

RESEARCH ARTICLE

Agroecology and revolution: Agricultural policies on land, autonomy, and priority crops

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The literature on agroecology in Cuba agrees that Cuban agroecology is small-scale, non-state, and not prioritized by state agricultural input allocation policies. This article grapples with these 3 assumptions by analyzing the historical and recent agricultural policies of the Cuban revolution in relation to land, producer autonomy, and conventional input allocation and by analyzing the performance of state and non-state agriculture in the period of 2009–2015. Based on in-depth interviews, and analysis of relevant policy documents and secondary data, this article argues that the revolution's historical policies and post-1990s anti-crisis policies regarding land distribution and limits to wealth accumulation, together with the country's long-stay financial constraints to purchase conventional inputs facilitated a more or less stable space for small-scale, non-state, non-prioritized agriculture. Nevertheless, the productive performance by crops shows that state and non-state agriculture obtain similar results and face similar challenges.

Keywords: Agroecology, Cuba, Land reform, Agricultural policies

We wanted to learn the answers to a host of questions . . . Is hunger really no longer a problem in Cuba? . . . Why is there food rationing in Cuba today? . . . What are Cuba's agricultural priorities? Has the importance and role of sugar changed with the revolution? Does Cuba aim to produce its own food and does it succeed? Are private farmers free to grow what they please and sell to whomever they wish? Or may they operate only under government contract? Which are more productive, private or state farms? What progress has been made in organizing cooperatives?

(Benjamin et al., 1984)

1. Introduction

The Cuban case has been described in multiple international publications as a country-wide triumph of the ecological approach over the conventional one (Altieri et al., 1999; Funes et al., 2002; Rosset et al., 2011; Rosset and Altieri, 2017; Mier y Terán et al., 2018). In an analysis of original articles on agroecology published in relevant databases, Cuba was the second most studied country and had the third most researchers affiliated to the topic in 2012 (Gómez et al., 2013). The Latin American movement, from which the pioneers of the Cuban movement found inspiration, and more recently in other regions, reference

the Cuban case for the application of agroecological approaches on a large scale (Sabourin et al., 2017; Rosset et al., 2019; Val et al., 2019). Prominent figures of global agroecology such as Miguel Altieri (University of California, Berkeley), Peter Rosset (Food First), and Eric Holt-Gimenez (Food First) praise in their works the development of agroecology in Cuba.

However, efforts to measure the dimensions and impact of agroecological practices at regional and national levels are very scarce. Leaders of the movement in Cuba recognize that this scarcity of impact studies weakens the movement's possibilities.¹ Initiatives to measure the economic impact of small agroecological systems have been carried out by organizations within the movement. Such is the case of the Antonio Núñez Jiménez Foundation, a representative of the permaculture movement. At its annual event in 2014,² its members were asked to present the economic impacts for their families of permaculture yards and plots based on a basic guide of indicators. However, the measurement was overly simple, especially regarding the costs of production.

Other studies measure some impacts on a small-scale, such as the study of Lucantoni (2020) that analyzes the impacts on food production, food and nutritional security, and living conditions of the conversion to agroecology of 1 family in the western region of the country. Case studies exist on the positive impacts of restoring soil fertility from agroecological practices (Treto et al., 2002; Funes-

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1. Interviews with pro-agroecological experts conducted by the author in the period July 2015 to March 2017.

2. The event took place in Havana, July 10–11, 2014. The author was invited to participate in the event.

Monzote, 2008), ecological pest control (Pérez and Vázquez, 2002; Vázquez and Pérez, 2016), and intercropping and integration of crops and livestock (Casanova et al., 2002; Monzote et al., 2002; Leyva et al., 2016), among others. In addition, there is growing gray literature and domestic publications (e.g., short-run publications of research centers and academic institutions) that gather specific experiences of the application of agroecological practices.

Pro-agroecology nationwide social and economic studies (e.g., Machín Sosa et al., 2010; Rosset et al., 2011; Vázquez et al., 2017; Fernández et al., 2018) with different levels of accuracy tend to be based on 3 main assumptions surrounding the agroecology movement in Cuba, namely that agroecological agriculture is mainly carried out by (1) small, (2) non-state actors (i.e., private and cooperative), and (3) who plant non-prioritized crops (i.e., not favored by preferential allocation of inputs for crops prioritized by the government). Taking this small, non-state, non-prioritized agriculture as a proxy for agroecology in Cuba, these studies put forward production and yield arguments, namely that small, non-state, non-prioritized agriculture (considered predominantly agroecological) produces more and more efficiently than state agriculture, being considered not predominately agroecological or not agroecological at all (e.g., Martin, 2002; Machín Sosa et al., 2010; Rosset et al., 2011; Chan and Freyre Roach, 2012; Vázquez et al., 2017; Lucantoni, 2020). This is presented as proof of the viability and suitability, in terms of productivity, of agroecological agriculture for the country.

An attempt to quantitatively measure the impact of Cuban agroecology on agricultural productivity and, therefore, on soil improvement was made by Betancourt (2020). Betancourt's study uses the variable of fertilizer use as a proxy of industrial agriculture and the productivity of 2 crops, maize and beans, as an indicator of soil improvement. The study identifies, in comparison with Latin American and Caribbean countries, low correlation between fertilizer use and the productivity of selected crops. The study concludes that the practice of agroecology in Cuba is the cause of the positive impacts on productivity. Yet Betancourt's (2020) study, from a statistical point of view, omits the impact of the anti-crisis policies implemented since the 90s (land delivery, opening of free markets, prioritization of food production for domestic consumption), which together served as an important stimulus for producers. Likewise, the selection of maize and bean crops ignores the policy of prioritizing the allocation of inputs to specific crops, which is typical of the agricultural policy on the island. This article addresses these factors in more detail, aiming to broaden the discussion and to provide a more nuanced view on the uptake of agroecology on the island.

To do so, this article conducts an analysis based on the bibliographic review, interviews with experts (Cuban and foreign) and pro-agroecological farmers, and available secondary data on agricultural performance in Cuba. The study does not underestimate the agroecology movement's accomplishments in Cuba (e.g., Urban Agriculture,

the *Movimiento Campesino a Campesino*, or individual pioneers), or questions the social and environmental positive impacts of agroecology as an agricultural model. Nonetheless, it makes arguments that help contextualize and explain these assumptions both historically and in recent times. It deals with the 3 broad assumptions separately, discussing historical evidence that explains the current state of scale, land management, and prioritization strategies of Cuban agriculture. It also shows the coherence between historical policies of the revolution (e.g., land reforms) and anti-crisis policies implemented by the Cuban government with the preconditions for the spread of agroecological agriculture, specifically, the increased space for small-scale, non-state agriculture in the Cuban agricultural system. Following this, a comparative analysis of state and non-state production performance of 6 crops (prioritized and non-prioritized) in the period of 1995–2015 is presented. Finally, the key messages are summarized.

2. Methodological approach and data collection

The study was conducted from a historical perspective that allowed the analysis of the assumptions in their connection with the history of agricultural policies in Cuba from the beginning of the revolution (i.e., 1959) until 2015. For this purpose, literature on Cuba's political and economic history and relevant agricultural policy documents were reviewed, and 30 in-depth interviews were conducted. This methodological approach, predominantly qualitative, was complemented with descriptive statistics based on secondary data related to agricultural production and yields of intentionally selected crops.

For the analysis of relevant policies on scale, tenure and ownership, and land use in Cuba, 2 types of documents were located: official regulations and policy documents from government institutions and political discourses, as well as trends described by experts on the country's economic and agricultural policy. The compilation of regulations was carried out by accessing the digital publications of the *Gaceta Oficial de la República de Cuba* (Official Gazette of the Republic of Cuba)³ available at www.gacetaoficial.gob.cu/es. Other documents produced by governmental institutions were identified from the literature review and accessed digitally or in situ at the institutions in Havana during field research (2 periods between 2015 and 2017). The approach to the literature tried to balance the use of domestic and foreign and sympathetic and critical sources dealing with the Cuban political and economic system and the experience of socialist and agroecological agriculture in the country.

Thirty formal in-depth interviews were conducted with 20 agroecological farmers in the central region of the country, 3 pro-agroecology NGO members, and 7 researchers on agriculture in Cuba (economists, agronomists, and sociologists) between July 2015 and July 2016. Both

3. The Official Gazettes are government publications containing the laws, decrees, and regulations in the country.

farmers' and experts' interviews were conducted using an unstructured, topic-based guide. The interviewees were chosen intentionally based on the snowball sampling method. The main objective was to reconstruct the agroecological movement's history in the experts' vision and the history of agroecological practices on specific farms. The interviews also explored the motivations for adopting agroecological practices, the perception of costs and benefits, and visions of the future of agroecology in the country and on farms specifically. Additionally, in analyzing the data and writing the results, the author carried out multiple consultations and interviews (formal and informal) with Cuban political scientists and economists and non-Cuban experts on the topic. Communications were established through email, phone calls, and video calls. These consultations helped clarify specific issues, such as providing details of historical processes and discussing interpretations of the results.

Secondary quantitative statistical information on agricultural yields, land use, input use, import–export totals, and other indicators relevant to the analysis were also incorporated into the study. To provide as consistent a picture as possible, priority was given to the use of official national statistics from the Oficina Nacional de Estadísticas e Información (National Office of Statistics and Information [ONEI]) and the FAO database (FAOSTAT, <https://www.fao.org/faostat/en/#home>) estimates (based on ONEI information).⁴ The problems of reliability of the statistical information provided by official Cuban sources, the intermittency in its publication, and the inconsistencies in the information over time have been addressed by several authors (Benjamin et al., 1984; Mesa-Lago, 1989; Mesa-Lago and Pérez-López, 2005; Wright, 2016). Nevertheless, the information provided by ONEI is the only accessible national information that offers comparability over time. In addition to information from ONEI and FAOSTAT estimates, data collected by various scholars of Cuban agriculture and economy were also used. In most cases, the author corroborated the data and estimates in at least 2 published sources. This information proved vital in periods where ONEI did not publish statistical information, for example, between 1990 and 1993 and in unpublished information on private agriculture.

3. The scale of Cuban agroecology

As early in the history of the revolution⁵ as May 1959, the first Agrarian Reform Law was signed. This law, combined with a second law signed in 1963, nationalized land belonging to foreign companies (25% of the agricultural land was owned by U.S. companies). *Latifundio* were thus eliminated. The reform set a maximum of 5 *caballerías* (67.10 ha) for private farmers. The land expropriated from foreign companies and large national owners, as well as

state land, was distributed free of charge to landless peasants previously working the land, agricultural workers, and individuals who requested it, up to an established “vital minimum” of 2 *caballerías* (26.84 ha) for a peasant family of 5 people.⁶ If the family worked an extension between 2 and 5 *caballerías*, the peasant could acquire the land above the 2 *caballerías* threshold by forced purchase from the previous owner or by purchase from the state.

The sale and leasing of the distributed land were prohibited, and the land could only be transferred indivisibly through inheritance (to a single male owner), sale to the state, or state-authorized exchanges. Few exceptions were made to the maximum of 67.10 ha. Only strategically valuable farms (sugarcane and cattle) with high yields and where their owners behaved according to revolutionary ideals could maintain extensions greater than 5 *caballerías*. Alternatively, several brothers acting together and complying with the previous requirements could cultivate an extension not greater than 5 *caballerías* per brother.⁷

The remaining undistributed land became state property. In the following years, the government implemented different policies that facilitated the leasing and purchase of farms by the state,⁸ for example, incentives such as the construction of modern rural communities and better access to technology for integrating state plans, as well as political pressure. As a result, the state increased its share to 70% of the total agricultural land, including 80% of livestock and 75% of sugarcane production (Valdés-Paz, 2009). In addition, the promotion of land collectivization since the mid-1970s⁹ meant that by 1987, the state owned around 83%¹⁰ of the land, the private sector owned 10.7%, and the remaining land was owned by Agricultural Production Cooperatives (CPAs; Figueroa-Albelo, 2003; Valdés-Paz, 2009).

President Fidel Castro stated in speeches in 1989–1990 that the state held 80% of the land, cooperatives had 12%, and 8% was in the hands of independent farmers (see, e.g., Castro, 1989a, 1989b, 1990a, 1990b, 1990c). At that time, the state sector was composed of state farms, military farms, and plots for self-consumption in state institutions (**Table 1**). At the end of 1992, the size of state agricultural farms averaged 13,413 ha in sugarcane, 28,000 in cattle ranching, 27,200 in rice, 17,400 in citrus and fruit, 4,300

6. In June 1961, there were 101,805 new agrarian reform owners who received 2,725,910 ha of land (Figueroa-Albelo, 2003).

7. Women could not inherit land at that time.

8. In 1977, 27,976 peasants had joined state enterprises with some 383,700 ha. In the period of 1977–1981, 18,402 farms were purchased with 257,300 ha (Figueroa-Albelo, 2003).

9. The cooperative movement between 1977 and 1987 absorbed around 44,000 farms, an area of more than 1,049,000 ha, which represented 51.3% of the peasant land area in 1978 (Figueroa-Albelo, 2003).

10. Fidel stated on May 17, 1987, that “State lands, acquired with the first and second agrarian reforms, and also, in a certain way, through purchases of land from peasants who could no longer work it, or who entered into the State’s agricultural plans, reached approximately 80%.”

4. World Bank dataset also uses ONEI among other sources.

5. The official date that establishes the beginning of the revolutionary period, understood as the date of the triumph of the revolutionary movement over the dictatorship of Fulgencio Batista, is January 1, 1959.

Table 1. Overview of Agricultural Production Organizations in Cuba

Sector	Agricultural Organization	Main Characteristics of the Agricultural Organization
State sector	State farms	Large-scale farms created after the first and second agrarian reform laws (1959 and 1963). Centralized planning of production and allocation of inputs
	New-type state farms (GENT, for the Spanish acronyms of <i>Granjas de Nuevo Tipo</i>)	Created in 1993 from state farms that were not able to be converted into UBPCs. They enjoy more management autonomy than standard state farms
	Military farms	Farms from the Ministry of Revolutionary Armed Forces (FAR), including farms of the Young Workers' Army (EJT) and the Ministry of Interior (MININT)
	Self-provisioning farms at workplaces and public institutions	Small–medium size plots intended for self-consumption
Non-state sector	Collective production	
	CPAs	First created in 1977, farmers had to voluntarily contribute their land and means of production to collective property and work and distribute the output collectively
	UBPC	Created in 1993, through the division of large state farms. Agricultural workers become cooperative members, but with strong state intervention. State enterprise-like entities
	Individual production	
	CCSs	Created at the beginning of the 1960s. Farmers own or lease their land, produce independently, but come together as a cooperative to share credit, infrastructure, and markets
Mixed sector	Individual farmers (private property and usufruct)	Farmers own or lease their land and produce independently
	Joint ventures between the State and foreign capital	State-controlled selective agreements for key crops

CPAs = Agricultural Production Cooperatives; CCSs = Credit and Service Cooperatives; UBPC = Basic Unit of Cooperative Production.

Elaborated by the author. *Source*: Figueroa-Albelo (2003), Funes-Monzote (2008), Valdés-Paz (2009), and Nova-González and Figueroa Alfonso (2018).

in *cultivos varios* (miscellaneous crops), and 3,100 in tobacco (Figueroa-Albelo, 2003).

The non-state sector was made up of CPAs, Credit and Service Cooperatives (CCSs), and independent non-cooperative farmers (see **Tables 1** and **3**). The CPAs, based on the union of peasants' land and means of production, constitute the result of the collectivization process and the 12% of the land referred to by Fidel. In the period of 1997–2015, CPAs averaged between 525 and 580 ha of agricultural land.¹¹

The private sector was made up of the CCSs, based on the independent production of its members and non-cooperative farmers (called dispersed or independent peasants in the literature and official statistical reports). This distinction is important because, in later political discourses, CCSs begin to be included in the category of "cooperatives." The official statistics also reflected this change of perspective, making analysis of the private sector more difficult.

The average size of peasant farms, as well as the number of independent peasants in Cuba, are data that can only be estimated in bits and pieces. Official statistics have been published only intermittently, and data specifically related to private agriculture are rarely included. The literature on the subject shows these discontinuities in official publications and, moreover, reflects the contradictions in the data published by the *Oficina Nacional de Estadísticas* (National Office of Statistics, ONE by Spanish acronyms) and the records of organizations such as *Asociación Nacional de Agricultores Pequeños* (ANAP, National Association of Small Farmers in English) or the Ministry of Agriculture (Benjamin et al., 1984; Mesa-Lago, 1989; Mesa-Lago and Pérez-López, 2005; Mesa-Lago and Pérez-López, 2013; Wright, 2016).

In June 1961, there were more than 150,000 private peasants with around 3.5 million ha (Figueroa-Albelo, 2003). Fidel stated that after the reform there were around 200,000 independent farmers with 20% of the land (Castro, 1987). According to Burnhill (2014), in 1965, there were 180,102 farmers on 2,128,418 ha. Official statistics record a decrease in non-state agricultural area (CCS and dispersed farmers who established

11. Author's estimates based on Valdés-Paz (2009), ONE (2000), and ONEI (2015, 2016).

Table 2. Peasants' Farms Size in Cuba, 1987

Hectares	% of the Total Number of Farms	Cumulative %
0–2.68	23.8	23.8
2.68–6.71	27.0	50.8
6.71–26.84	41.0	91.8
26.84–67.10	7.4	99.2
More than 67.10	0.8	100

Elaborated by the author. *Source:* Figueroa-Albelo (2003).

commitments with the state) from 1,072,400 ha in 1975 to 734,400 ha in 1976 (Comité Estatal de Estadísticas [CEE], 1983).

In 1989–1991, Fidel, trying to distance the Cuban experience from the collapsing USSR, emphasized in various speeches that Cuba did not have to move to private agriculture (see, e.g., Castro, 1989a, 1989b, 1990b). The explanation was that the revolution kept a private sector made up, at that point in time, of around 71,000 independent farmers on 650,000 ha (see, e.g., Castro, 1989b, 1990a, 1990b). In 1991, an official document from the *Asamblea Nacional del Poder Popular* (National Assembly of People's Power, ANPP by Spanish acronyms) stated that there were around 70,000 farmers in 1917 CCSs with more than 830,000 ha and around 8,000 independent farmers in 33,550 ha (ANPP, 1991).

Nonetheless, ANAP reported 2,703 CCS with a total of 86,096 members in 1994 (Valdés-Paz, 2009), averaging 10.21 ha per member and 325.3 ha per cooperative.¹² In 1998, the numbers were higher, with 119,964 CCS members on slightly more than 1.5 million ha and 10,271 *campesinos dispersos* on 304,600 ha (Valdés-Paz, 2009). Based on ANAP's reports, in 2009, there were 350,000 families in the peasant sector between CPAs and CCSs, which increased by land policies to around 75,000 more by mid-2010 (Rosset et al., 2011).

However, the agrarian reform imposed upper limits (67.10 ha) on the scale of the private sector that are still in force at the time of writing. The “vital minimum” of 2 *caballerías* (26.84 ha) has proven to be more problematic. State policies of buying and leasing land to private peasants stipulated the maintenance of 2–3 ha for family self-consumption. This, in addition to a set of illegalities, such as the subleasing and the appropriation of idle state land, meant that by 1987 more than 50% of private peasant farms had up to half a *caballería* (6.71 ha) (Table 2).

In 1993, the crisis made state large-scale agriculture more challenging. The state then divided the state farms (Decree-Law 142, September 21, 1993) and created the

Basic Units of Cooperative Production (UBPC) (Tables 1 and 3). The workers were converted into cooperative members and made responsible for farm production and management. The land was given in usufruct (with use rights) to the UBPCs, while remaining state property, and the UBPCs would acquire the means of production of the previous state farm (i.e., equipment, materials, etc.) from the state with payment facilities (Decree-Law 142, September 21, 1993). By the end of 1993, there were 1,556 sugarcane UBPCs and 451 UBPCs specializing in other crops (Deere et al., 2016). In the period between 1997 and 2015, the average size of the UBPCs was between 900 and 1,025 ha¹³ of agricultural land, with sugarcane UBPCs larger than average and urban agriculture UBPCs smaller than average.

Decree-Law 142 also contemplated the distribution of land to already established cooperatives when feasible (e.g., adjoining land) and the cooperatives requested it. The decree established the delivery of small plots (up to half a hectare) that could not be integrated into cooperatives in free usufruct. The plots were given to retirees or people who could not systematically work in agriculture in an effort to improve family food consumption.

The reforms promoted by President Raúl Castro's government, beginning in 2008, gave more space to the non-state sector in agriculture through the transfer of idle state lands (Table 4). The Raúl government passed a range of decrees in the period of 2008–2014 that allowed individuals to receive land with use rights (see Decree-law 259 and Decree-law 300 of 2008 and 2012, respectively). Landless individuals could obtain up to 13.42 ha (1 *caballería*)¹⁴ and others could expand their land up to 67.10 ha (the limit established in 1963) only if they were members of cooperatives or state farms. As legal entities, cooperatives and state farms could expand their boundaries further.

Given these changes, the relative weight of small-scale, non-state agriculture has become more significant over the years (Table 4). However, the legal position of this agriculture is not without its uncertainties, due to regulations that constrain farmer entrepreneurship. The right of usufruct over land is subject to being eliminated if the state considers it necessary. In 2015, the state retained 78.9% of the ownership of agricultural land, with 7.1% owned as part of cooperative ownership (CPA) and 14% by small farmers (CCS and independent farmers) (ONEI, 2016). The land management structure reflected in Table 4 also expresses the combination of types of tenure (Table 3), for example, CCS members with private and usufruct land and CPAs that increased their extension with state land.

4. Land tenure, property, autonomy, and agroecology

Cuban farmers or peasants, even *campesinos independientes* (meaning not cooperative and not participating

12. González Mastrapa (2016) reports, however, that in 1996, in non-sugarcane agriculture, there were 2,348 CCSs with 125,700 members, 23,000 independent farmers and 60,000 people working on state-owned plots.

13. Author's estimates based on Valdés-Paz (2009), ONE (2000), and ONEI (2015, 2016).

14. More recent regulations allow for 2 *caballerías* (26.84 ha).

Table 3. Degree of Autonomy From the State for Different Production Structures in Cuba

	Land Property	Land Management	Produce Commercialization	Formal Autonomy From State
State				
Different modalities of state-farms	State	State	State collection agency, state markets, state ration system, social institutions	None
Cooperatives				
UBPC ^a	State (usufruct)	Cooperative–State	State commitments (75%–80% of total production), state collection agency, cooperative markets, peasants' free market	Low–Medium
CPA ^b	Cooperative and state (usufruct)	Cooperative	State commitments (75%–80% of total production), state collection agency, cooperative markets, peasants' free market	Low–Medium
CCS ^c	Private and state (usufruct)	Private and cooperative	State commitments, state collection agency, cooperative markets, farm-door selling, peasants' free market	Medium
Private				
Individual peasants	Private and state (usufruct)	Private	State commitments, state collection agency, farm-door selling, peasants' free market	Medium–High

Elaborated by the author.

^aUBPC = Unidades Básicas de Producción Cooperativa (Basic Units of Cooperative Production).

^bCPA = Cooperativas de Producción Agropecuaria (Agricultural Production Cooperatives).

^cCCS = Cooperativas de Crédito y Servicios (Credit and Service Cooperatives).

Table 4. Evolution of Land Management of Cultivated Agricultural Land (% of Total Hectares), Cuba 1989–2016^a

	1989	1997	2007	2016
State	78.0	24.4	23.2	19.0
Non-state	22.0	75.6	76.8	81.0
Cooperative	18.7	69.9	67.9	54.8
UBPC ^b	—	47.0	39.8	30.7
CPA ^c	10.2	10.0	10.2	9.8
CCS ^d	8.5	12.9	17.9	14.3
Private individual farmers	3.3	5.7	8.9	26.1
Total (thousands of hectares of cultivated agricultural land)	100 (4,411.9)	100 (3,701.4)	100 (2,988.5)	100 (2,733.5)

Elaborated by the author. *Source*: ONEI (2017a, 2017b), ONE (2000, 2008, 2011), and CEE (1983).

^aThe data are based on Cuban official statistics on cultivated land (*superficie cultivada*), which comprises the land under temporary and permanent crops, artificial pastures and nurseries, and seed orchards.

^bUBPC = Unidades Básicas de Producción Cooperativa (Basic Units of Cooperative Production).

^cCPA = Cooperativas de Producción Agropecuaria (Agricultural Production Cooperatives).

^dCCS = Cooperativas de Crédito y Servicios (Credit and Service Cooperatives).

in state plans), are limited in autonomy by the state (Wright, 2012). Since the first years of the revolution in the 1960s, peasant agriculture has depended on the state sector for technical assistance, credit and investment,

inputs, mechanization services, and production storage (Valdés-Paz, 2009). The ability of farmers to choose what to produce, how to produce it, and to whom to sell it has been limited to varying degrees by prostate agricultural

policies and regulations, resulting in limited access to inputs and commercialization opportunities (García-Álvarez and Nova-González, 2014; Nova-González and Figueroa Alfonso, 2018).

Government policies aimed at assimilating the private sector were not only motivated by the ideological mandate of eliminating the private class during the first decades of the revolution. They also intended the promotion of (a) a technology-intensive model (high levels of mechanization and chemical inputs use, irrigation, agricultural genetics, and large-scale production); (b) crop specialization; and (c) centralized planning of agricultural activity.

Since 1967, peasants were encouraged to join, in multiple modalities, a single centralized production plan under the direction and control of the state (Valdés-Paz, 2009). There were 3 modalities: (1) “integral plans” (*planes integrales*) and (2) “specialized plans” (*planes especializados*), which involved the transfer of peasant land to the state, and (3) “directed plans” (*planes dirigidos*) through which peasants retained the ownership of the land, but the farms were articulated in agricultural development programs according to the goals assigned by the state to each rural area (Figueroa-Albelo, 2003). In this way, farmers concentrated their production on a key crop and diversified production was to be only aimed at meeting family needs on around 3 ha (Deere et al., 2016). This was believed to increase national production by facilitating technical assistance and access to inputs and machinery for farmers (Burnhill, 2014). In 1972, a total of 136,500 private farms were linked to the state system (Figueroa-Albelo, 2003). Specifically, 24,500 farms were integrated into state enterprises, 86,200 were working independently but subject to the state plan, and the remaining 25,800¹⁵ refused to be incorporated into any state plan, but delivered their production to the state (Figueroa-Albelo, 2003).

The state-controlled agricultural inputs and machinery (imports and production), and only state establishments could provide them. Private farmers had a marginal place in centralized input allocation policies. Deere et al. (1992) describe private agriculture relying on ox plow and family labor, while state farms were fully mechanized. Private farmers' limited access to inputs (seeds, tools, machinery, irrigation) was further affected by the economic crisis and the policy of prioritizing certain crops. The private importation of inputs, implements, and machinery was not permitted. This meant that, in effect, the private peasantry was at a disadvantage compared to state enterprises and CPAs. With this state of affairs, it is appropriate to assume that peasants were indeed already practicing low-input agriculture, at least with non-prioritized crops or special state plans, due to context constraints.

On the other hand, the state intermittently allowed private food commercialization (peasant free markets), between 1980 and 1986, and from 1994 onward. The opening of free markets had a positive impact on the production performance of private farmers (Figueroa-

Albelo and García de la Torre, 1984; Rosenberg, 1992; Marshall, 1998; Mesa-Lago, 2014), but in a very restrictive environment and after fulfilling state production commitments.

Therefore, peasants have to rely on the state collection and commercialization system and the black market. The collection system relies on plans and agreements based on the farms' potential productive capacities and on the state's interests with respect to the crops. At the end of the 1980s, the production plan to be delivered to the state and the planning of resources to carry out the plan were drawn up between the cooperatives, ANAP,¹⁶ the Private Sector Directorate of the Ministry of Agriculture, and the State Collection Company (Deere et al., 2016). In a country where the domestic food demand has not been met, there will always be space to negotiate over crops to a greater or lesser extent (this was confirmed in an interview with a CCS representative). Regardless, in times where supply and demand (free) markets were permitted, many farmers continued to rely on the state's collection system because of a lack of transportation and storage means and inappropriate regulations (e.g., between 1980 and 1986, farmers had to sell their produce themselves on the free market).

Nonetheless, these peasants, namely individual farmers and CCSs,¹⁷ enjoy more autonomy than state farm workers and members of collectivized CPAs and UBPCs¹⁸ (see **Table 3**). In a speech in 1992, Fidel Castro spoke contemptuously about private farmers:

We try with the farmers to use the most appropriate methods: What do they want to sow? The program is so much. So much garlic has to be sown, how many caballerías do you want? There you have it. So many carrots to plant, how many do you want? There you have it. “I don't like such a crop.” Don't worry, that the State will sow it. The State sows today what the farmers don't like. If they don't like to sow sweet potato so much, the State sows sweet potato, whatever is missing; if it's cassava, cassava; if it's tomato, tomato; if it's potato, potato. We ask

16. In principle, the plan included only peasant members of ANAP. However, ANAP accompanied its efforts to bring these farmers into the organization by developing special plans for individual farmers who were not members of ANAP (Deere et al., 2016).

17. Private farmers and CCS members, although these limitations, are not all poor. Unfortunately, there are no studies on poverty in rural Cuba, but based on field observations, private and CCS farmers have better economic conditions. Especially during the food crisis of the 1990s, they enjoyed the advantage of not being food insecure being able to produce their own food and benefited greatly from the black market and the free farmers' market. Having better economic opportunities allowed them also to acquire inputs in the black market. Some of them managed to construct houses, buy vehicles, and enjoy living standards well above average.

18. The levels of autonomy of CPAs and UBPCs from the state suffered variations during different periods, with the last period of analysis between 2008 and 2015 when greater levels of decentralization were allowed by the state.

15. These farmers are said to be in better economic conditions (Figueroa-Albelo, 2003).

individual farmers: How much potato do you want to plant, so much? Don't worry. The rest is sown by the state and the cooperatives. The cooperatives work very well and they deliver their products to the farmers, so there is no problem with that. (Castro, 1992)

Scientists and academics who prompted the organic or agroecological movement saw the possibility of putting their ideas to the test on small farmer plots that enjoyed relatively less dependence on the state, namely independent farmers and CCS members.¹⁹ In addition, studies on the experience of the Farmer-to-Farmer methodology in Cuba (Machín Sosa et al., 2010; Rosset et al., 2011) report that CCSs were more agile than CPAs in adapting to the Special Period conditions and adopting new cultivation techniques. These studies, along with the experts interviewed, highlight that, 3 factors facilitated the adoption and experimentation of agroecological practices in CCSs: productive decisions are made at the farm and family level, private farmers have a greater sense of belonging, and the benefits of work are more evident than in CPAs. In CPAs, on the contrary, decisions need the consensus of the assembly, the cultivation of collective lands and remuneration for collective results limits the sense of belonging and knowledge of the results. In the following years, ANAP's policies promoted the practice of assigning CPA members to specific plots in the cooperative to improve their sense of belonging (Machín Sosa et al., 2010).

Introducing experimentation and the use of low-input techniques to state farms with state-defined concerted production plans, assigned technology packages and with very vertical control and power structures would have been time-consuming and difficult. On the other hand, international partners were particularly interested to work with small farmers (Wright, 2005), probably motivated by international trends in the organic movement. Premat (2012) finds private *parcelas* were spaces of choice for international funders wanting to support the population without involving of the state. In turn, these *private parceleros* enjoyed a privileged position in the funding schemes of domestic and foreign NGOs.

Thus, the assumption that agroecological agriculture is more represented in non-state agriculture reflects internal factors related to the relative autonomy of farmers from the state. However, this perspective was also promoted externally by the work of international projects and

programs with interest in working specifically with small non-state farmers. In interviews with farmers, it is clear that they appreciate being part of international projects and enjoying the benefits these projects bring. Interestingly, the minor tools and inputs (e.g., rubber boots, machetes, gloves, fence wire, spray bags) that these projects distribute to farmers appear to be one of the main benefits of participating in these projects. The impact of these projects and programs on the consolidation of an agroecological mentality has not been measured. While some studies found an elevated commitment with agroecological principles and ideas (e.g., Rosset et al., 2019; Rosset and Val, 2019; Val et al., 2019; Val, 2022), other qualitative studies based on in-depth interviews reflect the presence of a mentality more akin to industrialized agriculture among non-state farmers (Enríquez, 2003; Wright, 2005; Funes-Monzote, 2008; Nelson et al., 2009; Wright, 2009).

As land is increasingly managed by non-state structures, more space is theoretically provided for the agroecological movement, strongly backed up by the fact that the percentage of cultivated land managed by CCSs and independent farmers more than doubled between 1997 and 2016 (see **Table 4**). Nonetheless, as Wright remarks: "campesino production was not necessarily ecological: campesino farmers were relatively wealthy and could afford to access agrochemicals sold on the black market" (2005, p. 273). Moreover, in times of economic improvement, resource allocation policies and crop prioritization can act as catalysts for increased use of conventional inputs. Although some opposition to the use of state-allocated resources by agroecological farmers has been experienced anecdotally, such confrontation to state policies is not observable in most of the country's cooperatives and farms.

5. Agrochemicals, yields, and agroecology

With economic improvement since the late 1990s, the import and consumption of agricultural chemical inputs has slightly increased (**Figures 1 and 2**). Although the total aggregated amounts of imports and consumption are lower than in the precrisis period, an analysis by crop could provide a different picture. Unpublished doctoral research and controlled-circulation studies on the island reflect high levels of pesticide residues in prioritized crops (Wright, 2005, 2012).

Different studies have identified higher intensities of use of agrochemicals in state-prioritized crops than in non-prioritized crops (Wright, 2005; Deere et al., 2016). In-depth interviews (experts and farmers) in the field corroborated this assertion. The state controls the importation of chemical inputs and domestic production. The different levels of imports and production over time depend on the fluctuating state purchasing power, investment capacities, and levels of prioritization of agriculture in the general political domain in the country.

Decisions regarding chemical input use on farms are taken by state agriculture organizations. This is especially true for prioritized crops through the delivery of "technical packages" decided in the production plan, that is, inputs, input usage directions, general planting guidelines, and official vertical channels of pesticide

19. Interestingly, farmers highlight how agroecology makes them less dependent on the state: "Unlike conventional agriculture, you cannot submit to large productions because the results are long term and you need a level of resources to be efficient, so the good thing about agroecology is that it makes you independent, you do not have to be thinking if there is fertilizer in the port or if the fuel arrived" (P007SS), "Agroecology makes you less dependent on the state, because you do it with the resources you generate on the farm, it's like establishing a closed cycle" (P005SS). Their statements overlook that it was actually their higher autonomy from the state that in the first place allowed them to experiment with agroecology.

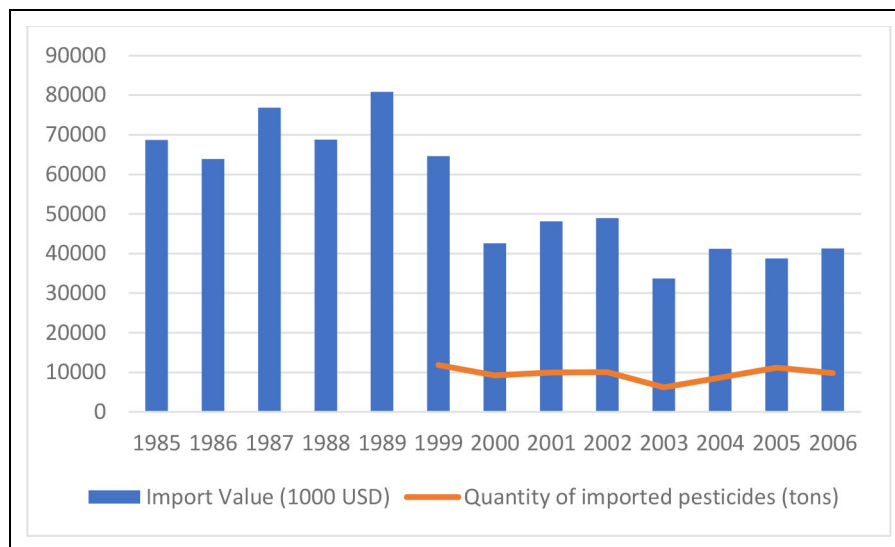


Figure 1. Total pesticides trade, Cuba 1985–2006. This graph shows pesticide import values for the period of 1985–2006 and the number of tons of imported pesticides in the period of 1999–2006. There is no information concerning pesticide imports between 1989 and 1999 or after 2006, nor information concerning quantities imported prior to 1999. *Source:* FAOSTAT_data_6-12-2020. Pesticide Trade.

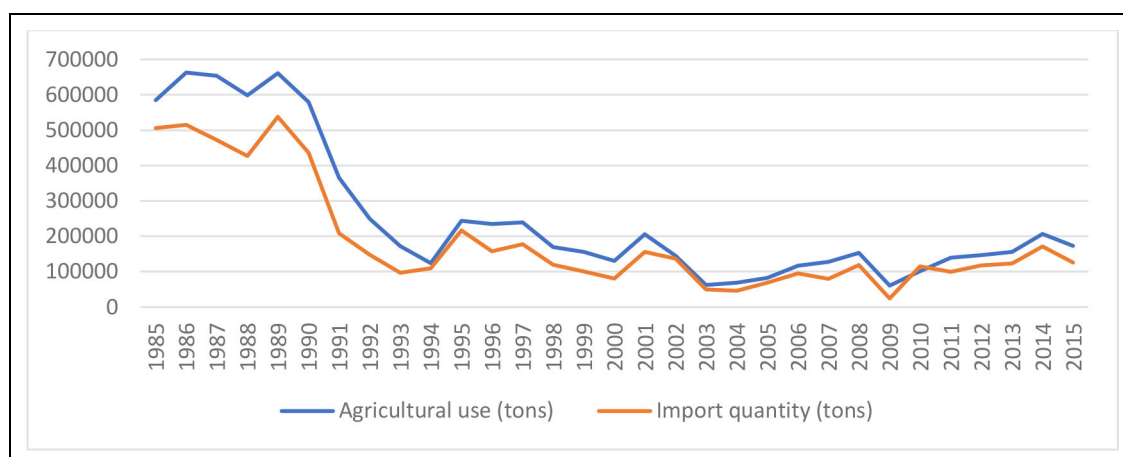


Figure 2. Total consumption of fertilizers, Cuba 1985–2015. This graph shows the number of tons of fertilizers used in agriculture (in blue) and the number of tons of imported fertilizers (in orange) in the period of 1985–2015. *Source:* FAOSTAT_data_9-16-2020. Fertilizers by Nutrient.

distribution. If state instructions are not followed, the farmer can be fined. Even if production plans are not met, state inspectors investigate whether the inputs contained in the “technical package” were diverted to other crops or sold on the black market. With these regulations being enforced there is little possibility or incentive for farmers with contracted prioritized crops to convert to organic or an agroecological approach. Moreover, farmers are subject to pressures for increasing production. This productivist approach threatens any attempts of long-term agroecological conversion.

We have had moments of ups and downs with the topic of agroecology because there are times when with agroecology we cannot respond to high productions, . . . , and on many occasions we have to respond to a productive commitment that with

agroecology is very difficult for us, it is difficult because resources are scarce and the results are not seen in the short term. (P007SS)

. . . sometimes what I was saying happens, a high level of production is needed at a certain moment and with agroecological practices you can reach them in the medium or long term and therefore you have to avoid some steps of agroecology to be able to respond to the growing needs of the population. (P007SS)

6. Looking at prioritized and non-prioritized crops

Because the “technical packages” are related to conventional or industrialized agriculture, one expects to find

significant differences in production levels and yields between the state and non-state agriculture and for prioritized and non-prioritized crops. The following analysis makes use of the same data accessible to agroecology proponents and critics and consequently has the same limitations. Especially significant in this case is that Cuban statistics on agricultural performance only distinguish between state and non-state productions, making the measurement of private farmers' performance impossible. In the non-state category, the UBPCs, CPAs, CCs, and independent farmers are included. UBPCs and CPAs, as previously mentioned, are not generally considered agroecological niches. Nevertheless, some success stories in UBPCs and CPAs appear in the studies of Funes-Monzote (2008), Wright (2005), and Funes et al. (2002) and are included in the Urban and Suburban Agriculture Program. Lastly, and crucially, Cuban statistics do not reflect farmers' production for self-consumption (and of course the black market) and only gather what was channeled by formal means.

To understand how these data are used in the context of pro-agroecology argumentation, here is a typical example from Machín et al. (2010):

Another way to tease out the relationship between peasants, food production and agroecology is to look at production data and use of agrochemicals. For example, the production of vegetables, which are typical peasant crops, fell by 65 percent from 1988 to 1994, but by 2007 had rebounded to 145 percent over 1988 levels. This increase came despite using 72 percent fewer agricultural chemicals in 2007 than in 1988. Similar patterns can be seen for other peasant crops like beans (down 77 percent in 1994, but at 351 percent over 1988 levels by 2007, with 55 percent less use of agrochemicals) and roots and tubers (down 42 percent in 1994, at 145 percent of 1988 levels by 2007, with 85 percent fewer agrochemicals). This contrasts dramatically with sugarcane, not a peasant crop, which saw yields fall in 1994 to 25 percent below 1988 levels, and fall another three percent by 2007, precisely the same time period during which production of the peasant crops leaped, and this even though the reduction in agrochemical use in sugar (down just five percent by 2007) was insignificant. (Machín et al., 2010, p. 52; reproduced also in the study by Rosset et al., 2011)

This kind of analysis overlooks important policy-shifts concerning land distribution (see **Table 4**) and crop prioritization. Before the collapse of the socialist bloc, Cuba was heavily reliant on sugar production, which was 74.7% of the total value of exports between 1985 and 1989 (Pollitt, 2004). In the late 1980s, the government launched the "Food Program," moving the focus to staples for domestic consumption in both state and non-state agriculture. This focus increased during the food crisis in

the 1990s when agroecology practices were spreading. After the fall of the USSR, sugar production was intermittently prioritized depending on world market prices, and the economy moved to being service driven (tourism and medical services). The comparison of agroecological outputs with sugarcane production in the above quote is tendentious. Sugarcane yields were declining since the mid-1980s for a variety of reasons involving field exhaustion by permanent year-on-year cultivation, soil compaction due to intensive use of heavy machinery, overuse of agrochemicals, dependence on import inputs, and poor planning (Pollitt, 2004; Marquetti Nodarse, 2016). Between 1997 and 2002, the government downsized the sugar industry by closing half of all sugar mills and short after dissolved the Ministry of Sugar. This transferred around 1.3 million ha to food production for domestic consumption and a growing tourism sector.

The analysis that follows looks at 6 specific crops in the period of 1995–2015: potatoes, citrus fruits, beans, maize, tomatoes, and sweet potatoes. Potatoes and citrus represent prioritized crops by the state. Potato cultivation is the paradigmatic example, according to the literature and interviews in the field, of a crop with prioritized allocation of resources and conventional inputs (irrigation systems, regular distribution of fuel, spare parts, fertilizers, and pesticides) and also prioritized collection and payment by the state.²⁰ Citrus fruits, once one of the key products of the exchange with the socialist bloc, are also prioritized by the state and produced on a large scale.

The remaining crops are not priority crops and are associated with small-scale, non-state agriculture. They constitute important crops for the Cuban diet and are produced for domestic consumption. In the case of sweet potatoes and tomatoes, they were selected considering their performance compared with 2 other countries, the Dominican Republic and Costa Rica. According to FAO estimates, in the year 2014, yields of sweet potato production in Cuba are higher than in the Dominican Republic and Costa Rica, while yields of tomato production are much lower.²¹ Nonetheless, sweet potato and tomato production are both reportedly among the few crops that recovered to precrisis levels of production (Brundenius, 2009).

As noted earlier, Cuban agroecologists assert that non-state (cooperative and private) agriculture with a low percentage of the land produces a high percentage of the country's food. The claim is true, but only at a nominal level. In 2015, non-state agriculture produced more than 90% of the national production of beans, maize, sweet potatoes, and tomatoes (see **Figure 5**) and more than 75% of potatoes (see **Figure 3**). However, once the relationship between the proportion of harvested area and

20. Pro-agroecology interviewees perceive potato cultivation as a whim of the revolution considering the island's climatic conditions and consider the cultivation of other roots and tubers (e.g., sweet potato, taro, manioc) more appropriate for Cuba.

21. See FAOSTAT_data_21-12-2021. Production. Crops and livestock products.

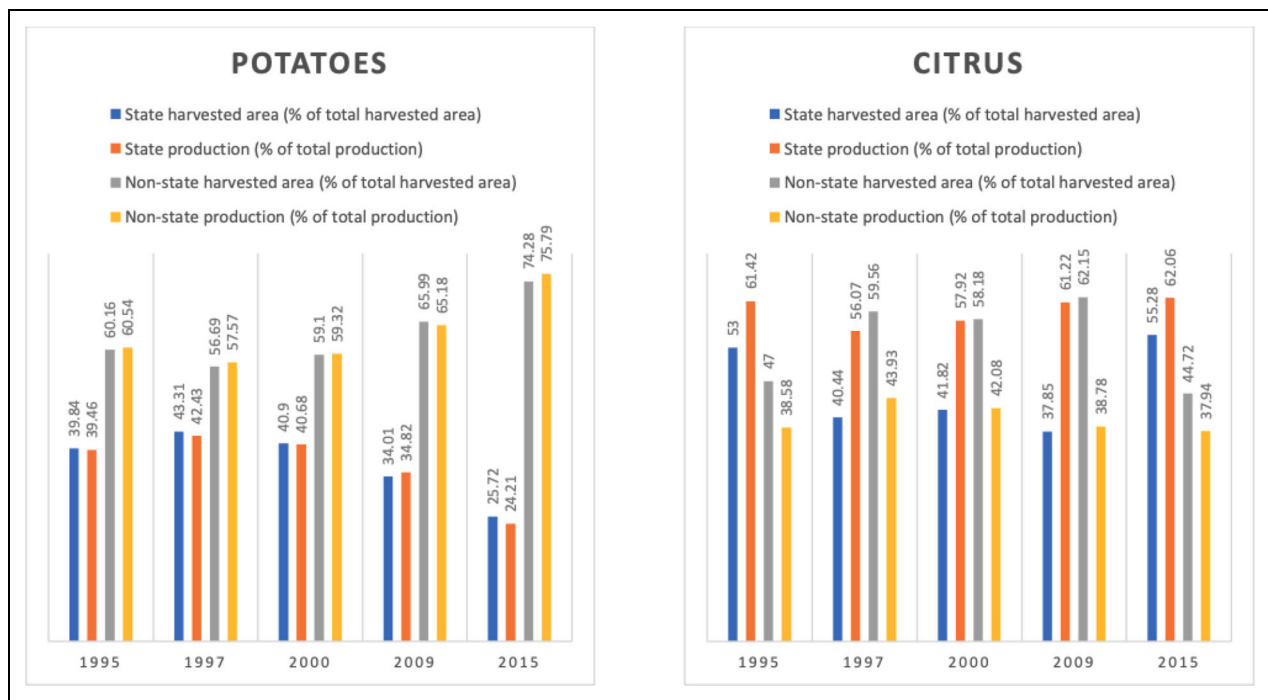


Figure 3. State and non-state land and production of prioritized crops, Cuba 1995–2015. This figure shows the proportion of harvested area (relative to the national total) and production (relative to the national total) of state and non-state agriculture of potatoes and citrus in the period of 1995–2015. The figure shows the similarities between the proportion of harvested area and production level in state (blue and orange) and non-state (gray and yellow) agriculture for potatoes and the dissimilarities for citrus. *Source:* Data compiled from ONE (2000) and ONEI (2015, 2016).

the proportion of production is considered, the statement becomes only partially relevant (see **Figures 3** and **5**). In the case of potatoes, beans, maize, tomatoes, and sweet potatoes, the percentage of production with respect to national production is an expression of the proportion of the harvested area. In other words, non-state production is greater because the area dedicated to these crops has also increased by very similar proportions.

The potato is a priority crop with very restrictive regulations for its commercialization. Potatoes are marketed through state-regulated distribution channels at controlled prices and are not allowed to be sold in supply and demand markets. Its absence in regulated establishments has political implications that are expressed in the discontent of the population. With such limited space in the informal market and no space in the private market, official data likely reflect real values.

Potato cultivation, as shown in **Figure 3**, is better represented in state agriculture than other non-prioritized crops (**Figure 5**). Presumably, although there are no data to prove it, UBPCs and CPAs produce a large share of non-state potatoes. However, on April 29, 1992, Fidel Castro supported this idea when he referred to potato production in the western region of the country. In the speech, Fidel affirmed that state farms cultivated 436 *caballerías* and obtained a yield of 6,193 quintals per *caballería*, CPAs²² cultivated 84.2 *caballerías* and had

a yield of 6,261 quintals per *caballería*, and finally individual farmers (and CCSs) cultivated 17.4 *caballerías* with yields of 4,569 quintals per *caballería*. Additionally, one of the famous “Gómez brothers”²³ (independent farmers) stands out in the speech as having achieved yields of 11,200 quintals per *caballería*. From 1992 onward, the land management structure has varied (see **Table 4**), yet no significant differences exist when considering the proportion of harvested land and production or productivity (see **Figure 4**).

In the literature, there are no recorded experiences of agroecological potato cultivation. However, some years ago, experiments in organic potato cultivation began to be conducted at 2 agricultural research centers.²⁴ However, neither of these experiments has been carried out on a large scale for national production.

The production levels and yields of state citrus agriculture (**Figures 3** and **4**) are, on the other hand, significantly higher than those of non-state agriculture. Citrus fruits constituted the second most important export item of Cuban agriculture in the years of the socialist bloc. More than 80% was produced in state farms with high

22. At that time, UBPCs had not been created.

23. The Gómez brothers also appear in a speech on May 17, 1991, where Fidel highlights their yields in sweet potato production.

24. See in the press, <https://www.canalcaribe.icrt.cu/estacion-de-indio-hatuey-lidera-siembra-de-papa-agroecologica/>; <https://www.radiosantispiritus.cu/es/2021/02/producen-papa-ecologica-en-taguasco/>.

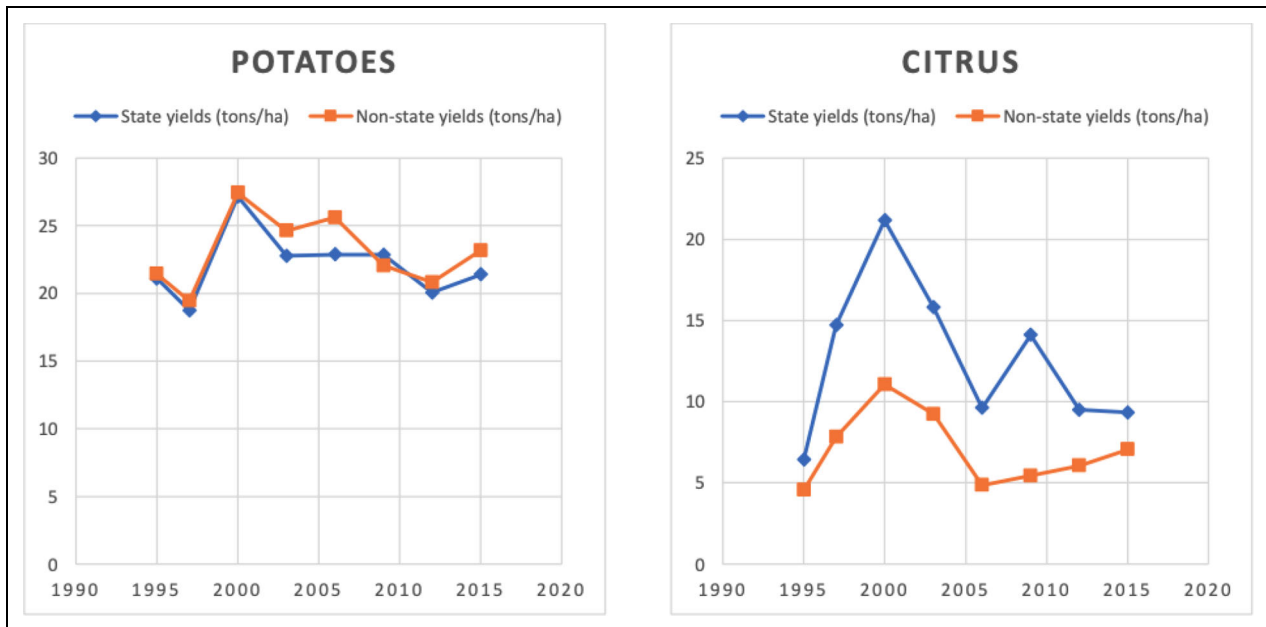


Figure 4. State and non-state yields of prioritized crops, Cuba 1995–2015. This graph shows a comparison of state (in blue) and non-state (in orange) agricultural yields of potatoes and citrus in the period of 1995–2015. *Source:* Data compiled from ONE (2000) and ONEI (2015, 2016).

levels of mechanization celebrated in Fidel’s speeches (Castro, 1986, 1987, 1990a). With the creation of the UBPCs in 1993, an important part of citrus production was formally transferred to the non-state sector. In 1997, over 85% of the land cultivated with citrus fruits was managed by the state sector (44.24%) and the UBPCs (41.44%).²⁵

In 1993, during the peak of the crisis, production fell by 32% compared to 1989.²⁶ By 2000, production levels had increased, but citrus production was affected by the citrus disease *huánglongbīng* (HLB; or citrus greening disease), reported in Cuba in 2007. Hence, production levels and yields fell dramatically. However, the differences between state and non-state performances remained stable between 1997 and 2009 (**Figure 4**). A proportion of the citrus cultivation was produced organically for export. However, this experience can hardly be classified as agroecological. Citrus cultivation was most likely carried out according to conventional standards of scale and mechanization in state farms and UBPCs, only without the application of chemical fertilizers and pesticides.

The non-prioritized crops analyzed are mostly produced by non-state agriculture (**Figure 5**). As a trend, the increase in the proportion of harvested area is reflected in the increase in the proportion of national production. However, the yield trend (**Figure 6**) shows that state yields

were significantly higher in 2009 for all the crops analyzed.

Until 2006, the state and non-state yields were quite close and showed a similar trajectory. The fall in non-state yields and the increase in state yields between 2006 and 2009 seem paradoxical. On the one hand, during Raúl Castro’s mandate, measures were implemented that favored non-state agriculture. Measures included, for example, an increase in prices paid to peasants for agricultural products, the settlement of state debts with peasants, and the distribution of land in usufruct (Mesa-Lago and Pérez-López, 2013; Nova-González and Figueroa Alfonso, 2018). While Cuba was hit by 4 hurricanes in 2008, small-scale peasant agriculture is reportedly more resilient to hurricane and drought impacts (Rosset et al., 2011).

Two explanations seem possible. The first is that, in the context of the world food crisis, the government prioritized inputs to state agriculture because it made up a greater proportion of regulated food distribution to the population through routes such as school and hospital canteens, for example. Fertilizers were also very scarce in 2009 (**Figure 2**), hence, this would have been a logical prioritization strategy.

The second explanation is more complex. Between 2000 and 2009, the proportion of state harvested area of the selected crops declined sharply (**Figure 5**), that is, from 20.24% to 3.75% for beans, from 18.49% to 4.45% for corn, from 20.84% to 7.69% for tomatoes, and from 19.83% to 11.43% for sweet potatoes. The change was the result of the land distribution policies of Raúl’s government that began in 2008. The thousands of hectares of idle state land distributed among individuals, cooperatives, and state farms multiplied the total harvested

25. Author’s estimates from data published by the *Oficina Nacional de Estadísticas* (ONE, 2000).

26. Author’s estimates from data published by FAOSTAT_data _21-12-2021. Production. Crops and livestock products.



Figure 5. State and non-state land and production of non-prioritized crops, Cuba 1995–2015. This figure shows the proportion of harvested area (relative to the national total) and production (relative to the national total) of state and non-state agriculture of beans, maize, tomatoes, and sweet potatoes in the period of 1995–2015. The figure shows the similarities between the proportion of harvested area and production level in state (blue and orange) and non-state (gray and yellow) agriculture. *Source:* Data compiled from ONE (2000) and ONEI (2015, 2016).

area of each of these items; 154.87% for beans, 116.59% for corn, 169.87% for tomatoes, and 99.26% for sweet potatoes.²⁷ The inexperience of the new landholders

(according to official reports in 2012, only 23% of the usufructuaries had previous experience in agriculture), and the conditions of the soils handed over (degraded or invaded by marabou and other weeds) may have decreased the sector's productivity. This would also explain the gradual recovery of non-state yields by 2012 and 2015 (Figure 6).

27. Estimated by the author, based on data on the harvested area from ONE (2000) and ONEI (2015).

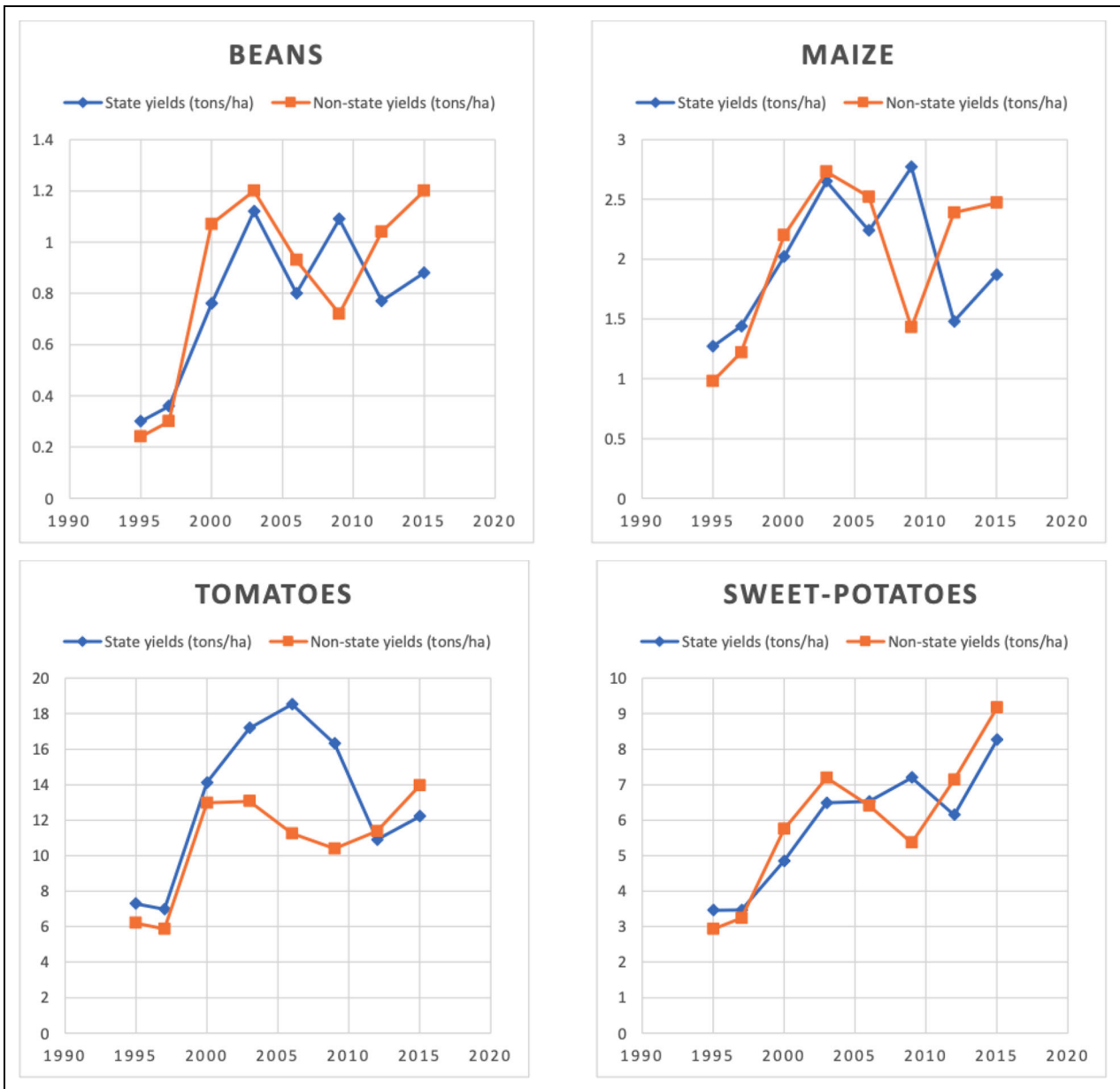


Figure 6. State and non-state yields of non-prioritized crops, Cuba 1995–2015. This graph shows a comparison of state (in blue) and non-state (in orange) agricultural yields of beans, maize, tomatoes, and sweet potatoes in the period of 1995–2015. *Source:* Data compiled from ONE (2000) and ONEI (2015, 2016).

The case of tomatoes, however, is unique. Tomato yields are much lower than those achieved in the Dominican Republic and Costa Rica, even when taking the higher value achieved by state agriculture. **Figure 6** shows the superiority of state yields up to 2012. In 2006, the state yielded 7 tons per hectare more than non-state agriculture and in the other crops studied the most marked differentiation occurred in 2009. In 1993, a study reported that tomato production was receiving preferential fertilizer allocation, only after potatoes, onions, and garlic (Deere et al., 2016). Tomato is one of the main crops of the urban agricultural system, in which the use of chemical inputs is prohibited. Unfortunately, there are no data to determine how much of non-state production is part of urban agriculture and no conclusions can be drawn on how the prohibition and the ecological approach impacted the yields.

Sweet potatoes have higher average yields than those of the Dominican Republic, Costa Rica, and the Caribbean in 2015.²⁸ Their cultivation in the country does not require many inputs because of the island’s climate. According to the data published by FAOSTAT, it is the only crop analyzed that has no recorded imports in the period.²⁹ Its production reflects the area harvested and its yields follow the same trajectory as the other non-prioritized crops.

Beans are an essential part of the Cuban diet. The non-state sector has historically produced the largest

28. See FAOSTAT_data_21-12-2021. Production. Crops and livestock products.

29. See FAOSTAT_data_21-12-2021. Trade. Crops and livestock products.

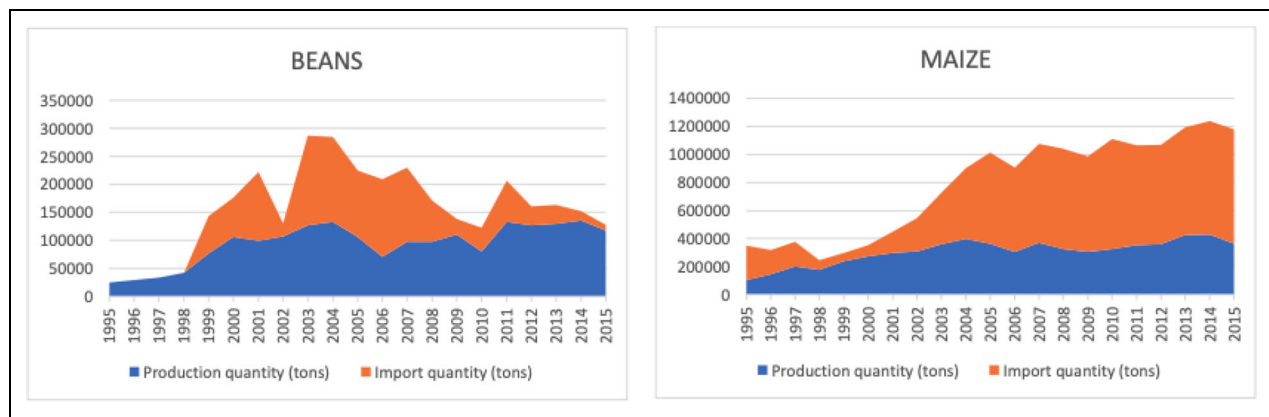


Figure 7. Availability of beans and maize, Cuba 1995–2015. This figure shows the availability levels of beans and maize in the period of 1995–2015, distinguishing domestic production values (in blue) and imports (in orange). *Source:* Data compiled from FAOSTAT_data_9-18-2020. Trade. Crops and livestock products.

proportion of beans. However, domestic demand is not been met and the country imports beans annually. The amounts imported vary. In 2001 and 2003–2007, the amount imported exceeded annual production (**Figure 7**). In terms of yields, bean production follows a similar trajectory to other products, with non-state yields recovering to 2003 levels by 2015.

The case of maize shows the most marked difference in yields in 2009, when state yields had nearly doubled non-state yields (2.77 and 1.43 tons/ha, respectively). It is in this same year, coincidentally, that the experimental cultivation of nationally produced transgenic maize is officially reported (Funes-Monzote and Freyre-Roach, 2009; Funes-Monzote, 2010). Although average maize yields are higher than those reported in the Dominican Republic, Costa Rica, and the Caribbean region, it appears that the area under cultivation is not sufficient to meet domestic demand and high amounts are imported each year (**Figure 7**). Interestingly, in the period of 2002–2012, between 60% and 100% of these imports came from the United States,³⁰ which highlights the interdependencies between production levels, land-use agricultural policies, and state food import decisions.

7. Discussion and concluding remarks

The study analyzed 3 widely accepted assumptions in agroecology studies in Cuba, namely that Cuban agroecology is carried out by small-scale, non-state farmers growing non-priority crops, as they relate to the policies for agriculture in the country. The analysis showed a correspondence between the above assumptions and agricultural policies in Cuba on land use and tenure and preferential allocation of inputs to priority crops.

Cuban agriculture is mostly small-scale due to the historical policies of the revolution (e.g., land reforms limiting the accumulation of land and wealth by private landowners) and the anti-crisis policies implemented by the Cuban government after the disappearance of the socialist bloc (e.g., the division of state lands). Private latifundia have

not existed since 1959 and policies implemented since the 1990s have increased the space for small-scale agriculture by distributing state land in usufruct to non-state actors, which drastically reduced state management (not ownership) of land. In collective production cooperatives (CPAs and UBPCs), models have been implemented to link farmers to specific plots in an attempt to mimic the model of independent production cooperatives (CCSs), which in effect expands the space for small-scale production.

Although food production is mostly carried out by non-state organizations, the state controls the distribution of inputs, machinery, production plans, and most of the marketing. However, private production has greater autonomy than state production, especially in non-priority crops. Policies for allocating agrochemical inputs to priority crops, coupled with the scarcity of long-stay inputs, have allowed relatively stable spaces in which agrochemicals and other inputs typical of conventional agriculture are very limited or inaccessible.

The study also tested the argument widely made by scholars on Cuban agroecology, namely that agroecological agriculture, understood as small-scale, non-state, non-priority crop agriculture, produces more and more efficiently than state agriculture (considered non-agroecological). The descriptive statistical analysis of the performance of selected 2 prioritized and 4 non-prioritized crops showed that the outputs of non-state production are proportional to the share of cultivated area per crop, which has increased in recent years due to the government's land distribution policies. In addition, the analysis by crop did not show marked differences between the yields of state and non-state agriculture. On the contrary, similar trends of increases or decreases emerged, depending on the years, in both prioritized and non-prioritized crops, with the exception of 2009. While no conclusive explanations can be drawn from this analysis, the finding does allow some hypotheses to be made.

First, Cuban agriculture is usually described as the most disappointing sector of the national economy (Mesa-Lago and Pérez-López, 2005; Brundenius, 2009; García-Álvarez and Nova-González, 2014). Many indicators show that its

30. See FAOSTAT_data_9-22-2020. Detailed trade matrix.

performance is below that of the region and below the levels reached in the country in the mid-1980s. The factors explaining the decrease in productivity are well documented in the literature. A list would include the exhaustion of soils after years of sugarcane monoculture and overfertilization but also the lack of incentives and policies of prioritization of a few export crops and food import policy. However, if attention is paid to the area cultivated per crop, it is observed that the crops that have recovered production levels (in total amounts) similar to those of the mid-1980s have done so from a proportionally greater increase in the area dedicated to that crop or production, which is also consistent with the fact that Cuba has not been able to match the availability of agrochemicals with the period before the fall of the socialist bloc.

The results seem to indicate that state and non-state agriculture face similar challenges, based on their similar production and yield behavior. This conclusion is consistent with the fact that crop prioritization policy does not distinguish between forms of land management, that is, potatoes are a prioritized and contracted crop in the state collection system and the allocation of inputs from their cultivation is similar for state and non-state farms.

The performance of non-prioritized crops, which receive limited or no input allocation relative to the country's financial and productive capacities, should theoretically showcase the differences brought about by agroecological approaches. However, since there are no significant disparities observed between state and non-state agriculture in these crops, it suggests that agroecological systems have achieved production levels comparable to conventional methods. This finding holds implications for the agroecological movement, as it highlights the potential of agroecology to deliver similar production outcomes while offering additional benefits such as environmental services and other positive impacts in various areas.³¹

In terms of productivity, a comprehensive cost and benefit analysis is needed to evaluate net differences in investment, energy use, soil conservation, and diminishing returns between conventional and agroecological agriculture in Cuba. Such analyses could further support the economic and ecological suitability of the agroecological model, considering factors like the scarcity of agrochemicals and limited access to imported inputs and machinery.

To deepen our understanding and test the hypotheses presented, additional studies are necessary. These studies should encompass a broader range of crops and collect data that differentiate strictly private production from state production, including military production. They should also examine the impact of changes in autonomy

and the potential for improved economic benefits in both state and non-state agriculture.

Data accessibility statement

The data used for the descriptive analysis of Cuban agriculture are available on the website of the National Office of Statistics and Information of Cuba (<http://www.onei.gob.cu/>) and in the FAO database (<https://www.fao.org/faostat/en/#home>). The regulations of the agricultural policy analyzed are available on the page of the Official Gazette of the Republic of Cuba (www.gacetaoficial.gob.cu/es).

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Competing interests

The author has no competing interests to declare.

Author contributions

Contributed to conception and design: GFA.

Contributed to acquisition of data: GFA.

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