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CGIAR RESEARCH PROGRAM ON Maize

Chiapas Study Report

Seed Sector functioning and the adoption of improved maize varieties

Photo: KIT – Geneviève Audet-Bélanger © Maize field around Tuxtla Gutierrez

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Acronyms

ASERCA	Agencia de Servicios a la Comercializacíon y Mercados Agropecuarios
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
DAP	Diammonium phosphate
EGS	Early generation seed
FGD	Focus group discussion
FIRA	Fideicomisos Instituidos en Relación con la Agricultura
GRC	Genetic resources conservation
INIFAP	Instituto Nacional de Investigacion Agricolas y Pecuarias
IOPV / OPV	(Improved) open pollinated variety
MASAGRO	Sustainable Modernization of Traditional Agriculture
Nxxx	Number of units (producers, harvests, etc.) surveyed contributing to data
PGRC	Plant Genetic Resources Centre
QDS	Quality declared seed
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
SNICS	Servicio Nacional de Inspección y Certificación de Semillas
SSA	Seed Sector Analysis
SVCA	Seed Value Chain Analysis

Exchange rate at the time of the study 0.06 Mexican pesos per US$1.

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Executive summary

This document describes the adoption and the impact of improved maize germplasm at small scale farmer level in Chiapas, Mexico. The study is part of a larger research project commissioned by the CGIAR Research Program MAIZE, with similar studies conducted in Malawi, Bihar in India and Zambia. The objective is to understand whether smallholder farmers have access to improved maize varieties, and if so, how the organization of the seed sector supports this.

In Tuxtla Gutierrez, the capital of Chiapas, a stakeholder workshop with key informant interviews was held. Focus group discussions (FGDs) with farmers and household surveys were conducted in two locations in the state. The first survey area was located around the capital, the second was at a higher altitude in Comitan, and was characterized by a strong presence of indigenous people.

Mexico is considered to be the center of origin of maize, which is a staple crop for the Mexican population. The country imports maize from the United States but also exports maize to neighboring countries like Guatemala. Prices for white maize in the country are largely influenced by American maize prices, while the Guatemalan market influences local yellow maize variety prices. The big milling companies purchase mostly white maize and sell the flour to *tortillerias*. High market demand for maize has led to a significant share of farmers adopting high yielding improved open pollinated varieties (IOPVs), and, specially, maize hybrid varieties.

Private international seed companies like Pioneer and Monsanto/Dekalb hold a large share of the market for maize seed, offering white and yellow maize hybrid varieties to producers through an extensive agro-dealer network. National companies are also active on the seed market, offering both IOPVs and hybrids to farmers. While large international companies carry out maize variety development and seed production, the International Maize and Wheat Improvement Center (CIMMYT) and national research institutions are also involved in variety development. However, these are subsequently made available to private seed companies for commercial seed production and sales.

Overall, there is limited seed production in Chiapas, and most seed produced in formal systems is imported from other states in the country. Most of the seed of large companies, Pioneer and Monsanto is certified seed, while most of the seed of national companies is sold as quality declared seed (QDS). Servicio Nacional de Inspección y Certificación de Semillas (SNICS) - the seed certification service in Chiapas, is perceived to have limited capacity, but this is not perceived as a major constraint to seed companies. The household survey showed that farmers pay little attention to certification; branding by seed companies is a much stronger indicator of quality to farmers. Financial and extension services for seed users have limited reach in Chiapas and are often intertwined, combining credit for inputs with crop management advisory services. The seed sector analysis resulted in the conclusion that the formal maize seed sector in Chiapas is benefiting of an increasing number of players. This has resulted in a large number of maize varieties being developed and marketed, however mostly by international seed companies.

The household survey provided valuable insights into the use of different variety types, appreciated varieties, agricultural practices, producers' preferences and productivity. Complemented by key informant interviews and FGDs, the survey provided information on the functioning of both the informal and formal seed systems at farm level. Commercial seed sales of IOPVs and hybrids were found to be very common in the lower altitude area around Tuxtla Gutierrez. Alternatively in highland Comitan, virtually 100% of the farmers are recycling traditional open pollinated varieties (OPVs) *criollos* at farm level, with currently no IOPVs and hybrids found in this agro-ecological area.

In Tuxtla Gutierrez, maize is an important cash crop. The farmers surveyed tend not to process it at farm level, but rather sell their maize and subsequently buy transformed maize products like *tortillas* and *nixtamal*. With the support of Agencia de Servicios a la Comercializacíon y Mercados Agropecuarios (ASERCA), a marketing and agricultural subsidy scheme, large grain buyers purchase maize at farm level at 3.3 pesos per kg (white maize). Yellow maize, from traditional

criollos varieties fetches a higher price of 4.1 pesos per kg when sold to traders, and is mostly exported to the Guatemalan market.

In Tuxtla Gutierrez, fields were planted with 67% hybrid, 16% IOPVs and 17% *criollos* varieties, with hybrid varieties of Pioneer and Monsanto/Dekalb representing the most popular among producers surveyed. High yielding varieties were prioritized in this location, whereas in Comitan, varieties were mainly selected based on the ability to recycle seed. These contrasting methods in the two survey locations highlight the different purposes of maize cultivation in the region. Tuxtla Gutierrez has a clear external market orientation and this is why IOPVs and hybrids, which both offer high yields (with IOPV seed being more affordable) are used by a large number of the producers interviewed. Conversely in Comitan, the traditional mixed *milpa* cropping system is predominant and the focus is on food production. Surplus crop is sold, but maize is mainly grown with the intention to be consumed within the community.

Local *criollos* varieties have a productivity of around 1.9 t/ha in Tuxtla Gutierrez, while IOPVs yield 3.9 and hybrids 4 t/ha. In Comitan, maize yields (*criollos* only) are lower at 1.3 t/ha. Most producers, both in Tuxtla Gutierrez and Comitan, use fertilizer, commonly a mix of NPK, urea and Diammonium phosphate (DAP) on their main maize field.

The most major event in Chiapas in the last decade(s) has been the collapse of the state seed company PRONASE, and the opening of the seed market to both national and international companies. These companies have been successful in providing access to improved varieties of maize (IOPVs and hybrids) in low altitude areas such as Tuxtla Gutierrez.

In summary, a significant demand for maize provides an output market for the producers in low altitude areas, and hence a demand for improved IOPVs and hybrid maize seed. However, very little change was reported in more indigenous, high altitude areas where *criollos* and the informal farmer-based seed system were, and remain, prevalent. It was not clear whether the private seed sector has already tried to introduce IOPVs and hybrids in the more isolated indigenous farmer communities, such as Comitan, but it was reported in key informant interviews and FGDs that hybrids do not offer good performance in higher altitudes areas. However, it is clear that the producers in Comitan are experienced in maize seed recycling and remain self-sufficient.

1 Introduction

In Latin America, the 21th century has so far seen continuous economic growth and diminishing inequalities with quickly developing food and agricultural markets. This translates into significant opportunities for agriculture-based economic development. Economic drivers are now in place for profit driven intensification of agriculture with the double objective of improving food and nutrition security of producers and fast growing urban populations, as well as rural economic development. An essential input for agricultural intensification is high quality seed with a high production potential, well adapted to both agro-ecology and to market demand. High quality seed is often not accessible and available, especially for the poorer households (Vakis *et al.,* 2015).

Through breeding, improved varieties of crops can be developed. The quality of seeds, both genetically and physiologically, determines to a large extent crop yield and produce quality, hence the crop's market value and/or its potential contribution to food security. Seed characteristics determine how the crop will cope with adverse conditions and risks (Louwaars and de Boef, 2012). IFAD (2011a) shows that in the 1980s and 1990s, the use of seed of improved varieties of crops accounted for half of the yield growth in China for example. In Latin America the adoption of improved varieties for cereals has drastically increased; the proportion of land sown with such varieties has doubled in 20 years (1982-2002) (IFAD, 2011b).

The Consultative Group on International Agricultural Research (CGIAR) Research Program (CRP) 'MAIZE', takes a holistic approach to increasing the contribution of maize to food security and poverty reduction (http://maize.org/). The MAIZE flagship project 5, aims at reducing constraints to seed production and increasing the number of MAIZE derived varieties available to farmers. The project intends to do this by improving access to germplasm through working with the National Agricultural

System and small scale, as well as larger seed companies. It is expected that improved access to germplasm and the release of improved varieties should positively impact on productivity and food security, as well as reduce demands on land and irrigation. For this, the maize seed sector in many countries needs to become more vibrant, plural, competitive and responsive to users' needs, in particular those of smallholder farmers.

The aim of this project is to document the adoption and impact of improved maize germplasm at poor, maize-dependent farmers' level, in combination with understanding how access to affordable quality maize seed can be achieved through seed sector development. The assumption is that understanding the challenges, opportunities and implications of changes in the maize seed value chain will improve research results, and support the higher adoption and impact of research-derived maize germplasm. For this project, independent studies were carried out in four areas (Mexico/Chiapas, India/Bihar, Malawi and Zambia). Subsequently, an overarching analysis process will take place. This report focuses on the outcomes for Chiapas, Mexico, where field work was connected with the Sustainable Modernization of Traditional Agriculture (MASAGRO) program[1], carried out by the Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA) – the Ministry of Agriculture, and the International Maize and Wheat Improvement Center (CIMMYT). MASAGRO has the specific objective to increase maize yields and the adoption of improved maize seed by developing and distributing low cost hybrids. The program includes supporting small and medium sized local seed companies in producing enough improved maize seed.

Maize is thought to originate in Mexico (Goodman, 1976), and was and is the most important staple crop in the country. Local varieties of the crop represent a wealth of biodiversity, and are linked with a long tradition of agronomic practices and cultural practices in Mexican society.

[1] www.masagro.mx

2 Methodology

The same methodology was applied for the four separate studies of the project (Mexico/Chiapas, India/Bihar, Malawi and Zambia). Chiapas was the third area in which research took place in July 2015. The state of Chiapas was selected because of its diverse seed sector with producers using *criollos*, the traditional local open pollinated varieties (OPVs), improved open pollinated varieties (IOPVs) and hybrids; as well as its alignment with CIMMYT's and MAIZE's work on seed sector development in Mexico through MASAGRO.

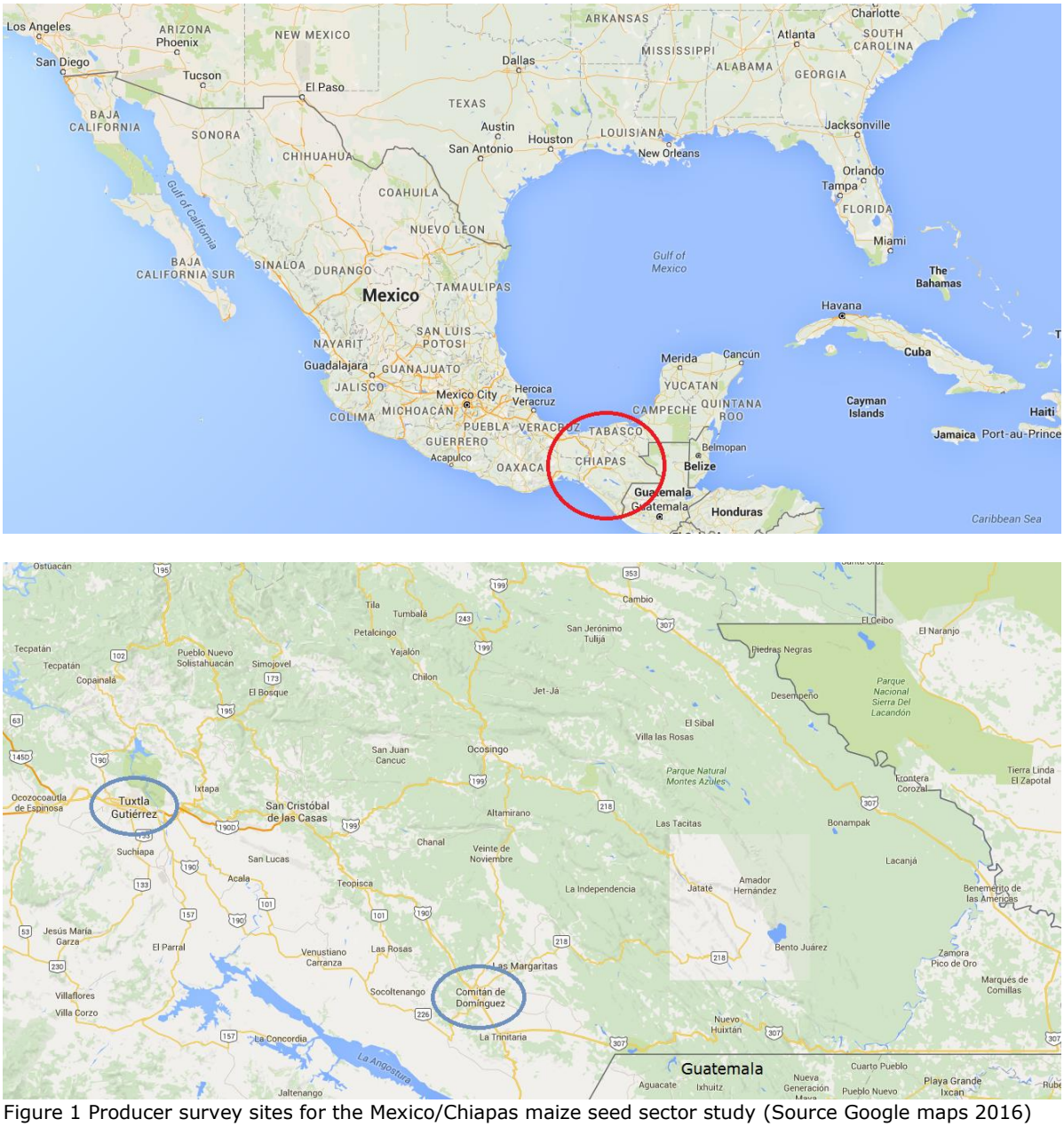

Figure 1 Producer survey sites for the Mexico/Chiapas maize seed sector study (Source Google maps 2016)

A mixed-method approach was used for data collection with limited adaptations from the other studies. A quantitative survey was developed for collecting data from farmer households. Results of the survey were enriched by means of focus group discussions (FGDs) with a selection of surveyed farmers and community members. Based on CIMMYT/MASAGRO's recommendations, two locations were selected for the survey: around the state capital Tuxtla Gutierrez, a location where OPVs and hybrids are commonly used and around Comitan, an indigenous area, higher in altitude where *criollos* are widely used. The survey provided quantitative information about

farmers' practices and access to and use of quality seed. Key interventions influencing the functioning of the seed value chain, perceived changes and views of key actors on what is needed to further optimize the seed value chain in the survey areas, were also explored through the survey and the FGDs.

Key stakeholder interviews and a seed sector workshop in the state capital, Tuxtla Gutierrez, form the qualitative part of the study. These qualitative tools have been designed to provide insight into factors, enablers and constraints of the seed sector.

The seed sector workshop was hosted by SAGARPA and combined with a MASAGRO convening, where more information on MASAGRO projects was provided to the major seed sector actors of the state. Therefore, in addition to the seed sector workshop, presentations on the potential of Chiapas and Mexico for maize production were given and more specific information on MASAGRO was shared with stakeholders from the local maize value chain.

This combination of qualitative and quantitative data provides insights into the seed sector functioning and the adoption of improved varieties of maize in Chiapas.

2.1 Data collection tools

The seed sector workshop and interviews make use of two qualitative data collection tools:

1) Seed Sector Analysis (Subedi *et al.,* 2013), a tool specially developed to understand the composition and variations within a seed sector.
2) Seed Value Chain Analysis (Audet-Bélanger *et al.,* 2013), which results in understanding the functioning of the seed value chain, flows of seeds, services, financial resources and knowledge.

The Seed Sector Analysis (SSA) is a multi-stakeholder process tool to understand the composition, distinctness and variations within a seed sector, and takes a systemic perspective in analyzing the role of seed systems and their complexity. It helps to identify specific seed systems by their domain of operation (farmers, public, private, NGO, others), crops and varieties, technologies, farmers targeted, seed quality assurance mechanisms, seed dissemination mechanisms, seed supply sources, service provision and associated strengths and weaknesses. This tool enables to discuss the establishment of key factors which have been instrumental in the development process, as well as the preconditions for this development to take place within a specific environment. It also explores the qualitative cause-effect relationship between maize seed sector development and the adoption of new germplasm.

A Seed Value Chain Analysis (SVCA) refers to the appraisal of the functioning of the chain; flows of the product, services, financial resources and knowledge are analyzed, to explore whether linkages between stakeholders are effective and efficient in terms of the performance of the entire value chain. It enables an understanding of the role played by various private and public actors in the development of the seed sector, and how the seed sector influences the impact of the introduction of improved germplasm. Both tools (SSA and SVCA) were useful in analyzing the formal systems' functioning.

A snowballing process was used to identify key informants to interview. Criteria for selection included relevance, diversity of stakeholders and role within the maize seed value chain. Unfortunately, it was not possible to meet with all the stakeholders identified as important due to time constraints. Overall, 17 interviews (21 persons) were conducted, with national and international seed companies, extension agents, agro-dealers, the seed trader association, policy-makers, NGO staff and researchers (Annex). The interviews provided good in-sights on seed sector functioning.

To gather quantitative information, the household survey was disseminated in the two locations. One day was allocated to training the enumerators and testing the tablet based data collection tool with producers around Tuxtla Gutierrez. Based on the training and the testing, the tool was

further adapted and tailored to the local context. Data collection lasted for 7 days. The first day of data collection is typically slower and less productive because enumerators have to get used to the tablet and the tool. Hence 4 days were spent around Tuxtla Gutierrez, while 3 days were spent around Comitan for the household data collection.

Because of the limited time available, sampling was done pragmatically. *Municipios* (Municipalities) and *localidades* (localities, units of municipalities) were selected based on a transect pathway based from a central starting location in Tuxtla Gutierrez and Comitan. The transect approach enabled the team to conduct the survey in *localidades* situated at various distances from the starting point. Each day, a different direction from the center was selected on which three to four villages were selected for the study with the support of the local consultant. The limited time allocated for the study did not allow for prior mapping or lists for the selection of *localidades*. However, efforts were made to survey in *localidades* which had at least 20 households and were representative of the zone's agricultural practices. On average, in each village 8 to 10 interviews were conducted. The selection of households was also based on a transect walk. Enumerators dispersed themselves in the *localidad* first, then interviewed one or two households in the area. For the second, or sometimes third household to be interviewed, enumerators were ask to perform a transect walk to the right of the household and select the 3rd house they encountered for the following interview to avoid households referring to family members or social relations for further interviews.

Municipios Tuxtla Gutierrez	Municipios Comitan
Ocozocoauta de Espinosa	Comitan de Dominguez
Venustiano Carranza	La Independencia
Villacorzo	La Trinitaria
La Concordia	Las Margaritas

Table 1 *Municipios* of the household survey

Each producer was asked to provide quantitative figures on seed use and maize production for the past two completed seasons. Further, they were asked to answer, in a more qualitatively manner, questions regarding maize seed use and production 10 years ago - since it is generally difficult to remember accurately such information over a long period of time. Each survey interview lasted on average for 40 minutes.

Additional to the household survey, FGDs were held with producers in the two survey locations. The *localidades* where the FGDs took place were selected with the support of the local consultant. Selection criteria included the general representativeness of the *localidad* and the survey area, as well as the ability to organize an FGD on short notice. In total, 18 producers were met, two groups were organized around Tuxtla Gutierrez, and one around Comitan.

2.2 Limitations

For each of the four studies in the global project, only limited time and resources were available, and they needed to be organized at relatively short notice. Therefore it was not always possible to realize all ambitions regarding numbers and depth of data collections, as well as opportunities to engage with key informants for workshops and interviews. Nevertheless, through efficient planning, working with high quality local consultants and providing enumerators with interactive survey tools pre-loaded on tablets, a wealth of data was collected in Chiapas.

The study includes a comparison with the past, to look for significant drivers of change in the sector. In the other three studies, a 10 year recall period has been used both for the seed sector workshop and the household surveys. For Chiapas, a 20 year recall period was selected during the seed sector workshop since there were indications that the sector has not seen many major changes in the past 10 years. However, with such a long timeframe for analysis, identifying drivers of change in the maize seed sector proved to be difficult. Therefore, for the household survey and interviews, a recall period of 10 years was maintained as the other studies.

For the workshop, the main constraint was one of time. With participants having to travel from various locations, only limited time was available for the seed value chain analysis and the seed sector analysis. However, participation levels were high and discussions were focused. Rather limited information was gathered during the workshop on seed sector functioning and triggers of change over the 20 year recall period (see also above).

With a fieldwork duration of 10 days, there was only 1 day to train enumerators and pre-test the survey, but because a significant number of questions had been used and tested in earlier surveys of past research projects from the team, it was possible to carry out the preparatory work for the survey in a single day. The survey data provide information for capturing, in quantitative terms, farmers' practices. Choices with regard to the amount of questions asked had to be made in order to keep the survey to an acceptable length. Hence, only a few questions were asked about maize production in general, and questions focused on a producers' two most recent, main plots of maize. The assumption behind this was that since producers are likely to apply different practices (sowing, varieties, inputs) on different plots of the same crop, those using improved maize varieties would do so in particular on their main maize plot. But because of this choice, it was difficult to capture through the survey the full mix of strategies that farmers use for maize production. For example, it is was not possible to assess the coverage and the volume of different maize varieties on the whole farm.

Only one women was interviewed as part of the survey. For this reason, gender disaggregation was not possible in the analysis. Surveyed villagers stated repeatedly that women are not involved in maize production. Also, a study on the participation of farm women in the *milpa* system in Yucatán, showed that women have close to no participation in the *milpa* cropping system of production or in the selection of varieties sown (Lope-Alzina, 2002). However traditionally, women used to have a greater participation in maize cultivation, particularly in regards to *criollos* production where women had an important role in selection and food preparation. Their involvement has reduced with the modernization of production practices, for example, increased mechanization has replaced hand labor which was previously done by women. Still, even in places characterized by more traditional production, men are deemed 'in charge', which explains why no women participated in the surveys (L. M. Donnet, CIMMYT, *pers comm*).

Thinking back 10 years in time proved to be extremely different for producers. First of all, many of the producers interviewed were not producing 10 years ago, or were producing in a different setting (part of the household, different geographic location, etc.). This makes data comparison between now and a decade ago difficult, and also introduces inconsistent data - even though very few quantitative questions were integrated in this part of the survey.

Overall, the stakeholder workshop provided good insights in the formal seed sector functioning, complemented with key-stakeholders interviews. Key informant interviews in Comitan revealed more information on the informal seed sector functioning. The findings of this study, in particular those of the survey, are indicative but cannot be generalized to country or even state level because of the limited size, the focus on the main maize plot of the farmer, and the specific locations of the household survey. Nevertheless, the results provide good insights into general seed sector functioning because of the diversity of the stakeholders interviewed and the mixed-methodology applied to collect information.

3 Seed Sector Functioning

3.1 The Maize Seed Value Chain

To understand seed sector functioning, it is helpful to analyze the operations in the seed value chain. Actors making-up the seed value chains are inherent components of the seed sector. By looking more closely to their roles, functions and appreciation by the sector over the years, it is possible to draw conclusions for the maize sector as a whole. The recall period used was 20 years. The information gathered during the workshop is focused on formal seed system functioning. Participants were asked to score operations and services in the chain on a scale of one to five, one being low level of functioning and five being excellent performance.

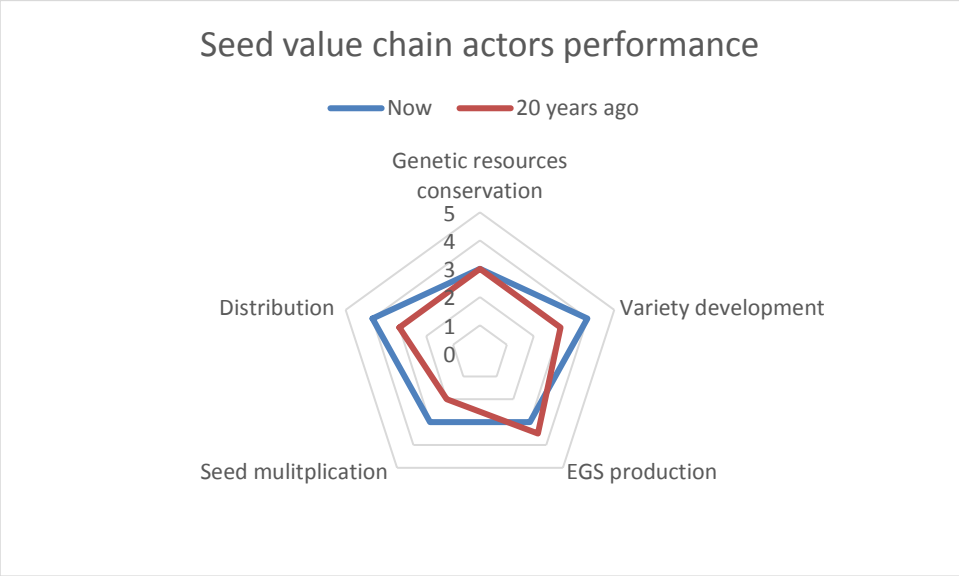

Figure 2 Seed value chain actors' performance (ranked during the workshop)

The following discussion of the seed sector elements includes the results of both the stakeholder workshop and key informant interviews.

Genetic resources conservation (GRC)
Currently, there are quite a few organizations which are involved in GRC including Comisión Nacional para el Conocimiento y Uso de la Biodiversidad - the national commission for use of biodiversity, Sistema Nacional de Recursos Fitogenéticos para la Alimentación y la Agricultura – the national system of plant genetic resources, CIMMYT, Instituto Nacional de Investigacion Agricolas y Pecuarias (INIFAP) - the Mexican agricultural research organization, universities and private companies. Universities and private companies mostly store the genetic resources required for the production of the varieties they produce. The diversity of players engaged in GRC has led to a decentralized system where accessions are collected across the country. At the INIFAP site of Rancho Nuevo in San Christobal de las Casas (Chiapas), where temperature is relatively cool, some 980 accessions of criollos material is kept, with duplication in Tepatitlan (Jalisco) at the National Centre for Genetic Resources. With an increasing recognition of the importance of Mexico as the center of origin of maize, significant resources are dedicated to GRC and trained technicians are employed to run the gene banks and ensure the maintenance of accessions.

In the past, INIFAP and CIMMYT were the only two organizations significantly involved in GRC. Accessions were collected in a few states but did not cover the diversity of the country. INIFAP's collection was controlled by the government and provided with limited resources, hence, had a localized coverage rather than an extensive, country wide catalogue of varieties and their specificities.

Variety development
Variety development has now become market orientated and largely led by the private sector. With large volumes of maize demanded nationally for home consumption and by large processing companies - in addition to a regional demand from countries south of Mexico - , seed sector players fit variety development to the needs of these different output markets. For example, in addition to the traditional national market for white maize and the Guatemalan native yellow maize market, there has been a push to improve yellow maize hybrid varieties as some processing industries (animal feed) demand it. Other variety development activities are for special uses, i.e. specific trait development such as pigment and flavors (red, purple for specialty food products) or protein content for animal feed. Tolerance to climatic shocks and adverse climatic conditions are also breeding goals for variety development. While private companies often specialize in hybrid varieties, the development of IOPVs is still receiving attention with some local companies picking-up IOPVs (and hybrids) still being developed by INIFAP. *Criollos* on the other hand are continuously going through rounds of light selection every time seed for recycling is selected in crops. This usually happens at community level and is not part of any formal commercial activity, but rather a way of maintaining, purifying and adjusting existing traditional varieties. NGO organizations such as the Red Maiz Criollo Chiapas are supporting such processes.

Current INIFAP varieties available for farmers in Chiapas include: hybrids: H-510, H-520, and IOPVs: V-526, Vs-535, Vs-536. There are also new hybrid varieties developed by CIMMYT as part of the MASAGRO project which are commercialized by national seed companies: PAS-524 and PAS-526. However, the vast majority of the varieties currently registered for Chiapas with Servicio Nacional de Inspección y Certificación de Semillas (SNICS) - the seed certification service in Chiapas, were developed by the private sector, especially by the multinationals Monsanto (Dekalb) and Pioneer.

The interviewees indicated that 20 years back, most of the variety development was focused on IOPVs and led by the public sector - INIFAP, CIMMYT and the universities. The main goal was to improve yields of white maize OPVs.

Production of early generation seed (EGS)
Private seed companies keep the production of the in-bred lines for hybrid production in their own hands, in their own fields. With more limited resources, reduced quantities of public sector in-bred lines are also produced in INIFAP's fields. While some decentralized locations of INIFAP are more active than others, capacity limitations remain an important issue. In the past, all seed production was centralized in the hands of the public sector with much inefficiency. The EGS of IOPVs were produced by INIFAP and later passed on to PRONASE (the national seed company) for multiplication. One objective of MASAGRO is to overcome this bottleneck in marketing varieties developed in Mexico by training seed companies and their staff in the production of hybrids' parental lines and hence, early generation maize seed. The idea is to support the development of specialized companies for parental line production to supply seed companies that focus on producing commercial seed for farmers.

Multiplication of seed
Chiapas based seed companies produce seeds in Chiapas and other Mexican states. Overall, the production that does take place in Chiapas is deemed efficient. Supervized by SNICS, it is usually done on own land or by out-growers. Seed production of IOPVs is mostly done by a few national companies like Semi Chiapas, PROASE and PROSESO. EGS is purchased by seed companies from INIFAP, 50% payment is required on order, and the remaining paid on delivery of the seed. This underlines that INIFAP has a role in variety development, but that INIFAP's role is not to do with seed multiplication.

The seed companies not based in Chiapas, such as the multinational companies, do not or only to a very limited extent, engage in seed production in Chiapas. They bring in seed from elsewhere, as quality declared seed (QDS).

For *criollos* varieties farmers usually do their own selection of plants and cobs which could be used as seed, with only a few seed producers specifically producing seed for sale of these varieties. Hence, most of the production is in fact carefully selected seed recycled from own fields at household level.

In the past, production of seed was controlled by PRONASE with EGS material provided by INIFAP. PRONASE was the national maize seed company and provider of maize seed to producers through a general subsidy scheme (now discontinued), with a limited share of the market captured by other seed companies. Market liberalization provided international seed companies with the opportunity to penetrate the market and take over the market from PRONASE, which was said to be delivering poorly on its mandate of providing quality maize seed to producers. PRONASE was discontinued in 2008.

Seed marketing
Marketing is mostly done through networks of agro-dealers and local agents of seed companies. They are covering a large area. Producers mostly purchase the seed without subsidies, although there are small subsidy programs which include support for purchasing maize seeds - one example is the program 'Chiapas Solidadario' (Solidarity Chiapas).

Most dealers stock a number of varieties from diverse companies. They get their stock as consignment from the companies and return unsold stocks at the end of a season. Almost all hybrids sold in Chiapas are 3-way crosses, while single crosses are starting to be appreciated by producers in the higher yielding production areas under irrigation and best drylands. When selecting a maize variety, producers mostly take the brand as guarantee for quality, paying limited attention to whether it is certified or not. International companies have a relatively good name with producers. PROASE and PROSESO are two local companies who are marketing both IOPVs and hybrids from material developed from INIFAP, and new hybrids from CIMMYT and MASAGRO. PROASE was set up by investigators of PRONASE when it collapsed. For *criollos*, although most producers are recycling their own seed, there is an informal trading market. A kg can fetch around 8 pesos, double the price of grain.

In the past, only PRONASE was responsible for the marketing of maize seed. Additional to being available at agro-dealer shops, the Credito Bancario (Banrural) made it possible for producers to access input packages (including seeds) at a subsidized rate through groups of producers associating in groups for this purpose. This kind of package linked to producer groups, specially associated for this purpose, is still available and used by producers to finance their access to inputs in combination with extension services. The package increasingly involves the private sector including seed companies. Banrural packages also include facilitating contact with buyers for the commercialization of the maize grain produced. These packages are sought after especially for the agro-chemical inputs, rather than the seed (varieties) which are widely available.

3.2 Services

Certification
Certification of seed is done by SNICS for the different seed categories: basic, certified and quality declared. In Chiapas about 30% of the seed sold is certified (IOPVs and hybrids) and the rest is quality declared. The process of seed certification has barely changed over the years.

For seed certification, the seed multiplier must enroll in the National Catalogue of Plant Varieties, and register for seed inspection (103 pesos per ha for IOPVs and 154 pesos per ha for hybrids). SNICS performs at least two inspections, one on planting and the other while flowering. The producer must give notice of harvest and once the seed is sorted, SNICS performs a germination and purity test in the laboratory on a sample of the seeds. If the seeds do not meet the 90% rule (purity and germination) the seed is not certified. In addition, SNICS charges 1.37 pesos for each label put on a bag of seed for certification.

The seed certification services are not deemed very efficient by companies, which leads them to certify only a share of their production and also to sell seeds as quality declared. Since producers trust brands more than certification, there is limited value perceived in acquiring a full certification over supplying QDS. However, in Chiapas small companies reported that certifying a certain volume of seed through SNICS allows for some laboratory testing to be performed, because these small companies may not have good facilities for such tests themselves. Through this process, the companies get a small sample of their seed verified and certified and sell the rest as QDS.

Financial services
Maize farmers tend to have limited access to financial services. Fideicomisos Instituidos en Relación con la Agricultura (FIRA), the Mexican agricultural trust fund, is a second-tier development bank that offers credit and guarantees, training, technical assistance and technology-transfer support to the agriculture, livestock, fishing, forestry and agribusiness sectors in Mexico. FIRA channels its funding mostly through Financiera Nacional de Desarrollo Agropecuario - the national financing for rural development, and private international banks which in turn, support different streams of finance for farmers and seed companies alike. In the past, FIRA channeled financial services through Banrural and national private banks. Producers with land titles were then able to access packages of inputs through financial agreements. This was rather widely available and generally appreciated. The current Fundar project, a collaboration between Monsanto and FIRA focuses on expanding the territory under hybrid maize production through supporting groups with credit for input packages and extension services. The access to these packages is strictly regulated and the availability not widely opened. This explains why workshop participants deemed access to finance worse now, than 20 years ago.

Seed extension
To promote the use of improved varieties of maize, there are programs from the public and private sector which are supporting producers and essentially offering extension services. Funding for such programs varies from national public funding to resources provided by private seed companies, or a mix of these. A lot of the extension services are offered as support for the inputs credit scheme, but these are not available to all farmers (see above). Some of the seed companies also provide direct advice services to producers and agro-dealers. MASAGRO uses a 'hub' structure to develop technology testing, adaptation and extension to reach farmers. The most experimental level 'Plataformas de uso technologico – CIMMYT/MASAGRO' (platforms for technology testing), create space for various stakeholders to work together on testing agricultural practices, and the evaluation of varieties through demonstrations to producers. The technologies tested in the platforms are then replicated in farmers' modules, each module consisting of two plots, one with the farmer's practice (called 'witness plot') and the other with the new technology (called 'innovation plot'); this is a quasi-experimental level. Subsequently, the technologies are applied at the scale of the farmer's field (whole or part), which are called the 'extension areas'.

There is no concerted national or state level extension service strategy. Private companies also have demonstration plots through which they exhibit new available varieties, including their own extension agents which are supporting producers through training. For farmers, this is probably the main activity through which they learn about new varieties. In the past, there were official agents of Apoyo a la Cadena Productiva de los Productores de Maíz y Frijol - support for maize and beans producers, and dedicated agricultural extension officers which used to be contracted on a monthly basis. This was a rather bureaucratic procedure which was completely in the hands of the public sector. Poor functioning and limited services characterized the system and led to its collapse.

Quality control in marketing
The quality of marketed seed is thought to be better now than it used to be, following the entry of international seed companies to the market. The change is attributed to the fact that international companies, operating in a competitive environment have no other option than to maintain a certain standard of quality. However, in the past, PRONASE was the main seed supplier in the country and did not invest much in the quality of products because of their secure market.

Because of this, there used to be a general discontent with the quality of the products marketed by PRONASE. SNICS has also tightened its requirements for seed certification. However, the only means through which quality is controlled when seeds are distributed by agro-dealers is via bi-annual SAGARPA visits, who test a few products in stock. Hence, there is limited control exercized by the public sector and much is left to the companies to protect and strengthen their good reputation by offering quality seed.

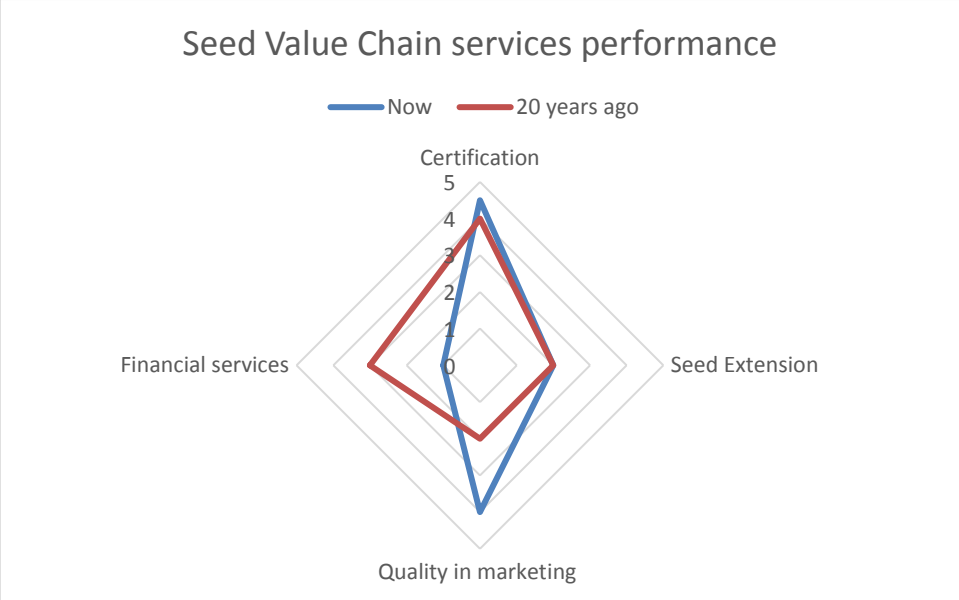

Figure 3 Seed value chain services performance ranked during the workshop

3.3 The role of the public sector and the private sector in sector functioning

The public sector of Chiapas has seen its role in seed sector functioning diminish over time. With the limited variety development which takes place, the dissolution of PRONASE (national seed company) and the limited quantities of EGS produced to supply local seed companies, the public sector is much less involved as an actor than it used to be. The private company breeding programs for hybrid maize are more responsive to the needs of the producers and such varieties are widely promoted. Where the public sector still contributes to seed sector functioning is in the production of EGS of IOPVs, which are subsequently commercially multiplied by small local companies. IOPV production is easier to handle than hybrids, and the companies might later on engage in hybrid production. Within MASAGRO, some companies in Chiapas have agreements with CIMMYT for germplasm and INIFAP does test the material coming from CIMMYT as part of a seed trial collaborative network. Seed companies, INIFAP and breeders at the university conduct trials, the results of which are analyzed by CIMMYT and distributed to all collaborators in the network.

Public services remain active in various capacities in the seed value chain. The most important is probably seed certification. However, quantities of maize seed certified by SNICS in Chiapas are limited. There are two reasons for this. The first is that not all seed from the large multinational companies is produced in Chiapas and is therefore certified in other states, or produced in other countries of Latin and South America. The second is that it is not mandatory for companies operating in Chiapas to get their seed certified, quality declared is sufficient. Many companies do not consider the certification service timely and efficient (although not costly), and would rather sell their seed production as quality declared rather than certified. Producers on the other hand, do not pay much attention to whether the seed is QDS or certified and make their selection based on the brand. The quality control of seed marketing, something the public sector should also be doing, is rather limited and it seems that much is left in the hands of seed companies to provide quality seed to producers.

The public and the private sector work jointly when it comes to the access of financial and extension services. More often than not, these services are intertwined in the form of 'packages' which can be accessed by producers in groups or cooperatives. In addition, private seed companies have agents who support producers in the production of maize, which acts as promotion for the company and the varieties.

There is no subsidy on maize seed, except as part of the input subsidy arrangements in the Banrural packages, which are only provided to a small number of farmers. However there is a support program for the commercialization of maize through Agencia de Servicios a la Comercializacíon y Mercados Agropecuarios (ASERCA) – an agency which provides services related to the marketing of agricultural products. Mexico does import some maize from the United States and is keen to promote the use of hybrid varieties and boost production. This is the reason why ASERCA provides service coverage for both producers and buyers and also Apoyo Complementario al Ingreso del Productor en Agricultura por Contrato – a price premium to the maize price produced under contracts. There is also a support for yellow maize production. Registered buyers like MASECA (one of the largest flour and *tortilleria* companies) receive a subsidy to decrease the difference with the international market price of maize when purchasing maize from local producers. Most producers interviewed argued that the subsidy should not be based on the international market price because this is perceived to be highly influenced by the United States maize market price, where corn production is subsidized and mechanized, driving prices down.

While the private sector is clearly a driver when it comes to seed sector functioning, especially variety development and multiplication, the driving forces emerging from the public sector are much less clear and sometimes seem to be hindering and unresponsive to the needs of the private sector. Most of the positive changes in the ranking diagrams (figure 2 & 3) are attributable to the private sector's involvement, and many of the activities and services which are typically under the responsibility of the public sector have decreased in performance.

4 Evidence of use of improved varieties at farmers' level

4.1 Maize and livelihood strategies

Using the Out of Poverty Index methodology[2], it can be assessed that virtually all households surveyed live above international poverty standards, in this case of US$2.5 per day (Table 2). This calculation is made on the basis of 10 questions related to the assets of a household, around topics such as number of household members, education, and house construction materials and electronics.

Likelihood of household to be living on US$2.50/day or less in percent	N	%	Cumulative %
51.3	1	0	0
25.2	1	0	1
33.4	9	3	3
18.7	31	9	13
14.6	43	13	26
7.6	39	12	37
4.5	68	21	58
3.8	67	20	78
2.8	67	20	98
1.1	4	1	99
0.8	2	1	100

Table 2 Likelihood of households to be under international poverty standards - US$2.5/day 2005 purchasing power parity (N households 332)

The majority of households (70% now and 10 years ago) rely on agriculture for over 75% of their revenues (Table 3). Moreover, maize contributes in an important way to the income generated through agricultural activities, with 85% of households reporting it contributes to more than 75% of their agricultural income. In Chiapas, maize is an essential part of the diet and what is not consumed can be sold nationally or regionally, where there is also an important demand for maize. While maize is central to the Mexican diet, many maize producers buy maize products rather than processing it themselves, hence the important share of maize in farmers' income (Table 9). In Chiapas, *tortillas* are largely made from maize flour as opposed to maize *nixtamal* dough (the traditional processing). The large flour firms buy their maize locally but also import some quantities of maize from the other states in Mexico for flour production. A large number of *tortillerias* then produce the *tortillas* out of maize flour and this is the main form in which the people in Chiapas consume maize related products, especially in low altitude areas.

Share of income	Total agricultural activities now	Total agricultural activities 10 years ago	Share of maize in agricultural income now	Share of maize in agricultural income 10 years ago
Little (10% or less)	3	3	0	0
A quarter (25%)	7	7	0	0
Half (50%)	19	20	15	17
Three quarters (75%)	31	25	26	23
Nearly all (90%)	9	12	26	17
Full (100%)	30	33	32	44

Table 3 Agricultural activities and income (N households 332)

The largest share of producers (38%) reported gross revenues between 10,000 and 50,000 pesos which is roughly between US$550 and US$2,700 for their main plot. Twenty two percent of the harvests were kept for consumption (including processing into flour and *nixtamal*). Only 2% of

[2] The PPI is statistically-sound, yet simple to use methodology: the answers to 10 country specific questions about a household's characteristics and asset ownership are scored to compute the likelihood that the household is living below the poverty line – or above by only a narrow margin. http://www.progressoutofpoverty.org/

recorded sales were higher than 100,000 pesos (US$5,500) for the harvest of the main maize plot.

	Freq.	%	Cum.
No income	144	22	22
1 to 2,000	33	5	27
2,001-5,000	73	11	38
5,001-10,000	98	15	52
10,001-50,000	253	38	91
50,001- 100,000	47	7	98
More than 100,000	16	2	100

Table 4 Gross revenues from maize sales in pesos (N sales 664)

Producers got on average 3.65 pesos per kg of maize. Half of recent sales reported resulted in more than 10,000 pesos. Maize outlets vary depending on the color of the maize and regional preferences. Earnings vary depending on the output market, with Guatemala recognized as offering higher prices than what can be fetched selling in Mexico. MASECA, a flour and industrial *tortilleria* company is one of the most important buyers nationally and is linked to the ASERCA subsidy scheme. The scheme supports grain prices for producers and stimulates the use of hybrid varieties that have characteristics such as better flour yield in milling, better color and grain homogeneity. However, most producers don't find the scheme very remunerative and prefer selling to traders selling to Guatemala when possible, which buy yellow and white maize. Most of the maize purchased for human consumption by large buyers, like MASECA, is white. In Chiapas, yellow maize of native varieties is also popular for consumption, especially in indigenous areas (*criollos* varieties), and even for export to Guatemala. Yellow maize is also dominant in the grain markets for animal feed (dominated by imported yellow corn of hybrid varieties) but in this case of hybrid varieties. Producers in FGDs reported that yellow maize of the native *criollos,* usually fetches a higher price than white maize, which was confirmed by the data of the household survey. *Criollos*, of which a large share is yellow maize (Table 13, Table 14) fetched an average selling price of 4.1 pesos per kg while IOPVs and hybrids, predominantly white, fetched 3.3 pesos per kg. The difference in mean price fetched for *criollos* and IOPVs, and *criollos* and hybrids, is highly statistically significant (p-value<1%). The difference in mean price between IOPVs and hybrids is not significant (Table 5).

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Variety	Average	95% Conf. interval low	95% Conf. interval high	N harvests
Criollos	4.1	4.0	4.2	230
IOPVs	3.3	3.1	3.4	60
Hybrids	3.3	3.3	3.4	228
Total	3.7	3.6	3.7	518

Table 5 Average selling price in pesos per kg in recent seasons according to variety type

4.2 Site comparison

Producers grow maize in the spring-summer period (April to September). Households were asked for data on their last season as well as second to last season for their main maize plot. Average plot size in Tuxtla Gutierrez is 3 ha and 1.7 ha in Comitan.

An important difference between the two sites is the maize cropping systems used. C*riollos* are used by all the producers around Comitan whilst the majority of producers are using hybrid varieties around Tuxtla Gutierrez, although some are also using *criollos* and improved OPV varieties (Table 6). In addition, it is clear that at both locations households tend to stick to a certain type of maize seed from one season to the next.

Second last season	Last season			
Tuxtla Gutierrez	Criollo	IOPV	Hybrid	Total

Criollo	27	0	3	30
IOPV	0	29	0	29
Hybrid	0	3	116	119
Total	27	32	119	178
Comitan	Criollo	IOPV	Hybrid	Total
Criollo	154	0	0	154
IOPV	0	0	0	0
Hybrid	0	0	0	0
Total	154	0	0	154

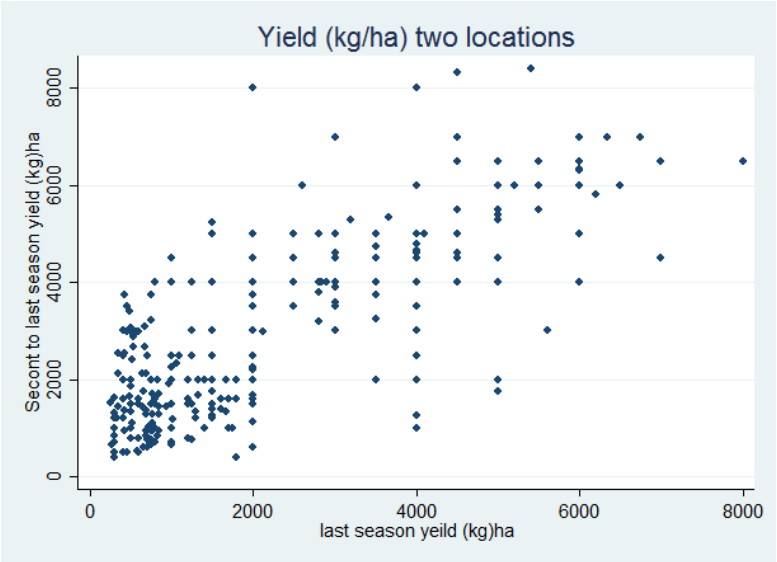
Table 6 Cross tabulation of type of seed used over the last 2 seasons per location

There are clear yield differences between the two survey locations and between the two seasons surveyed. The last maize season yields in Tuxtla Gutierrez were on average 3,155 kg/ha while the previous season's reached 4,068 kg/ha. In Comitan, yields in the last season were 912 kg/ha, less than a third of that reported in Tuxtla Gutierrez and 1,629 kg/ha in the second to last season. Over 50% of the producers interviewed reported that the spring/summer season of 2014, the season reported as the last maize crop, had been bad in both survey locations, with 9% in Tuxtla Gutierrez and 25% in Comitan even reporting it had been a 'very bad' season for maize yields (Table 7).

Last Season	Mean yield/ha	95% Conf. interval low	95% Conf. interval high	N harvests	N farmers
Tuxtla Gutierrez	3155	2909	3401	178	89
Comitan	912	790	1034	139	70
Second last season	Mean yield/ha	95% Conf. interval low	95% Conf. interval high	N harvests	N farmers
Tuxtla Gutierrez	4068	3823	4314	177	89
Comitan	1629	1494	1763	149	75

Table 7 Yields (kg/ha) per location and season

In both locations the yields of the last maize season was found to be significantly correlated with the yield of the second to last season, although to a more limited extent in Comitan.



Correlation	Tuxtla Gutierrez	Comitan
	Last season	Last season
Second last season	0.64	0.23
p-value	<1%	=1%

Table 8 Correlation between yields per ha by season and location

Due to the observed differences between locations and seasons, data are discussed separately for locations in the remainder of this chapter, and where necessary, also separately for seasons. When aggregated, they are referred to as 'recent seasons' or 'recent crops'.

4.3 General information

Maize is an important item of a Mexican's diet however, there is a clear distinction in consumption habits between survey locations. While 42% of the producers in Comitan process and consume at least 50% of their production at home, in Tuxtla Gutierrez this is only done by 5% (Table 9). This was also confirmed during the FGDs and interviews. (Own) Maize for food consumption is much more important in Comitan than in Tuxtla Gutierrez where people buy processed maize products.

	Tuxtla Gutierrez			Comitan		
	Freq.	%	Cum %	Freq.	%	Cum %
No Consumption	77	22	100	8	3	100
1-25% Consumption	229	64	78	53	17	97
26-50% Consumption	32	9	14	94	31	80
51-75% Consumption	4	1	5	24	8	50
76-90% Consumption	0	0	4	29	10	42
91-99% Consumption	4	1	4	59	19	32
100% - Consumption only	10	3	3	40	13	13
Total	356	100		307	100	

Table 9 Ratio of consumption to production in Tuxtla Gutierrez and Comitan

The bulk of the main maize plots surveyed (79%) were situated on a flat area (*terreno plano*). Some production occurs also on steep slopes (*de ladera*), but not frequently for the main maize plot (Table 10). A higher proportion of the plots surveyed in Tuxtla Gutierrez (32%) is located on steep slopes as compared to Comitan (8%).

Terrain type for main maize plot	De ladera	%	Plano	%
Tuxtla Gutierrez	112	31.5	244	68.5
Comitan	26	8.4	282	91.6

Table 10 Terrain type for main maize plot (N recent crops 664)

Average land farmed by producers is 3.3 ha (N170) in Tuxtla Gutierrez and 2.1 ha in Comitan (N153). The main plot dedicated to maize cultivation is on average 3.0 ha in Tuxtla Gutierrez and 1.7 ha in Comitan, ranging from 1 ha to about 30 ha in Tuxtla Gutierrez and from 0.3 ha to 10 ha in Comitan. In Tuxtla Gutierrez, 12% of the plots over the last two seasons were irrigated in contrast with only 3% in Comitan. Often producers do not plant maize as a stand-alone crop. Over the last two seasons, 32% and 50% of crops were intercropped in Tuxtla Gutierrez and Comitan, respectively. The traditional *milpa* cropping system, which is particularly common in Comitan, favors the intercropping of crops like maize, beans and pumpkins for example.

4.4 Maize varieties, variety selection and seed renewal

Varieties

An overwhelming majority of the main plots (99%) are sown with only one variety of maize (Table 11). Having a single variety ensures greater homogeneity in the harvest, something which is appreciated by buyers. Subsidies for seed are not very much part of the seed sector promotion, subsidies are however available for fertilizers as part of extension packages. Of the plots surveyed, particularly in Comitan, households appear to make use of such fertilizer packages (Table 12). Seeds are generally not part of the packages as they are widely available.

Number of varieties on main plot	Freq.	Percent	Cum.
1	658	99	99
2+	6	1	100
Total	664	100	

Table 11 Number of varieties on main maize plot over two seasons (N plots recent seasons 664)

	Tuxtla Gutierrez		Comitan	
Subsidies on inputs	Freq.	Percent	Freq.	Percent
No subsidy	296	83	160	52
Seed only	4	1	0	0
Seed & fertilizer	9	3	0	0
Fertilizer only	47	13	148	48
Total	356	100	308	0

Table 12 Subsidies received on inputs (N plots recent seasons 664)

In Tuxtla Gutierrez, where hybrid varieties are most widely used, Pioneer varieties are most widely sown (168 or 46% of plots in recent seasons), although many producers did not recall the name of the variety sown (see Pioneer unknown varieties). Varieties from Monsanto/Dekalb and American Seed & Genetics (hybrids), are also used by a number of producers. Other companies and varieties, including those developed by the public sector, are only used by a small fraction of producers interviewed (Table 12). During FGDs, it appeared that the brand name is more important to producers than the name of the variety, or whether the seed is certified. Producers consistently named Pioneer and Monsanto/Dekalb as reliable brands for well-performing hybrid maize varieties.

Varieties – Tuxtla Gutierrez	N	%	RW4000	6	2
Pioneer unknown varieties	119	33	P4063W	5	1
P4082W	44	12	DK-370	5	1
Criollo blanco	41	12	Novacem	4	1
Monsanto/Dekalb unknown varieties	38	11	Ceres	4	1
DK 390	21	6	*V-526 (Tuxpeno Tardivo)*	2	1
Criollo amarillo	17	5	Asgrow	2	1
American Seed & Genetics unknown varieties	17	5	RW4001	2	1
H-520	10	3	*V-424*	2	1
DK 395	7	2	Other	4	1
DK-380	6	2	Total	356	100

Table 13 Varieties of maize used in recent seasons in Tuxtla Gutierrez. Varieties developed by the public system are in italics. Other numbered varieties are hybrids. Only the varieties marked with a (V) are known to be IOPVs. Listed varieties other than Pioneer (P), Dekalb (DK) and American Seed & Genetics, may be hybrids or IOPVs.

Criollo amarillo (local yellow maize) is the variety which was most widely sown in Comitan over the last 2 seasons (76%), followed by *criollo blanco* (23% of varieties sown in the past 2 seasons). However, it should be remembered that these two *criollos* are probably not two varieties, but actually consist of a group of related local varieties that may have undergone divergent selection in the fields of farmers. Producers of Comitan expressed a clear preference for yellow maize which they also consume (Table 14). The *Amarillo chapingo* may in fact be an improved *criollo* which has been improved with the support of the Universidad Autonoma Chapingo, Chapingo Autonomous University, yet its use does not appear to be widespread (1% of plots sown).

Varieties Comitan	N	%
Criollo amarillo	235	76
Criollo blanco	71	23
Criollo amarillo chapingo	2	1
Total	308	100

Table 14 Varieties of maize used in recent seasons in Comitan

Variety selection

The selection of the variety to plant is very much related to producers' location. Hybrid maize varieties are not perceived to perform well at higher altitudes in Mexico and this is a situation recognized by the seed industry. Hence, location of producers plays an important role in variety selection. Cultural practice is another factor which influences variety selection. This came out very strongly when visiting some of the stakeholders in Comitan, like the NGO Red Maiz Criollo Chiapas.

Producers were requested to select the two main reasons for them to select the variety they had chosen (Table 15). The question was asked once per survey. Reasons for selecting the variety sown varies among producers interviewed and survey location. Around Tuxtla Gutierrez, yield potential is the most important factor for choosing varieties. With most producers selling the majority of their production, maximization of profits through higher yields is the strategy adopted here. Fifty five percent of answers relate to yield potential. Only 10% of the answers selected concern the specific possibility of recycling the seed from that variety.

In Comitan, maize production revolves around the *milpa*, a traditional indigenous, mixed cropping-based farming system. With most of the maize produced also consumed by the household, producers much prefer the *criollos* varieties which are better adapted to the local climatic and soil conditions, and which can be recycled for sowing in the next year (88%). https://www.flickr.com/photos/131614333@N02/28599198513

	Tuxtla Gutierrez		Comitan	
	Freq	%	Freq	%
I get better yields	105	55	0	0
I trust the origin of the seed	35	18	4	2
Ability to recycle	19	10	151	89
It is the variety that was available at the time	12	6	12	7
Drought tolerant	6	3	0	0
Easy to store	3	2	0	0
Preferred grain type	2	1	1	1
I got the seeds of this variety for free	2	1	0	0
These seeds were subsidized	2	1	0	0
Good taste	0	0	1	1
Other	4	2	1	1
N of answers	190	100	170	100

Table 15 Reason for the variety sown according to location (N of answers 360)

Subsequently, producers were asked whether in addition to the two main selection criteria for variety selection, they had considered the final use of the maize in their decision. Producers did so in 33% of all of cases, at similar rates in Tuxtla Gutierrez and Comitan. These producers were then asked to choose from a multiple choice menu the main reasons for choosing the variety in relation to final use. The most important characteristic relating to final use in Tuxtla Gutierrez was grain color (yellow or white) (64% of answers), while in Comitan, where maize is used much more for home consumption, flavor (56%) was most important, followed by grain color (yellow preferred).

Tuxtla Gutierrez	Freq.	%
Color of grain	40	64
Price paid by buyers	8	13
Flavor	3	5
Easy to store	2	3
Dedicated to animal feed	2	3
Other use related reasons	8	13
Total	60	100
Comitan		
Flavor	30	56
Color of grain	21	39
Price paid by buyers	2	4
Easy to store	1	2
Total	54	100

Table 16 Percentage of answers to multiple choice question on selection criteria of maize variety according for final use of the maize (N answers 117)

There is a striking difference between the two locations when it comes to who influences producers on variety selection. Family friends and neighbors have more or less the same influence on convincing farmers to use a certain variety (37%) in both locations. However in Comitan, producers rely much more on themselves and their own experimentation to select the variety they sow (64%). In Tuxtla Gutierrez, the predominant source of information is family, friends and neighbors (37%), followed by 21% of the producers relying on themselves for the selection of the variety. Seed companies and extensions services are also playing an important role in convincing farmers to use certain varieties (12%). The latter two are simply not very active in the indigenous areas around Comitan, but it is not clear whether seed companies and extension services have actually tried and failed, or have not (yet) made the effort. However, according to comments made during FGDs and key informant interviews, so far seed companies' materials do not seem to be adapted to the indigenous areas, which explains why they are absent. When reflecting on the past, producers interviewed in Comitan said they mostly relied on the same sources of influence as they do now. On the other hand in Tuxtla Gutierrez, producers used to rely more on themselves (40%) and their social network (49%), with producers formerly also relying more on *criollos* than improved (hybrid) varieties (Table 17).

	Tuxtla Gutierrez			Comitan	
Source (%)	Now	10 yrs ago	Source (%)	Now	10 yrs ago
Family, friends, neighbors	37	49	Myself	64	62
Myself	21	40	Family, friends, neighbors	36	38
Seed Company	12	4	Farmer group/asso/coop	0	0
Extension services	11	1	Agro-dealer	0	0
Agro-dealer	8	2	Seed Company	0	0
Farmer group/asso/coop	7	1	Demonstration plots	0	0
Demonstration plots	3	4	Extension services	0	0
Subsidy Program	2		Subsidy Program	0	0

Table 17 Influence on variety used now and 10 years ago (N answers 332, 149)

Type of seed used

There is also a clear distinction between the survey locations when it comes to the type of varieties used by producers. Around Tuxtla Gutierrez, the majority of plots in recent seasons were planted with hybrid varieties (70%), whilst around Comitan, all plots in recent seasons were planted with *criollos* varieties now and 10 years ago. In Tuxtla Gutierrez, 52% of plots used to be sown with *criollos* in the past, now it is only 16% of the plots which are planted with these local varieties. Fourteen percent of producers in Tuxtla Gutierrez used to rely on IOPVs, a rate which has barely changed over the years and is now at 17% (Table 18). Producers in Comitan reported having had the opportunity to test material from CIMMYT in the past, but this has not yet translated into using different types of seed. Producers generally reported that they have limited options and that the *criollos* varieties remain the best option for them. However, they are interested in testing new improved varieties. https://www.flickr.com/photos/131614333@N02/29219525755

	Tuxtla Gutierrez		Comitan	
Variety type used (%)	Now	10 yrs ago	Now	10 yrs ago
Criollo (local variety)	16	52	100	100
IOPV	17	14	0	0
Hybrid	67	34	0	0
N total	356	86	308	63

Table 18 Type of varieties used in the two survey locations

Source of the seed

In Tuxtla Gutierrez, sources of seed are very diverse. Forty nine percent of the seed sown on main plots in recent seasons was sourced from an agro-dealer, while 18% was sourced from a local agent of a seed company. About 16% of the plots were sown with recycled seed, in line with the fact that 16% of producers around Tuxtla Gutierrez use *criollos* (Table 19). 10 years ago, 53% of the plots in Tuxtla Gutierrez were sown with seed sourced from farmers' own field or the

social network, very much in line with the fact that 52% of the farmers reported to have used *criollos* 10 years ago.

With producers relying on themselves for variety selection and with the entire sampled group of producers using *criollos*, it is unsurprising to find that 100% of seed is sourced from own fields in Comitan. Table 15 shows that the ability to recycle seed is an important selection criteria for varieties in Comitan. This practice is something that has not changed during the last 10 years.

	Tuxtla Gutierrez		Comitan	
Source of seed (%)	Now	10 yrs ago	Now	10 yrs ago
Agro-dealer	49	36	0	0
Local agent of a seed company	18	1	0	0
Own field	16	47	100	100
Rural market	11	8	0	0
Government project	3	0	0	0
Neighbor, family or friend	2	7	0	0
Seed producer	1	0	0	0
NGO Project	1	0	0	0
Farmer group, cooperative or association	1	1	0	0
N total	356	86	308	63

Table 19 Source of seed used on main plots now and 10 years ago

Most of the *criollos* seed is sourced from own fields, with very limited quantities of seed traded – both in Tuxtla Gutierrez and Comitan. Maize IOPVs are predominantly sourced from local representatives of seed companies and agro-dealers, while hybrid varieties are mostly sourced from agro-dealers, rural markets and local agents (Table 20). Not all agro-dealers sell IOPVs, but most who have IOPVs also stock some hybrid varieties. During the fieldwork, it has not been possible to meet producers who produce quality seed of *criollos* and sell this on the informal market.

Tuxtla Gutierrez	Criollo	IOPV	Hybrid	Total
Own field	25	1	0	26
Neighbor, family or friend	2	1	0	3
Farmer group, cooperative or association	0	0	2	2
Agro-dealer	0	11	79	90
Rural market	0	5	14	19
Local agent of a seed company	0	11	19	30
Seed producer	0	0	2	2
Government project	0	2	3	5
NGO Project	0	1	0	1
N total	27	32	119	178
Comitan	Criollo	IOPV	Hybrid	Total
Own field	153	0	0	153
Neighbor, family or friend	1	0	0	1
N total	154	0	0	154

Table 20 Source of the seed in relation to the type of seed for recent main plots (N plots 332)

Seed renewal

Producers were asked about their seed renewal practices. In Tuxtla Gutierrez, 82% of the responses pointed at a seasonal seed renewal rate, in line with the large number of producers using hybrid varieties (Table 21). In Comitan, seed stocks don't get renewed. Instead, producers are practicing careful selection of plants and cobs in their own fields from which seed can be recycled. Ten years ago, just over 52% of producers in Tuxtla Gutierrez said they were generally not renewing their seed, very much in line with the fact that 52% were then using *criollos* varieties.

	Now Tuxtla Gutierrez		Now Comitan		10 years ago Tuxtla Gutierrez		10 years ago Comitan	
Renewal rate	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Never renew	61	17	308	100	45	52	63	100

Every season	290	82	0	0	40	47	0	0
Every 2 seasons	0	0	0	0	0	0	0	0
Every 3 seasons	4	1	0	0	1	1	0	0
Every 4 seasons	1	0	0	0	0	0	0	0
Total	356	100	308	199	86	100	63	100

Table 21 Seed renewal rate (N recent plots 664, N 10 years ago 149)

From the relatively limited number of harvests from which seed had been recycled in Tuxtla Gutierrez, 25 kg/ha of maize was kept as seed for *criollos* (N 50) and 33 kg/ha for IOPVs (N 3). In Comitan, it was found that of the 308 recent plots in the survey, seed had been saved from 291 plots, on average 23 kg/ha.

Tuxtla Gutierrez	Mean	95% Conf. interval – low	95% Conf. interval - high	N
Criollo	25	20	29	50
IOPV	33	na	na	3
Comitan	Mean	95% Conf. interval – low	95% Conf. interval - high	N
Criollo	23	25	28	291

Table 22 Quantity of maize kept as seed per variety type and location (kg/ha) of main plot (N plots 344). Na – not applicable.

Distance to seed

In Tuxtla Gutierrez, 47% of producers reported not having to travel to access seed. This is likely due to the fact that agro-dealers and agents can be found at the level of the *localidad*, making it easy for producers to access quality seed. Also, with a majority of producers paying to renew their seed stocks, there is high demand for seed companies and agro-dealers. Eighty five percent of producers in Comitan reported not having to travel at all, consequent to the fact that virtually all producers source seed from their own plots. Therefore when a travel distance was mentioned, it is likely to be attributable to the distance to the field from which cobs were retained (Table 23).

	Tuxtla Gutierrez		Comitan	
Distance to access seed (km)	Freq.	Percent	Freq.	Percent
0	168	47	261	85
0.1 to 0.4	14	4	0	0
0.5 to 1.4	81	23	17	6
1.5 to 1.9	2	1	0	0
2.0 to 4.9	29	8	23	0
5 to 9.9	4	1	7	8
10 km +	58	16	0	2
	356	100	308	100

Table 23 Distance producers travelled in km to seed for recent plots

Seed prices

Although not reported by producers when seed sources were surveyed, farmers, particularly in Comitan, mentioned seed price of *criollos* varieties - only 9 pesos per kg. It is possible that producers source part of their seeds from their field and acquire a certain quantity through informal trade. IOPVs and hybrid varieties fetch a much higher price, around 90 pesos per kg in the area of Tuxtla Gutierrez, with only 4 pesos of difference between seed of IOPVs and hybrid varieties (Table 24).

Tuxtla Gutierrez	Mean	95% Conf. interval – low	95% Conf. interval - high	N
Criollo	11	3	20	15
IOPV	87	81	93	57
Hybrid	91	88	94	236
Comitan	Mean	95% Conf. interval – low	95% Conf. interval - high	N
Criollo	9	8	10	131

Table 24 Average price paid for seed per kg in recent seasons according to variety type (N purchases 439)

4.5 Inputs

In both survey locations, producers use inputs for the production of maize. About 43% of the plots over the past two seasons have received NPK in both locations. Diammonium phosphate (DAP) is more commonly used in Tuxtla Gutierrez (on 70% of plots) than in Comitan (on 44% of plots). Urea is widely used in both locations with rates close to 100% of recent plots. Manure and compost are not a part of common practices. Herbicide usage is very common while pesticides are used on approx. 65% of plots. Fungicides were hardly used on the maize plots from which data was gathered (Table 25). Practically all producers interviewed used less quantities of inputs 10 years ago (Table 26).

% of plots	NPK	DAP	Urea	Manure	Compost	Herbicide	Pesticide	Fungicide
Tuxtla Gutierrez	44	70	98	0	0	98	70	0
Comitan	43	44	99	0	0	99	64	1

Table 25 Fertilizer and agrochemical use (N plots 664)

% of answers	NPK	DAP	Urea	Manure	Compost	Herbicide	Pesticide	Fungicide
Don't know	15	21		0	99	1	11	0
less	84	76	95	98	1	94	87	0
Equal	1	1	3	2	0	5	2	0
More		2	2		0	0	0	0

Table 26 Usage of agrochemical inputs 10 years ago (N 97)

As a general trend, more fertilizer was used on IOPVs and hybrids then on *criollos*. NPK and urea were used on *criollos* in larger quantities in Comitan than in Tuxtla Gutierrez (Table 27).

Average quantity (kg) used per ha	NPK	Urea	DAP
Tuxtla Gutierrez			
Criollo	207	178	45
IOPV	335	304	75
Hybrid	350	274	70
Comitan			
Criollo	257	239	32

Table 27 Volumes of fertilizer used per ha according to location and variety type

4.6 Yields

Locations and seasons demonstrated clear and significant (P<1%) differences in mean yield (Table 8 Correlation between yields per ha by season and location). The sites are clearly different in geography and in farming systems, with a clear variance in variety use patterns as demonstrated above.

In Tuxtla Gutierrez, hybrids and IOPVs are resulting in higher yields, with on average 4 t/ha over the two seasons, and *criollos* offering significantly (P<1%) lower yields at 1.9 t/ha (Table 28). However, this is still significantly (P<1%) higher than in Comitan with an average of 1.3 t/ha (Table 29). The difference between Tuxtla Gutierrez and Comitan in yields of *criollos* could reflect both the agro-ecological characteristics of the two locations, as well as the difference in market orientation and germplasm. In Tuxtla Gutierrez most maize farmers surveyed sell their maize, while in Comitan maize is mostly used for home consumption (50% of producers interviewed consumed at least 50% of their harvest, while only 5% of producers did so in Tuxtla Gutierrez). Under the *milpa* cropping system practiced by the farmers in Comitan, most important is the contribution of the crop to food security, including its qualities for consumption and the complementarity with other crops within the cropping system.

Yields (kg/ha)	Mean	95% Conf. interval – low	95% Conf. interval - high	N
Tuxtla Gutierrez				
Criollo	1898	1666	2129	57
IOPV	3887	3470	4305	61
Hybrid	3951	3740	4162	237
Comitan				

Criollo	1283	1183	1383	288

Table 28 Average yields according to type of seed in recent seasons (kg/ha)

T-test for yield comparisons between variety types	Criollo Tuxtla Gutierez	IOPV Tuxtla Gutierrez	Hybrid Tuxtla Gutierrez
Criollo Tuxtla Gutierrez		-1990***	-2053***
IOPV Tuxtla Gutierrez			64
Hybrid Tuxtla Gutierrez			
Criollo Comitan	614***		

Table 29 T-test for yield comparisons between variety types. Column minus rows, *p-value<=10%, **p-value<=5%, ***p-value<=1%

Fertilizers such as NPK, DAP and urea are widely used among producers. Whether producers sow *criollos*, IOPVs or hybrids in the two survey locations, the majority make use of at least one fertilizer. Generally speaking, higher average yields were reached on recent plots receiving all three fertilizers (NPK, DAP and urea), in contrast to the plots on which only one or two products were used. In Tuxtla Gutierrez, it was found that maize yields were higher with all three fertilizers for IOPVs and hybrids in comparison with a partial package of one or two fertilizers. Both in Tuxtla Gutierrez and Comitan, average yields of *criollos* with a full package are not significantly higher than the mean of plots only receiving a partial package of inputs (Table 30). This suggests that the fertilizer effect may be greater on hybrids than it is on *criollos*. In both locations there were no producers using not using any of the inputs. In general, inputs use was less 10 years ago (Table 26).

Tuxtla Gutierrez full input package (NPK and DAP and Urea)	Mean yield (kg/ha)	95% Conf.interval low	95% Conf.interval high	N plots
Criollo	2145	1781	2510	21
IOPV	4469	3797	5142	13
Hybrid	4350	4064	4636	106
Tuxtla Gutierrez partial package (One or two out of NPK, DAP and Urea)				
Criollo	1753	1459	2047	36
IOPV	3730	3237	4223	48
Hybrid	3628	3333	3923	131
Comitan				
Criollo (full package)	1457	1242	1671	72
Criollo (partial package)	1225	1112	1338	216

Table 30 Recent yields in relation to fertilizer use in both survey locations

Yield levels do not account for intercropping which was practiced on 40% of plots over the last two seasons (32% of plots around Tuxtla Gutierrez and 49% of plots around Comitan). *Criollos* are more likely to be intercropped (45%) than hybrids varieties (29%) in Tuxtla Gutierrez, while IOPVs were intercropped in 33% of cases. It is difficult to estimate the impacts of intercropping on yields as all farmers adopt different crops, slightly different techniques and crop coverage varies. However, there is an average yield difference of 500 kg/ha between plots which were intercropped and pure-stand plots in Tuxtla Gutierrez, which may account for the space taken within the plots by the crop(s) used for intercropping.

The difference in mean yield between pure-stand and intercropping in Tuxtla Gutierrez for all variety type is significant (p-value<1%), however this is due to the large difference found in *criollos* average yields (p-value<1%). The difference in yields for IOPV and hybrid pure-stand and intercropped is not statistically significant. Moreover, in Comitan, no significant difference between intercropped plots and pure-stand plots were found. Intercropping is common under the *milpa* cropping system (Table 31). The positive difference in Comitan for the intercropping is

likely related to improved soil fertility, especially if using lower fertilizer quantities. Also, it should be realized that *criollos* are usually planted at lower densities relative to hybrids and thus the intercropping might not affect crop density as much in Comitan as in Tuxtla Gutierrez.

Tuxtla Gutierrez	Mean	Conf.interval 95% low	Conf.interval 95% high	N plots
Criollo (pure-stand)	2297	1973	2620	31
IOPV (pure-stand)	4020	3509	4530	41
Hybrid (pure-stand)	3982	3757	4208	169
Pure-stand average	3772	3574	3970	241
Criollo (intercropped)	1421	1195	1648	26
IOPV (intercropped)	3617	2880	4354	20
Hybrid (intercropped)	3872	3388	4355	68
Intercropping average	3268	2901	3635	114
Comitan				
Pure-stand	1222	1095	1349	152
Intercropping	1351	1193	1509	136

Table 31 Recent yields (kg/ha) of the two locations according to planting pattern and variety type

5 Observations and Conclusions

The two survey locations exhibited very different characteristics. Tuxtla Gutierrez demonstrated a higher yield level overall and a diverse set of varieties, from *criollos* to hybrids, being grown. At Comitan, farmers appear firmly committed to *criollos* varieties.

In Comitan, producers continue to rely very much on their local traditional varieties for maize production. Much of this maize is dedicated to consumption within the household and hence yellow color and taste are central in variety selection. Recycling varieties by selecting the best plants and cobs of maize for seed is also part of the traditional way by which maize is produced, along with the *milpa* cropping system. In case of need, it's possible to buy and trade seed within the communities, but sourcing of seed remains dependent on the informal networks of producers. Producers are open to testing new genetic material, but said that it is difficult to get the right combination of desired traits and adaptation to their production climate. Although there is a market for maize, it is not a driving force for producers to change seeds, practices and maximize yields. Yields tend to be low in the area (1.2 t/ha).

In Tuxtla Gutierrez, maize is grown to be sold. Most production is of white maize. Larger farmers sell to industry, such as MASECA, the flour industry, which is the largest buyer in Chiapas. In addition, maize is sold to small local mills for *nixtamal*, which is used to produce the local food *pozol*, the main way in which maize is eaten in Chiapas - *pozol* being in Chiapas what *tortillas* are in other states in Mexico. Farmers selling to these small mills are also small farmers. Some maize grain is also sold to the animal feed industry. Producers in Tuxtla Gutierrez tend not to mill their own maize or consume large volumes of their own production.

IOPVs and hybrid varieties are sown on most of the plots surveyed for the research and are appreciated for their high yielding potential. Yields are much higher in Tuxtla Gutierrez than in Comitan, with an average of 3.6 t/ha. Hybrids and IOPVs are out yielding *criollos,* which are yielding 1.9 t/ha, which is 0.7 t/ha more than in Comitan.

The source of the seed sown is often the agro-dealer, rural market or agents of seed companies. Much of the sourcing is done through formal channels, but information on which varieties to use comes mostly from farmers' social networks, family and neighbors. Producers don't really care about whether the seed they acquire is certified or whether it is QDS – in fact most producers do not know the difference between the two. What does matter is the brand and the reputation of the company. Pioneer and Monsanto/Dekalb are particularly appreciated brands. Companies are attracting producers by marketing their product through field agents, which provide extension information and knowledge to producers.

When it comes to seed sector functioning, the private sector was found to be the driving force behind much of what could be called adoption of improved varieties of maize – the 'formal' systems. In the past, the now dissolved national seed company PRONASE, did not succeed to reach producers with quality seed in Chiapas. Now in the hands of the private sector, variety development and seed production seem to satisfy the needs of the more commercially oriented producers established around Tuxtla Gutierrez. Although the certification of seed seems to be a weak link in Chiapas, it does not appear to result in the marketing of sub-quality seed, because good quality seed is imported by seed companies with their reputation as 'guarantee'.

It was noted that around Tuxtla Gutierrez, IOPVs are grown by a significant number of farmers, and that IOPVs are performing at comparable levels to hybrids. The use of IOPVs appears to have stayed constant from 10 years ago at around 15%. Most of the IOPVs grown now in Tuxtla Gutierrez were developed by CIMMYT and INIFAP, the Mexican agricultural research organization. However, with the ongoing shift of maize variety development from the public sector to the private sector, it remains to be seen whether IOPVs will continue to be developed as an attractive choice for farmers in the future. Private seed companies bringing maize varieties to the market usually focus on hybrid varieties.

When it comes to the functioning of the *criollos* seed system, it remains informal and largely self-sufficient. The current capacity of farmers to recycle their own quality seed is instrumental to the survival and the functioning of the system, with limited exchange and sales characterizing access to seed. The driving force behind the informal recycling of seed seems to be the producers themselves, with support from projects and programs improving access to inputs.

The study in Chiapas clearly demonstrates that both the informal (which includes farmers' recycled seed) and the formal seed systems are important in maize production in the region. Farmers make extensive use of both systems depending on their cropping system and geographical location. The two survey sites demonstrate well the diversity found in the maize seed sector and that formal and informal seed systems can coexist. On the other hand, there is tension between safeguarding the national heritage of Mexico, by protecting and strengthening traditional cropping systems and *criollos* varieties, and technological advancements through breeding to improve yields. This seems to be mirrored by CIMMYT's shift since the 1990's, from the promotion and development of IOPVs towards hybrids, yet with the recognition that in some areas, it will be difficult to find acceptance for IOPVs and hybrids (Morris, 2002). The strong self-reliance of farmers in *criollos* areas indicates that the involvement of producers in trials and research is imperative in attempts to both strengthen and sustain indigenous seed systems.

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7 Annex: List of interviews

The fieldwork was conducted in collaboration with two local consultants because of the split location and the in-depth knowledge of the locations required for the surveys. For Tuxtla Gutierrez, agricultural engineer Juan Diego Lopez was hired and in Comitan, agricultural engineer Fidel Ochoa. Both are collaborators of MASAGRO. Key responsibilities of the consultants included organization of the workshop, hiring and coordination of enumerators (Ingeniero Lopez), facilitation of the identification process of key informants, organization of FGDs and Spanish facilitation. Locations for the household survey were also suggested by the local consultants. Laura Donnet and Arturo Silva Hinojosa from CIMMYT were instrumental in selecting the local consultants and supporting the set-up and facilitation of the workshop.

Activity	Dates (2015)	Location	Participants
Stakeholder workshop	June 30th	Tuxtla Gutierrez	36
Key informant interviews	July 2nd – July 9th	Tuxtla Gutierrez and Comitan	17
Survey	July 2nd – July 9th	Tuxtla Gutierrez and Comitan	332
Focus group discussions	July 4, 5 and 7th	Tuxtla Gutierrez and Comitan	3/18

Table 32 Data collection activities

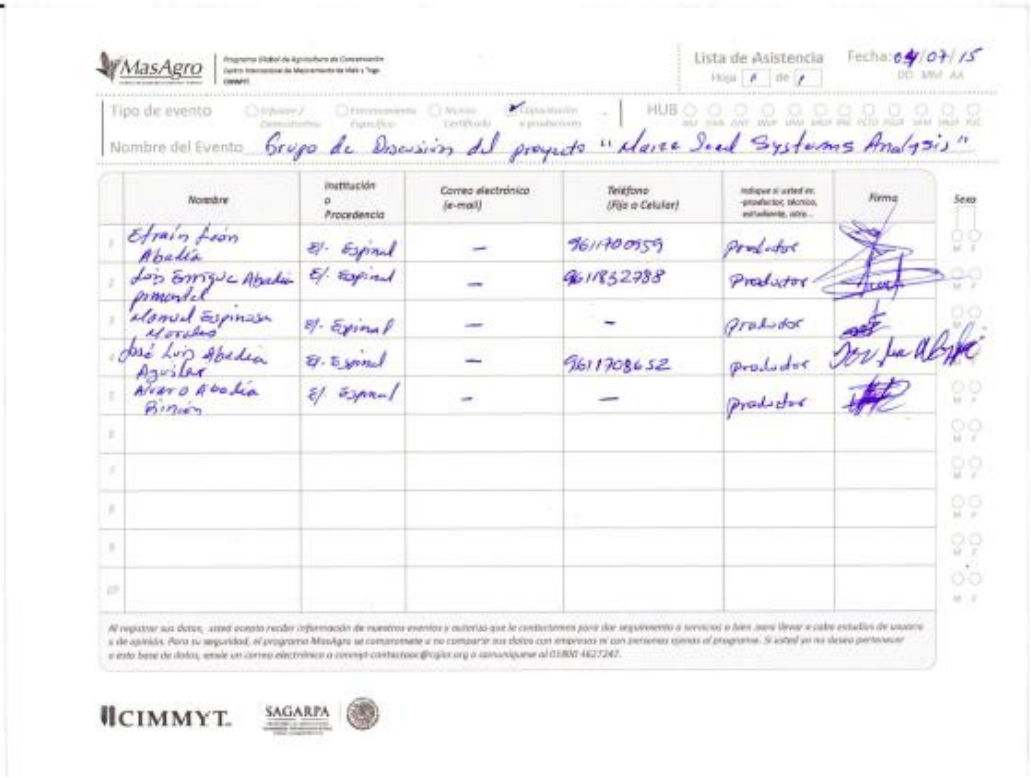
Key informant Interviews:

Ing. Cosme Valdez Pineda.	SAGARPA (Comitan)
Alberto Garcia Vazquez	Seed retailer, market, Comitan de Dominguez, Chiapas
El Semillero	Input dealer
Lic. Javier Gonzalez Esquerra	Owner of "Grupo Tecnológico Agroindustrial S.A. de C.V., grain producer and input dealer
Ing. Jorge Jimenez Utrilla	Department Chief Instituto Tecnologico de Comitan
Ing. Arturo Farrera	Coordinator of la Red de Maiz Criollo Chiapas, San Christobal de las Casas
Saul Ruiz Moreno	Asociacion Civil Meseta Comiteca, on extension services
Ing. Jose Martin Flores Guillen	Producer, owner: Refacciones y Servicios Agricolas de Comitan
Jose Alberto Estrada Teco	Input-dealer, Guadalupe Victoria. Municipio de Ocozocoautla de Espinosa.
Ing. Julio Cesar Aguilar Pérez	SNICS, Tuxtla Gutierrez
Ing. Alvaro Gutierrez Figueroa & Ing. Geu Rincon Gonzalez & Ing. Valentin Alvarado Contreras & Ing. Joaquin Hernandez Gomez	Fideicomisos Instituidos en Relacion con la Agricultura (FIRA)
Ing. Uldamir Rivera Abundez	Sales representative Syngenta
Ing. Moises Alejandro Martinez Aguilar	Alianza Agropecuaria Comercial y de Servicios S.C.
Ing. Edgar Martinez Molina	Sales representative Dekalb y CB in Chiapas-Tabasco
Dr. Nestor Espinosa Paz	Researcher Instituto Nacional de Investigaciones Forestal, Agrícolas y Pecuarias (INIFAP)
Ing. Carlos Serrano Tort	Commercial Manager of Agri-Star
Ing. Marcelo Ruiz	Researcher and producer PROASE
Oscar Arreola Castellanos	Grain traders, Granos Arreola Castellanos S.P.R. Ciudad de Cintalapa, Chiapas

FGDs

San Antonio Venecia, Las Margaritas (Comitan area07-07-2015):
Alfredo Rodriguez Gomez,
Omar de Jesus Gomez Gomez,
Ricardo Rodriguez Espinoza,
Antelmo Rodriguez Gomez,
Gilberto Gomez Gomez,
Conrrado Gomez Hernandez

Ejido Espinal de Morelos, Municipio de Ocozocoautla de Espinosa (Tuxtla Gutierrez area, on 04-07-2015)



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Lista de Asistencia — Hoja 1 de 1 — Fecha: 04/07/15 (DD MM AA)

Tipo de evento: ○ Difusión / Demostrativo ○ Entrenamiento Específico ○ Mesa Certificada ✓ Capacitación a productores — HUB

Nombre del Evento: Grupo de Discusión del proyecto "Maize Seed Systems Analysis"

	Nombre	Institución o Procedencia	Correo electrónico (e-mail)	Teléfono (Fijo o Celular)	Indique si usted es: productor, técnico, estudiante, otro...	Firma	Sexo
1	Efraín Jesús Abadía	Ej. Espinal	–	9611700959	Productor		
2	Luis Enrique Abadía Mendel	Ej. Espinal	–	9611852788	Productor		
3	Manuel Espinosa Morales	Ej. Espinal	–	–	Productor		
4	José Luis Abadía Aguilar	Ej. Espinal	–	9611708652	Productor		
5	Alvaro Abadía Bimón	Ej. Espinal	–	–	Productor		
6							
7							
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CIMMYT. SAGARPA

FGD Ejido Vicente Guerrero, municipio de Venustiano Carranza, Chiapas (Tuxtla Gutierrez area, on 05-07-2015)

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Nombre del Evento: Grupo de Discusión del proyecto "Maize Seed Systems Analysis"

	Nombre	Institución o Procedencia	Correo electrónico (e-mail)	Teléfono (Fijo o Celular)	Indique si usted es: productor, técnico, estudiante, otro...	Firma	Sexo
1	Octavio Ruiz Martinez	Ej. Vicente Guerrero	–	9921063875	Productor		
2	Mauro Ruiz Martinez	Ej. Vicente guerrero	–	–	Productor		
3	Eldido Gonzalez Zuñiga	Ej. Vicente guerrero	–	–	Productor		
4	Jose Ramirez Rosales	Ej. Vicente guerrero	–	9921143016	Productor		
5	Maria Luisa Perez Ixta	Ej. Vicente Guerrero	–	–	Productor		
6							
7							
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9							
10							

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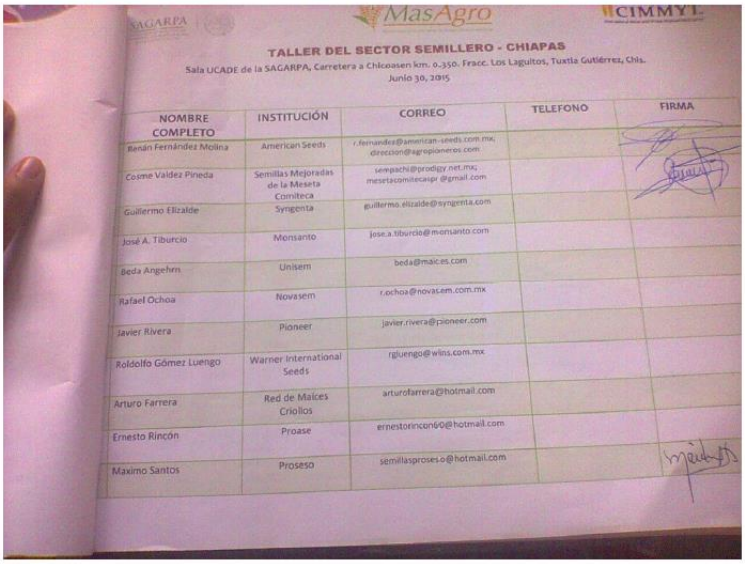
Stakeholder workshop



SAGARPA MasAgro CIMMYT

TALLER DEL SECTOR SEMILLERO - CHIAPAS

Sala UCADE de la SAGARPA, Carretera a Chicoasen km. 0.350. Fracc. Los Laguitos, Tuxtla Gutiérrez, Chis.
Junio 30, 2015

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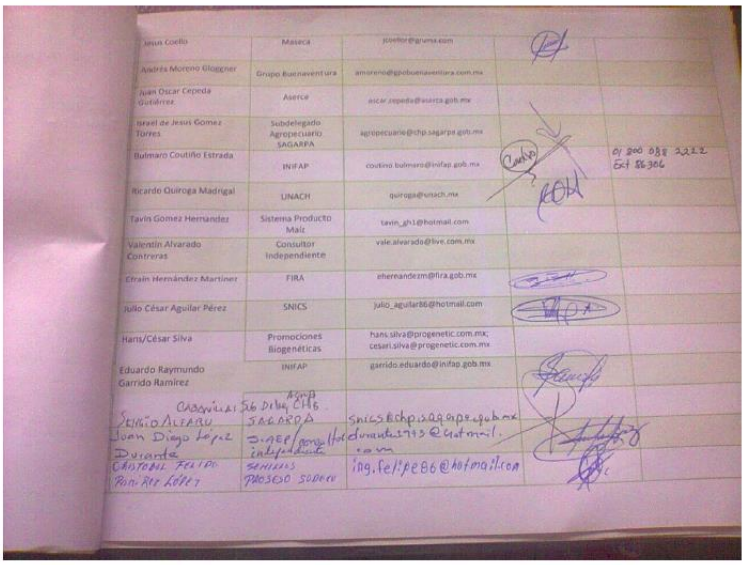

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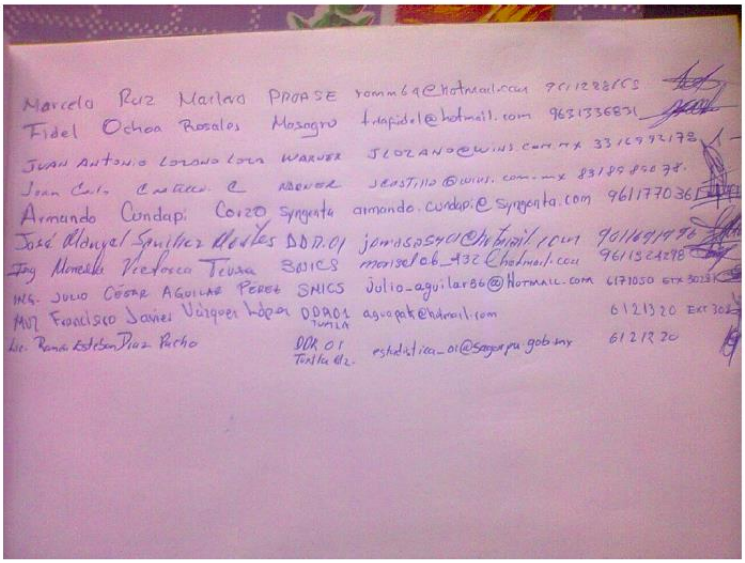

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