finally, farmers were asked if they implemented any bio-security measures on their farms. The results showed that 59 (84.3%) of farmers did not implement measures, while 11(15.7%) stated that they implemented bio-security measures on their farms.

Table 5. *Farmers' Perceptions of Praedial Larceny During the Pandemic*

		District						
		Moruga	Tableland	Princes Town	Piparo	Barrackpore	Bonne Aventure	**Total**
Have you experience farm theft during COVID 19?	No	8.6%	35.7%	11.4%	0.0%	5.7%	1.4%	62.9%
	Yes	0.0%	11.4%	4.3%	4.3%	8.6%	7.1%	35.7%
	Don't know	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	1.4%
Has farm theft increased during COVID 19?	No	4.3%	15.7%	8.6%	0.0%	1.4%	0.0%	30.0%
	Yes	4.3%	22.9%	7.1%	4.3%	11.4%	10.0%	60.0%
	Don't know	0.0%	8.6%	0.0%	0.0%	1.4%	0.0%	10.0%
Have you implemented bio-security measures on your farm?	No	8.6%	41.4%	12.9%	2.9%	11.4%	7.1%	84.3%
	Yes	0.0%	5.7%	2.9%	1.4%	2.9%	2.9%	15.7%
Total		**8.6%**	**47.1%**	**15.7%**	**4.3%**	**14.3%**	**10.0%**	**100.0%**

6.0 Responses

6.1 Farmers' Responses to Shocks Faced During the Pandemic

To the question posed in this section of the survey, 42 (60%) pineapple farmers stated that they experienced sudden shocks, while 27 (38.6%) stated they had no shocks during the pandemic. One (1.4%) farmer indicated he did not know if he experienced any sudden shocks. The major causes of shock recorded were loss of employment as four (5.7%) farmers indicated they lost their job; loss of income 12 (17.1%); increased price of agricultural inputs 31 (44.3%); death of household members 2 (2.9%); sickness 6 (8.6%); reduction of production 9 (12.9%); sudden reduction in access to credit one (1.4%); and increased pest and diseases 14 (20%). There were no losses to natural hazards and no other shocks mentioned by the farmers. Table 6 highlights that farmers in all districts

6.2 Farmers' Responses Regarding Sources of Income During the Pandemic

Table 7 indicates that 39 (55.7%) the main source of income was from the sale of farm produce, while 30 (42.9%) of farmers stated that their income was form other employment, and one (1.4%) indicated their income came from other sources.

It was observed that the main source of income for the farmers of Tableland, Princes Town, and Piparo came from the sale of agricultural produce, while in the other districts' income came from other sources except for Barrackpore, which had similar responses to both variables (see Table 7). Further, 20 (28.6%) farmers stated that

75% of their total income was from the sale of agricultural produce, 16 (22.9%) stated their income from agricultural sales was between 50%–74%, 18 (25.7%) indicated that the sale of agricultural produce was between 25%–49%, 13 (18.6%) said sales were below 24% and three (4.3%) stated they were unable to say what percentage of total income was from the sale of agricultural produce.

Farmers were asked if they were able to transport their pineapple produce during the pandemic, and 64 (91.4%) indicated that they were able to do so, while six (8.6%) stated that they could not transport their produce. Further, 38 (54.3%) farmers had to destroy part of their produce due to lack of marketing and storage capacity compared to 32 (45.7%) that indicated that they did not have to do so.

When questioned on the selling price of their produce compared with pre-pandemic prices, one (1.4%) farmers stated that prices were much higher than usual, while one (1.4%) stated higher than usual, 32 (45.7%) indicated that prices remained the same or around the same, and 36 (51.4%) disclosed that prices were 20% lower in comparison.

From the Tableland District, the farmers had similar responses as they indicated prices were the same or lower. All other districts except Bonne Aventure had similar results, except for one farmer in Bonne Aventure who stated that prices were higher In Piparo, one farmer stated that prices were much higher than the pre-pandemic prices.

Table 6. *Responses Regarding Sources of Income and Sale of Crops During the Pandemic*

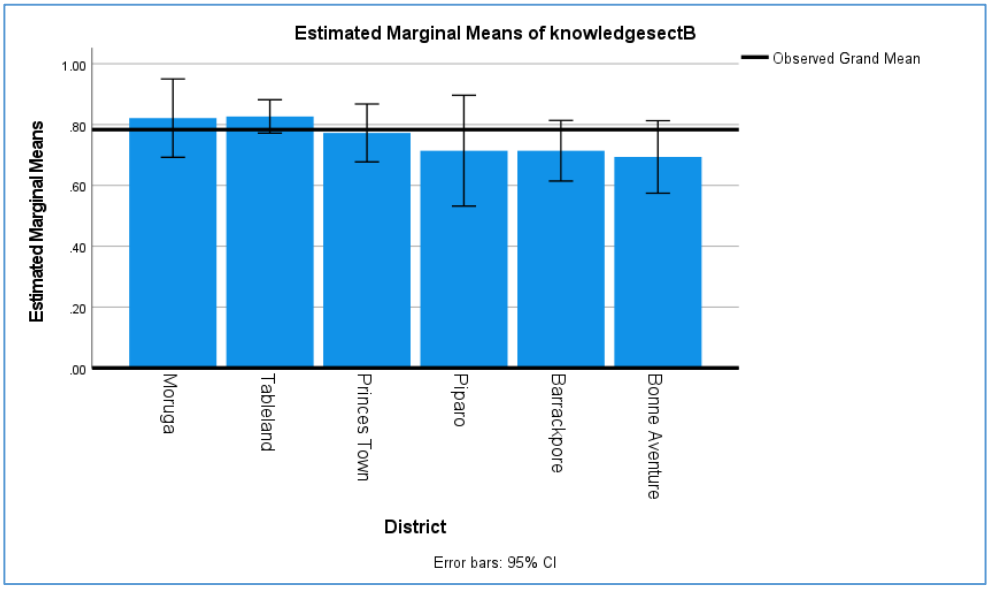
		District						Total
		Moruga	Tableland	Princes Town	Piparo	Barrackpore	Bonne Aventure	
What has been your main source of income?	Sale of farm produce	2.9%	25.7%	12.9%	2.9%	7.1%	4.3%	55.7%
	Other employment	5.7%	21.4%	2.9%	0.0%	7.1%	5.7%	42.9%
	Other sources	0.0%	0.0%	0.0%	1.4%	0.0%	0.0%	1.4%
What percentage of your total income is from agriculture?	Over 75%	2.9%	7.1%	7.1%	1.4%	5.7%	4.3%	28.6%
	Between 50% -74%	1.4%	11.4%	5.7%	1.4%	1.4%	1.4%	22.9%
	25% -49%	1.4%	17.1%	1.4%	0.0%	4.3%	1.4%	25.7%
	Below 24%	2.9%	11.4%	1.4%	1.4%	0.0%	1.4%	18.6%
	Don't know	0.0%	0.0%	0.0%	0.0%	2.9%	1.4%	4.3%

		District						Total
		Moruga	Tableland	Princes Town	Piparo	Barrackpore	Bonne Aventure	
Were you able to transport and sell your produce during the pandemic?	No	0.0%	2.9%	2.9%	0.0%	0.0%	2.9%	8.6%
	Yes	8.6%	44.3%	12.9%	4.3%	14.3%	7.1%	91.4%
Did you destroy part of your produce due to lack of market and storage?	No	2.9%	30.0%	7.1%	1.4%	2.9%	1.4%	45.7%
	Yes	5.7%	17.1%	8.6%	2.9%	11.4%	8.6%	54.3%
Comparison of selling price during the pandemic versus pre-pandemic	Much higher (over 20%)	0.0%	0.0%	0.0%	1.4%	0.0%	0.0%	1.4%
	Higher than usual (19% higher)	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	1.4%
	Same or around same	4.3%	24.3%	4.3%	1.4%	10.0%	1.4%	45.7%
	Lower than usual (up to 20% lower)	4.3%	22.9%	11.4%	1.4%	4.3%	7.1%	51.4%
Total		**8.6%**	**47.1%**	**15.7%**	**4.3%**	**14.3%**	**10.0%**	**100.0%**

Figure 1 shows the marginal means between farmers' knowledge of weeds, soil erosion, food security and food safety among the districts (P =0.194). However, it was observed that Piparo, Barrackpore and Bonne Aventure Districts were below the grand mean, while Tableland and Moruga farmers are above the grand mean at the 95% CI.

Table 7 shows that 41 farmers agreed and six strongly agreed that their farms had adequate access to planting materials, 14 were neutral, and nine disagreed. Thirty-six farmers agreed that they had good weed management, while 25 were neutral and six disagreed. In terms of soil erosion control, 32 farmers agreed and three strongly agreed that they had good control; 27 were neutral, 7 disagreed, and two strongly disagreed with the statement. Twenty-nine farmers strongly agreed that the prices of farm input increased due to COVID-19, 19 agreed, and 11 were neural. Eight farmers disagreed with three farmers strongly disagreeing with that statement.

Figure 1: Farmers estimated marginal mean for knowledge.

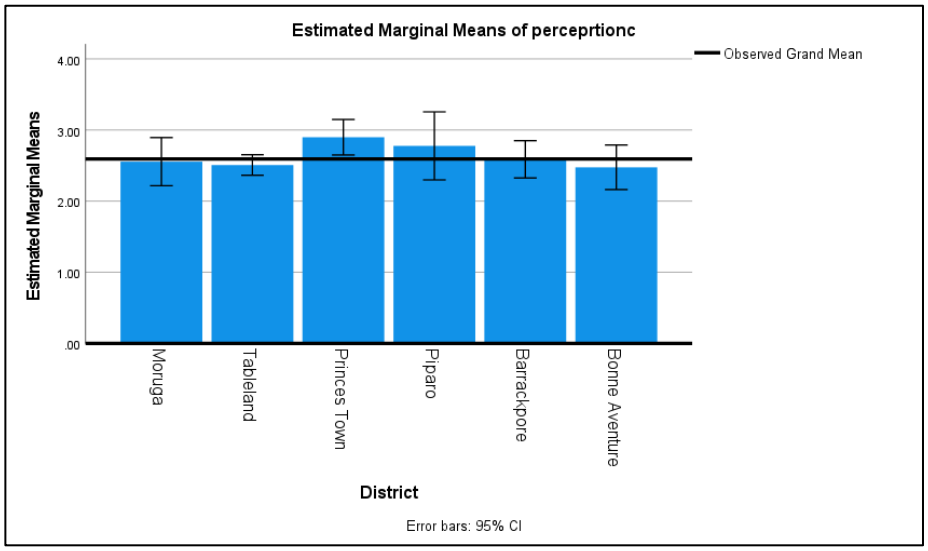


Thirty-one farmers agreed that farm activities were not affected by COVID-19, while seven strongly agreed, 16 were neutral, 13 disagreed, and three strongly disagreed. On the question regarding changes in farm income, 35 farmers agreed, while 18 strongly agreed that their income changed due to COVID-19. Twelve farmers were neutral, and 5 farmers disagreed with that statement. Twenty-six farmers agreed that they had to diversify production since the pandemic, while six strongly agreed, 25 were neutral, 11 disagreed, and two strongly disagreed with the statement. Thirty-one farmers agreed that farming activities will continue to be impacted by the pandemic, while 15 strongly agreed, 19 were neutral, four disagreed, and one strongly disagreed with the statement.

Figure 2 shows the estimated marginal means in farmers' perceptions of weeds, soil erosion, food security, and food safety, with a calculated p-value of 0.117. However, it's worth noting that the Tableland and Bonne Aventure Districts scored below the overall average, while the Moruga and Barrackpore Districts scored at the average. On the other hand, Princes Town and Piparo Districts slightly exceeded the overall average. This suggests that variations in perceptions existed between districts, as indicated by the 95% confidence interval.

It was observed that 35 farmers agreed, four strongly agreed, 22 were neutral, and nine disagreed that they were successful in controlling difficult weeds. Thirty-two farmers were neutral on the question relating to their ability to address soil conservation, 29 agreed, three strongly agreed, five disagreed, and one strongly disagreed on that topic. Eighteen farmers strongly agreed that they had produced quality pineapple over the last five years, while 36 agreed, 13 were neutral, and three disagreed with that statement. Nineteen farmers strongly agreed that they had to purchase cheaper chemicals due to COVID-19, while 27 agreed, seven were neutral, 16 disagreed, and one strongly disagreed. In terms of accepting food aid due to the pandemic, 29 farmers strongly disagreed, 22 disagreed, six were neutral, 12 agreed, and one strongly agreed with that statement.

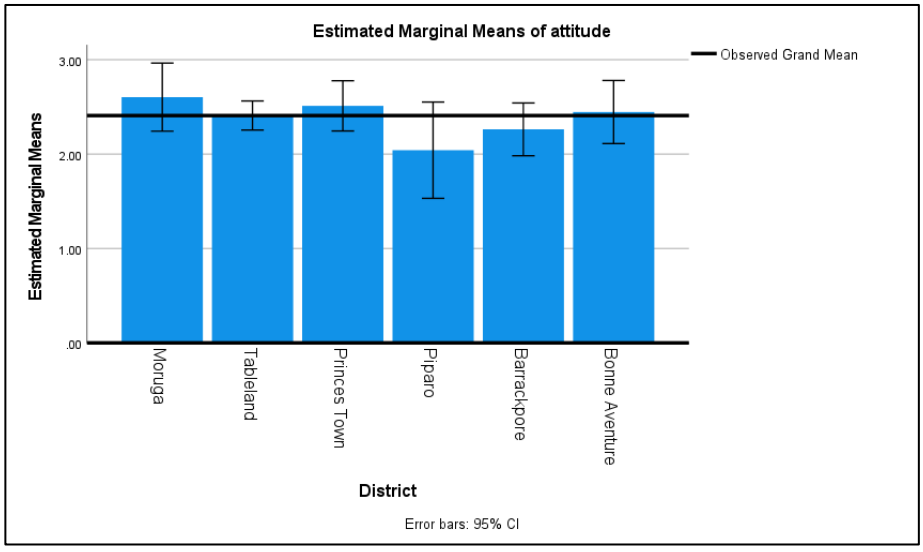
Figure 3: Farmers' estimated marginal means of perception.



Twenty-seven farmers were neutral and indicated that they could not supply the market with a consistent supply of pineapples during COVID-19, 18 disagreed, two strongly disagreed, 18 agreed, and five strongly agreed that they could not supply pineapples at that time. In providing food for the farm family, 38 farmers agreed that they were concerned about this issue due to the pandemic, while 17 strongly agreed, 11 were neutral, three disagreed, and one strongly disagreed with the statement. Twenty farmers now produce more food in addition to pineapples because of the pandemic, while 19 strongly agreed, 17 were neutral, and 14 disagreed with that statement.

Figure 3 shows the marginal means in farmers' attitude of weeds, soil erosion, food security and food safety as statistically the P = 0.428. However, it is noted that Tableland and Bonne Aventure districts lie on the grand mean whilst Moruga and Prince Town are above the mean. Barrackpore and Piparo districts are below the grand mean. Consequently, differences exist in the means between the districts at the 95% CI.

Figure 3: Farmers' estimated marginal means of attitude.



7.0 Discussion

The primary objective of the survey conducted among pineapple farmers was to gather first-hand information regarding the challenges they encountered during the pandemic lockdown. Additionally, the study aimed to assess farmers' knowledge, attitudes, and perceptions concerning various interconnected aspects and practices related to pineapple cultivation. The majority of the interviewed farmers were residents of the Tableland District, historically a key hub for pineapple production in Victoria County, boasting over 100 participating farmers. Over the past decade, there has been an expansion of pineapple production in districts such as Princes Town and Barrackpore, driven by farmers seeking to diversify their agricultural activities or bring new lands into production.

Most of the farmers have been cultivating pineapples for the past five years on lands they either own or are family-owned. The predominant age group among the farmers falls within the range of 34 to 54 years, with a majority being male. Furthermore, many of these farmers have received both primary and secondary level education and serve as the sole breadwinners for their families. This demographic information implies that pineapple farmers in Victoria County are relatively young, possess some level of education, and may be receptive to learning and adapting to improve their businesses. Implementing environmentally friendly practices and appropriate technologies, where available, could help reduce their reliance on agrochemicals and hired labour, enabling them to manage their farms more resiliently in the face of external market shocks. For instance, offering training in Integrated Weed Management systems could encourage the adoption of recommended practices.

A recurring concern expressed by farmers was the limited availability of high-quality and sufficient planting materials. Farmers feared that the upcoming pineapple crop might lead to reduced fresh fruit volumes in the market, potentially causing price spikes and anxiety among consumers about food prices. Those farmers who did possess planting materials typically reserved them for replacing old crops or expanding their fields. Notably, the price of pineapple plants had doubled in many instances, ranging from TTD $14,000 to $28,000 (USD $2,065 - $4,130). This price increase was attributed to lapses in field management during the period under study. Additionally, the study revealed that farmers had limited knowledge about the types of weeds in their fields, leading to unnecessary and expensive applications of various agrochemicals for weed control. Even when presented with sample images, farmers often mistakenly identified the weeds as "mixed weeds" instead of correctly recognizing them as grasses. Dependence on herbicide applications was a primary weed management strategy.

Regarding soil erosion, at least 60% of the farmers needed prompting to differentiate between various types of soil erosion they experienced. Farmers cultivating on hillside terrains were particularly vulnerable to soil erosion. This highlighted an opportunity for agricultural extension services to educate farmers about soil erosion types and mitigation methods.

Another significant challenge faced by farmers was a shortage of labour. Many farmers relied on migrant labour, which was a cost-effective option despite the health and safety challenges posed by the COVID-19 pandemic. Pineapple farming, being labour-intensive, involves manual work, especially in land preparation, as there are no machinery options for planting. The study suggests that exploring the development of a pineapple planter could be beneficial in addressing this issue,

although it was acknowledged that this was beyond the scope of the current study. Nonetheless, continuous extension support and collaboration with research institutions were recommended to benefit rural farmers.

Praedial larceny (farm theft) continued to be a persistent issue. The biannual pineapple cropping cycle means that flower induction occurs at staggered times throughout the harvest season. Consequently, farmers who did not reside on their farms were susceptible to theft, resulting in losses.

Regarding income sources, the data collected were not deemed entirely reliable, but it did indicate that at least 50% of the farmers derived their income from the sale of agricultural produce. The study also highlights that while farmers may have a good understanding of weeds, they require information on integrated weed management. Similarly, their soil erosion management practices needed strengthening.

Statistical analysis indicated no significant differences among farmers from various districts in terms of their knowledge about weeds, soil erosion, food security, and food safety, with a p-value of 0.194. However, it was observed that farmers in the Piparo, Barrackpore, and Bonne Aventure Districts scored below the grand mean, while those in the Tableland and Moruga Districts scored above the grand mean at the 95% confidence interval. This suggests that farmers in the former districts may require training in weed management and soil erosion mitigation.

The COVID-19 pandemic continued to pose challenges to pineapple farmers in Victoria County. Notably, the high prices of agricultural inputs, such as urea and herbicides, were a pressing concern. This underscored the urgency for interventions and retooling of the farming demographic to enhance their adaptability to the new normal and implement fresh approaches for the sustainability of their livelihoods. Adopting conservation agriculture and climate-smart practices could be favourable for sustainable pineapple production in the post-COVID years, alongside providing agribusiness management support.

Reviewing the existing literature, it is evident that the COVID-19 pandemic and associated restrictions had a significant impact on various aspects of agriculture, including pineapple farming, not only in Trinidad and Tobago, but also globally. Restrictions on movement, labour shortages, increased costs of agricultural inputs, and disruptions in the supply chain were among the challenges faced by farmers. The pandemic also highlighted the vulnerability of food systems and the importance of food security. In developing countries, the lack of access to insecticides and pesticides led to reduced yields, while transportation disruptions affected the distribution of agricultural produce.

In the case of pineapple farmers in Victoria County, limited access to export markets and processing facilities posed challenges, and online sales were primarily conducted through entrepreneurs offering food baskets with smaller quantities of pineapples.

The study emphasizes the need for land tenure reform and documentation, as many farmers struggled to provide appropriate documentation for crop transportation during lockdowns. Additionally, the study highlights the need for improved transportation infrastructure to support agricultural supply chains.

The study's findings underscore the resilience of pineapple farmers in Victoria County in the face of the challenges of the COVID-19 pandemic. Their ability to adapt to changing circumstances and willingness to learn and implement new practices highlight the potential for sustainable pineapple production in the region.

This study provides valuable insights into the knowledge, perceptions, and challenges faced by pineapple farmers, offering a foundation for recommendations and interventions to support their livelihoods in the future.

8.0 Conclusion

This study aims to gain insights into the experiences of pineapple farmers in Victoria County during the COVID-19 pandemic lockdown and assess the challenges they faced. The survey covered approximately 42% of registered pineapple farmers in the region and revealed significant disruptions in their day-to-day operations, planning, and planting cycles due to the pandemic. These disruptions included the high cost of agricultural inputs, limited markets, and income losses.

One promising avenue for these farmers to reduce production costs is the implementation of sustainable management strategies. Collaborative field trials with participating farmers have shown that practices such as mulching can effectively reduce the need for herbicides, thus lowering production costs. Additionally, adopting these strategies can address food safety concerns raised by consumers, reduce labour costs associated with herbicide application, minimize environmental herbicide impact, and prevent herbicide-related stress on pineapple plants. While farmers' responses to the questionnaire were positive, many would benefit from training in weed management, soil conservation, and other agricultural practices to ensure the long-term sustainability of their farming businesses.

In light of the heightened importance of food safety and food security during the pandemic, farmers must adapt to the "new normal." Government agencies such as the Ministry of Agriculture, Land and Fisheries (MALF), the National Agriculture and Marketing Development Company (NAMDEVCO), and the Agricultural Development Bank (ADB) need to formulate comprehensive programs to address the challenges faced by pineapple farmers and the agricultural community in general.

Pineapple farmers should also consider forming farmer groups or cooperatives to advocate for government intervention on key issues like the prices of agricultural inputs. Farmers acknowledged the recurring issue of pineapple gluts, typically occurring from March to May when production peaks simultaneously. By strategically planting pineapples in late October and utilizing mulching during the dry season, farmers can stagger their yields, avoiding the glut period and potentially commanding premium prices for their produce around June to August.

Various challenges related to farming families, including sickness and death due to the pandemic, persist. Furthermore, issues such as access roads, infrastructure (e.g., bridges, crossings, water, and electricity), and sanitation concerns in some areas need to be addressed.

9.0 Recommendations

1. *Promotion of Sustainable Practices*: Encourage pineapple farmers to adopt sustainable practices such as mulching, integrated weed management, and good agricultural practices to reduce production costs, enhance crop quality, and minimize environmental impact.
2. *Training and Capacity Building*: Provide training and capacity-building programs for farmers in weed management, soil conservation, and other relevant agricultural practices to improve their knowledge and skills.

3. *Government Support*: Government agencies, including MALF, NAMDEVCO, and ADB, should develop and implement programs to support pineapple farmers in addressing the challenges they face, including access to affordable agricultural inputs.
4. *Formation of Farmer Groups*: Encourage pineapple farmers to establish farmer groups or cooperatives to collectively advocate for their interests, negotiate better prices for inputs, and address common challenges.
5. *Staggered Planting*: Promote staggered planting practices to mitigate pineapple gluts and enable farmers to command premium prices for their produce during non-glut periods.
6. *Infrastructure Development*: Address issues related to access roads, infrastructure (bridges, crossings, water supply, electricity), and sanitation concerns to improve the overall working and living conditions for farming families.
7. *Continued Research and Collaboration*: Foster ongoing collaboration between farmers and research institutions to develop and refine sustainable agricultural practices that benefit both farmers and the environment.

By implementing these recommendations, pineapple farmers in Victoria County can enhance their crop yields and quality while ensuring the long-term sustainability of their farming practices, ultimately improving their standard of living and resilience to market fluctuations and external shocks.

References

Alabi J. O., Joseph O. J., & Babatola L. A. (2021). Impact of Covid – 19 pandemic on postharvest losses in fresh pineapple (*Ananas Comosus* (L.) Merrill) in Ilorin, Nigeria. *International Journal of Advanced Research in Multidisciplinary Studies*, *1*(1), 31–40.

Blazy, J. M., Causeret, F., & Guyader, S. (2021). Immediate impacts of COVID-19 crisis on agricultural and food systems in the Caribbean. *Agricultural Systems, 190*, 103106. https://doi.org/10.1016/j.agsy.2021.103106. 103-106.

Bochtis, D., Benos, L., Lampridi, M., Marinoudi, V., Pearson, S., & Sørensen, C.G. (2020). Agricultural workforce crisis in light of the COVID-19 pandemic. *Sustainability*, *12*(19), 8212. https://doi.org/10.3390/su12198212

Food and Agriculture Organization (FAO). (2020). Novel Coronavirus (COVID-19) Q&A: COVID-19 pandemic – impact on food and agriculture. *Author*. http://www.fao.org/2019-ncov/q-and-a/en/

Gray R. S. (2020). Agriculture, transportation, and the COVID-19 crisis. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, *68*(2), 239–243. https://doi.org/10.1111/cjag.12235

Haqiqi I., & Horeh, M. B. (2021). Assessment of COVID-19 impacts on U.S. counties using the immediate impact model of local agricultural production (IMLAP). *Agricultural systems, 190*, 103132. https://doi.org/10.1016/j.agsy.2021.103132

Kabir, K. H., Chowdhury, A. (2023). Development plans to tackle threats to agricultural sustainability in Bangladesh, Canada and Trinidad and Tobago following COVID-19. *Local Development and Society*, *4*(1), 31–55. https://doi.org/10.1080/26883597.2021.1977976

Martinez, C., Pasteiner, D., Barrozo, T., (2020, August 26). COVID-19 delivers investment boom for Latin America's online delivery and logistics start-ups. *Forbes*. https://www.forbes.com/sites/mergermarket/2020/08/26/covid-19-delivers-investment-boom-for-latin-americas-online-delivery-and-logistics-startups/?sh=6561dc507779

Mussell, A., Bilyea, T., & Hedley D. (2020, March). *Agri-food supply chains and Covid-19: Balancing resilience and vulnerability*. Policy note. http://www.agrifoodecon.ca/uploads/userfiles/files/agri-food%20supply%20chains%20and%20covid-19%20mar%2022-20.pdf

Mthembu, B. E., Mkhize, X., Arthur, G. D. (2022). Effects of COVID-19 pandemic on agricultural food production among smallholder farmers in Northern Drakensberg Areas of Bergville, South Africa. *Agronomy*, *12*(2), 531. https://doi.org/10.3390/agronomy12020531

OECD. (2021). *COVID-19 and food systems: Short- and long-term impacts*. OECD Food, Agriculture and Fisheries Papers, No. 166. https://doi.org/10.1787/18156797

Pu, M., & Zhong, Y. (2020). Rising concerns over agricultural production as COVID-19 spreads: Lessons from China. *Global food security*, *26,100409*. https://doi.org/10.1016/j.gfs.2020.100409

Workie, E., Mackolil, J., Nyika, J., & Ramadas, S. (2020). Deciphering the impact of COVID-19 pandemic on food security, agriculture, and livelihoods: A review of the evidence from developing countries. *Current Research in Environmental Sustainability*, *2*, 1–6. https://doi.org/10.1016/j.crsust.2020.100014