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Characterization of agricultural practices in the community Mulato Viejo in Oaxaca

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ABSTRACT

Objective: To describe the standard of living in the "Mulato Viejo" community; culture and their agricultural practices facing the current governmental development policies.

Design/methodology/approach: The study was conducted during 2019, applying surveys and interviews to key informants with experience in community-elected positions.

Results: The results showed that families practice some traditional farming techniques based on family labor. There was also a lag in the incorporation of women (5.5%), and in the generational renewal of producers. For example, 84% are older than 40 years-old and out of those, only 69% completed elementary education. Thus, they do not know the rationality fundamentals of the agricultural practices they use. This limits the use of machinery to reduce the workload and the production costs, or to innovate.

Study limitations/implications: The main limitations were the sample size and the replicability of the study; a single community was analyzed. It is proposed then to expand the study to other communities with similar characteristics.

Findings/conclusions: Semi-traditional agriculture has preserved local landraces of maize. Yet, it is necessary for the community to incorporate dynamics that may diversify agricultural activities, crops; and allow establishing networks of cooperation and intra-community trade. So that agricultural activities may become an economic option profitable to further generations, who would have a greater capacity to acquire the bases for a sustainable agriculture. With the goal to improve yield but, with the challenge of keeping the traditional agricultural practices intact.

Keywords: Mulato Viejo, rural nucleus, solidarity networks.

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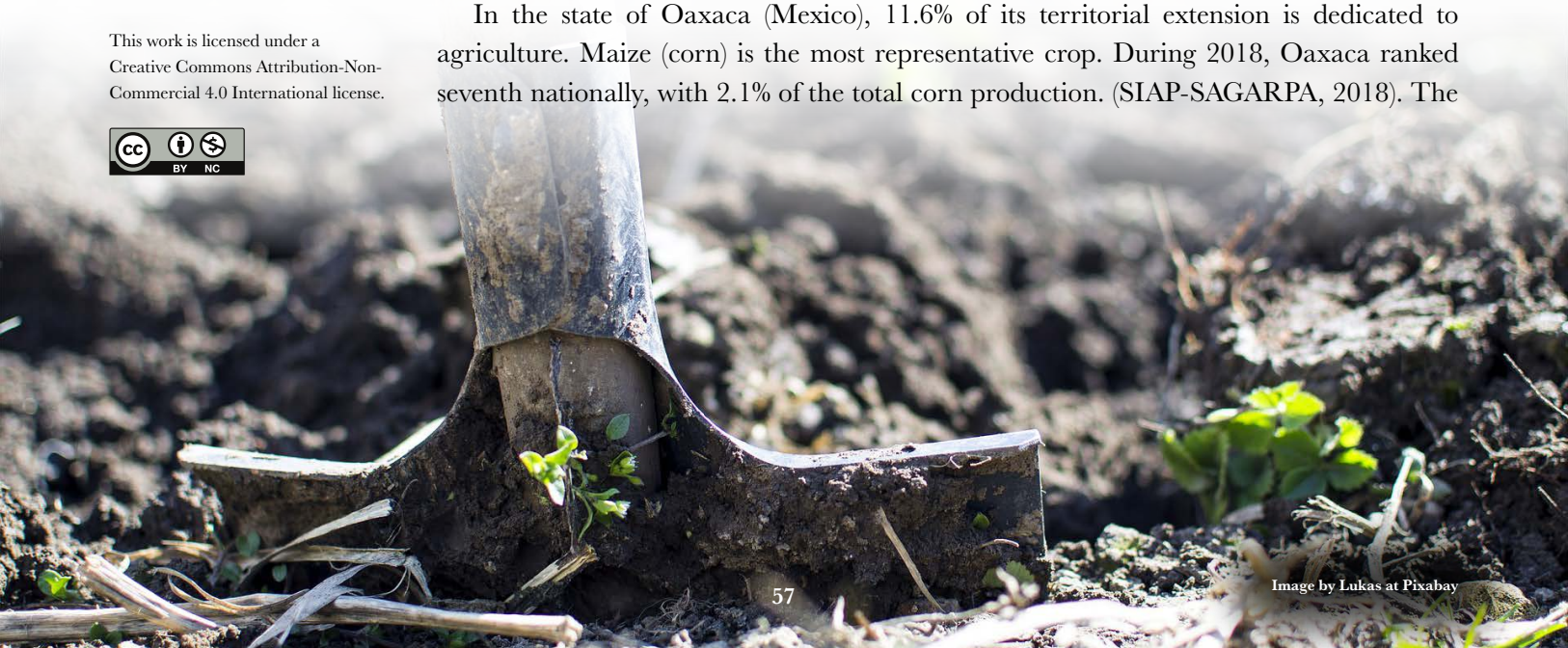
INTRODUCTION

In the state of Oaxaca (Mexico), 11.6% of its territorial extension is dedicated to agriculture. Maize (corn) is the most representative crop. During 2018, Oaxaca ranked seventh nationally, with 2.1% of the total corn production. (SIAP-SAGARPA, 2018). The



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most important regions for the cultivation of this cereal are the Isthmus, the Mixteca, the Central Valleys and the Coast (Government of Oaxaca, 2015). In addition to those regions there is the Papaloapan region, which is defined by the watersheds of the Tonto and Cosamaloapan rivers. White corn is the one mainly sown, which is used for self-consumption and transformation activities. In the municipality of Loma Bonita, a total of 5293 hectares were planted in 2019, out of which 1320 ha produced maize grain; 4062 ha, sugar cane; 1460 ha, pineapple, and 39 ha, Hevea (rubber tree) (ASERCA, 2019).

In 2017, the Cuenca region (named after the basin territory) produced 80 000 to 90 000 Mg of corn. Which represents about 10% of the state's production. However, within the basin itself there are large variations in maize planting yields. In the particular case of the Municipality of Loma Bonita, Oaxaca, the corn yield is 2.8 Mg ha^{-1}; this figure is below the national average for the grain, which is 3.84 Mg ha^{-1}. (Sánchez-Hernández *et al.*, 2019). Maize cultivation is important but not a priority for the economy in this municipality, as they base their economy on livestock, sugar cane, and pineapple plantations. However, due to cultural and food affinities, many of the producers maintain the planting of corn as one of their main agricultural activities.

In recent years, there has been a strong impulse on social programs that stimulate rural development, through a variety of social and economic supports, such as "Crédito a la palabra" (agreement-based credits), "Programa de producción para el bienestar" (Pro-Welfare production program), "Programa de precios de garantía" (Guarantee-prices program) for corn and beans. Other governmental programs are "Apoyo a construcción de vivienda" (Housing construction Support), the program "Jóvenes escribiendo el futuro" (Youth Writing the Future), "Becas para el bienestar" (Welfare through scholarships), etc. Additionally, there has been renewed interest in analyzing and get to know the traditional agricultural practices.

In this regard, Oaxaca has been a strong beneficiary of those initiatives. However, it is important to characterize the population of communities with small number of inhabitants, in order to use them as models for evaluating the impact of social support programs. All of this, to generate proposals that make the programs more appropriate, but at the same time try to influence the communities. Onto the goal of adapting some organizational and community participation proposals to the type of producers, regions and products; In order to generate analyses that correlate and link the productive, environmental, social, cultural and economic aspects involved.

The aim of the study is to describe as a case study, one of the rural communities comprised in the Municipality of Loma Bonita in the state of Oaxaca (Mexico); with particular interest on the cultural practices for planting maize.

MATERIALS AND METHODS

The study was carried out in the community of "Mulato Viejo", located in the Municipality of Loma Bonita, Oaxaca (17° 57' 40" N, 95° 54' 27" W). A non-probabilistic method was used, through a heuristic approach, called "snowball". The study team contacted Zenaida Zuñiga, inhabitant of the community, who introduced them to her relatives, whom are key informants with experience in community positions (community

representative, president of the ejido, etc.); in turn, they assisted us for the distribution and application of surveys to heads of household who are direct producers. The data were collected during October 2018 and until June 2019.

In order to meet the objective proposed in the research, a survey was designed to analyze and evaluate the characteristics of the cultural practices of maize planting (use of machinery, origin of the seed, fertilization, etc.); Likewise, information was collected on the socioeconomic characteristics of the community (schooling, land tenure, sex, secondary occupations, etc.); The surveys were conducted on the total number of maize producers, this is, 18 heads of household. Additionally, cob samples were collected from the September-October-2018 harvest and recorded using photographic evidence. The results were analyzed using descriptive statistics (means, mode, percentages).

RESULTS AND DISCUSSION

The community of Mulato Viejo belongs to the municipality of Loma Bonita in Oaxaca, is part of the 4 communities that make up the ejido of San Benito el Encinal. It is located at 2 km from San Benito, 11 km away of the municipal seat. The rural nucleus consists of two sectors. The first consists of the houses that are organized around the main street, in north-south orientation, along an approximate distance of 2 km. The second sector includes the plots, surrounding the houses, an approximate area of 200 ha.

The Organic Law for the municipalities of the state of Oaxaca, (Municipal Organic Law of the state of Oaxaca 2018) defines "Mulato Viejo" as a "rural nucleus", based on the number of inhabitants. The administrative organization includes a municipal agent, who is assisted by an alternate, a secretary and a treasurer. They are responsible for managing the necessary support for the community and serve as a liaison with the municipal seat; who validates their election by citizen vote every three years. Its legal organization includes a judge; a police commander, and 5 active police officers. The headquarters of this administration is located in the facilities of the so-called "Agency"; which includes the multipurpose hall and the prison. Although there is a remuneration for the positions, the time of dedication to the activities of communal representation is partial, so the attention to the people who require it happens under personal request.

In "Mulato Viejo", there is a commercial sector with: 3 grocery stores with basic products, 2 commercial mills, a beer store (franchise of Grupo Modelo). In terms of services, it has a church (Catholic), a medical office, which functions as a headquarters for National vaccination campaigns, although it does not have a staff doctor; the first attention is received in the clinic of San Benito el Encinal. The entire community is electrified by the Federal Electricity Commission (CFE); It has a drinking water system, although it is also common to use water from the well or the stream that passes through the community. In regard to the education sector, it has three schools, a preschool that has been operating since 1991 and a secondary (junior-high) school inaugurated in 2006. Both are dependent on the National Education Commission (CONAFE) as well as a primary school under the State Institute for Education of the Oaxaca People (IEEPO) (Figure 1).

In the visit to the community, it was observed that there is no drainage system, nor industry of any kind, the economic activity is of a primary type (agriculture and livestock,

Figure 1. Social infrastructure in Mulato Viejo, Oaxaca (Mexico). a) "Niños Héroes" community preschool; b) "Belisario Domínguez" primary school; c) "Octavio Paz" community junior (secondary) school; d) the Catholic Church; and e) Agency (Photography: own elaboration).

forest management, etc.), when there is surplus in production, transformation activities are carried out with maize corn. In the case of the tertiary sector, this consists of commercial activities and transport services that are provided outside the community.

In 2019, a total of 255 people lived in the community of "Mulato Viejo"; 64.7% are women and 35.3% are men. This population is distributed in about 55 families, of which 47.0% are engaged in agricultural activities. Mainly, to the planting of corn, pineapple, chili pepper, pumpkin, and sugarcane; as well as to the collection of rubber, and livestock. Meanwhile, the other 53% carry out activities other than those mentioned above, such as retail trade, transport, day laborers for wage, etc. (Figure 2).

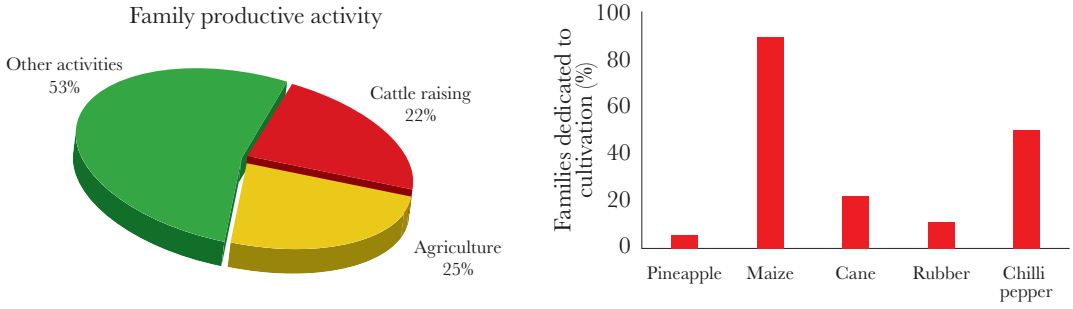

Figure 2. Primary economic activities in the community of Mulato Viejo, Oaxaca, Mexico. The percentages of families dedicated to this activity and the main crops obtained are shown (Source: own elaboration).

The combination of agricultural activities with activities that are not, is called multiactivity. Osorio-García *et al.* (2015) described this phenomenon and emphasized that it rarely implies the total abandonment of agricultural labor. This is the case of the producers in Mulato Viejo, who carry out transport activities or salaried work outside the community; However, they continue to carry out their agricultural work, in particular, the planting of corn, since they consider it essential for family food security. Additionally, the multiactivity in the community is directly related to age. Young people are the ones who look for other alternatives in addition to agricultural work; this trend changes as one advances within the age intervals.

The land tenure regime is the ejido. The distribution of land properties was made during the founding of the ejido San Benito el Encinal in 1940, and only included those who at that time lived and worked the land in the community. The successive inheritances or sales of land resulted in that, currently, not all those who cultivate the land are "ejidatarios" (ejido tenants). Among the interviewees, only 38.9% own land and are ejidatarios; among them, the proportion is 73.3% men and 26.6% women. The latter, although they are the owners, delegate the activities to the male heads of family. Likewise, 16.7% have their own land, inherited or purchased; and 44.4% do not have their own land, but rent the land. Therefore, for the purposes of this study, it was called as "Producer" who performs the tasks of planting, cultivation and harvesting of corn, regardless of whether or not he owns the land.

In "Mulato Viejo", the corn producers are mostly (95%) male, while women are engaged in household-related tasks. In contrast, the National Agrarian Registry (RAN), in 2018, indicated that 26.3% of the ejidatarios of the country, belong to the female gender who do develop activities related to agriculture. Then, it can be observed that in the community of "Mulato viejo" there is a lag in the feminization of agricultural work. In Mexico, generally, ejidatarias (female land tenants) access land and engage in agricultural activities since they inherit the land by death of the original owner, father or husband; therefore, they become the head of the family (Ramírez, 2011). However, the ejidatarias of "Mulato Viejo" are not in this case. In the first place, there are only 2 ejidatarias who dedicate their lands to the planting of corn, and in both cases, there is a man as head of the family; so, the planting work falls on the latter.

The 84% of producers are classified in two age intervals, 40 to 60 and 60 to 80 years old; only 11% are between 20 and 40 years old. Therefore, the population dedicated to the lands is aging, which will affect the trend that the community continues to dedicate to agriculture. This is also related to the level of schooling; mainly, 69% of producers have elementary schooling, and 22% secondary. Then, young people who do not have farmland that allows them to obtain economic remuneration for this activity, become demotivated and look for other economic activities to which to dedicate outside the community, which generates migration.

Cultural practices are defined as the techniques that are performed for the management of a crop; before, during and after harvest. In regard to corn, three types are managed. The community call them "criollo", "hybrid" and "unknown" variety. The creole corn is 39% of the planted material, it comes from free mixtures made during

the various planting cycles. Other 33% of producers indicate that they sow commercial hybrid varieties, which are acquired through social programs. Whereas the remaining 28% do not know the variety they sow. All producers alternately sow all three types depending on their availability (Table 1).

From the samples of cobs obtained in the community, using the method proposed by Aragón *et al.* (2006) and through the graphic comparison with the images proposed by those authors, three different races were tentatively identified: "criollo" (creole), which may correspond to cv. large Zapalote; "hybrid", which corresponds to cv. Vandeño and the unknown variety may be a Tepencintle. The values of the analyzed characteristics are shown in Table 1.

The average area destined for planting is 0.785 ha, the largest planting area is 3 ha, and the smallest is 0.118 ha. The cultural practices prior to planting are limited to primary tillage of the land (78%), the orography of the community prevents the use of heavy machinery leaving as an option manual work and the use of small-scale machinery such as motor growers and mini-tractors, brush cutter, etc., tough local producers do not know them. All of producers (100%) use agrochemical methods for fertilization and pest control and only 6% have incorporated the use of sustainable technologies, specifically, the use of compost. The planting method used by 83% of producers is manual, using the "coa" (a wooden tool similar to a tree planter, which they call "espeque"). However, it should be noted that the innovation that has been most appropriated by the producers of this community is the method of spraying fertilizers or pest control chemicals with a sprayer backpack (Figure 3).

Table 1. Evaluated characteristics of the maize varieties planted in the community of Mulato Viejo, Oaxaca (Mexico).

Sample 1 /Unknown variety/ Zapalote	**Sample 2/hybrid/Vandeño**	**Sample 3/Creole/Tepencintle**
		
Length/width ratio		
2.88	3.23	3.95
Number of rows		
7	5	5

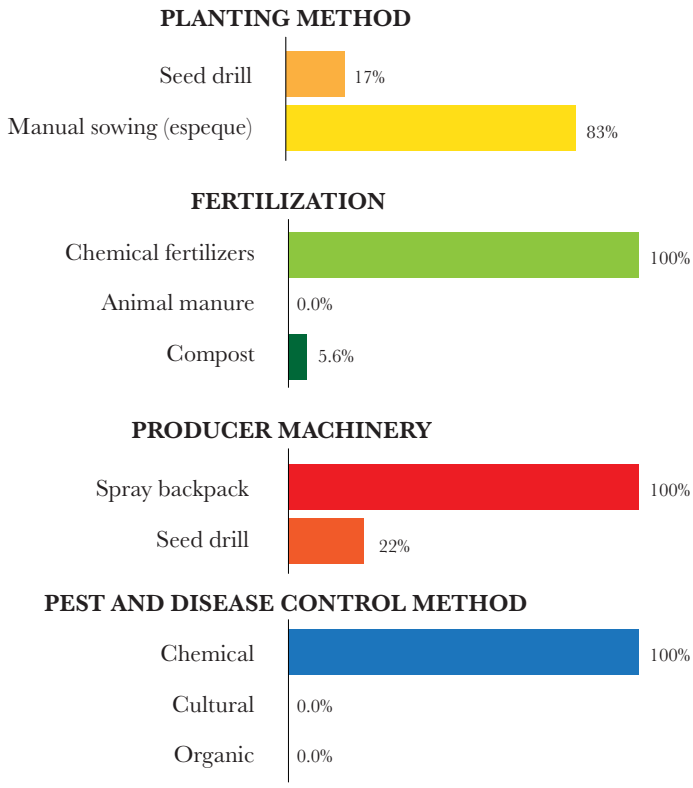

Figure 3. Agricultural practices in the community Mulato Viejo, Oaxaca (Mexico) (Source: own elaboration).

These results show that producers have a very low level of incorporation of new technologies. Damián-Huato *et al.* (2013) evaluating the degree of appropriation of technologies by producers in Puebla, did not find improved yields. However, they could observe that producers progressively assimilate technology that in the long run improves production. This process was also observed in "Mulato Viejo" where the results of technological appropriation by producers is similar to those of the rest of the state. In 2014, for example, the MasAgro (Crops for Mexico) project reported that 60-70% of producers in Oaxaca have adopted the use of spray backpacks, staggered fertilization, and use of pesticides (Rodríguez-Vázquez, 2014). This figure is close to the national average of 65%.

On the other hand, it is important to note that what at first glance seems to be lag in the modernization of the field, has indirectly facilitated the permanence of the traditional agriculture, which has preserved both the ancient cultural-related practices and local maize breeds. Although the producers interviewed do not record their production per year, they estimate that 89% is destined for family consumption and the remaining 11% is marketed in small quantities.

The production is sold as grain and other by-products such as "olotes" (cob cores, to feed livestock) and cob husks (as envelopes for the food called "tamale") or as processed products. Regarding this processing, 89% is for tortillas; followed by 56% for tamales, 22% is destined for the elaboration of atoles (beverages made of cooked corn), and smaller quantities for thickening (17%) and silage (11%) (Figure 4). Transformation activities are

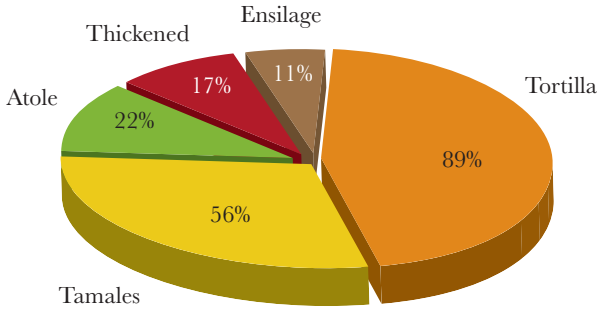

Figure 4. Products after the transformation of maize production (corn) in the community of Mulato Viejo, Oaxaca (México) (Source: own elaboration).

made by the women of the community who also commercialize the processed products. There are no clear records of the revenue generated by those sales.

In this study, the agricultural practices of the Mulato Viejo community were described. This rural nucleus is a case study environment where you can observe the conditions of small communities, where peasant agriculture is developed with traditional practices in small areas (0.76 ha on average). Primarily through family labor, with limited application of technologies and contemporary methods of production. The harvest is mainly destined for self-consumption (Sánchez-Olearte *et al.*, 2015).

In this rural nucleus, some of the problems nationally identified that contribute to the progressive abandonment of agricultural activities are present; agriculture is no more the main support of the family economy. Those problems include the fragmentation of the rural population of producers, and scarce opportunities for marketing their derived products. Additionally, in Mulato Viejo there is lag, both in the generational rotation of producers and in the incorporation of women into agricultural activities. All of the inhabitants dedicated to planting (100%) are men, although, the available data on land tenure in Oaxaca indicate that a large percentage of tenants are women. In this community, the property documents are registered with the name of the head of the family, the male who is also in charge of the work of planting, harvesting and direct marketing of the grain. The participation of women is limited to the processing of grain for self-consumption or to the sale of derived products.

It is important to involve young people in the knowledge of maize cultivation, so that in the future when they are in charge of agricultural practices, they shall have knowledge and skills that allow them to do it effectively. Additionally, it is considered that young people are more open to the incorporation of new technologies, which would contribute to improving yields and reducing the economy of self-consumption. A greater challenge is the incorporation of women, the support programs to the field have stimulated such incorporation. However, most of the time, due to the social customary division of activities, women are reluctant to join the field, since it would represent an increase in their daily workload for the family.

Finally, it is essential to make improvements in production, in order to obtain a surplus, and then decide what to do with the harvested corn or the processed product (whether sell it individually or as bulk at wholesale prices). To obtain greater profits and improve the

economic conditions of the inhabitants of the community of Mulato Viejo, it is important that all producers establish networks of solidarity collaboration. These networks would allow the reinforcement of local or regional systems where the subsistence of all individuals is guaranteed within a solidarity logic, which in turn generate products and services useful enough to be socially reproduced, even if these are not competitive in the market (Coraggio, 2007; Soria Sánchez *et al.*, 2015).

It is also important to identify the key roles and functions of social actors for management among stakeholders in order to obtain self-sufficient food production (Núñez-Ríos *et al.*, 2020). Or else, establishing a network of solidarity collaboration that would allow the best use of resources, the delimitation of functions and the identification of areas of opportunity or empty market niches. After identifying the networks and the functions of the actors, a multi-year strategic plan should be implemented based on them, to ensure implementation, monitoring and evaluation.

CONCLUSIONS

The agricultural practices of the community of Mulato Viejo (Oaxaca, Mexico) show the typical characteristics of the rural nuclei of the country. Due to this, they are models that allow us to observe variables and evaluate the effect of small-scale actions, with the aim of implementing them in larger communities or even nationally. These actions should include a multiannual strategy, the delimitation of the roles of the social actors already present (authorities, producers, etc.), identifying the empty market niches and encourage producers to create networks of solidarity collaboration.

All of the above must be monitored in order to make the necessary adjustments. Considering that the objective is to raise the standard of living of the associated producers, their families and the community, aiming to create sources of work, the rational extraction of natural resources, agricultural practices that allow the conservation and improvement of native maize races. As well as to produce, transform and market, both the direct products from harvest and others transformed within the community, promoting the generational renewal of producers and the incorporation of women into agricultural practices.

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REFERENCES

ASERCA, (2019). Agencia de Servicios a la Comercialización y Desarrollo de Mercados Agropecuarios. Revisado https://www.gob.mx/aserca/articulos/maiz-grano-cultivo-representativo-de-mexico?idiom=es. Fecha de consulta: 15 de nov 2021

Aragón-Cuevas, F., Taba, S., Hernández-Casillas, J.M., Figueroa-Cárdenas, J.D. y Serrano-Altamirano, V. (2006). Actualización de la información sobre los maíces criollos de Oaxaca. Informe final. SNIB-CONABIO Proyecto No.C5002. México, D.F. Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias.

Coraggio, J. (2007) "Instituciones, cultura y ética en el desarrollo local" el seminario internacional sobre desarrollo económico local: Experiencias de desarrollo local con diferentes énfasis: político institucional, sostenibilidad, cultural (pp.1-8), Bogotá. En: http://www.ungs.edu.ar/Ico/contenidos/downloads/CORAGGIO_Instituciones_cultura_etica_en_el_desarrollo_local_pdf.

Damián-Huato, M.A., Cruz-León, A., Ramírez-Valverde, B., Romero-Arenas, O., Moreno-Limón, S., Reyes-Muro, L. (2013). Maíz, alimentación y productividad: modelo tecnológico para Productores de temporal de México. *Agricultura, Sociedad y desarrollo 10*(2) 157- 176. doi: www.scielo.org.mx/pdf/asd/v10n2/v10n2a2.pdf.

Gobierno de Oaxaca. (2015). Ley orgánica Municipal del estado de Oaxaca 2018, Capitulo 1, articulo 15. https://www.finanzasoaxaca.gob.mx/pdf/asistencia/leyes_fiscales/2015/pdf/LOM.pdf. Fecha de consulta 11 julio de 2019.

Núñez-Ríos, J.E. Aguilar-Gallegos, N., Sánchez-García, J.Y., Cardoso-Castro P.P. (2020). Systemic Design for Food Self-Sufficiency in Urban Areas. *Sustainability*, 12, 7558. doi:10.3390/su12187558.

Ramírez, D. (2011).Productividad agrícola de la mujer rural en Centroamérica y México. Comisión Económica para América Latina y el Caribe (CEPAL).ONU.

Registro Agrario Nacional (2019) Convocatorias Oaxaca 2019 [Internet], [citado 15 dic 2019) Disponible en: https://www.gob.mx/agricultura/oaxaca/documentos/convocatorias-oaxaca-2019?idiom=es Fecha de consulta 13 nov 2021.

Secretaría de Desarrollo Agrario, Territorial y Urbano (2019) ¿Qué hacemos? [Internet], [citado 15 dic 2019] Disponible en: https://www.gob.mx/sedatu/que-hacemos

Registro Agrario Nacional (2018) ¿Qué son las Sociedades Rurales? [Internet], [citado 15 dic 2019] Disponible en: https://www.gob.mx/ran/articulos/que-son-las-sociedades-rurales?idiom=es

Ródriguez-Vazquez, H. (2014).Oferta disponible para implementar tecnologías MasAgro. Sagarpa-Cimmyt. Chapingo. México.

Sánchez-Hernández, MA., Jiménez-Maya, JB., Morales-Terán, G., Acevedo-Gómez, R., Antonio-Estrada, C., Villanueva-Verduzco, C. (2019). Rendimiento de grano en maíces adaptados a condiciones de la baja cuenca del Papaloapan. *Tropical and Subtropical Agroecosystems 22*(1): 519-529.

Solano, C. (2016). Diagnóstico de la Cadena de Valor Maíz-Tortilla en las Regiones de Oaxaca. En Diagnosticos Regionales. COPLADE. disponible en: http://www.coplade.oaxaca.gob.mx/wpcontent/uploads/2017/04/Perfiles/AnexosPerfiles/5.%20CV%20MAIZ.pdf.

Osorio-García, N., López-Sánchez, H., Ramírez-Valverde, B., Gil-Muñoz, A., y Gutiérrez-Rangel, N. (2015). Producción de maíz y pluriactividad de los campesinos en el Valle de Puebla, México. *Revista Electrónica Nova Scientia. 7*(2): 577-600. http://www.redalyc.org/articulo.oa?id=203338783030

Soria Sánchez, G., Palacio Muñoz, V.H., Trujillo Ortega, L.E. (2015). Redes de colaboración solidaria para la autosuficiencia alimentaria: propuesta para la población rural. *Estudios sociales.* 23: 46, 43-270.