



# Local dynamics of native maize value chains in a peri-urban zone in Mexico: The case of San Juan Atzacualoya in the state of Mexico

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## ABSTRACT

In Mexico, maize forms of production range from industrial scale with hybrid maize, to smallholder farmers who mainly grow local varieties, contributing significantly to the national provision for human consumption. The objective of this study was to describe the local value chains of native maize in a peri-urban community in the east of the Valley of Mexico, exploring its contribution to the livelihoods of the families living within 50 km of Mexico City. Through a mixed quantitative (320 surveys) and qualitative (53 interviews) analysis, we found that more than 60% (250 tons) of the annual production of native maize in San Juan is locally consumed as tortillas: firstly, manually transformed by the women of the village for auto-consumption and local sale, and secondly, mixed by tortillerias with hybrid maize from other regions. More than 400 families in this locality (approximately one third) are directly involved in the production-transformation-consumption chain of native maize. Of the maize producing families, half consume their own product. There are 70 women involved in transformation that thereby obtain 75% more value for the native maize grain. More than a quarter of the tortillas consumed by the population originate in this local production and transformation. Based on this study, in the national current context of food supply and agricultural development, the development of these local markets that are economically equitable is a viable economic model that limits the number of intermediaries and favors diversity of the raw materials, products and actors involved in transformation and distribution.

## 1. Introduction

Demand for maize in Mexico has increased rapidly over the last three decades in response to a growth in poultry and pork production (maize, particularly yellow maize, is an important component of animal feed) and increased demands from the starch industry. Mexico imported 14 million tons of maize in 2015–2016 (SAGARPA, 2017), the majority being yellow maize from the United States (11 millions tons). Mexico produced around 28 million tons of maize in 2015–2016, 25 million tons of white maize and 3 million of yellow maize (SAGARPA, 2017). Mexico is largely self-sufficient in white maize, the majority of which is for direct human consumption. Yellow maize is largely for animal feed (Sweeney et al., 2013).

The Mexican agriculture sector is essentially bimodal and this stems from the 1940s. The maize sector is characterized by a large section of poor, small-holder maize producers that have historically relied on labor-intensive production methods and who largely grow white maize, and a more productive commercial sector that farms irrigated land

(Eakin et al., 2014; Sweeney et al., 2013). The commercial and irrigated agricultural sector in the northwest, northeast, and central-west produces both white and yellow maize and, while it constitutes a small share of the total land area sown with maize, it contributes an increasing share of output. For example, high-yielding maize is now a monoculture in the state of Sinaloa, occupying as much as 90 percent of the planted area in some districts (Eakin et al., 2014).

Research has, however, documented the persistence of native maize varieties, mainly at small-scale, that are adapted to the changes and opportunities of the market (Eakin et al., 2014), and thus make a significant contribution to maize supply at national level, particularly that destined for human consumption (Appendini, 2014). More than 250 maize races have been identified in the American continent (Bird and Goodman 1977; Vigouroux et al., 2008) and 59 of them have been registered in Mexico (Sánchez et al., 2000). Twenty-five Mexican land races are used for human consumption with a great diversity of physical, chemical, nutritional and taste characteristics (USDA-ARS, 2005 in Antuna-Grijalva et al. 2008).

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Some authors have demonstrated the inefficiency of some maize seed input chains despite several decades of formal plant improvement and promotion of the resulting improved and higher-yielding varieties (Hellin et al., 2013). There are also advantages to the cultivation of native maize varieties as opposed to formally improved ones. Firstly, they complement the means of subsistence of families (Jarvis et al., 2011; Eakin et al., 2014), particularly in peri-urban zones where diversification of farmers' income sources is commonly based on formal employment and non-farming micro-businesses. Secondly, they provide a quality food source (Appendini et al., 2003; Isakson, 2009; Lerner and Appendini, 2011), used to produce a wide variety of traditional food products called *antojitos* such as tamales, sopes, quesadillas, tlacoyos, elotes, among others (Fernández Suárez et al., 2013). It is said that there are more than 700 ways to eat maize (Echeverría and Arroyo, 2000). Thirdly, many of these native varieties are adapted to local climatic conditions (Eakin, 2005, 2006; Hellin et al., 2014) and are important as part of climate change adaptation strategies (Lazos and Chauvet, 2012). Fourthly, monetary production costs are less than hybrids (Guillén Pérez et al. 2002; Turján Altamirano et al. 2012; Turrent-Fernández et al., 2012). Fifthly, native varieties often command better prices in specialized maize markets (Keleman et al., 2009). However, these “niche” markets (for example, for colored maize) are limited and do not have mechanisms to benefit a large section of the producers (Hellin and Keleman, 2013). Native maize varieties are mainly accepted by small companies, generally from the informal sector – for which reason it is difficult to find information – to produce a wide range of maize based food products (Hellin et al., 2013:321; Eakin et al., 2014). Part of the importance of the cultivation of native maize lies in their cultural value, this is of particular relevance in the Mexican context.

Despite the persistence of native maize, there is concern regarding the possible reduction in cultivation of native maize in Mexico. According to Foyer (2015), re-evaluation of local maize has been largely limited to the scientific sphere, in a political context of opposition to the green revolution, and in favor of the diversity of maize as both a genetic resource and a cultural heritage. The defense of maize has been associated with the concept of bio-cultural diversity, marking a movement in which maize diversity has become an explicitly political resource. Defense of local maize varieties is a characteristic of collective mobilizations to oppose wider social dynamics around rural and agricultural models, as well as biotechnologies driven in the last decade, proposing as an alternative a model of society that considers its relationship with the environment (Foyer, 2015:1–2; Foyer, 2010). However, without entering into the political debate surrounding maize in Mexico, we know relatively little about the structure, function and motivations involved in this complex and informal system of production-transformation-consumption of native maize products, a system that involves various actors. Methods of native maize production are heterogeneous and locally differentiated, the processes of transformation and the products derived from the maize are diverse, and the markets in which the consumers participate are heterogeneous (Keleman et al., 2013; Eakin et al., 2014).

Peri-urban regions, such as the Valles Altos of Mexico, present particular characteristics. These include: high pressure on agricultural land, growing population densities; expansion of urban centers; and speculation on the part of property developers (Aguilar and Ward, 2003). The expansion of Mexico City's has had great impact on local agricultural activities and maize production. Mexico City's population grew from 3 to 18 million between 1950 and 2000 (Garza, 2000) with much expansion towards the North and the East of the Metropolitan Area. This rapid change had important impacts on the livelihoods of rural families in terms of the urbanization of once rural areas and the generation of off-farm work opportunities. Commuting and migration for paid jobs or studies has become a common phenomenon, especially for the younger generation. Agriculture, and specifically native maize production, in mainly performed by the older generation (Arango Miranda, 2006).

Urbanization also has an impact on the cost of living and the price, quality and diversity of food. Food security in urban and peri-urban zones, in contrast to rural zones, tends to depend more on the availability of industrialized goods than on local food production. The population becomes more dependent on the fluctuations of international markets and of the food types available in the supermarkets. However, local maize products remain very popular and street vendors offer a large variety of products from the Mexican culinary tradition (Appendini, 2012; Appendini and Quijada, 2016; Fuentes-Ponce, 2018).

In the region of eastern State de México, maize cultivation has become particularly difficult for small producers since the 1980s. This has largely been due to the phasing out subsidies including those that guaranteed a minimum sale price for maize (Nadal, 1999). Today, the main subsidy for maize production is PROAGRO Productivo (formerly known as PROCAMPO) that provides small amount of money (between 40 and 80 USD per Ha for those who own less than 20 has) for the purchase of inputs (SAGARPA, 2017). In addition, the business Gruma S.A.B. de C.V., developed technology for the production of maize flour, reducing the demand for native maize cultivated in the region since it was not competitive in terms of price and could not meet the quality standards demanded by the maize flour industry (Hellin et al., 2010).

Land reform in the 1990 had an impact on the production of native maize. In Mexico there is a form of land tenure called *Ejido* which is a product of the post-revolutionary agrarian reform process whereby the government distributed state-owned land to farmers (*ejidatarios*). Between 1917 and 1992, the Mexican state reallocated half the land in the country. Collective decision making on the use of natural resources such as forest or water sources was combined with the allocation of arable land for individual use. The ejido property rights system that combined collective and individual features outlawed any kind of land transactions (Bouquet, 2009). In 1992, a major reform was carried out based on issuing individual land titles and the legalization of land markets on agricultural plots. The objective was to define clearly property rights to individuals and to legalize land transactions (sale or lease) on *ejido* land, thus opening the land market to the private investments. These changes in the land tenure system have had an important effect on the type of agriculture performed in rural Mexico. Commercially-oriented farmers have expanded by buying or renting land.

Despite this unfavorable context, the small-scale farmers that continue cultivating maize in the Valles Altos of Mexico often prefer native varieties, which account for 94% of the cultivated area, while the national average is 75% (Espinosa-Calderón et al., 2013). The activities of production, transformation and sale of native maize are conducted mainly in the informal sector (Hellin et al., 2010).

In order to understand the importance of native maize to the livelihood of the peri-urban farmers and population in general, it is necessary to understand the dynamics of local native maize markets, especially the quantities of maize produced, maize types cultivated, and the number of families involved in the production, transformation and consumption of this maize. Trade (seed, grain or transformed product) is mainly limited to, heterogeneous and commonly informal markets where data are scarce. For this reason, studies are necessary that allow an integral understanding of the processes related to production, transformation and sale, as well as the consumption of native maize. This information would provide elements for the construction and application of public policies regarding agricultural production, specifically of native maize in peri-urban zones, with the ultimate aim of simultaneously conserving agricultural activity and supporting local economic development.

The objective of the present case study was to describe local native maize value chains, from production to transformation, distribution and consumption, and to document their contribution to livelihood security in the context of a peri-urban community in the eastern Valle de México.

## 2. Materials and methods

We conducted our study in a zone of Valles Altos of Mexico, called San Juan Atzacualoya, a locality of the municipality of Tlalmanalco, in

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